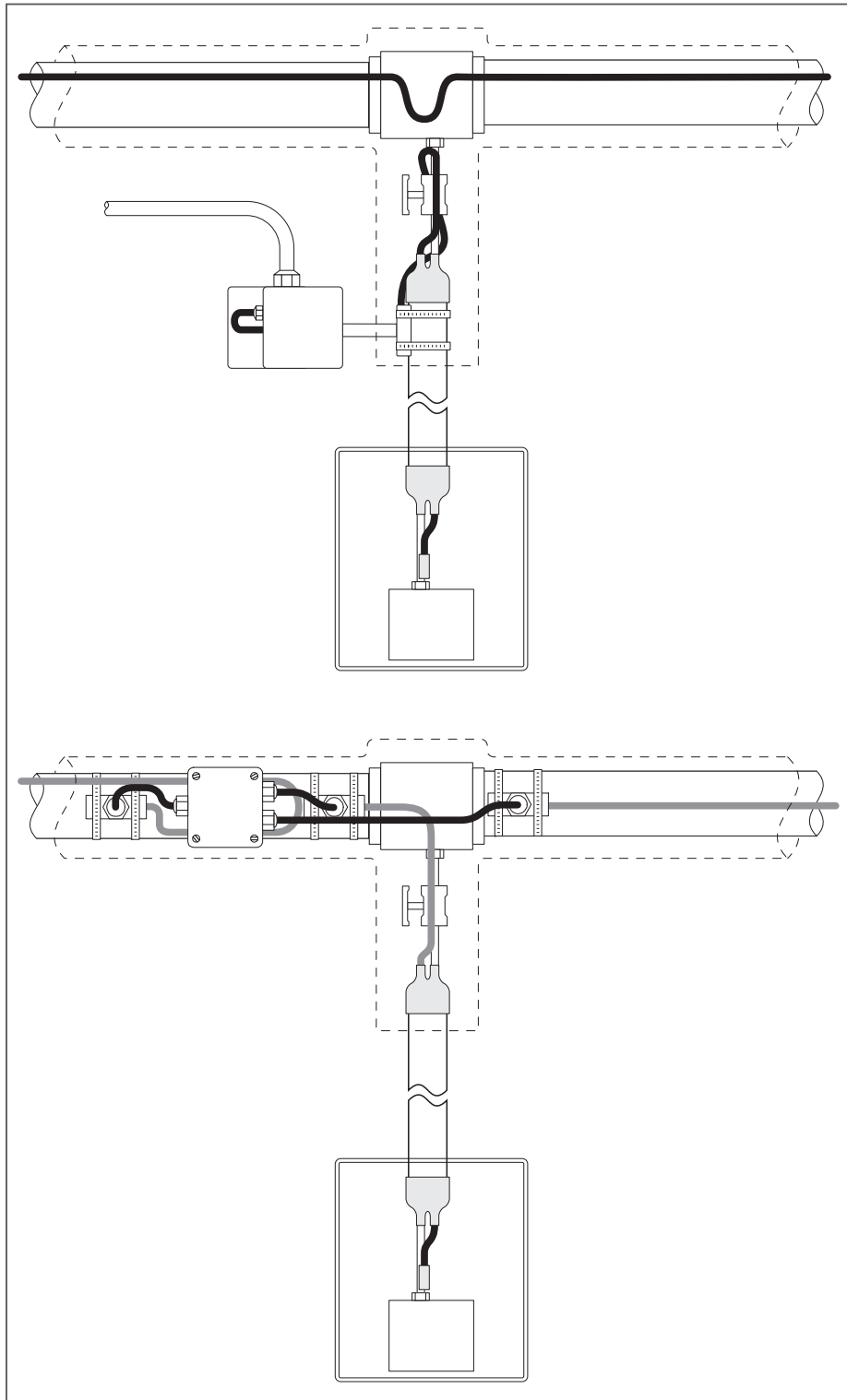


Raychem RTB Tubing Bundles Installation Guide

HEATING SOLUTIONS FOR INSTRUMENT AND SMALL-DIAMETER PROCESS LINES



 WARNING:**Fire and shock hazard.**

Raychem heat-tracing systems must be installed correctly to ensure proper operation and to prevent shock and fire. Read these important warnings and carefully follow all the installation instructions.

- To minimize the danger of fire from sustained electrical arcing if the heating cable is damaged or improperly installed, and to comply with Pentair Thermal Management requirements, agency certifications, and the national electrical codes, ground-fault equipment protection must be used on each heating-cable branch circuit. Arcing may not be stopped by conventional circuit breakers.
- Approvals and performance of the heat-tracing systems are based on the use of Pentair Thermal Management specified parts only. Do not substitute parts or use vinyl electrical tape.
- Bus wires will short if they contact each other. Keep bus wires separated.
- Components and cable ends must be kept dry before and during installation.
- The black heating-cable core and fibers are conductive and can short. They must be properly insulated and kept dry.
- Damaged bus wires can overheat or short. Do not break bus wire strands when preparing the cable for connection.
- Damaged heating cable can cause electrical arcing or fire. Do not use metal attachments such as pipe straps or tie wire. Use only Pentair Thermal Management-approved tapes and cable ties to secure the cable to the pipe.
- Do not attempt to repair or energize damaged cable. Remove damaged cable at once and replace with a new length using the appropriate Pentair Thermal Management splice kit. Replace damaged components.
- Re-use of the grommets, or use of the wrong grommet, can cause leaks, cracked components, shock, or fire. Be sure the type of grommet is correct for the heating cable being installed. Use a new grommet whenever the cable has been pulled out of the component.
- Use only fire-resistant insulation which is compatible with the application and the maximum exposure temperature of the system to be traced.
- To prevent fire or explosion in hazardous locations, verify that the maximum sheath temperature of the heating cable is below the auto-ignition temperature of the gases in the area. For further information, see the design documentation.
- Material Safety Data Sheets (MSDSs) are available from the Pentair Thermal Management Customer Service Center, and at www.thermal.pentair.com.

