

TubeTrace[®], ThermoTube[®]

and Custom CEMS Tubing Bundles

INSTALLATION PROCEDURES



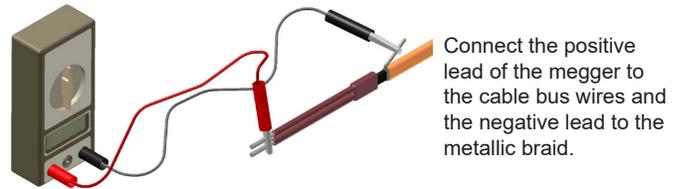
TubeTrace® & ThermoTube® Tubing Bundles

Receiving, Storing and Handling

1. Inspect materials for damage incurred during shipping. Report damages to carrier for settlement.
2. Identify the tubing bundle type to ensure the proper material and quantity has been received. Boxes and reels are marked on the outside with part number, length, product description, weight and customer purchase order number. Compare information on box or reel with packing slip and purchase order to verify receipt of correct shipment.
3. For electrically heated TubeTrace, the heat trace should be tested to ensure electrical integrity with at least a 500 Vdc megohmmeter (megger) between the heat trace bus wires and the heat trace metallic braid. IEEE 515 and IEC 60079-30 recommend that the test voltage for polymer insulated heat trace be 2500 Vdc. Minimum resistance should be 20 megohms. **(Record 1 on Field Test Report)**
4. The ends of TubeTrace & ThermoTube tubing bundles are factory-sealed to prevent dirt, moisture and insect intrusion. As a preventive measure, keep ends sealed until final connections are made. Cut ends may be temporarily sealed with plastic wrap and tape.
5. Cardboard boxes and wooden reels of product should be stored indoors away from water and/or driving rain. However, wooden reels may be stored outdoors using protective covering.
6. TubeTrace & ThermoTube tubing bundles are shipped with the end of the tubing strapped to the side of wooden reel. Use caution when releasing the end of tubing from reel as it may be under tension and may uncoil when released.

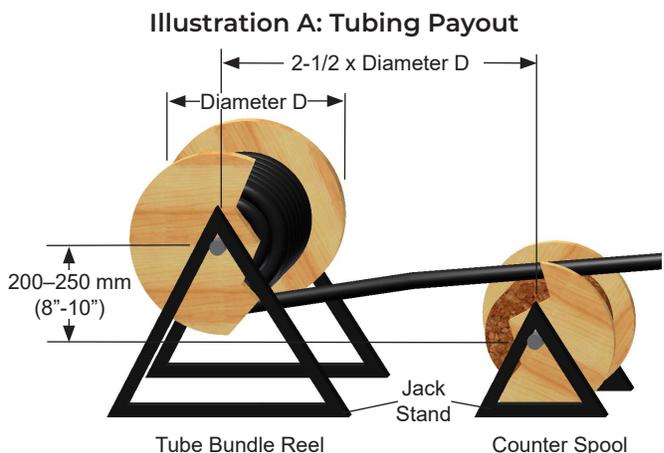
Installation Checklist

- Use caution when trimming bundle with electric heat trace and/or other components.
- **MI mineral insulated heat trace is factory fabricated and cannot be cut in the field.**
- Identify marking on analyzer bundles to locate probe and analyzer ends to verify bundle is installed correctly.
- Use a counter spool to uncoil and straighten bundle.
- Allow long radius, sweeping bends.
- Allow condensation slope as required.
- Maintain recommended support centers.
- Secure bundle runs individually.
- Do not overtighten support clamps.
- Follow minimum bend radius as specified.
- Seal splices with approved kit.
- Insure all connections are tight and sealed.
- Seal all exposed ends with RTV sealant.



