RTB Tubing Bundles

Raychem

This section provides an overview and general design guidelines for Raychem tubing bundle heat-tracing systems. For complete design assistance, contact your Chemelex representative or visit our website at chemelex.com.

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INTRODUCTION

Chemelex provides a total solution for heat tracing instrument and small-diameter process lines. Raychem brand RTB tubing bundles are a pre-traced and pre-insulated 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

SYSTEM OVERVIEW

An RTB system consists of pre-traced and pre-insulated 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 needs.

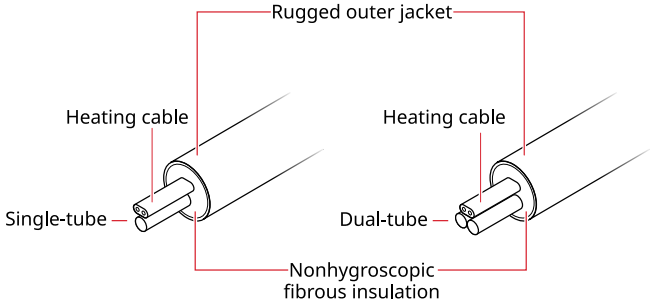


Fig. 1 Tubing bundles, single- and dual-tube construction

Raychem RTBs 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. The RTB's unique parallel construction allows for a tight bending radius (down to 6 inch) and eliminates possible tube kinking. 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 3A,3B or Table 4
- The ambient temperature range is different than –30°C to 38°C (–20°F to 100°F)
- Supply voltages of 208 Vac or 277 Vac are used
- Temperature control is critical

Approvals and Certifications

Raychem tubing bundle heat-tracing systems are approved and certified for use in nonhazardous and hazardous locations by many agencies. Please refer to the technical datasheets for more details.

PRODUCT SELECTION

Overview

The product selection process involves three basic steps:

1. Gather the necessary information.
2. Select the tube type.
3. Select the product / elements based for your application.

Before beginning, take a moment to understand the structure underlying tubing bundle catalog numbers. You will refer to this numbering convention throughout the product selection process. Based on your application: Electric Traced, Steam Traced, or Pre-insulated Only (PIO), your goal is to determine the tubing bundle catalog number for the product that best suits your needs.

Sample applications will be followed throughout the product selection process.

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

Fig. 2 Tubing bundle catalog number elements

Product Selection
1. Gather information
2. Select tube type
3. Select the product / elements

Step 1. Gather the necessary information

First, determine the application that best suits your project, and then go to the respective section that describes the information you will need to gather for that application.

The applications are:

- Electric Traced Lines: For freeze protection and temperature maintenance.
- Steam Traced Lines: For freeze protection and temperature maintenance.
- Pre-insulated Only (PIO) Lines: For steam distribution supply lines, condensate return and personnel protection.

For Electric Traced Lines

To select the tubing bundle for electric traces lines, gather and record the following information:

- Required number of process tubes (one or two)
- Required process tubing size (refer to Table 1)
- Required process tube material _____
- Required process tube wall thickness _____
- Desired maintain temperature range (for selection of the heating cable) _____
- Service voltage for the heating cable _____
- Process operating temperature (for selection of the appropriate materials and heating cable) _____
- Maximum exposure temperature (for selection of the appropriate materials and heating cable) _____
- Temperature class (T-rating) for applications in hazardous locations (for heating cable selection) _____
- Jacket material (see RTB Electric Traced Bundles data sheet [H57179] for options) _____

Example: Electric Traced sample application

Number of process tubes	2
Process tubing size	½ inch
Process tube material	Stainless steel 316 (seamless)
Process tube wall thickness	0.049 inch
Maintain temperature	10°C (50°F)
Service voltage for heating cable	120 V
Process operating temperature	38°C (100°F)
Maximum exposure temperature	65°C (150°F)
T-rating	T6
Jacket material	Standard TPU

