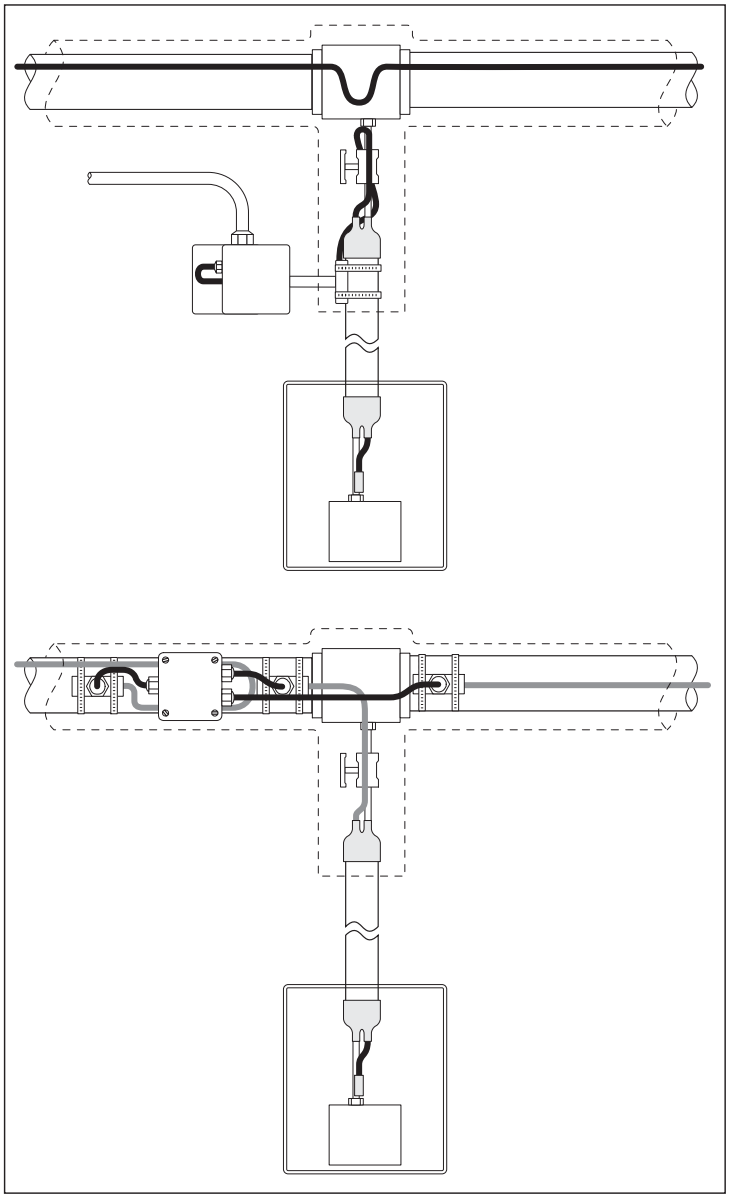
Raychem

RTB Tubing Bundles Installation Guide

Heating Solutions for Instrument and Small-Diameter Process Lines



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⚠ WARNING:

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 Chemelex 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 Chemelex 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 Chemelex-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 Chemelex 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) maybe obtained from Tech support: 800-545-6258, Thermal.TechSupport@Chemelex.com

Contents

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 Chemelex representative or Chemelex directly.

Chemelex

15375 Memorial Drive
Houston, TX 77079
USA
Tel: (800) 545-6258
Email: Thermal.TechSupport@Chemelex.com
chemelex.com

Important: For the Chemelex 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 Part1 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 BTV, XTVR and HTV heating cables that are approved and certified for use in nonhazardous and hazardous locations by many agencies, including FM Approvals, CSA International, SGS, DNV, and ABS. For more details, consult the heating cable data sheets included in the Industrial Heating Product and Design Guide (H56550). Data sheets can be found on the Chemelex web site, chemelex.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

Chemelex provides a total solution for heat tracing instrument and small-diameter process lines. Raychem 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

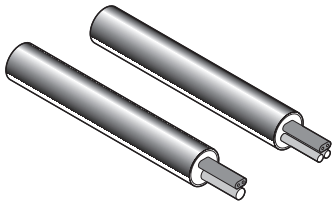
The following literature should be reviewed in order to complete the design and installation of RTB Tubing Bundles systems:

- Product Datasheet (H57179)
- Installation and Maintenance Guide (H57274)
- Design Guides for Insulated Pipes and Tubing (H56882) and Tubing Bundles (H56886)

This literature is available from your representative or by searching for the H number at www.chemelex.com.

2.1 Product Line

Tubing bundles

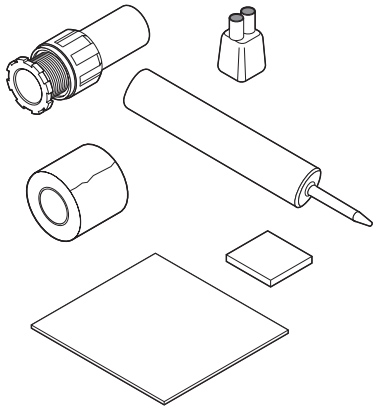


RTB tubing bundles are available in a wide range of tubing and heater options (see bundle ordering options on page 7).