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1. GENERAL INFORMATION

1.1 USE OF THE MANUAL

This installation and maintenance manual is for Raychem RTB Tubing Bundles systems only. For information regarding other applications, design assistance or technical support, contact your Pentair Thermal Management representative or Pentair Thermal Management directly.

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 **Important:** For the Pentair Thermal Management warranty and agency approvals to apply, the instructions that are included in this manual and product packages must be followed.

1.2 SAFETY GUIDELINES

The safety and reliability of any heat-tracing system depends on proper design, installation and maintenance. Incorrect handling, installation, or maintenance of any of the system components can cause underheating or overheating of the pipe or damage to the heating-cable system and may result in system failure, electric shock or fire.

1.3 ELECTRICAL CODES



Sections 427 (pipelines and vessels) and 500 (classified locations) of the National Electrical Code (NEC), and Part 1 of the Canadian Electrical Code, Sections 18 (hazardous locations) and 62 (Fixed Electric Space and Surface Heating), govern the installation of electrical heat-tracing systems. All heat-tracing-system installations must be in compliance with these and any other applicable national or local codes.

1.4 WARRANTY AND APPROVALS

The RTB system uses Raychem brand BTV and XTV heating cables that are approved and certified for use in nonhazardous and hazardous locations by many agencies, including FM Approvals, CSA International, PTB, Baseefa (2001) Ltd., DNV, and ABS. For more details, consult the heating cable data sheets included in the Industrial Heating Product and Design Guide (H56550) and the Technical Databook for Industrial Heat-Tracing Systems (DOC-389). Data sheets can be found on the Pentair Thermal Management web site, www.thermal.pentair.com.



IMPORTANT WARNINGS AND NOTES

The following icons are used extensively throughout this manual to alert you to important warnings  that affect safety and to important notes  that affect the proper operation of the unit. Be sure to read and follow them carefully.

2. INTRODUCTION

Pentair Thermal Management provides a total solution for heat tracing instrument and small-diameter process lines. Raychem brand tubing bundles (RTB) are a pretraced and preinsulated tubing alternative to field tracing and insulating. RTB systems combine Raychem electric or steam heat tracing with tubing and insulation for a single bundle that can be cut to length in the field.

Typical RTB applications include:

- Impulse lines - to flow transmitters, pressure transmitters, level transmitters, and pressure switches
- Sample lines - to analyzers and chromatographs
- Process lines - for steam supply, condensate return, water purge, chemical feed, and air lines

For European systems, the following Pentair Thermal Management literature should be reviewed in order to complete the design and installation of RTB Tubing Bundles systems:

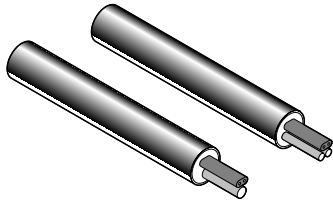
- Installation and Maintenance Manual (DOC-071)
- Components Selection Guide (DOC-565-R1)
- Electrical Protection Bulletin (DOC-057)
- Technical Data Book for Industrial Heat-Tracing Systems (DOC-389-R10)

For North American systems, the following Pentair Thermal Management literature should be reviewed in order to complete the design and installation of RTB Tubing Bundles systems:

- Installation and Maintenance Guide (H57274)
- Design Guide for Insulated Pipes and Tubing (H56882)

This literature is available from your Pentair Thermal Management representative.

2.1 PRODUCT LINE

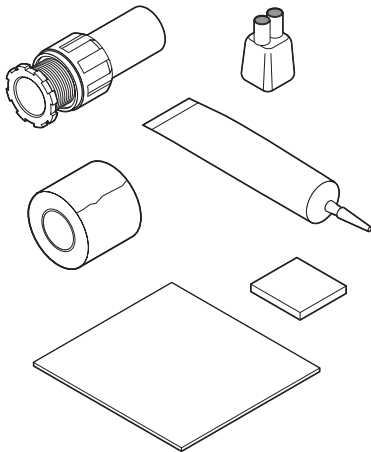


Tubing bundles

RTB tubing bundles are available in a wide range of tubing and heater options (see bundle ordering options on page 7).

Trace-heating components

RTB tubing bundles use the full range of XTV and BTV power connection and end seal kits.



Bundle accessories

RTB bundle accessories include heat-shrinkable boots for sealing bundle ends, heat-shrinkable cable entry seals, a jacket patch kit for sealing around thermostat sensor entries, and a high-temperature silicone sealant for sealing bundle ends.

2.2 SYSTEM OVERVIEW

An RTB system consists of pretraced and preinsulated tubing bundles. Each tubing bundle can be configured as single- or dual-tube, as shown below, and can be constructed in various sizes and materials to meet your small-diameter process piping needs.

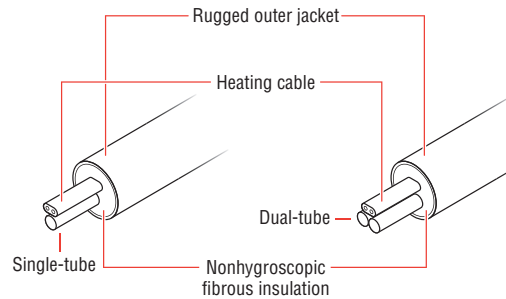


Figure 1 Tubing bundles, single and dual-tube construction

Raychem tubing bundles (RTB) are pre-engineered to ensure consistent and repeatable performance for maintenance-free operation. Compared to field fabrication, they simplify design and significantly reduce installation time. Each bundle can be cut to length in the field and is powered and terminated with simple RTB connection kits. The insulating material consists of a nonhygroscopic fibrous glass for maximum heat-loss prevention. Finally, each RTB is encased in a high-performance polyurethane outer jacket that provides superior UV resistance and installation capability to -40°C (-40°F).