For Steam Traced Lines

To select the tubing bundle for steam traced lines, gather and record the following information:

- Required number of process tubes (one or two) _____
- Required process tubing size (refer to Table 1)
- Required process tube material _____
- Required process tube wall thickness _____
- Desired maintain temperature range _____
- Steam pressure _____
- Steam tracing tubing size, material and wall thickness _____
- Process operating temperature _____
- Maximum exposure temperature _____
- Jacket material (see RTB Electric Traced Bundles data sheet [H57179] for options) _____

Example: Steam Traced sample application

Number of process tubes	2
Process tubing size	½ inch
Process tube material	Stainless steel 316 (seamless)
Process tube wall thickness	0.049 inch
Maintain temperature	10°C (50°F)
Steam pressure	2 Bar (15 psig)
Steam tracing tubing size	⅜ inch
Steam tracing tubing material	Copper
Steam tracing wall thickness	0.032 in
Process operating temperature	38°C (100°F)
Maximum exposure temperature	65°C (150°F)
Jacket material	Standard TPU

For Pre-insulated ONLY (PIO) Lines

To select the tubing bundles for pre-insulated only (PIO) lines, gather and record the following information:

- Required number of process tubes (only one available) _____
- Required process tubing size (refer to Table 1)
- Required process tube material _____
- Required process tube wall thickness _____
- Process operating temperature _____
- Maximum exposure temperature _____
- Jacket material (see RTB Electric Traced Bundles data sheet [H57179] for options) _____

Example: Pre-insulated Only sample application

Number of process tubes	1
Process tubing size	½ inch
Process tube material	Stainless steel 316 (seamless)
Process tube wall thickness	0.049 inch
Process operating temperature	38°C (100°F)
Maximum exposure temperature	65°C (150°F)
Jacket material	Optional Artic PVC

Product Selection
1. Gather information
2. Select tube type
3. Select the product / elements

Step 2. Select the tube type

For Electric, Steam and Pre-insulated ONLY (PIO) Lines

The table that follows lists possible RTB combinations of tube size and wall materials. For other configurations, contact your Chemelex representative.

TABLE 1 RAYCHEM TUBING BUNDLE OPTIONS

	Tubing size (nominal)							
	1/8"	1/4"	3/8"	1/2"	6 mm	8 mm	10 mm	12 mm
Tubing wall material and thickness								
Stainless steel 316 (seamless)								
0.035"	•	•	•	•				
0.049"				•				
0.065"				•				
1.0 mm					•	•	•	•
1.5 mm								•
Stainless steel 316 (welded)								
0.035"		•	•	•				
Alloy 600 (seamless)								
0.035"		•	•					
0.049"				•				
Copper								
0.030"		•						
0.032"			•					
0.049"				•				
1.0 mm					•	•	•	•
PFA Teflon								
0.030"		•	•					
0.060"				•				
1.0 mm					•	•		

Example: Electric Traced tube number / size / material selection

Number of process tubes	2 (from Step 1)
Process tubing size	½ inch (from Step 1)
Process tube material	Stainless steel 316 (seamless) (from Step 1)
Process tube wall thickness	0.049 inch (from Step 1)
Catalog number	RTB-2-1/2-S-049-XXXX

Selection of the heating cable will fill in the one element missing from the catalog number of your Raychem brand RTB tubing bundle.

Product Selection
1. Gather information
2. Select tube type
3. Select the product / elements

Step 3. Select the product / elements for your application

For Electric Traced Lines

Raychem RTB Electric Traced tubing bundles are available with BTV, XTVR and HTV heating cables. Use BTV heating cables for maintain temperatures up to 32°C (90°F). For higher maintain temperatures or exposure temperatures above 85°C (185°F), use XTVR or HTV heating cables. Use Table 2 to identify the cable family that meets your maximum continuous and intermittent temperatures. For maintain and exposure temperatures that exceed the maximum for BTV, XTVR and HTV, contact your Chemelex representative.