Trace-heating components

RTB tubing bundles use the full range of BTV, XTVR and HTV power connection and end seal kits as applicable for each cable family.

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.

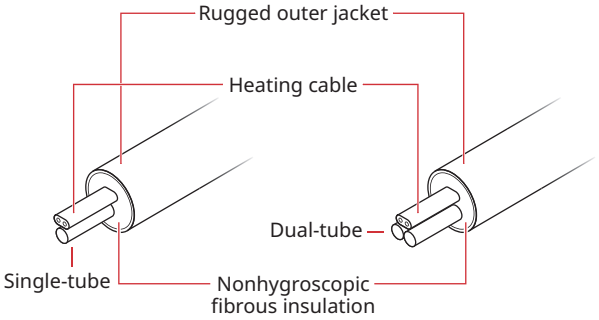


Figure 1 Tubing bundles, single and dual-tube construction

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 thermoplastic outer jacket (Arctic PVC is optional) that provides superior UV resistance and installation capability to –40°C (–40°F).

Contact your Chemelex representative for design assistance for the following applications:

- The desired maintain temperature range or process tube size does not appear in Table 1A or Table 1B
- 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**

Electric Traced heating options
5B1 = 5BTV1-CT
8B1 = 8BTV1-CT
10B1 = 10BTV1-CT
5B2 = 5BTV2-CT
8B2 = 8BTV2-CT
10B2 = 10BTV2-CT
5XR1 = 5XTVR1-CT
10XR1 = 10XTVR1-CT
15XR1 = 15XTVR1-CT
20XR1 = 20XTVR1-CT
3XR2 = 3XTVR2-CT
5XR2 = 5XTVR2-CT
8XR2 = 8XTVR2-CT
10XR2 = 10XTVR2-CT
12XR2 = 12XTVR2-CT
15XR2 = 15XTVR2-CT
20XR2 = 20XTVR2-CT
3H1 = 3HTV1-CT
5H1 = 5HTV1-CT
8H1 = 8HTV1-CT
10H1 = 10HTV1-CT
12H1 = 12HTV1-CT
15H1 = 15HTV1-CT
20H1 = 20HTV1-CT
3H2 = 3HTV2-CT
5H2 = 5HTV2-CT
8H2 = 8HTV2-CT
10H2 = 10HTV2-CT
12H2 = 12HTV2-CT
15H2 = 15HTV2-CT
20H2 = 20HTV2-CT
28H2 = 28HTV2-CT

Steam Traced heating options
LTS = Low-temperature steam
HTS = High-temperature steam

Preinsulated Only
PIO = Preinsulate only

Process tube wall thickness
030 = 0.030 in
032 = 0.032 in
035 = 0.035 in
049 = 0.049 in
062 = 0.062 in
065 = 0.065 in
10 = 1.0 mm
15 = 1.5 mm

Process tube material
S = Seamless 316 SS
W = Welded 316 SS
M = Alloy 400
C = Copper
P = PFA

Process tubing size
1/8 = 1/8 in
1/4 = 1/4 in
3/8 = 3/8 in
1/2 = 1/2 in
3/4 = 3/4 in
6 = 6 mm
8 = 8 mm
10 = 10 mm
12 = 12 mm

Number of process tubes
1 = Single-tube
2 = Dual-tube

* Standard jacket is TPU, for optional Arctic PVC jacket add suffix "C" example RTBC
** Requires the selection of tubing size = XX, tubing material = X, and wall thickness = XXX for both LTS and HTS

Examples:

Electric Traced	RTB-2-1/2-S-049-10XR1
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 artic PVC

Thermal insulation

- Fibrous glass
- Water-soluble chlorides less than 30 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

Tables 1A and 1B show 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 1A or 1B 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 XTVR or HTV 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 1A: Single Tube