Tubing Bundle Layout

1. Determine lengths and number of fittings prior to uncoiling tubing bundle since repeated uncoiling and re-coiling may “work harden” the tubing or damage the bundle.
2. Position reel such that the tubing bundle may be pulled from the reel toward the least accessible end point allowing installation to begin at the end-point working back toward the reel. **MI mineral insulated heat trace is factory fabricated and cannot be cut in the field.**
3. To uncoil and straighten TubeTrace & ThermoTube tubing bundles, anchor the loose end of the tubing on a flat surface and roll the hand coil or shipping reel. If additional straightening is needed, apply moderate tension to the tubing bundles.
4. Wooden spools of TubeTrace or ThermoTube tubing bundles containing long lengths of tubing can be placed on a pay-off tray as shown in illustration A. To “pay-off” tubing bundles, place the reel containing the tubing bundle on one tray allowing the tubing to freely unspool from the bottom of the reel over the top of a second counter spool.
5. Straighten tubing bundle by utilizing the counterspool located in front of the reel containing the tubing bundle (see illustration A). The counterspool should be located at a distance of 2-1/2 times the diameter of the tubing bundle’s shipping reel. Include a vertical offset of 200 to 250 mm (8” to 10”) between the reel elevations.



INSTALLATION PROCEDURES

Installation Methods

Horizontal Runs

1. TubeTrace and ThermoTube tubing bundles may be installed in cable trays or by using individual strut channel.
2. Tubing bundle should be secured with clamps or cable ties every 1.5–1.8 m (5–6 ft.) for horizontal runs. **Do not deform bundle jacket while securing tubing bundle to supports.**
3. Tubing bundle run should include a snaking effect in tray to allow for expansion and contraction of tubing bundle. **Provide 300 mm (1 ft.) of slack for every 30 m (100 ft.) of tubing bundle.**
4. Do not overlap tubing bundles in cable tray. Install cable tray covers where foot traffic is expected to prevent stepping on bundle.
5. It is recommended that TubeTrace & ThermoTube tubing bundles maintain a 25 mm (1 in.) per 6 m (20') slope toward the instrument.

Vertical Runs

1. TubeTrace and ThermoTube tubing bundles may be installed in cable trays or using individual strut channel.
2. Secure bundle with clamps or cable ties every 3 to 4.5 m (10' to 15') on vertical runs. **Do not deform bundle jacket while securing tubing bundle to supports.**
3. **It is recommended to allow an expansion loop every 30 m (100 ft.) to allow for expansion and contraction of tubing bundle. Provide 300 mm (1 ft.) of slack for every 30 m (100 ft.) of tubing bundle run.**
4. For specific installations, such as Analytical/CEMS, if the vertical run is offset around the stack, pull sufficient tubing bundle up the stack to make the offset, secure bundle on the vertical run before routing the bundle around the stack. Take extra precaution to not damage the internal components of bundle. Stage multiple Kellems* grips on vertical runs to reduce pulling tension on the bundle.