For more detailed heating cable information, please refer to the Self-Regulating Cables design guide (H56882) of the Industrial Heat Tracing Solutions Products & Services Catalogue (H56550).

TABLE 2 OVERVIEW OF BTV, XTVR AND HTV HEATING CABLE CHARACTERISTICS

Code	Volts	W/ft	W/m	Max continuous exposure* and maintain	Max intermittent exposure**	T-rating	Raychem heating cable***
5B1	120	5	16	65°C (150°F)	85°C (185°F)	T6	5BTV1-CT
8B1	120	8	26	65°C (150°F)	85°C (185°F)	T6	8BTV1-CT
10B1	120	10	33	65°C (150°F)	85°C (185°F)	T6	10BTV1-CT
5B2	240	5	16	65°C (150°F)	85°C (185°F)	T6	5BTV2-CT
8B2	240	8	26	65°C (150°F)	85°C (185°F)	T6	8BTV2-CT
10B2	240	10	33	65°C (150°F)	85°C (185°F)	T6	10BTV2-CT
5XR1	120	5	16	150°C (302°F)	250°C (482°F)	T3A	5XTVR1-CT
10XR1	120	10	33	150°C (302°F)	250°C (482°F)	T3	10XTVR1-CT
15XR1	120	15	49	150°C (302°F)	250°C (482°F)	T2D	15XTVR1-CT
20XR1	120	20	66	150°C (302°F)	250°C (482°F)	T2D	20XTVR1-CT
3XR2	240	3	10	150°C (302°F)	250°C (482°F)	T3A	3XTVR2-CT
5XR2	240	5	16	150°C (302°F)	250°C (482°F)	T3A	5XTVR2-CT
8XR2	240	8	26	150°C (302°F)	250°C (482°F)	T3A	8XTVR2-CT
10XR2	240	10	33	150°C (302°F)	250°C (482°F)	T3	10XTVR2-CT
12XR2	240	12	39	150°C (302°F)	250°C (482°F)	T3	12XTVR2-CT
15XR2	240	15	49	150°C (302°F)	250°C (482°F)	T3	15XTVR2-CT
20XR2	240	20	66	150°C (302°F)	250°C (482°F)	T3 (240V)	20XTVR2-CT
3H1	120	3	10	205°C (400°F)	260°C (500°F)	T3A	3HTV1-CT
5H1	120	5	16	205°C (400°F)	260°C (500°F)	T3	5HTV1-CT
8H1	120	8	26	205°C (400°F)	260°C (500°F)	T3	8HTV1-CT
10H1	120	10	33	205°C (400°F)	260°C (500°F)	T3	10HTV1-CT
12H1	120	12	39	205°C (400°F)	260°C (500°F)	T3	12HTV1-CT
15H1	120	15	49	205°C (400°F)	260°C (500°F)	T3	15HTV1-CT
20H1	120	20	66	205°C (400°F)	260°C (500°F)	T2D	20HTV1-CT
3H2	240	3	10	205°C (400°F)	260°C (500°F)	T3A	3HTV2-CT
5H2	240	5	16	205°C (400°F)	260°C (500°F)	T3	5HTV2-CT
8H2	240	8	26	205°C (400°F)	260°C (500°F)	T3	8HTV2-CT
10H2	240	10	33	205°C (400°F)	260°C (500°F)	T3	10HTV2-CT
12H2	240	12	39	205°C (400°F)	260°C (500°F)	T3	12HTV2-CT
15H2	240	15	49	205°C (400°F)	260°C (500°F)	T3	15HTV2-CT
20H2	240	28	92	205°C (400°F)	260°C (500°F)	T2B	28HTV2-CT

* Heating cable power on (= maximum maintain temperature)

** BTV - 1,000 hours, XTVR/HTV - 2000 hours cumulative power on or off

*** Heating cable details – For additional information, refer to datasheets H51086 (BTV), H61687 (XTVR) and H86869 (HTV).
For additional design and installation information, refer to Tubing Bundles Selection and Installation Guide (H55626) and the Design Guide for Tubing Bundles (H56886).