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

Code			Tube Size																			
			6 mm or ¼"				8 mm				3/8"				10 mm				12 mm or ½"			
120 vac	240 vac	Heater Type	°C		°F		°C		°F		°C		°F		°C		°F		°C		°F	
5B1	5B2	5BTV1-CT / 5BTV2-CT	20	52	68	126	18	52	64	126	17	52	63	126	17	51	63	124	15	51	59	124
8B1	8B2	8BTV1-CT / 8BTV2-CT	32	58	90	136	31	58	88	136	30	57	86	135	29	57	84	135	27	56	81	133
10B1	10B2	10BTV1-CT / 10BTV2-CT	35	60	95	140	34	59	93	138	33	59	91	138	32	58	90	136	30	58	86	136
--	3XR2	3XTVR2-CT	16	85	61	185	14	83	57	181	12	81	54	178	11	81	52	178	8	78	46	172
5XR1	5XR2	5XTVR1-CT / 5XTVR2-CT	36	95	97	203	33	92	91	198	31	91	88	196	30	90	86	194	27	87	81	189
--	8XR2	8XTVR2-CT	59	109	138	228	56	106	133	223	53	104	127	219	52	103	126	217	48	100	118	212
10XR1	10XR2	10TVR1-CT / 10TVR2-CT	71	114	160	237	67	111	153	232	64	109	147	228	63	108	145	226	59	105	138	221
--	12XR2	12TVR2-CT	81	120	178	248	78	117	172	243	75	115	167	239	74	115	165	239	69	111	156	232
15XR1	15XR2	15TVR1-CT / 15TVR2-CT	94	132	201	270	91	130	196	266	88	127	190	261	87	127	189	261	82	123	180	253
20XR1	20XR2	20TVR1-CT / 20TVR2-CT	112	143	234	289	108	140	226	284	105	138	221	280	104	138	219	280	99	134	210	273
3H1	3H2	3HTV1-CT / 3HTV2-CT	13	83	55	181	11	81	52	178	9	79	48	174	8	79	46	174	6	76	43	169
5H1	5H2	5HTV1-CT / 5HTV2-CT	38	99	100	210	35	97	95	207	33	94	91	201	32	94	90	201	28	91	82	196
8H1	8H2	8HTV1-CT / 8HTV2-CT	54	105	129	221	51	103	124	217	48	101	118	214	47	100	117	212	42	97	108	207
10H1	10H2	10HTV1-CT / 10HTV2-CT	75	120	167	248	71	117	160	243	68	115	154	239	67	114	153	237	62	111	144	232
12H1	12H2	12HTV1-CT / 12HTV2-CT	83	124	181	255	80	122	176	252	77	121	171	250	75	118	167	244	70	117	158	243
15H1	15H2	15HTV1-CT / 15HTV2-CT	96	134	205	273	93	131	199	268	90	129	194	264	89	128	192	262	83	125	181	257
20H1	20H2	20HTV1-CT / 20HTV2-CT	117	150	243	302	114	147	237	297	110	145	230	293	109	144	228	291	104	140	219	284
--	28H2	28HTV2-CT	144	170	291	338	141	168	286	334	137	166	279	331	136	165	277	329	131	161	268	322

Table 1B: Dual Tube

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

Code			Tube Size																			
			6 mm or ¼"				8 mm				3/8"				10 mm				12 mm or ½"			
120 vac	240 vac	Heater Type	°C		°F		°C		°F		°C		°F		°C		°F		°C		°F	
5B1	5B2	5BTV1-CT / 5BTV2-CT	21	53	70	127	19	52	66	126	18	52	64	126	17	51	63	124	15	51	59	124
8B1	8B2	8BTV1-CT / 8BTV2-CT	34	59	93	138	32	58	90	136	31	57	88	135	30	57	86	135	28	56	82	133
10B1	10B2	10BTV1-CT / 10BTV2-CT	37	60	99	140	35	59	95	138	33	59	91	138	33	59	91	138	31	58	88	136
--	3XR2	3XTVR2-CT	19	87	66	189	15	84	59	183	13	82	55	180	12	81	54	178	8	78	46	172
5XR1	5XR2	5XTVR1-CT / 5XTVR2-CT	40	97	104	207	36	94	97	201	33	91	91	196	32	91	90	196	27	87	81	189
--	8XR2	8XTVR2-CT	64	111	147	232	59	108	138	226	55	105	131	221	54	104	129	219	48	100	118	212
10XR1	10XR2	10TVR1-CT / 10TVR2-CT	75	116	167	241	70	113	158	235	66	110	151	230	65	109	149	228	59	105	138	221
--	12XR2	12TVR2-CT	86	123	187	253	81	119	178	246	77	116	171	241	75	115	167	239	69	111	156	232
15XR1	15XR2	15TVR1-CT / 15TVR2-CT	99	135	210	275	94	131	201	268	90	129	194	264	89	128	192	262	82	123	180	253
20XR1	20XR2	20TVR1-CT / 20TVR2-CT	116	145	241	293	111	142	232	288	107	139	225	282	106	138	223	280	100	134	212	273
3H1	3H2	3HTV1-CT / 3HTV2-CT	16	85	61	185	13	82	55	180	10	80	50	176	9	79	48	174	6	76	43	169
5H1	5H2	5HTV1-CT / 5HTV2-CT	42	102	108	216	38	98	100	208	34	95	93	203	33	95	91	203	28	90	82	194
8H1	8H2	8HTV1-CT / 8HTV2-CT	58	108	136	226	54	105	129	221	50	102	122	216	48	101	118	214	43	96	109	205
10H1	10H2	10HTV1-CT / 10HTV2-CT	79	123	174	253	74	119	165	246	70	116	158	241	68	115	154	239	62	110	144	230
12H1	12H2	12HTV1-CT / 12HTV2-CT	89	129	192	264	84	127	183	261	81	124	178	255	78	121	172	250	73	115	163	239
15H1	15H2	15HTV1-CT / 15HTV2-CT	101	137	214	279	96	133	205	271	92	130	198	266	90	129	194	264	84	125	183	257
20H1	20H2	20HTV1-CT / 20HTV2-CT	122	153	252	307	117	149	243	300	113	146	235	295	111	145	232	293	104	140	219	284
--	28H2	28HTV2-CT	149	173	300	343	144	170	291	338	140	167	284	333	138	166	280	331	132	161	270	322