* Kellems is a trade name of Hubbell Killark

Illustration B: Typical Tube Bundle Installation

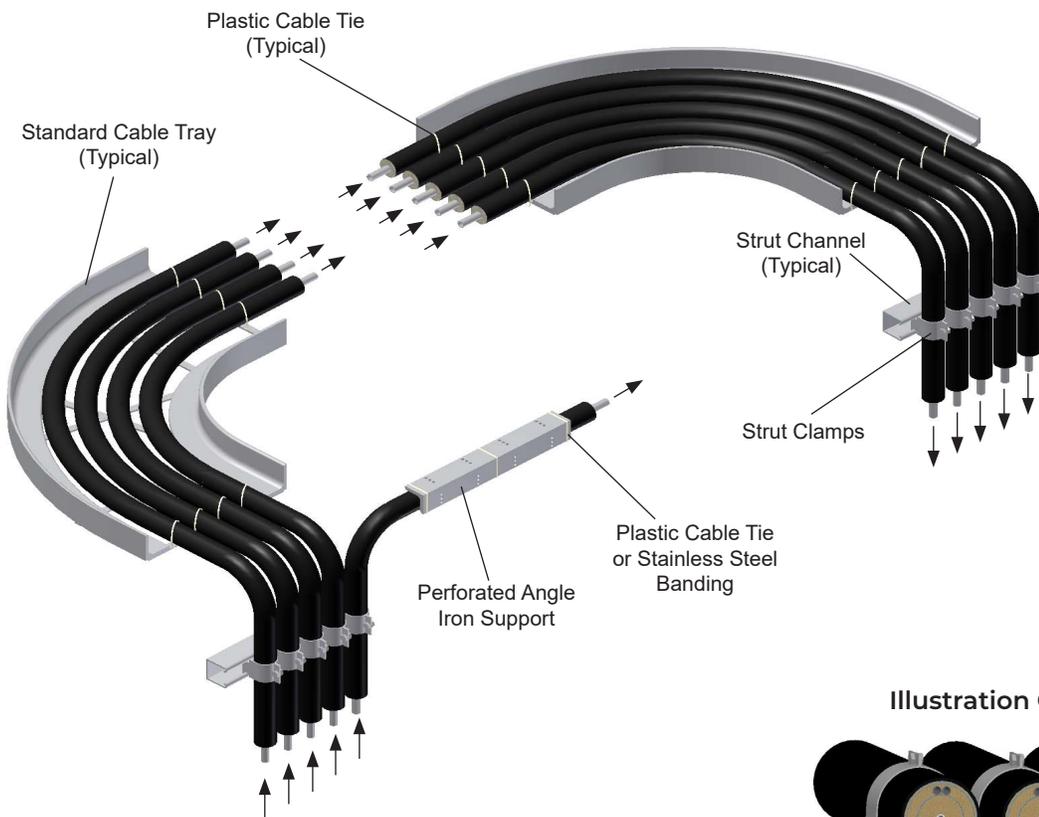
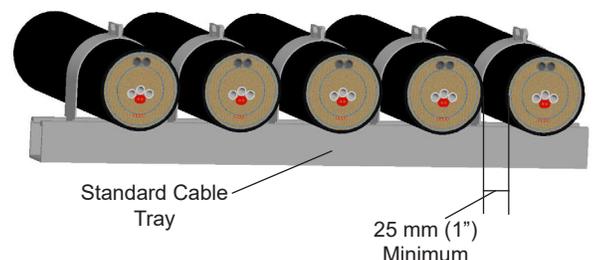


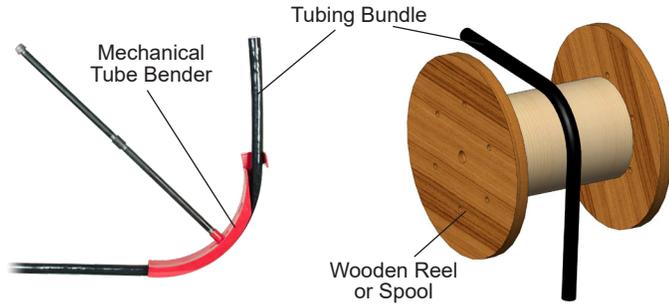
Illustration C: Typical Installation



TubeTrace® & ThermoTube® Tubing Bundles

Bending Procedure

Thermon tubing bundles should be installed so there is no strain on any fittings after the installation is complete. The cross-sectional area of the tubing bundle should not be flattened, kinked or wrinkled. Refer to Table 1 for the minimum acceptable bend radius for each type of Thermon tubing bundle. Use a properly sized Thermon mechanical tubing bender to assure constant radius bends where possible. For a bend radius greater than 25 cm (10 in.) use a wooden reel or spool as shown below.

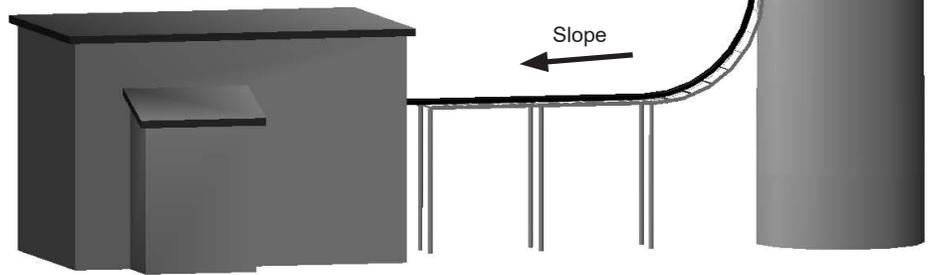


The Cross-Sectional Area of The Tubing Bundle Should Not Be Flattened, Kinked or Wrinkled.



