Mineral Insulated Heating Cables

This section provides an overview and general design guidelines for mineral insulated heat-tracing systems. For complete design assistance, contact your Tyco Thermal Controls representative or phone Tyco Thermal Controls at (800) 545-6258. Also, visit our Web site at www.tycothermal.com.

Contents

Introduction

Pyrotenax MI heating cable is the ideal choice when an application's temperature or power output requirements exceed the capabilities of self-regulating and power-limiting heating cables.

Pyrotenax mineral insulated heating cables offer a wide variety of solutions for industrial heat-tracing applications. MI heating cables are series-type heating cables and suitable for maintain temperatures up to 1022°F (550°C) and exposure temperatures up to 1200°F (650°C). MI heating cable is the ideal choice when an application's temperature and power output requirements exceed the capabilities of self-regulating and power-limiting heating cables.

MI heating cables can be used for applications with the following requirements:

- Maintain temperature up to 1022°F (550°C)
- Power output to 61 W/ft (200 W/m)
- Maximum heating cable exposure temperature to 1200°F (650°C)

  Higher temperature and power capabilities are available; contact Tyco Thermal Controls for additional information.

Typical Applications

Typical applications for MI heating cables are listed in Table 1.

Table 1 Examples of MI Heating Cable Applications

Refining crude distillation	Chemical and petrochemical	Power generation
Hydrocracking	Phthalic anhydride	High-pressure feedwater
Coking	Benzene	Blowdown lines
Wax	Styrene	Instrument lines
Sulphur	Propylene glycol	Steam lines
Asphalt	Ethylene glycol	De-aerator lines
Heavy residue	Polyethylene	High-pressure condensate
Gas condensate prevention	Polypropylene	
Bitumen	Chlorine	
	Acrylic acid	
	Adipic acid	
	Dimethyl terephthalate	
	Synthetic fiber polymers	
	Nylon monomer	
	Paints and resins	

Mineral Insulated Heating Cable Construction

Pyrotenax MI heating cables provide superior strength in dynamic cut-through, crush, and corrosion tests. Special annealing processes maximize flexibility for ease of on-site handling.

MI heating cables consist of one or two conductors embedded in a highly dielectric magnesium oxide insulation surrounded by a metal sheath of Alloy 825. This nickel alloy is recognized for its high temperature service and resistance to pitting, acid, salt, and alkali corrosion. In addition, Alloy 825 provides excellent protection against stress corrosion cracking and has a long history of success in heat-tracing applications, particularly at high temperatures.

MI heating cables provide superior strength in dynamic cut-through, crush, and corrosion tests. Special annealing processes maximize flexibility for ease of on-site handling.

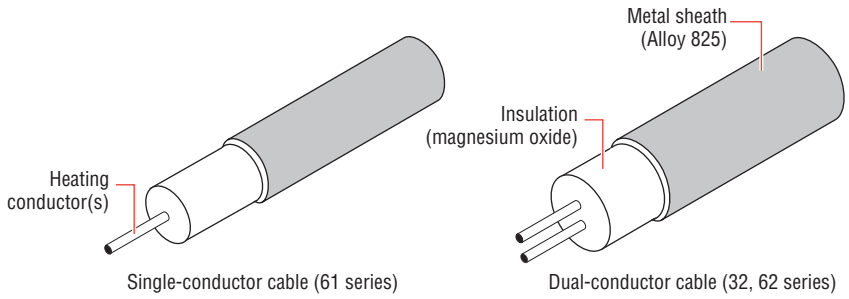


Fig. 1 Single- and dual-conductor cables

MI heating cable sets are supplied factory terminated and ready to install. They include a heating section and a nonheating cold lead section.

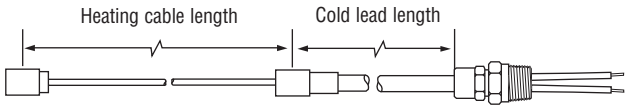


Fig. 2 Typical MI heating cable set (dual conductor)

System Overview

Typical Mineral Insulated Heating Cable System

A typical MI heating cable system is shown in Figure 3. Unlike self-regulating or power-limiting cables, MI heating cables are supplied in fixed lengths, so determining and ordering the correct cable length is critical. The heating cable is attached to the pipe with metal banding or tie wire. The cold lead cable is connected to a junction box, which in turn is connected to the power supply.

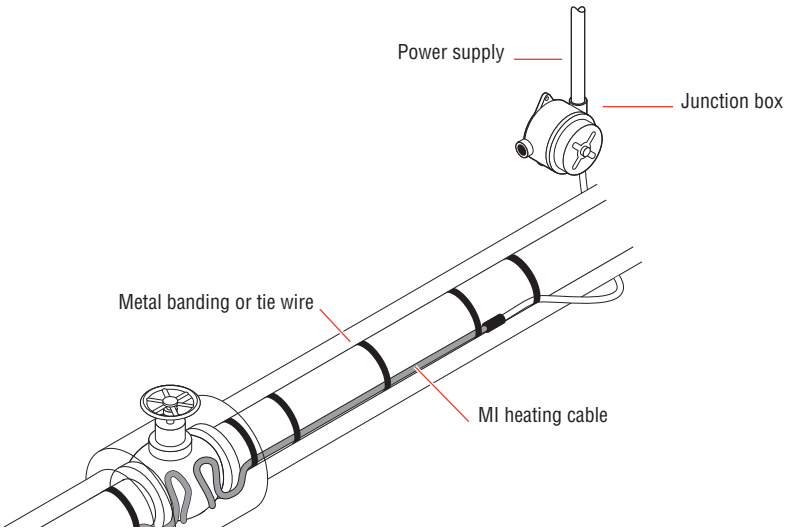


Fig. 3 Typical Mineral Insulated heating cable system

Ground-Fault Protection

To minimize the danger of fire from sustained electrical arcing if the heating cable is damaged or improperly installed, and to comply with the requirements of Tyco Thermal Controls, agency certifications, and national electrical codes, ground-fault equipment protection must be used on each heating cable branch circuit. Arcing may not be stopped by conventional circuit protection. Many DigiTrace control and monitoring systems meet the ground-fault protection requirement.