Contact your Chemelex representative for design assistance for the following applications:

- The desired maintain temperature range or process tube size does not appear in Table 1A or Table 1B.
- 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

Table shows the maximum bundle length that may be powered from different sized 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 Chemelex 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 (ft/m) vs. Circuit Breaker Trip Rating (AMPS)

Raychem Heating cable	Ambient temperature at start-up		120-volt cable										240-volt cable									
	°F	°C	15 A		20 A		30 A		40 A		50 A		15 A		20 A		30 A		40 A		50 A	
			ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m
5BTV	50	10	230	70	270	82	270	82	270	82	†	†	460	140	540	165	540	165	540	165	†	†
	0	–18	140	43	190	58	270	82	270	82	†	†	285	87	380	116	540	165	540	165	†	†
	–20	–29	125	38	165	50	250	76	270	82	†	†	250	76	330	101	500	152	540	165	†	†
	–40	–40	110	34	145	44	220	67	270	82	†	†	220	67	295	90	440	134	540	165	†	†
8BTV	50	10	150	46	200	61	210	64	210	64	†	†	300	91	400	122	420	128	420	128	†	†
	0	–18	100	30	130	40	200	61	210	64	†	†	200	61	265	81	400	122	420	128	†	†
	–20	–29	85	26	115	35	175	53	210	64	†	†	175	53	235	72	350	107	420	128	†	†
	–40	–40	80	24	105	32	155	47	210	64	†	†	155	47	210	64	315	96	420	128	†	†
10BTV	50	10	120	37	160	49	180	55	180	55	†	†	240	73	315	96	360	110	360	110	†	†
	0	–18	80	24	110	34	160	49	180	55	†	†	160	49	215	66	325	99	360	110	†	†
	–20	–29	70	21	95	29	140	43	180	55	†	†	145	44	190	58	285	87	360	110	†	†
	–40	–40	65	20	85	26	125	38	170	52	†	†	125	38	170	52	255	78	340	104	†	†
3XTVR2-CT	50	10	N/A										480	146	640	195	960	293	979	298	979	298
	0	–18											415	126	553	169	830	253	979	298	979	298
	–20	–29											394	120	526	160	789	240	979	298	979	298
	–40	–40											376	115	501	153	751	229	979	298	979	298
5XTVR1-CT 5XTVR2-CT	50	10	180	55	240	73	360	110	373	114	373	114	360	110	480	146	720	219	744	227	744	227
	0	–18	155	47	207	63	310	94	373	114	373	114	311	95	414	126	621	189	744	227	744	227
	–20	–29	147	45	196	60	294	90	373	114	373	114	295	90	393	120	589	180	744	227	744	227
	–40	–40	139	42	186	57	279	85	372	113	373	114	280	85	374	114	561	171	744	227	744	227
8XTVR2-CT	50	10	N/A										261	80	348	106	522	159	578	176	578	176
	0	–18											227	69	302	92	453	138	578	176	578	176
	–20	–29											216	66	287	87	431	131	575	175	578	176
	–40	–40											205	62	274	84	411	125	548	167	578	176
10XTVR1-CT 10XTVR2-CT	50	10	111		148		221		256		256		221	67	295	90	443	135	509	155	509	155
	0	–18	96		128		192		256		256		192	59	256	78	383	117	509	155	509	155
	–20	–29	91		121		182		242		256		182	55	243	74	364	111	485	148	509	155
	–40	–40	87		115		173		231		256		173	53	231	70	346	105	462	141	509	155
12XTVR2-CT	50	10	N/A										192	59	256	78	384	117	456	139	456	139
	0	–18											166	51	222	68	332	101	443	135	456	139
	–20	–29											158	48	211	64	316	96	421	128	456	139
	–40	–40											150	46	200	61	301	92	401	122	456	139
15XTVR1-CT 15XTVR2-CT	50	10	72	22	96	29	144	44	193	59	200	61	144	44	193	59	289	88	385	117	407	124
	0	–18	63	19	84	26	127	39	169	52	200	61	125	38	167	51	251	77	334	102	407	124
	–20	–29	60	18	81	25	121	37	161	49	195	59	119	36	159	48	238	73	318	97	392	119
	–40	–40	58	18	77	23	115	35	154	47	189	58	114	35	151	46	227	69	302	92	378	115