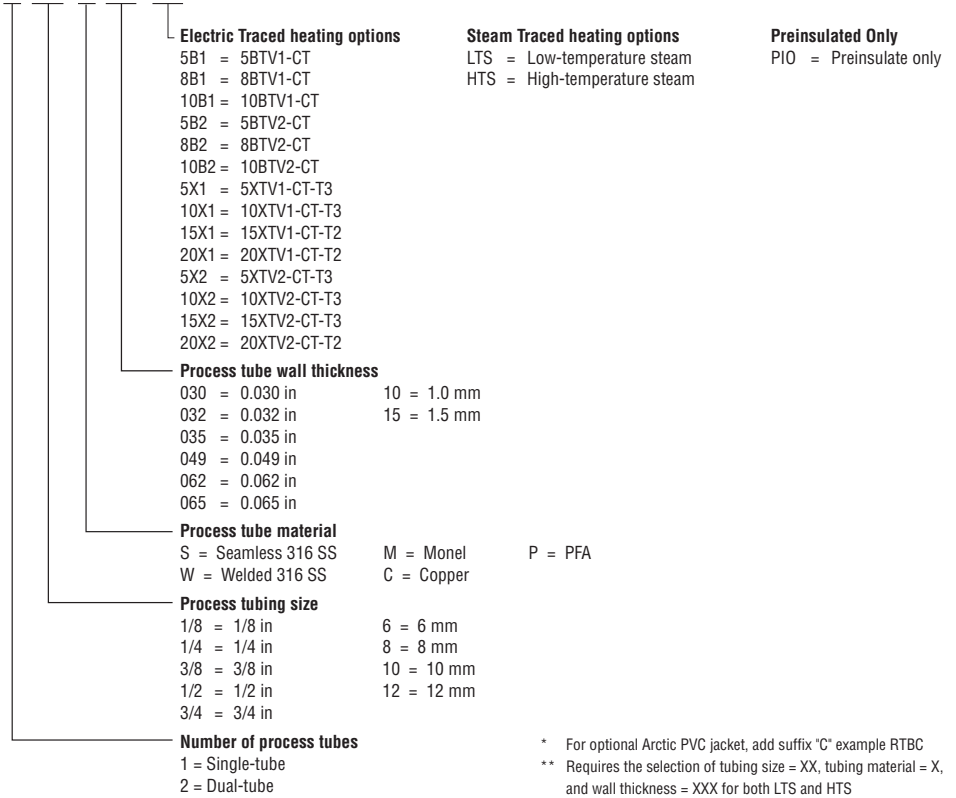
Contact your Pentair Thermal Management representative for design assistance for the following applications:

- The desired maintain temperature range or process tube size does not appear in Table 1 on page 8, Table 2 on page 9, or Table 3 on page 10
- The ambient temperature range is not between -30°C to 38°C (-20°F to 100°F)
- Supply voltages of 208 Vac and 277 Vac are used

2.3 TUBING BUNDLE CATALOG NUMBER

RTB comes in a variety of configurations. The following chart outlines the elements that constitute a bundle configuration and the corresponding catalog number. Other configurations are available on request.

RTB* - X - XXX - X - XXX - XXX-X**



Examples:
 Electric Traced RTB-2-1/2-S-049-10X1
 Steam Traced RTB-2-1/2-S-049-LTS-3/8-C-035
 Preinsulated Only RTBC-1-1/2-S-049-PIO

2.4 BUNDLE MATERIALS

Bundle jacket

- Thermoplastic polyether urethane elastomer
- Halogen-free
- Abrasion resistant
- UV-resistant
- Low-temperature flexibility
- Optional arctic PVC

Thermal insulation

- Fibrous glass
- Water-soluble chlorides less than 100 ppm
- Non-hygroscopic

Tubing

- Welded stainless steel tubing complies with ASTM A-269.
- Seamless stainless steel tubing complies with ASTM A-269 and A213-EAW.
- Metric tubing sizes provided with inspection certificate per EN10204.

3. VERIFY PRODUCT SELECTION

3.1 HEATER TYPE AND TEMPERATURE RANGE

Table 1 shows the minimum and maximum temperatures that can be maintained by the process tube over an ambient temperature range of -30°C to 38°C (-20°F to 100°F).

- In Table 1, find the column for the desired process tube size. Within the column, find the heater(s) that maintains a minimum temperature at or above the desired maintain temperature.
- If more than one heating cable will maintain the temperature, choose the one with the lowest maximum temperature. Make sure that:
 - The T-rating of the heating cable is adequate
 - Only XTV is used if the maximum system exposure temperature is above 85°C (185°F)
 - A thermostat will be used if the maximum temperature in the table is higher than desired set point

Table 1: Process Tube Maintain Temperatures (Minimum-Maximum) for Ambient Range of -30°C to 38°C (-20°F to 100°F) at 120/240 V

Heater Type	Tubing Size									
	6 mm or 1/4 in		8 mm		3/8 in		10 mm		12 mm or 1/2 in	
	°C	(°F)	°C	(°F)	°C	(°F)	°C	(°F)	°C	(°F)
Single-tube										
5BTV1 and 2	19–52	(66–126)	18–52	(64–125)	16–51	(61–124)	15–51	(60–123)	14–50	(58–122)
8BTV1 and 2	32–58	(90–136)	31–57	(88–135)	29–57	(85–134)	28–56	(83–134)	27–56	(81–133)
5XTV1 and 2	31–92	(87–197)	28–90	(82–194)	26–88	(78–190)	23–87	(74–189)	21–84	(70–184)
10XTV1 and 2	63–110	(145–231)	60–108	(139–226)	56–105	(133–222)	53–105	(128–220)	51–101	(123–214)
15XTV1 and 2	84–126*	(184–250)*	81–123*	(177–250)*	78–120	(172–248)	77–120	(170–247)	71–116	(161–240)
20XTV1 and 2	111–151*	(232–250)*	107–148*	(224–250)*	103–145*	(217–250)*	102–144*	(215–250)*	96–139*	(204–250)*
Dual-tube										
5BTV1 and 2	18–52	(64–125)	16–51	(61–124)	14–50	(58–122)	13–49	(56–121)	12–49	(53–120)
8BTV1 and 2	32–58	(89–136)	30–57	(86–135)	28–56	(82–133)	26–56	(79–132)	24–55	(76–131)
5XTV1 and 2	29–91	(85–196)	25–88	(77–190)	22–85	(71–184)	19–84	(66–183)	16–80	(60–176)
10XTV1 and 2	61–109	(142–228)	56–105	(133–221)	52–102	(125–215)	48–101	(119–213)	44–96	(112–205)
15XTV1 and 2	83–124*	(181–250)*	77–119	(171–247)	73–116	(162–241)	71–115	(160–240)	64–110	(148–230)
20XTV1 and 2	109–149*	(228–250)*	102–144*	(216–250)*	97–140*	(206–250)*	95–139*	(203–250)*	87–132*	(189–250)*

The temperatures included in Table 1 are approximate. For critical applications contact your Pentair Thermal Management representative.