Note: All heating cables have a fluoropolymer outer jacket (CT)

Example: Electric Traced selection

Service voltage for heating cable	120 V (from Step 1)
Process operating temperature	38°C (100°F) (from Step 1)
Maximum exposure temperature	65°C (150°F) (from Step 1)
Appropriate heating cable	BTV1

Expected maintain temperature range

Tables 3A and 3B provide the minimum and maximum expected maintain temperatures of the tubing bundle for ambient temperatures ranging from –30°C to 38°C (–20°F to 100°F).

Go to the column with the tube size you selected and find the heating cable(s) that will maintain the tubing bundle at your minimum temperature requirement or higher. If more than one heating cable will maintain your application's temperature range, choose the cable with the lowest maximum temperature. A thermostat should be used if the maximum temperature in the table exceeds the maximum desired value. Note the heating cable type and the temperature range.

TABLE 3A - SINGLE TUBE: PROCESS TUBE MAINTAIN TEMPERATURES (MINIMUM–MAXIMUM) FOR AMBIENT RANGE OF –30°C TO 38°C (–20°F TO 100°F) AT 120/240 V

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

RAYCHEM-DG-H56886-RTBtubingbundle-EN-2507

TABLE 3B - DUAL TUBE: PROCESS TUBE MAINTAIN TEMPERATURES (MINIMUM–MAXIMUM) FOR AMBIENT RANGE OF –30°C TO 38°C (–20°F TO 100°F) AT 120/240 V

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

The temperatures included in Tables 3A and 3B are for approximation. For critical services applications contact your Chemelex representative.

Example: Electric Traced selection

Number of process tubes	2 (from Step 1)
Process tubing size	½ inch (from Step 1)
Process tube material	Stainless steel 316 (seamless) (from Step 1)
Process tube wall thickness	0.049 inch (from Step 1)
Maintain temperature	10°C (50°F) (from Step 1)
Service voltage	120 V (from Step 1)
Selected heating cable type	5BTV1 (from previous page)
Min./max. temperature from table	18°C to 51°C (64°F to 125°F) (from Table 3B)
Catalog number	RTB-2-1/2-S-049-5B1 (RTB-2-1/2-S-049 is derived from Step 2)

For Steam Traced Lines

Raychem RTB Steam Traced tubing bundles are designed to use steam as a heating medium. The performance of each type of product is dictated by construction and positioning of the insulation with the finished product.

Light Traced Steam (LTS) applications are constructed by separately insulating the TRACER tubing and creating a fixed separation from the process tube(s). The resulting performance characteristics allow LTS to be ideal for freeze protection of small diameter process lines such as instrument impulse lines and can maintain temperatures up to 95°C (200°F).

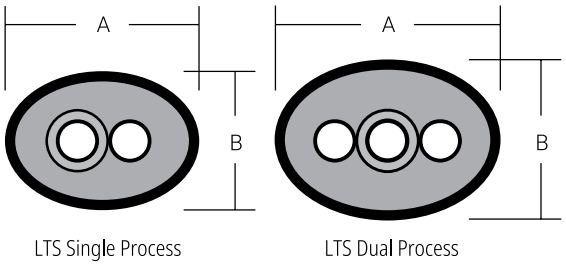


Fig. 3 Light Traced Steam (LTS)

Heavy Traced Steam (HTS) applications are constructed with intimate contact between the TRACER tubing and process tube(s). This construction allows for maximum transfer of heat between the tubes and is ideal for higher maintain applications such as analyzer sample transport and small diameter process lines containing product where temperature maintenance or viscosity control is necessary.