Raychem Heating cable	Ambient temperature at start-up		120-volt cable										240-volt cable									
	°F	°C	15 A		20 A		30 A		40 A		50 A		15 A		20 A		30 A		40 A		50 A	
			ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m
20XTVR1-CT	50	10	58	18	77	23	115	35	154	47	169	52	115	35	154	47	230	70	307	94	339	103
	0	–18	51	16	68	21	102	31	135	41	151	46	100	30	134	41	200	61	267	81	301	92
20XTVR2-CT	–20	–29	49	15	65	20	97	30	130	40	146	45	95	29	127	39	191	58	255	78	289	88
	–40	–40	47	14	62	19	93	28	124	38	141	43	91	28	121	37	182	55	243	74	279	85
3HTV	50	10	241	73	322	98	482	147	485	148	485	148	482	147	643	196	964	294	978	298	978	298
	0	–18	213	65	284	87	426	130	485	148	485	148	415	126	554	169	831	253	978	298	978	298
	–20	–29	203	62	271	83	407	124	485	148	485	148	395	120	527	161	791	241	978	298	978	298
	–40	–40	195	59	260	79	390	119	485	148	485	148	378	115	504	154	756	230	978	298	978	298
5HTV	50	10	180	55	240	73	360	110	372	113	372	113	360	110	480	146	720	219	751	229	751	229
	0	–18	157	48	209	64	314	96	372	113	372	113	314	96	418	127	627	191	751	229	751	229
	–20	–29	151	46	201	61	302	92	372	113	372	113	299	91	398	121	598	182	751	229	751	229
	–40	–40	145	44	194	59	291	89	372	113	372	113	285	87	380	116	571	174	751	229	751	229
8HTV	50	10	131	40	174	53	261	80	289	88	289	88	261	80	348	106	523	159	581	177	581	177
	0	–18	113	34	151	46	227	69	289	88	289	88	229	70	305	93	457	139	581	177	581	177
	–20	–29	108	33	144	44	216	66	288	88	289	88	218	66	291	89	437	133	581	177	581	177
	–40	–40	103	31	138	42	207	63	276	84	289	88	209	64	278	85	418	127	557	170	581	177
10HTV	50	10	111	34	148	45	221	67	254	77	254	77	221	67	296	90	443	135	508	155	508	155
	0	–18	97	30	130	40	195	59	254	77	254	77	196	60	261	80	392	119	508	155	508	155
	–20	–29	93	28	124	38	185	56	247	75	254	77	187	57	249	76	374	114	498	152	508	155
	–40	–40	89	27	118	36	177	54	236	72	254	77	178	54	238	73	357	109	476	145	508	155
12HTV	50	10	96	29	128	39	192	59	226	69	226	69	192	59	256	78	384	117	462	141	462	141
	0	–18	85	26	114	35	171	52	226	69	226	69	167	51	223	68	335	102	446	136	462	141
	–20	–29	81	25	109	33	163	50	217	66	226	69	160	49	213	65	319	97	426	130	462	141
	–40	–40	78	24	104	32	156	48	207	63	226	69	153	47	204	62	305	93	407	124	462	141
15HTV	50	10	75	23	101	31	151	46	198	60	198	60	151	46	202	62	302	92	400	122	400	122
	0	–18	67	20	89	27	133	41	177	54	198	60	132	40	176	54	264	80	352	107	400	122
	–20	–29	63	19	84	26	127	39	169	52	198	60	126	38	168	51	252	77	336	102	397	121
	–40	–40	60	18	80	24	121	37	161	49	190	58	120	37	160	49	240	73	320	98	381	116
20HTV	50	10	60	18	80	24	120	37	160	49	169	52	115	35	154	47	230	70	307	94	330	101
	0	–18	53	16	71	22	106	32	141	43	155	47	101	31	135	41	203	62	271	83	294	90
	–20	–29	51	16	68	21	101	31	135	41	149	45	97	30	129	39	194	59	259	79	283	86
	–40	–40	49	15	65	20	97	30	130	40	144	44	93	28	124	38	186	57	248	76	273	83
28HTV2-CT	50	10	N/A										86	26	114	35	172	52	229	70	231	70
	0	–18											76	23	101	31	152	46	202	62	208	63
	–20	–29											73	22	97	30	145	44	194	59	200	61
	–40	–40											70	21	93	28	139	42	185	56	193	59

† Not permitted, for these design conditions, use a smaller circuit breaker or alternate heating cable.
For a fully optimized design, use TraceCalc Pro design software or contact your Chemelex representative.
Note: Chemelex and the U.S. National Electrical Code require both ground-fault protection of equipment and agrounded metallic covering (usually braid) on all heating cables. All Raychem products meet the metallic covering requirement.

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, XTVR, HTV heating cable, as applicable. Typical component systems are shown below. Consult the guide for specific component selection information.