Table 1: Bend Radius

Nominal Bundle O.D. mm (in.)	Minimum Bend Radius mm (in.)	Nominal Weight kg/m (lbs/ft)
Electrical Traced Bundles		
33 (1.3)	152 (6)	0.476 (0.32)
36 (1.4)	178 (7)	0.744 (0.5)
38 (1.5)	178 (7)	0.893 (0.6)
43 (1.7)	203 (8)	1.04 (0.7)
46 (1.8)	228 (9)	1.19 (0.8)
48 (1.9)	254 (10)	1.34 (0.9)
53 (2.1)	279 (11)	1.41 (0.95)
56 (2.2)	305 (12)	1.49 (1)
58 (2.3)	305 (12)	1.64 (1.1)
76 (3)	406 (16)	2.6 (1.75)
79 (3.1)	406 (16)	2.75 (1.85)
89 (3.5)	508 (20)	3.13 (2.1)
Steam Traced Bundles		
38 (1.5)	178 (7)	0.744 (0.5)
41 (1.6)	178 (7)	0.893 (0.6)
43 (1.7)	178 (7)	0.893 (0.6)
46 (1.8)	203 (8)	1.04 (0.7)
48 (1.9)	228 (9)	1.19 (0.8)
51 (2)	279 (11)	1.34 (0.9)
53 (2.1)	279 (11)	1.41 (0.95)



Typical CEMS Installation

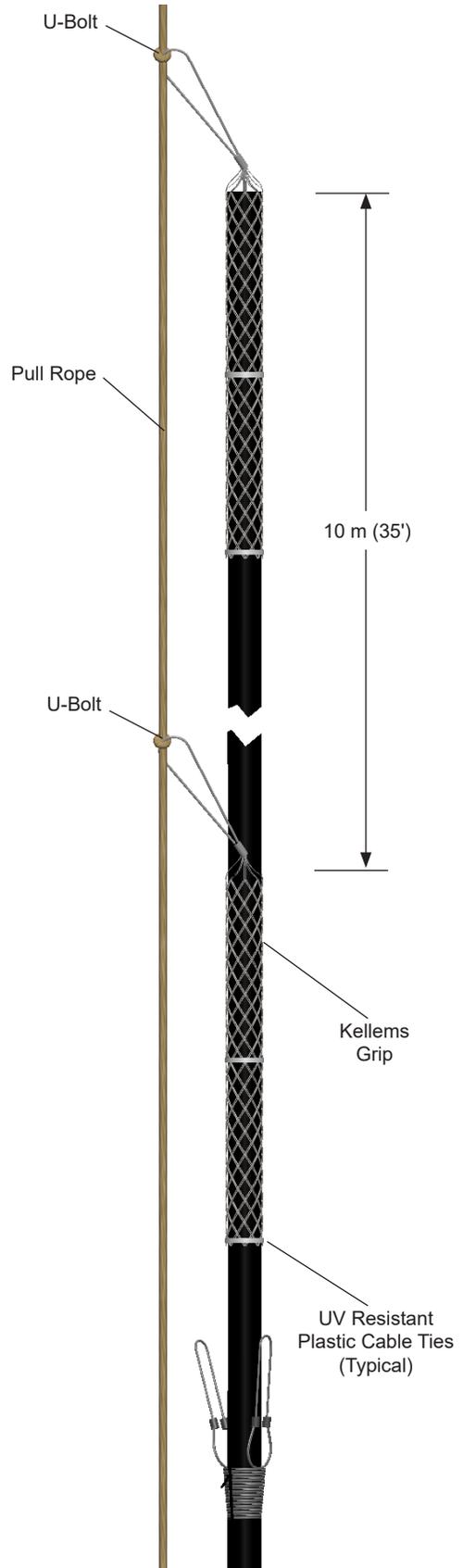
Pulling Procedures

1. The pulling line should be connected to the tube bundle using an appropriate sized Kellems grip for your application. Do not use a damaged grip for pulling bundle. Pulling tension should not exceed 23 kg (50 lbs.) with a minimum pulling line of 15 mm (5/8").