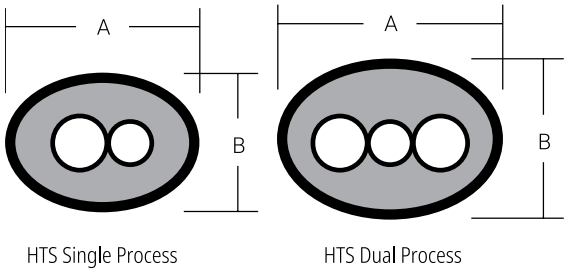


Fig. 4 Heavy Traced Steam (HTS)

TABLE 4 : PROCESS TUBE MAINTAIN TEMPERATURES (MINIMUM–MAXIMUM) FOR AMBIENT RANGE OF –30°C TO 38°C (–20°F TO 100°F)

	2 Bar (15 psig)		4.4 Bar (50 psig)		9.6 Bar (125 psig)	
	°C	(°F)	°C	(°F)	°C	(°F)
LTS w/ One ½" process tube						
⅜" TRACER	17–65	(62–143)	26–74	(78–165)	35–84	(95–193)
½" TRACER	29–71	(84–159)	39–83	(102–181)	51–95	(123–203)
LTS w/ Two 1/2" process tubes						
⅜" TRACER	17–65	(62–143)	26–74	(78–165)	35–84	(95–193)
½" TRACER	29–71	(84–159)	39–83	(102–181)	51–95	(123–203)
HTS w/ One ½" process tube						
⅜" TRACER	118–119	(244–246)	145–146	(293–294)	175–176	(347–348)
HTS w/ Two ½" process tubes						
⅜" TRACER	118–119	(244–246)	145–146	(293–294)	175–176	(347–348)

The preceding performance data is typical. Considerations regarding various ambient conditions and maximum run length need to be taken into consideration when selecting TRACER size and pressure.

For additional data on performance and run lengths contact Chemelex.

Example: Steam Traced selection

Number of process tubes	2 (from Step 1)
Process tubing size	½ inch (from Step 1)
Process tube material	Stainless steel 316 (seamless) (from Step 1)
Process tube wall thickness	0.049 inch (from Step 1)
Maintain temperature	10°C (50°F) (from Step 1)
Steam pressure	2 Bar (15 psig) (from Step 1)
Steam tracing tubing size	3/8 (from Step 1)
Steam tracing tubing material	Copper (from Step 1)
Steam tracing wall thickness	0.032 inch (from Step 1)
Process operating temperature	38°C (100°F)
Maximum exposure temperature	65°C (150°F)
Catalog number	RTB-2-1/2-S-049-LTS-3/8-C-032

For Pre-insulated ONLY (PIO) Lines

Raychem RTB Pre-insulated Only (PIO) tubing bundles are designed specifically for liquid and gas transport lines. These products are used where heat loss, weatherproofing, and personnel protection are important. These are an inexpensive and faster alternative to field insulation of small diameter process lines.

Typical usage includes not only liquid and gas transport lines, but also steam supply lines, condensate return lines, energy conservation, weatherproofing, and personnel protection. Temperature limit is a maximum process temperature: 204°C (400°F). Maximum jacket surface temperature is: 60°C (140°F) @ 27°C (80°F) with 16 km/h (10 mph) wind. Minimum recommended slope for steam line condensate run-off is
¼ inch per foot.

TABLE 5 : INSTALLATION AND DETAILS

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

Example: Pre-insulated Only selection

Number of process tubes	1 (from Step 1)
Process tubing size	½ inch (from Step 1)
Process tube material	Stainless steel 316 (seamless) (from Step 1)
Process tube wall thickness	0.049 inch (from Step 1)
Process operating temperature	38°C (100°F)
Maximum exposure temperature	65°C (150°F)
Catalog number	RTBC-1-1/2-S-049-PIO

The creation of a bill of materials involves three basic steps:

1. Determine the total length of tubing bundle and heating cable.
2. Determine the circuit breaker trip rating for bundle.
3. Determine the type and quantity of connection kits, accessories and controllers.