- Use RTB Design Guide (H56886) for components selection

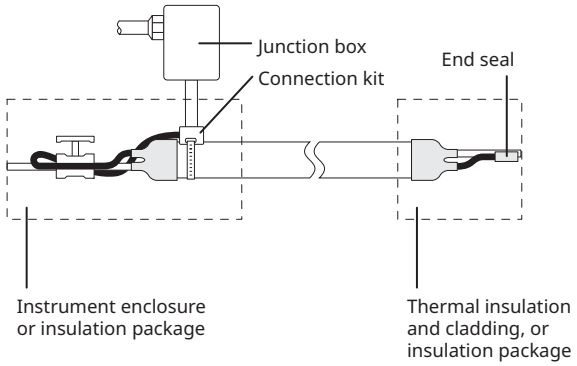


Figure 2 Typical North American power connection and end seal

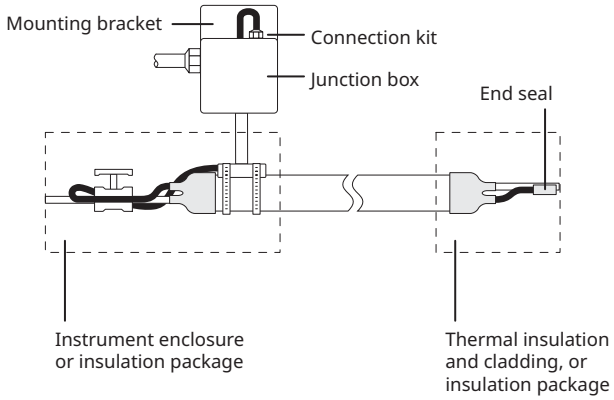
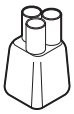


Figure 3 Typical North American power connection and end seal

3.4 Select Bundle Accessories


RTBK-B2A


RTBK-B3A

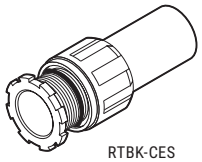
Heat-shrinkable boots (RTBK-B) are used for sealing bundle ends. The boots are designed to provide a weatherproof seal at the end of the tubing bundles. These boots may be used on all electric-traced bundles. For steam-traced bundles, use silicone sealant RTB-TPKSK-10-SEALANT.

Use RTBK-B1A for preinsulate only

Use RTBK-B2A for single tube bundles

Use RTBK-B3A for dual tube bundles

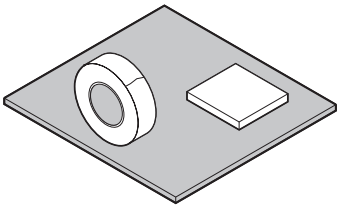
Important: Although RTB tubing bundles use a non-hygroscopic thermal insulation, all bundle ends and jacket penetrations must be sealed to keep the insulation from getting wet. Wet insulation will not maintain the designed pipe temperature.


RTBK-CES

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.

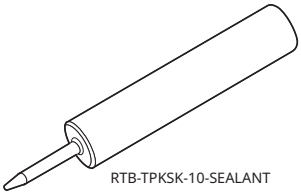
Tubing size	Single-tube bundle	Dual-tube bundle
¼–⅜" (6–10 mm)	RTBK-CES4	RTBK-CES4
½" (12 mm)	RTBK-CES4	RTBK-CES5

Jacket patch kits (RTB-TPKJP-1-PATCH-KIT) 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-SEALANT) 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.



RTB-TPKSK-10-SEALANT

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, XTVR or HTV heating cable, as applicable.

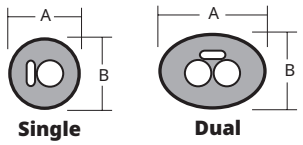
All bundle ends must be temporarily sealed from moisture ingress during installation.

4.2 Weights and Dimensions

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

Table 3: Electric bundle weights and dimensions

	Nominal weight		Nominal dmiensions			
			A		B	
	kgm/	(lb /ft)	cm	(in)	cm	(in)
S nigprocessel ¼" tube	0.45	(0.3)	2.8	(1.1)	2.5	(1.0)
S nigprocessel ⅜ " tube	0.60	(0.4)	3.3	(1.3)	2.5	(1.0)
S nigprocessel ½ "tube	0.74	(0.5)	3.6	(1.4)	2.8	(1.1)
Duprocessal ¼" tubes	0.60	(0.4)	3.3	(1.3)	2.8	(1.1)
Duprocessal ⅜" tubes	0.89	(0.6)	3.8	(1.5)	3.0	(1.2)
Duprocessal ½" tubes	1.19	(0.8)	4.3	(1.7)	3.6	(1.4)

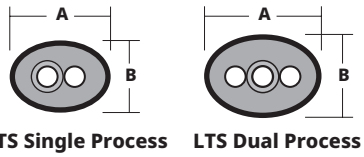


Single Dual

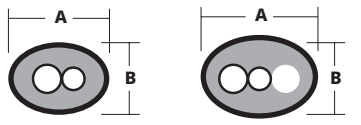
Mnimium bending radius 20 cm (8 in)
Maximum support centers-ft. Horizontal 2 m (6.5 ft) Vertical 4 m (13 ft)