* Requires overtemperature line-sensing thermostat to ensure operation below maximum continuous exposure temperature of the heating cable.

Contact your Pentair Thermal Management representative for design assistance for the following applications:

- The desired maintain temperature range or process tube size does not appear in Table 1 on page 8, Table 2 on page 9, or Table 3 on page 10
- The ambient temperature range is not between -30°C to 38°C (-20°F to 100°F)
- Supply voltages of 208 Vac and 277 Vac are used

3.2 ELECTRICAL SIZING AND RUN LENGTH

Tables 2 and 3 show the maximum bundle length that may be powered from different sized circuit breakers. Use Table 2 for European type circuit breakers. Use Table 3 for North American circuit breakers. Note that ground-fault equipment protection (residual current device) is required on each heating cable branch circuit. To reduce the risk of fire caused by damage or improper installation, circuit breakers with a 30-mA trip level must be used. Alternative designs providing comparable levels of ground-fault protection may also be acceptable. Contact your Pentair Thermal Management representative for assistance if you need to size circuit breakers for use under different start-up conditions. For maximum protection, use the smallest circuit breaker consistent with the length of heating cable installed.

Table 2: Maximum Circuit Length vs. Circuit Breaker Rating: 120 Vac

Heating Cable	Start-up temp.		15 A		20 A		30 A		40 A		50 A	
	°C	°F	m	ft	m	ft	m	ft	m	ft	m	ft
5XTV1-CT-T3	10	50	55	180	73	240	110	360	117	385	117	385
	-18	0	49	160	64	210	98	320	117	385	117	385
	-29	-20	46	150	61	200	93	305	117	385	117	385
	-40	-40	44	145	59	195	88	290	117	385	117	385
10XTV1-CT-T3	10	50	34	110	44	145	67	220	82	270	82	270
	-18	0	29	95	40	130	59	195	79	260	82	270
	-29	-20	29	95	38	125	58	190	76	250	82	270
	-40	-40	27	90	37	120	55	180	73	240	82	270
15XTV1-CT-T2	10	50	23	75	30	100	46	150	61	200	67	220
	-18	0	20	65	27	90	41	135	55	180	67	220
	-29	-20	20	65	26	85	40	130	52	170	66	215
	-40	-40	18	60	24	80	38	125	50	165	62	205
20XTV1-CT-T2	10	50	15	50	2	6	37	120	49	160	58	190
	-18	0	15	50	21	70	32	105	43	140	55	180
	-29	-20	15	50	20	65	32	105	43	140	52	170
	-40	-40	15	50	20	65	30	100	40	130	50	165
5BTV1-CT	10	50	70	230	82	270	82	270	82	270	*	*
	-18	0	43	140	58	190	82	270	82	270	*	*
	-29	-20	38	125	50	165	76	250	82	270	*	*
	-40	-40	34	110	44	145	67	220	82	270	*	*
8BTV1-CT	10	50	46	150	61	200	64	210	64	210	*	*
	-18	0	30	100	40	130	61	200	64	210	*	*
	-29	-20	26	85	35	115	53	175	64	210	*	*
	-40	-40	24	80	32	105	47	155	64	210	*	*
10BTV1-CT	10	50	37	120	49	160	55	180	55	180	*	*
	-18	0	24	80	34	110	49	160	55	180	*	*
	-29	-20	21	70	29	95	43	140	55	180	*	*
	-40	-40	20	65	26	85	38	125	52	170	*	*

* For these design conditions, use a smaller circuit breaker or alternate heating cable.

Table 3: Maximum Circuit Length vs. Circuit Breaker Rating: 240 Vac

Heating Cable	Start-up temp.		15 A		20 A		30 A		40 A		50 A	
	°C	°F	m	ft	m	ft	m	ft	m	ft	m	ft
5XTV2-CT-T3	10	50	110	360	146	480	219	720	233	765	233	765
	-18	0	96	315	128	420	191	625	233	765	233	765
	-29	-20	90	295	120	395	181	595	233	765	233	765
	-40	-40	87	285	116	380	174	570	232	760	233	765
10XTV2-CT-T3	10	50	67	220	90	295	134	440	165	540	165	540
	-18	0	59	195	79	260	117	385	157	515	165	540
	-29	-20	56	185	75	245	113	370	151	495	165	540
	-40	-40	53	175	72	235	108	355	143	470	165	540
15XTV2-CT-T3	10	50	46	150	61	200	91	300	122	400	136	445
	-18	0	40	130	53	175	81	265	108	355	134	440
	-29	-20	38	125	50	165	76	250	102	335	128	420
	-40	-40	37	120	49	160	73	240	98	320	123	405
20XTV2-CT-T2	10	50	35	115	46	150	70	230	162	530	116	380
	-18	0	30	100	41	135	62	205	84	275	105	345
	-29	-20	30	100	40	130	61	200	81	265	101	330
	-40	-40	29	95	38	125	58	190	78	255	98	320
5BTV2-CT	10	50	140	460	165	540	165	540	165	540	*	*
	-18	0	87	285	116	380	165	540	165	540	*	*
	-29	-20	76	250	101	330	152	500	165	540	*	*
	-40	-40	67	220	90	295	134	440	165	540	*	*
8BTV2-CT	10	50	91	300	122	400	128	420	128	420	*	*
	-18	0	61	200	81	265	122	400	128	420	*	*
	-29	-20	53	175	72	235	107	350	128	420	*	*
	-40	-40	47	155	64	210	96	315	128	420	*	*
10BTV2-CT	10	50	73	240	96	315	110	360	360	360	*	*
	-18	0	49	160	66	215	99	325	110	360	*	*
	-29	-20	44	145	58	190	87	285	110	360	*	*
	-40	-40	38	125	52	170	78	255	104	340	*	*

* For these design conditions, use a smaller circuit breaker or alternate heating cable.