Bill of Materials
1. Determine length of bundle and cable
2. Determine trip rating
3. Select components, accessories and controllers

Step 1. Determine the total length of tubing bundle and heating cable

For electric applications, the length of the heating cable is typically identical to the required length of the tubing bundle. For all applications, be sure the length you order includes an additional one meter (three feet) for each power connection and end seal.

Bill of Materials
1. Determine length of bundle and cable
2. Determine trip rating
3. Select components, accessories and controllers

Step 2. Determine circuit breaker trip rating for bundle

Determine the maximum heating cable length permitted on one circuit breaker.
Tables 7 and 8 in the Self-Regulating Cables design guide (H56882) show the maximum heating cable length that may be powered from different-sized circuit breakers for different start-up temperatures. Different electrical codes and standards, refer to the heating cable datasheets applicable in this region.

If the length of your tubing bundle exceeds the maximum circuit length, either increase the rating of the circuit breaker or split the bundle into several circuits.

Note: Chemelex and national electrical codes require ground-fault equipment protection to provide maximum safety and protection from fire.

⚠ WARNING: Fire hazard
There is a danger of fire from sustained electrical arcing if the heating cable is damaged or improperly installed. To comply with Chemelex requirements, certifications, and national electrical codes, and to protect against the risk of fire, ground-fault equipment protection must be used on each heating cable circuit. Arcing may not be stopped by conventional circuit breakers.

Example: Circuit breaker trip rating determination

Catalog number	RTB-2-1/2-S-049-5B1 (from Product Selection, Step 3)
Heating cable type	5BTV1 (from Product Selection, Step 3)
Tubing bundle length	46 m (150 ft)
Start-up temperature	0°C (32°F) Default
Circuit breaker size	15 A
Maximum circuit length	42 m (140 ft)
Number of circuits	2

Bill of Materials
1. Determine length of bundle and cable
2. Determine trip rating
3. Select components, accessories and controllers

Step 3. Determine the type and quantity of the connection kits, accessories and controllers

Now that you have determined your circuit-breaker rating and number of circuits, use Table 6 on page 13 to determine the number of connection kits and accessories required. BTV, XTVR and HTV heating cables must be connected and terminated with appropriate power connection and end seal kits (see figure below).

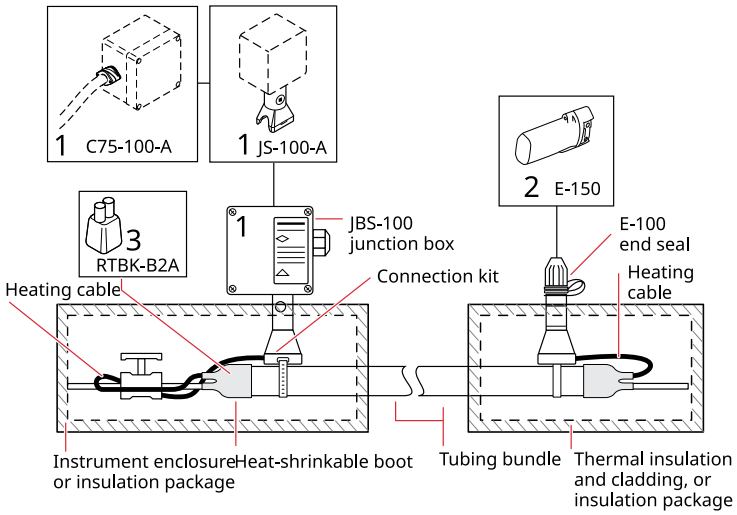


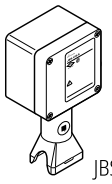
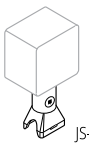
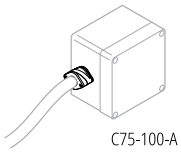
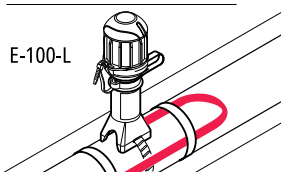
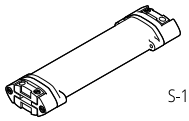
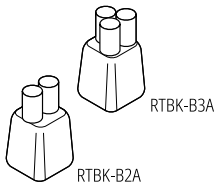
Fig. 5 Tubing bundle connection kits