Table 4: Steam bundle weights and dimensions

	Nominal weight		Nominal dmiensions			
			A		B	
	kgm/	(lb /ft)	cm	(in)	cm	(in)
LTS-One ⅜ "Process with ⅜" Tracer	0 .5	(0 .74)	4 .1	(1 .6)	2 .8	(1 .1)
LTS-One ½ "Process with ⅜" Tracer	0 .6	(0 .89)	4 .8	(1 .9)	3 .0	(1 .2)
LTS-One ½ "P rocessw ith ½ " Tracer	0 .7	(1 .04)	4 .8	(1 .9)	3 .0	(1 .2)
LTS-Two ⅜ "Process with ⅜" Tracer	0 .6	(0 .89)	5 .8	(2 .3)	3 .0	(1 .2)
LTS-Two ½ "Process with ⅜" Tracer	0 .8	(1 .19)	6 .6	(2 .6)	3 .3	(1 .3)
LTS-Two ½ "P rocessw ith ½ " Tracer	0 .9	(1 .34)	6 .6	(2 .6)	3 .3	(1 .3)
HTS-One ⅜ "Process with ⅜" Tracer	0 .5	(0 .74)	3 .8	(1 .5)	3 .0	(1 .2)
HTS-One ½ "Process with ⅜" Tracer	0 .6	(0 .89)	4 .1	(1 .6)	3 .0	(1 .2)
HTS-One ½ "P rocessw ith ½ " Tracer	0 .7	(1 .04)	4 .3	(1 .7)	3 .0	(1 .2)
HTS-Two ⅜ "Process with ⅜" Tracer	0 .6	(0 .89)	5 .1	(2 .0)	3 .0	(1 .2)
HTS-Two ½ "P rocessw ith ½ " Tracer	0 .8	(1 .19)	5 .6	(2 .2)	3 .0	(1 .2)



LTS Single Process LTS Dual Process

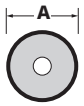


HTS Single Process HTS Dual Process

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

Table 5: 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 ¼” process lin	20 (8)	1.8 (6)	4.6 (15)	0.30 (0.2)	2.5 (1.0)
One ⅜” process lin	20 (8)	1.8 (6)	4.6 (15)	0.45 (0.3)	3.2 (1.2)
One ½” 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 (½-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: 305 mm (12 in)

Maximum support centers: Horizontal = 2 m (6 ft), Vertical = 5 m (15 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 (½ 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 (½ in) between bundles.

Fig. A

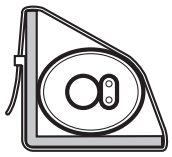
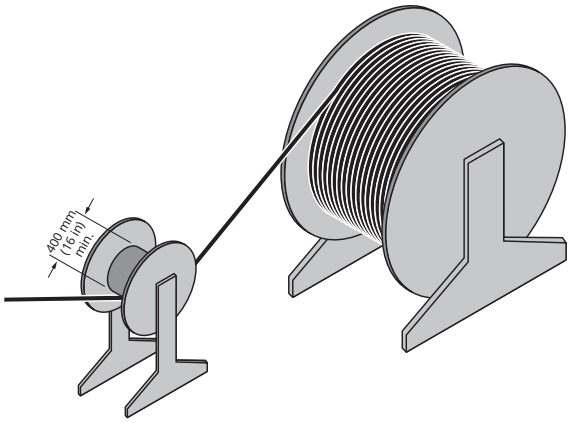


Fig. B

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 305 mm (12 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 and 5 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

Figure 5 - Heating cable powered from a tee connection

Important Installation Notes:

- Electrically heated RTB Tubing Bundles must be installed with power connection and end seal kits specifically approved for use with BTV, XTVR and HTV heating cable, as applicable.
- 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.

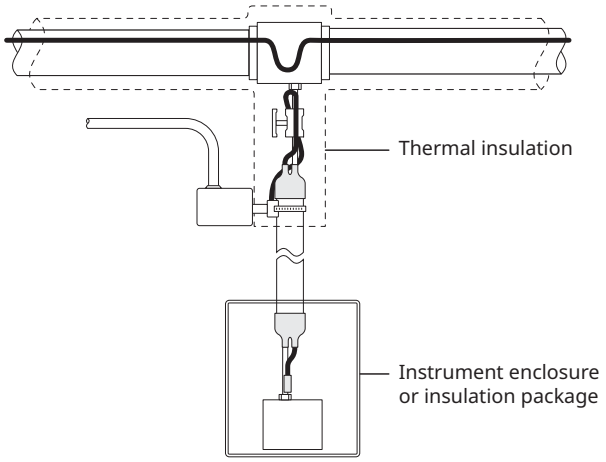


Figure 4 Typical power connection and end termination

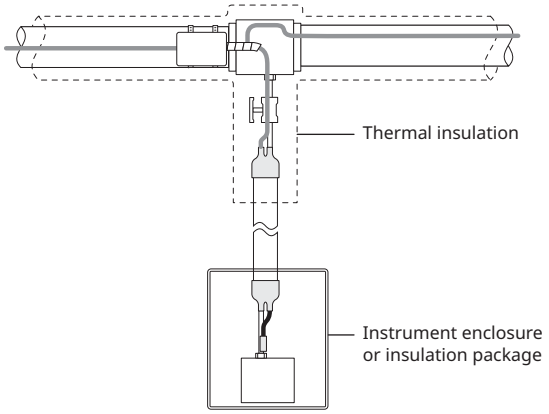


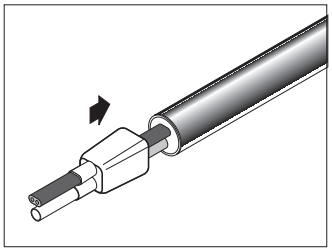
Figure 5 Typical heating cable powered from a tee connection

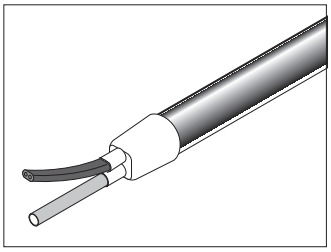
IMPORTANT: Do not power the bundle heating cable from a tee connection if a line sensing thermostat is used on the main line.