3.3 SELECT COMPONENTS

The heating cable on RTB Tubing Bundles must be connected with power connection and end seal kits specifically approved for use with BTV and XTV heating cable. Typical North American and European component systems are shown below. Consult the appropriate guide for specific component selection information.

- Use RTB Design Guide (H56886) for North American components selection
- Use Components Selection Guide (Doc-565-R1) for European components selection

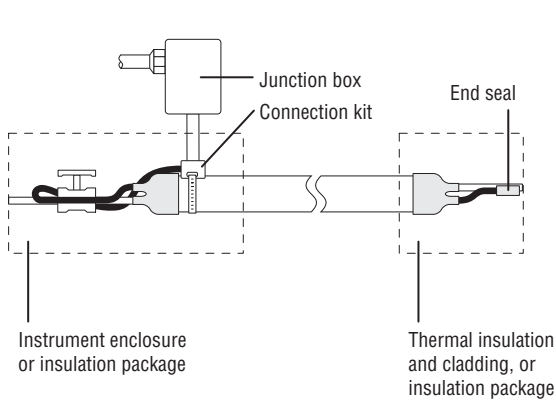


Figure 2 Typical North American power connection and end seal

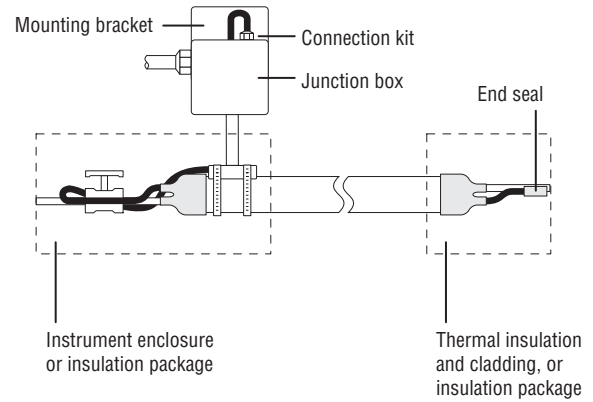
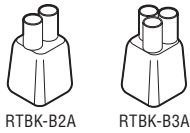


Figure 3 Typical North American power connection and end seal

3.4 SELECT BUNDLE ACCESSORIES



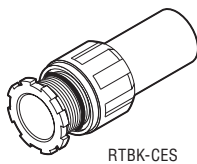
Heat-shrinkable boots (RTBK-B) are used for sealing bundle ends. The boots are designed to provide a weatherproof seal at the end of the tubing bundles. These boots may be used on all electric-traced bundles. For steam-traced bundles, use silicone sealant (TPK-SK-10).

- Use RTBK-B1A for preinsulate only
- Use RTBK-B2A for single tube bundles
- Use RTBK-B3A for dual tube bundles



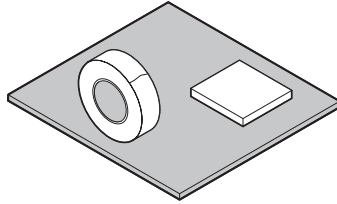
Important: Although RTB tubing bundles use a non-hygroscopic thermal insulation, all bundle ends and jacket penetrations must be sealed to keep the insulation from getting wet. Wet insulation will not maintain the designed pipe temperature.

Heat-shrinkable entry seals (RTBK-CES) may be used to provide a waterproof fitting where the bundle enters an enclosure or penetrates a bulkhead. Use the table below to select the appropriate entry seal for your tubing size. The thermally stabilized modified polyolefin entry seal includes an O-ring assembly that seals at the enclosure, and a heat-shrinkable nose that seals to the bundle.



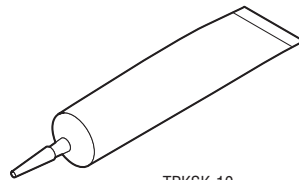
Tubing size	Single-tube bundle	Dual-tube bundle
1/4-3/8" (6-10 mm)	RTBK-CES4	RTBK-CES4
1/2" (12 mm)	RTBK-CES4	RTBK-CES5

Jacket patch kits (RTB-TPKJP-1) must be used for sealing around line-sensing thermostat entries. The kit contains thermal insulation, fiberglass tape to hold the insulation in place, and a black, self-sealing rubber patch for weatherproofing the bundle.



TPKJP-1

Silicone sealant (RTB-TPKSK-10) is a black silicone RTV sealant used for sealing the ends of the tubing bundle from moisture. Cure time is approximately 24 hours at 25°C (77°F). The 280 gm (10 ounce) tube will seal approximately 10 bundle ends. Silicone sealant can be used for either electric- or steam-traced bundles.



TPKSK-10

4. INSTALLATION

4.1 DESCRIPTION

RTB tubing bundles are designed to be used as heated instrument lines or small-diameter process lines. The bundles are designed for single-use, fixed installation applications.

The minimum installation temperature for RTB Tubing Bundles is -40°C (-40°F).

Do not use RTB tubing bundles in the following applications:

Applications that flex in normal use.

Applications where the bundle is moved and re-used.

Electrically heated RTB tubing bundles must be installed with power connection and end seal kits specifically approved for use with BTV and XTV heating cable.

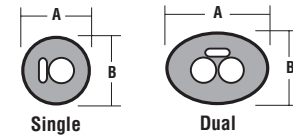
All bundle ends must be temporarily sealed from moisture ingress during installation. Tape a plastic bag in place to seal the end of the bundle.

4.2 WEIGHTS AND DIMENSIONS

The following tables show nominal weights and outside dimensions for a variety of bundle configurations.