Standard Duty Support Grips Double Eye, Closed Mesh				
Kellems Catalog Number	Bundle Diameter Range mm (inches)	Breaking Strength N (lbs.)	Pulling Eye Length mm (inches)	Mesh Grip Length mm (inches)
02401005	25.4–31.5 (1.00–1.24)	11877 (2670)	127 (5)	355.6 (14)
02401006	31.7–37.8 (1.25–1.49)	19972 (4490)	127 (5)	381 (15)
02401007	38.1–44.2 (1.50–1.74)	19972 (4490)	127 (5)	431.8 (17)
02401008	44.4–50.5 (1.75–1.99)	22241 (5000)	152.4 (6)	482.6 (19)
02401009	50.8–63.2 (2.00–2.49)	39767 (8940)	152.4 (6)	533.4 (21)
024010010	63.5–75.9 (2.50–2.99)	39767 (8940)	152.4 (6)	584.2 (23)
024010011	76.2–88.6 (3.00–3.49)	53379 (12000)	203.2 (8)	635 (25)
024010012	88.9–101.3 (3.50–3.99)	53379 (12000)	203.2 (8)	685.8 (27)

2. Position tubing bundle reel at the top or base of the stack in line with cable tray to reduce overall friction on pulling run. Pulling should allow someone at the end to stop the reel from turning when the pulling force is stopped.
3. Extreme pulling tension may tend to flatten the tubes and damage heat tracing as they round corners, etc. Observe the minimum bending radius of the tubing bundle during pulling operation. (Refer to Table 1 Bend Radius)
4. For rounding corners, a pulley or roller may be utilized while passing over sharp edges that might damage the bundle. Both the pulleys and rollers can be rented at many electrical supply houses.
5. Kellems grips are required for permanently securing the bundle to the stack every 10 m (35 ft).
NOTE: Kellems grips used for bundle installation will also be used to permanently attach bundle to support structure.
6. After determining the total number of Kellems grips required for permanent installation, slide grips required over bundle as shown on Illustration D. Use UV resistant plastic cable ties to prevent Kellems grips from slipping during bundle installation.
7. Attach pull rope to the pulling eye in the Kellems grip. Do not connect any type of hook, clamp or attachment hardware to any other part of the grip.
8. Secure pulling rope to first Kellems grip leaving sufficient line for additional grips as required. See pulling detail illustration. **Do not exceed spacing of 10 m (35 ft) between grips.**