4.7 Bundle Sealing

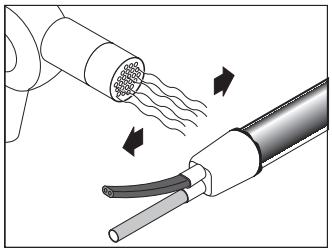
Heat-shrinkable Boot Installation

- 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.



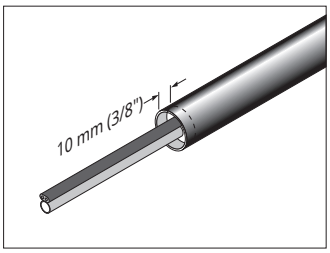


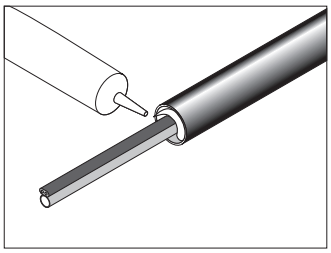
- Use a heat gun to shrink the boot over the bundle, tube(s) and heating cable. Applying heat evenly, move the heat source back and forth over the boot. Once the boot has assumed the shape of the bundle and tubes and an adhesive bead is visible, stop applying heat; further heating will not make the boot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



RTV Sealant

- To seal the bundle with RTV sealant, cut the thermal insulation back under the jacket about 10 mm (⅜ 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.

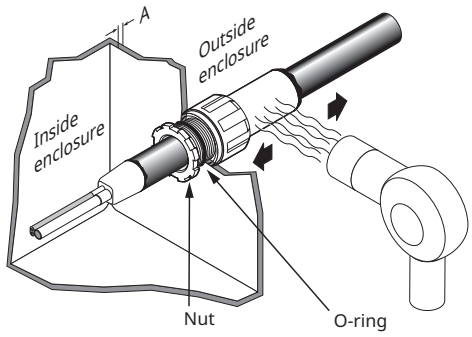




4.8 Bundle Sealing

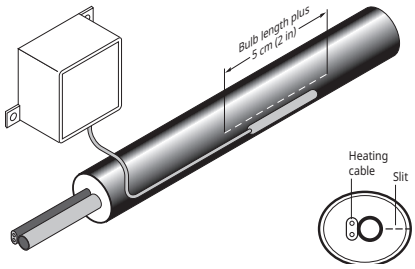
- Place the rigid, externally threaded nut through the enclosure hole so that the flanged end is on the inside of the enclosure.
- Place the O-ring over the threaded end position against the outside of the enclosure.
- Using appropriate spanner wrenches, screw the shrinkable internally threaded nose 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)

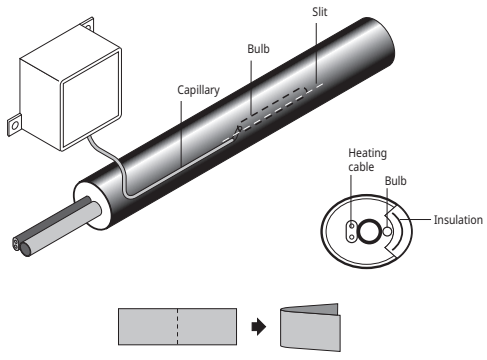


4.9 Thermostat Jacket Patch

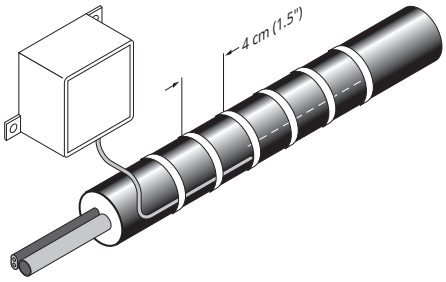
- Locate a suitable mounting location for the thermostat housing. Route the capillary along the bundle, away from heat sources other than the heating cable in the bundle.



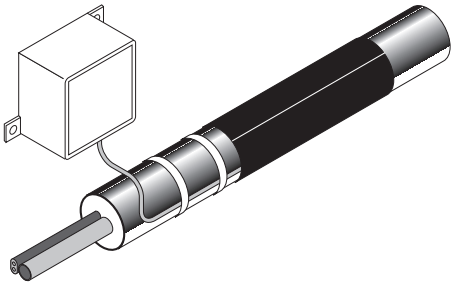
- Locate the heating cable in the bundle. The heating cable can usually be felt through the bundle and thermal insulation. Make a slit lengthwise along the bundle opposite the heating cable, where the capillary bulb will be placed. The slit should be about 50 mm (2 in) longer than the length of the bulb. 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 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, 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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