Table 4: Electric bundle weights and dimensions

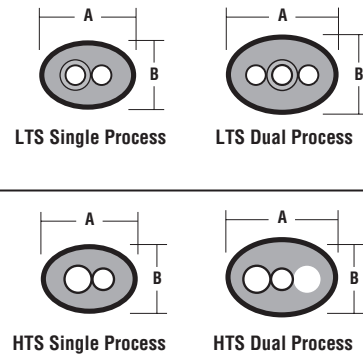
	Nominal weight		Nominal dimensions			
			A		B	
	kg/m	(lb/ft)	cm	(in)	cm	(in)
Single 1/4" process tube	0.45	(0.3)	2.8	(1.1)	2.5	(1.0)
Single 3/8" process tube	0.60	(0.4)	3.3	(1.3)	2.5	(1.0)
Single 1/2" process tube	0.74	(0.5)	3.6	(1.4)	2.8	(1.1)
Dual 1/4" process tubes	0.60	(0.4)	3.3	(1.3)	2.8	(1.1)
Dual 3/8" process tubes	0.89	(0.6)	3.8	(1.5)	3.0	(1.2)
Dual 1/2" process tubes	1.19	(0.8)	4.3	(1.7)	3.6	(1.4)



Minimum bending radius 20 cm (8 in)
Maximum support centers-ft. Horizontal 2 m (6.5 ft) Vertical 4 m (13 ft)

Table 5: Steam bundle weights and dimensions

	Nominal weight		Nominal dimensions			
			A		B	
	kg/m	(lb/ft)	cm	(in)	cm	(in)
LTS - One 3/8" Process with 3/8" Tracer	0.5	(0.74)	4.1	(1.6)	2.8	(1.1)
LTS - One 1/2" Process with 3/8" Trace	0.6	(0.89)	4.8	(1.9)	3.0	(1.2)
LTS - One 1/2" Process with 1/2" Tracer	0.7	(1.04)	4.8	(1.9)	3.0	(1.2)
LTS - Two 3/8" Process with 3/8" Tracer	0.6	(0.89)	5.8	(2.3)	3.0	(1.2)
LTS - Two 1/2" Process with 3/8" Tracer	0.8	(1.19)	6.6	(2.6)	3.3	(1.3)
LTS - Two 1/2" Process with 1/2" Tracer	0.9	(1.34)	6.6	(2.6)	3.3	(1.3)
HTS - One 3/8" Process with 3/8" Tracer	0.5	(0.74)	3.8	(1.5)	3.0	(1.2)
HTS - One 1/2" Process with 3/8" Tracer	0.6	(0.89)	4.1	(1.6)	3.0	(1.2)
HTS - One 1/2" Process with 1/2" Tracer	0.7	(1.04)	4.3	(1.7)	3.0	(1.2)
HTS - Two 3/8" Process with 3/8" Tracer	0.6	(0.89)	5.1	(2.0)	3.0	(1.2)
HTS - Two 1/2" Process with 1/2" Tracer	0.8	(1.19)	5.6	(2.2)	3.0	(1.2)



Minimum bending radius 20 cm (8 in)
Maximum support centers-ft. Horizontal 1.8 m (6 ft) Vertical 4.6 m (15 ft)

Table 6: Preinsulated tubing bundle weights and dimensions

	Minimum bend radius	Support centers m (ft)		Nominal weight	Nominal dimensions "A"
	cm (in)	Horizontal	Vertical	kg/m (lb/ft)	cm (in)
One 1/4" process lin	20 (8)	1.8 (6)	4.6 (15)	0.30 (0.2)	2.5 (1.0)
One 3/8" process lin	20 (8)	1.8 (6)	4.6 (15)	0.45 (0.3)	3.2 (1.2)
One 1/2" process lin	20 (8)	1.8 (6)	4.6 (15)	0.60 (0.4)	3.4 (1.3)



4.3 STORAGE

When storing the bundle, take the following precautions:

- All bundle ends must be sealed at all times to prevent moisture ingress.
- Protect the bundle from the weather.
- Protect the bundle from mechanical damage.
- Store at temperatures between -40°C (-40°F) and 60°C (140°F).

4.4 POSITIONING AND SUPPORT

Positioning

Follow these six guidelines to position the tubing bundle:

- Position along existing structures, such as beams and columns, for support.
- Avoid areas where the ambient temperature may exceed 38°C (100°F).
- Maintain a 12-mm (1/2-in) clearance between bundles.
- Allow 300–450 mm (12–18 in) of straight tubing bundle before connecting to fittings.
- Add enough length to the bundle to connect to the heating cable power supply. (See Section 3.6). Include the length from the process connection location to the power junction box plus 150 mm (6 in) inside the junction box.

Minimum bending diameter: 400 mm (16 in)

Maximum support centers: Horizontal = 2 m (6 ft), Vertical = 4 m (12 ft)

Supports

Supports and hangers must have a large surface area (Fig A) and be designed so they cannot be overtightened and crush the tubing bundle. Do not use u-bolts as supports.

An angle iron may be used as a support (Fig. B). Place the bundle in an angle sized 12 mm (1/2 in) larger than the largest dimension of the bundle. Secure the bundle with metal or plastic straps. Do not use wire ties.

Cable trays may also be used as supports. Maintain a minimum of 12 mm (1/2 in) between bundles.



Fig. A

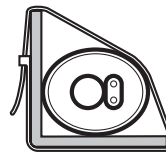
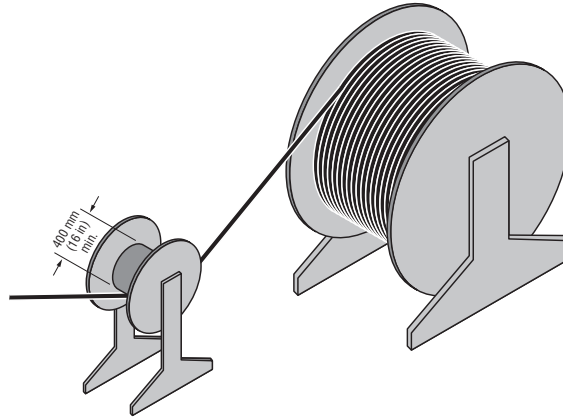


Fig. B

4.5 UNCOILING AND BENDING

Method 1: Roll the bundle off the shipping reel onto the floor or other flat surface. This will leave a slight bow that can be taken out by hand.

Method 2: Use a second smaller spool to straighten the product as it is taken off the larger shipping spool.