Illustration D: Pulling Detail



TubeTrace® & ThermoTube® Tubing Bundles

Tubing Bundle Attachment Methods

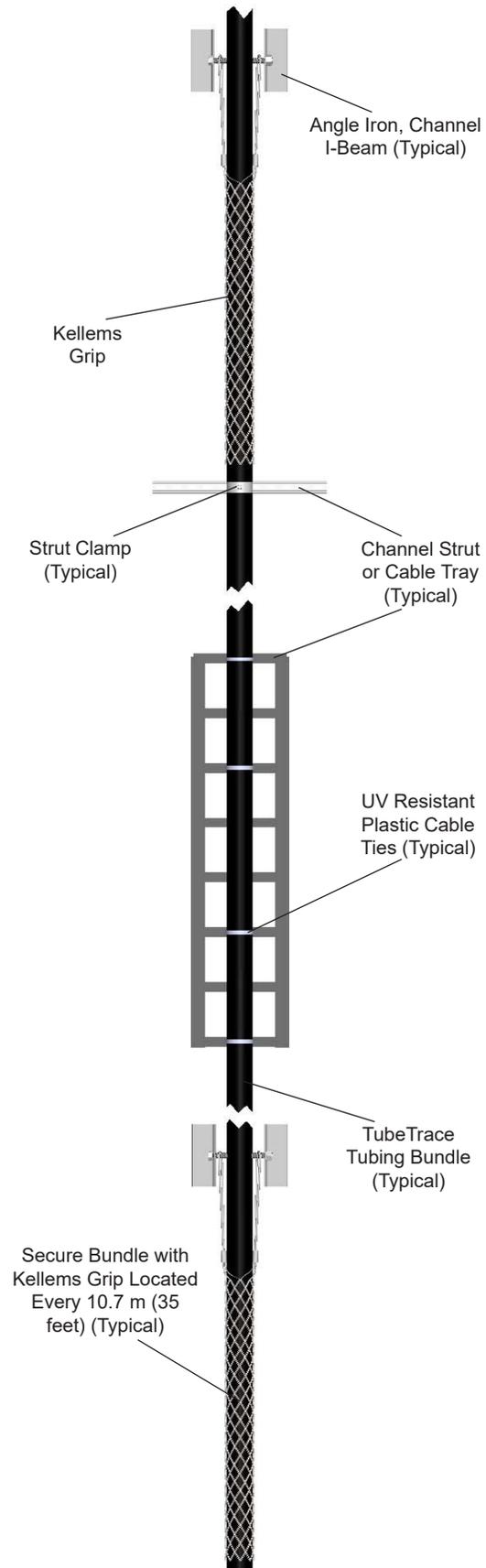
- For ease on installation and maintenance, route multiple runs of tubing bundles symmetrically utilizing the most accessible path possible. Routing should take advantage of existing cable trays, angles, channels, struts and I-beams for support. Maintain a 25 mm (1") minimum clearance between lines. Do not secure bundles to each other.
- After pulling bundle into position, insure sufficient bundle is available to make final connections. Secure top Kellems grip to support structure, with additional Kellems grips located every 10.7 m (35 ft).
- Allow expansion loop in tray every 30 m (100 feet) for expansion and contraction of tubing bundle. Provide 300 mm (1 foot) of slack for every 30 m (100 feet) of tubing bundle.**
- Secure tubing bundles to support structure every 1.5 to 1.8 m (5 to 6 feet) on horizontal straight runs and every 3 to 4.5 m (10 to 15 feet) on vertical runs. Provide additional support within 450 mm (18 inches) of any connection point or transition fitting and within 150 to 250 mm (6 to 10 inches) of any bends.
- Cable trays and channel struts provide optimal support for multiple passes of TubeTrace and ThermoTube tubing bundles. Secure bundle to cable tray using UV resistant plastic cable ties, or preferably stainless steel bundle clamps or standard conduit straps for channel strut attachment (see Table 2 for clamp sizing). Use caution when securing bundle to structure. **Do not deform or crush the thermal insulation and outer jacket.**
- As an option, angle iron may be used to support tubing bundles on long vertical and horizontal runs. Angle iron should be sized approximately 12 mm (1/2 in) larger than the bundle O.D. Place the angle over the bundle to prevent moisture buildup. Secure bundle to the angle using UV resistant cable ties or stainless steel banding.

Table 2: Strut Clamp Selection

Nominal Bundle O.D. mm (in)	Strut Clamp Size mm (in)
25 (1)	32 (1-1/4)
32 (1-1/4)	38 (1-1/2)
41 (1-5/8)	51 (2)
67 (2-5/8)	64 (2-1/2)
86 (3-3/8)	76 (3)
92 (3-5/8)	89 (3-1/2)

- For electrically heated TubeTrace, before making power connection, the heat trace should be tested to ensure electrical integrity with at least a 500 Vdc megohmmeter (megger) between the heat trace bus wires and the metallic braid. IEEE 515 and IEC 60079-30 recommend that the test voltage for polymer insulated heat trace be 2500 Vdc. Minimum resistance should be 20 megohms. **(Record 2 on Field Test Report)** After the power connection is completed, temporarily energize heat trace so that the energized test values can be recorded. **(Record 3 on Field Test Report)**