TABLE 6 : RTB CONNECTION KITS AND ACCESSORY QUANTITIES REQUIRED

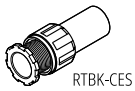
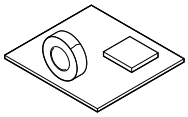
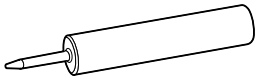
Description	Catalog number	Quantity
Connection kits for heating cables		
Power connection kits		1 per circuit
Single entry power connection	JBS-100	
Junction box stand	JS-100	
Gland connection	C75-100-A	
End seals and splice kits*		1 per circuit
End seal, above insulation	E-100	
End seal, with light	E-100-L	
End seal kit (low profile)	E-150	
Splice kits (not shown)	S-150, T-100	As required
Splice kit (heat shrink)	S-20/S-40	As required
End seal (heat shrink)	E-20/E-40	As required
Tubing bundle accessories		
Heat-shrinkable boots		1 per connection kit
Boot for single tube	RTB-RTBK-B1A	
Boot for single tube with electric trace	RTB-RTBK-B2A	
Boot for dual tubes with electric trace	RTB-RTBK-B3A	
Heat-shrinkable enclosure entry seal (not shown)		1 per enclosure entry
Entry seal for single and dual tubes from ⅛"–⅜" (6 mm–10 mm) and ½" (12 mm) single tubes	RTB-RTBK-CES4	
Entry seal for ½" (12 mm) dual tubes	RTB-RTBK-CES5	
Other		As required
Jacket patch kit	RTB-TPKJP-1-PATCH-KIT	
Silicone sealant	RTB-TPKSK-10-SEALANT	

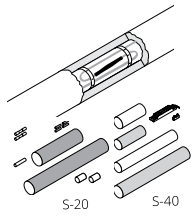
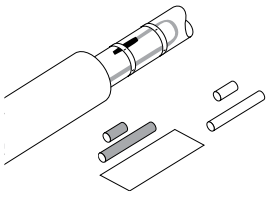
⚠ **WARNING:** Fire hazard
To prevent fire or shock, Raychem brand specified connection kits must be used. Do not substitute parts or use vinyl electrical tape.