Do not bend tighter than the minimum bending diameter of 400 mm (16 in)

- The bundle jacket will wrinkle when the bundle is bent. This is a normal condition, and does not affect the performance or life of the bundle.
- When bending the bundle, use a mandrel that is at least as big as the minimum bending radius, such as a small spool or a pipe bender shoe.
- For dual-tube bundles, bend on the small dimension; the bundle will tend to twist and then bend on this dimension naturally.
- To bend on the larger dimension, grasp the bundle firmly and twist it 90 degrees. Then make the bend. This technique may also be used to position the tubing for process connections.

4.6 ELECTRIC TRACE-HEATING CONNECTIONS

Figures 4-7 show typical tubing bundle power connection and end seal installations. The tubing bundle heating cables are shown powered from a separate power feed, and from a tee connection.

Figure 4 - Power connection and end termination (Europe)

Figure 5 - Heating cable powered from a tee connection (Europe)

Figure 6 - Power connection and end termination (North America)

Figure 7 - Heating cable powered from a tee connection (North America)

Important Installation Notes:

- Electrically heated RTB Tubing Bundles must be installed with power connection and end seal kits specifically approved for use with BTV and XTV heating cable.
- Make sure that all pipes and tubes are thermally insulated.
- Do not power the tubing bundle heating cable from a tee connection if a line sensing thermostat is used on the main line, as flow in the main line will shut down the tubing bundle heating cable.

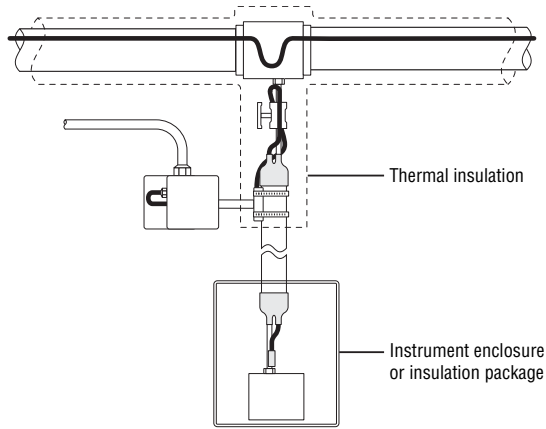


Figure 4 Typical power connection and end termination (Europe)

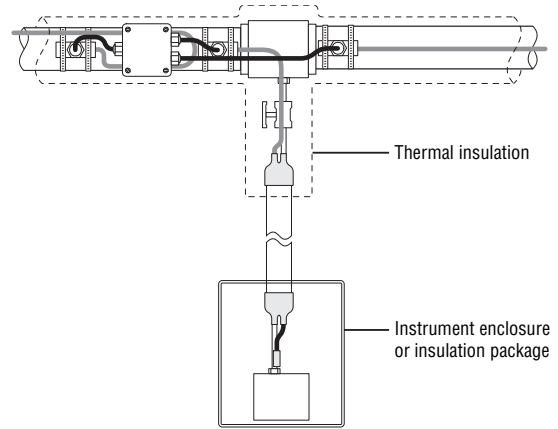


Figure 5 Typical heating cable powered from a tee connection (Europe)

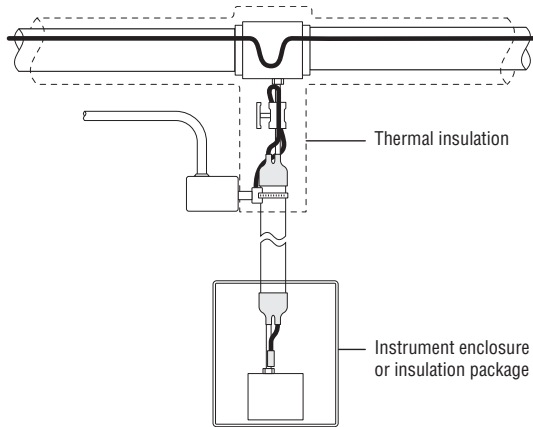


Figure 6 Typical power connection and end termination (North America)

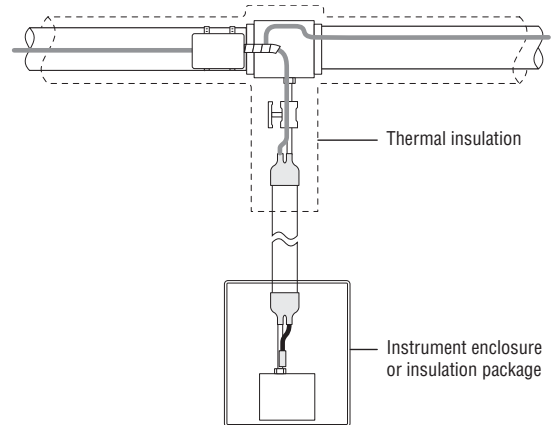


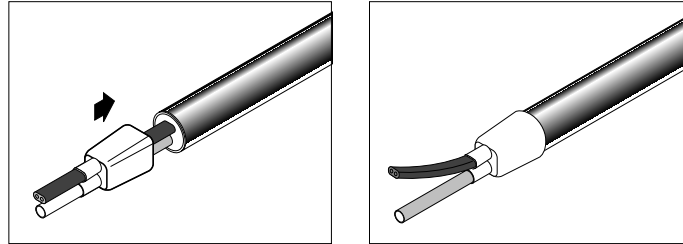
Figure 7 Typical heating cable powered from a tee connection (North America)

IMPORTANT: Do not power the bundle heating cable from a tee connection if a line sensing thermostat is used on the main line.

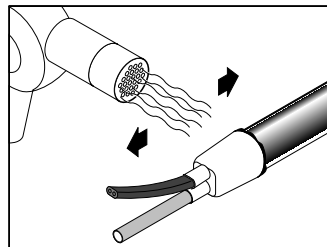
4.7 BUNDLE SEALING

Heat-shrinkable Boot Installation

- Cut back the bundle, leaving the desired length of tubing and cable exposed.
- Use a tubing bender to bend the process tube(s) to the correct instrumentation centers before installing the boot. This will result in a more compact installation.
- Slip the boot over the end of the bundle with one tube or cable in each leg until the bundle seats at the bottom of the boot.