Illustration E: Typical Vertical Attachment



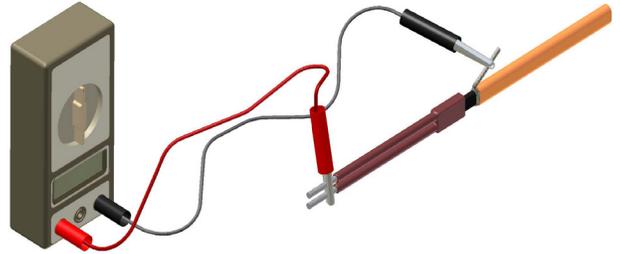
TubeTrace® Tubing Bundle Field Test Procedure

1. Verify that bundle is properly secured to the support structure without causing deformation to insulation and outer jacket.
2. Thoroughly inspect the TubeTrace tubing bundle to ensure all bends are free of kinks and wrinkles and that flattening has not occurred. Refer to the Bending Procedures.
3. Visually inspect bundle for any damage incurred during shipment. Tubing bundle with electric heat trace should be tested to ensure electrical integrity with at least a 500 Vdc megohmmeter (megger) between the heat trace bus wires and the metallic braid. IEEE 515 and IEC 60079-30 recommend that the test voltage for polymer insulated heat trace be 2500 Vdc and 1000 Vdc for MI. Minimum resistance should be 20 megohms. **(Record 1 on Field Test Report.)**

A. Connect the positive lead of the megger to the bus wires.

B. Connect the negative lead of the megger to the metallic braid.

C. Energize the megger and record the reading. Readings between 20 megohms and infinity are acceptable. Readings below 20 megohms may mean the electrical insulation has been damaged on polymer insulated heat trace. Recheck the heat trace for physical damage between the braid and the heating element; small cuts or scuffmarks on the outer jacket will not affect the megger reading unless there was actual penetration through the braid and dielectric insulation jacket.



4. Clean the tubing before connection. After all connections have been completed, test the circuit for leaks by subjecting to pressure equal to or greater than which is to be used in the system, or preferably with suitable hydrostatic tests. Repair any steam and/or process leaks and retest the system.
5. Properly terminate all heat tracers with appropriate heat trace termination kit.
6. Once the installation is complete, recheck the heat trace with at least a 500 Vdc megohmmeter (megger) between the heat trace bus wires and the metallic braid as outlined above. IEEE 515 and IEC 60079-30 recommend that the test voltage for polymer insulated heat trace be 2500 Vdc and 1000 Vdc for MI. Minimum resistance should be 20 megohms. **(Record 2 on Field Test Report.)**
7. Properly terminate and seal all open ends of each bundle using the appropriate FAK Bundle Accessory Kit.
8. After the power connection is completed, record the panel location and circuit breaker information. Ensure all junction boxes, temperature controllers, cable glands, etc. are properly secured. Set the temperature controller (if applicable) to the manual setting and apply rated voltage to the heat tracing circuit(s) for 5 minutes. Record the ambient temperature, measure and record the circuit(s) voltage at the heat trace connection and electrical current. **(Record 3 on Field Test Report.)**

NOTE: To ensure the warranty is maintained through the life of the installation, the testing outlined on this sheet must be completed on the installed heat trace.

TubeTrace® Tubing Bundle Field Test Report
(Make additional copies as required for each circuit.)

Customer: _____ Contractor: _____
Address: _____ Address: _____

Phone No: _____ Phone No. _____
Project Reference: _____

Record 1: Prior to Installation

Bundle Model #: _____
Reel Length (indicate ft or m): _____
Reel Number: _____
Insulation Resistance (M-Ohms): _____
Tested By: _____ Date: _____
Witnessed By: _____ Date: _____

Record 2: After Installation is Complete

Insulation Resistance (M-Ohms): _____
Heated Length* (indicate ft or M): _____
Circuit of Heater Number: _____
Tested By: _____ Date: _____
Witnessed By: _____ Date: _____

* Note, tubes may extend beyond tube bundle length.

Record 3: Commissioning / Energized Test Values

Electrical Control Panel Number: _____
Circuit Breaker Number: _____
Connected Voltage (Vac): _____
Ambient Temperature (deg. F or C): _____
Recorded Amps (After 5 Min.): _____
Tested By: _____ Date: _____
Witnessed By: _____ Date: _____