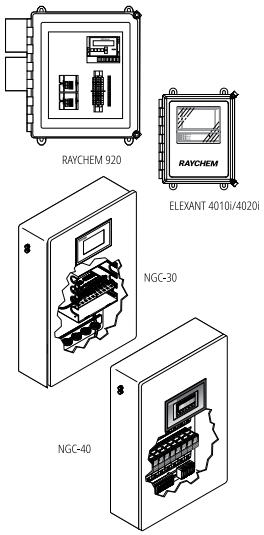
TABLE 7 : AVAILABLE SYSTEM COMPONENTS, ACCESSORIES AND CONTROLLERS

System Components	Power Connection Kits for Heating Cable	Electric Traced	Steam Traced	Pre-insulated Only
 JBS-100	**JBS-100** Power connection for one heating cable in nonhazardous, Zone 1, 2 and Division 2 hazardous locations. Includes cold-applied heating cable core seal. Requires one pipe strap to be ordered separately. For North America approvals: (H56827) JBS-100-A, JBS-100-L-A (with red indicator light)	☑		
 JS-100-A	**JS-100-A** (H56450) Junction box stand for one heating cable in nonhazardous and Division 2 hazardous locations. A separate customer-supplied NEMA 4X junction box is required. Includes cold-applied heating cable core seal. Requires one pipe strap to be ordered separately.	☑		
 C75-100-A	**C75-100-A (North America: H56343)** A gland kit used to transition heating cables into a junction box in nonhazardous and hazardous locations. Includes cold-applied heating cable core seal. A terminal block (3 x 12 AWG) is included. This kit does not include the junction box or the conduit.	☑		
 E-100-L	**End Seal Kits for Heating Cable** **E-100** End seal for heating cable in nonhazardous, Zone 1, 2 and Division 2 hazardous locations. Re-enterable. Includes cold-applied heating cable core seal. Requires one pipe strap to be ordered separately. Lighted versions for ease of status monitoring are available. For North America approvals: (H56829) E-100-A, E-100-L-A (with red indicator light), E-100-L-E (with green indicator light)	☑		
 E-150	**E-150** (North America: H56835); Low-profile end seal for heating cable in nonhazardous, Zone 1, 2 and Division 2 hazardous locations. Includes cold-applied heating cable core seal.	☑		
 S-150	**Splice Kits for Heating Cable** **S-150** (North America: H56835) Splice kit for two heating cables in nonhazardous, Zone 1, 2 and Division 2 hazardous locations. Includes cold-applied heating cable core seal. Consult the data sheets in the Technical Data section for more specific information. For attachment and other accessories for the heating cables, please refer to Self-Regulating Cables of the Industrial Heat Tracing Solutions Products & Services Catalogue (H56550).	☑		
Accessories				
 RTBK-B3A RTBK-B2A	**Heat-Shrinkable Boots** 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-B2A for single-tube bundles with electrical heat tracing Use RTBK-B3A for dual-tube bundles with electrical heat tracing **Important:** Although RTB uses a nonhygroscopic thermal insulation, all bundle ends and jacket penetrations must be sealed to keep the insulation from getting wet.	☑	☑	☑

RAYCHEM-DG-H56886-RTBtubingbundle-EN-2507

System Components	Power Connection Kits for Heating Cable	Electric Traced	Steam Traced	Pre-insulated Only
 RTBK-CES	**Heat-Shrinkable Entry Seals** May be used to provide a waterproof fitting where the bundle enters an enclosure or penetrates a bulkhead. 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. **Heat-Shrinkable Sizing Criteria** Tubing size in inches (mm) / 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	☑	☑	☑
 RTB-TPKJP-1-PATCH-KIT	**Jacket Patch Kits** 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.	☑	☑	☑
 RTB-TPKSK-10-SEALANT	**Silicone Sealant** 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 10-ounce (280 g) tube will seal approximately 10 bundle ends. Silicone sealant can be used for either electric or steam-traced bundles.	☑	☑	☑
	**Electric Traced Label** Attach the label to the outside of the thermal insulation weather barrier to indicate presence of electrical heat tracing. Use one label for every 3 meters (10 ft) of pipe, alternating on either side of the pipe. Also, available in other languages. Refer to our website for other regions.	☑		

	**Heat Shrink Splice Kits for Heating Cable** S-20 / S-40 (See datasheet EU 1637 for more details) S-20 - BTV and Q_TVR heating cables S-40 - XTVR and HTV heating cables For non hazardous, Zone 1, Zone 21 and Division 2 locations	☑		
 E-20/E-40	**Heat Shrink End Seal Kits for Heating Cable** E-20 / E-40 (See datasheet EU 1636 for more details) E-20 - BTV and Q_TVR heating cables E-40 - XTVR and HTV heating cables For non hazardous, Zone 1, Zone 21 and Division 2 locations	☑		

	RTB can be operated uncontrolled or with temperature controls that you are using for other heat-tracing applications. Temperature control will be necessary if the maximum value of the temperature range determined in Step 2 exceeds the maximum maintain temperature for the heating cable. For more detail, see the Control and Monitoring design guide design guide (H56889).	☑		

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