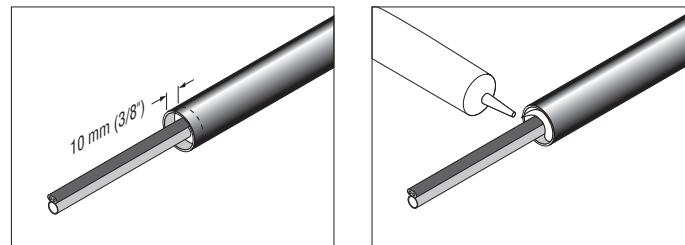


- Use a heat gun to shrink the boot over the bundle, tube(s) and heating cable. Applying heat evenly, move the heat source back and forth over the boot. Once the boot has assumed the shape of the bundle and tubes and an adhesive bead is visible, stop applying heat; further heating will not make the boot shrink more tightly.



RTV Sealant

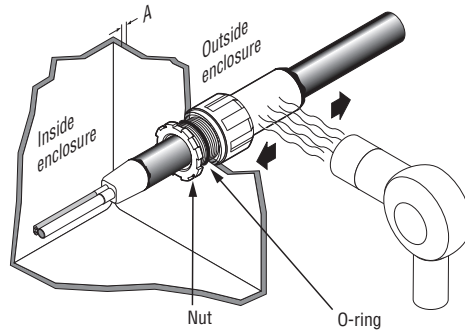
- To seal the bundle with RTV sealant, cut the thermal insulation back under the jacket about 10 mm (3/8 in). It is important to cut the insulation out rather than push it back. Fill the end with sealant, making sure that all exposed insulation is protected.



4.8 Bundle Sealing

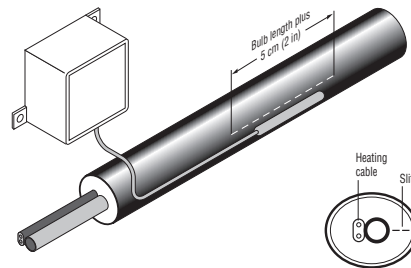
- Place the rigid, externally threaded nut through the enclosure hole so that the flanged end is on the inside of the enclosure.
- Place the O-ring over the threaded end position against the outside of the enclosure.
- Using appropriate spanner wrenches, screw the shrinkable internally threaded nose on to the rigid nut and tighten.
- Shrink the expanded nose by applying heat with a heat gun. Applying the heat evenly, move the heat source back and forth over the nose. Once the boot has assumed the shape of the bundle and the tubes and an adhesive bead is visible, stop applying heat; further heating will not make the nose shrink more tightly.

Model number	Panel (A) maximum thickness	Nose I.D. minimum expanded I.D.	Maximum recovered I.D.	Mounting hole diameter
RTB-CES4	10 mm (0.38 in)	40 mm (1.60 in)	20 mm (0.75 in)	50 mm (2.00 in)
RTB-CES5	20 mm (0.75 in)	70 mm (2.75 in)	35 mm (1.43 in)	75 mm (3.00 in)

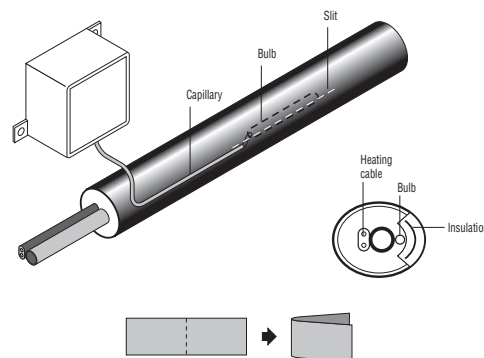


4.9 THERMOSTAT JACKET PATCH

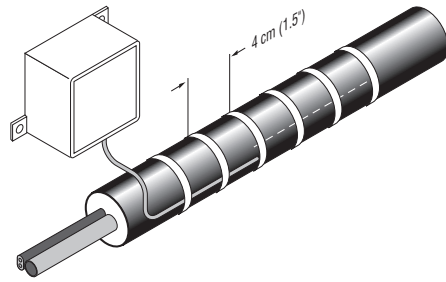
- Locate a suitable mounting location for the thermostat housing. Route the capillary along the bundle, away from heat sources other than the heating cable in the bundle.



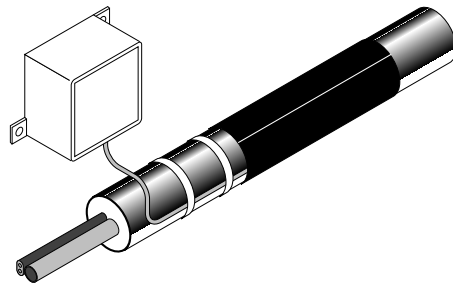
- Locate the heating cable in the bundle. The heating cable can usually be felt through the bundle and thermal insulation. Make a slit lengthwise along the bundle opposite the heating cable, where the capillary bulb will be placed. The slit should be about 50 mm (2 in) longer than the length of the bulb. The slit must go through the thermal insulation and Mylar film.
- Insert the bulb into the bundle in direct contact with the tube. Cut the 50-mm-wide (2-in-wide) thermal insulation into three pieces, each about 25 mm (1 in) shorter than the length of the slit. For each piece, fold the tape along the cut length to make a double layer 25 mm (1 in) wide. Work each of the three pieces into the slit, positioning them on top of the capillary bulb, and under the outer jacket.



-
- Use the fiberglass tape to wrap the bundle at the slit area. Space the tape wrap every 40 mm (1.5 in). Secure the capillary to the bundle with the tape, for a distance of at least 50 mm (2 in) from the end of the slit. Apply a liberal bead of silicone sealant along each side of the capillary.



- Use the black rubber patch supplied with the jacket patch kit to wrap the bundle at the slit. Cut the patch so that it extends 50 mm (2 in) past the slit in both directions. Remove the protective backing and wrap the patch around the slit area, overlapping the edge. Press into place.



- Use a heat gun to shrink the boot over the bundle tubes and tracer. Applying heat evenly, move the heat source back and forth over the boot. Once the boot has assumed the shape of the bundle and tubes, stop applying heat; further heating will not make the boot shrink more tightly. Cut the tubing and cable to the length required for instrument and cable connections.



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