Approvals and Certifications

Tyco Thermal Controls mineral insulated heating systems meet the requirements of the U.S. National Electrical Code and the Canadian Electrical Code.

MI heating cable systems are approved for use in nonhazardous and hazardous locations through various approval agencies. Refer to the MI Heating Cable–Alloy 825 data sheet for more detailed information. The datasheet can be found on the Tyco Thermal Controls Web site, www.tycothermal.com.

Thermal Design and Heating Cable Selection

The following steps illustrate the process for designing a mineral insulated heat-tracing system. For a complete design, you must use TraceCalc Pro design software or contact Tyco Thermal Controls for design assistance. Use Appendix C to submit the required data for your application.

The heating cable selection process involves four basic steps:

1. Gather the necessary information.
2. Determine the power output and heating cable length.
3. Select the heating cable design configuration.
4. Select the heating cable type, reference, and cold lead.

Example: The example carried through this section shows a simple freeze protection application for a high-pressure condensate line in a power plant. It is simplified, but shows the basic principles of an MI series resistance heating cable design.

Heating Cable Selection
1. Gather information
2. Determine pipe heat loss and total heating cable length
3. Select heating cable design configuration
4. Select heating cable type, reference, and cold lead

Step 1 Gather the necessary information

- Pipe size and material _____
- Insulation type and thickness _____
- Maintain temperature (T_M) _____
- Minimum ambient temperature (T_A) _____
- Service voltage (V) _____
- Maximum exposure temperature _____
- Area classification _____
- Pipe length (L) _____
- Number of pipe supports _____
- Number and size of valves _____

Example: Gather information

Pipe size and material:	1-inch steel pipe
Insulation type and thickness:	1/2-inch glass fiber
Maintain temperature:	40°F
Minimum ambient temperature:	0°F
Service voltage:	120 V
Maximum exposure temperature:	680°F
Area classification:	Nonhazardous
Pipe length:	80 ft
Pipe supports:	Thermally insulated (already insulated; excluded from example calculations)
Valves:	2 x 1-inch light valves (threaded)

Heating Cable Selection
1. Gather information
2. Determine pipe heat loss and total heating cable length
3. Select heating cable design configuration
4. Select heating cable type, reference, and cold lead

Step 2 Determine the pipe heat loss and total heating cable length

THERMAL DESIGN (REQUIRED POWER OUTPUT)

To select the proper heating cable, first calculate the pipe heat loss for your application as outlined in Self-Regulating Thermal Design publication. For applications with higher maintain temperatures, use TraceCalc Pro design software or contact your Tyco Thermal Controls representative.

Example: MI heating cable is required because of the high maximum exposure temperature.

Pipe heat loss: P = 3.5 W/ft x 40/50 = 2.8 W/ft (9.2 W/m)
(from Self-Regulating Design section, Thermal Design)

TOTAL HEATING CABLE LENGTH

The total length of the MI heating cable (L) needs to accommodate pipe length and additional cable required to compensate for heat loss of valves and supports, as well as an installation allowance for field variances (see Table 2).

The length of the heating cable can be determined by using Table 2 and the following worksheet. For small pipes or applications with low power requirements, a single run of two conductor heating cable will often be sufficient. For larger pipes or higher temperatures, multiple runs of single or two conductor heating cable may be required. It is recommended that the design and cable selection process start by assuming a single run of cable and only increase the number of runs if no satisfactory solution can be found.

Depending on the complexity of the application, Steps 2 through 4 can be an iterative process. We recommend using TraceCalc Pro design software. Contact your Tyco Thermal Controls representative for assistance.

Table 2 Typical Allowances per Run of Cable (ft)

NPS	Light valve (flanged)	Light valve (threaded or welded)	Heavy valve (flanged)	Heavy valve (threaded or welded)	Typical pipe shoe	Flange (pair)	Field variance
0.5"	1	1	1	1	3	1	2%
0.75"	1.5	1	1.5	1	3	1	2%
1"	2	1	2	1	3	1.5	2%
1.5"	2.5	1.5	3	1.5	3	1.5	2%
2"	2.5	2	3.5	2	3	1.5	2%
3"	3	2.5	4	2.5	3	2	3%
4"	4	3	5	3	3	2	3%
6"	5	3.5	6	3.5	3	2	3%
8"	7	4	8	4	3	2	3%
10"	8	5	10	5	3	3	3%
12"	9	6	12	6	3	3.5	3%
14"	10	7	14	7	4.5	4	3%
16"	11	8	16	8	4.5	4.5	3%
18"	12	9	18	9	4.5	5.5	3%
20"	13	10	20	10	4.5	6	3%
24"	15	12	24	12	4.5	7	3%

1. "Light valve" refers to 150 lb valves; "heavy valve" refers to 300 lb valves. For other fittings and support, contact Tyco Thermal Controls.
2. Allowances above are based on typically available fittings and supports, with insulation that is equivalent to the pipe insulation.
3. For pipes requiring more than two runs of heating cable, apply the full allowance for each run of cable on each fitting or support as long as space allows. However, MI heating cables must not touch or overlap. The minimum spacing between cables is 1" (25 mm). Contact Tyco Thermal Controls if more than two runs are needed or if cable spacing is less than 1" (25 mm).
4. For some applications, it may be physically impossible to install all of the recommended heating cable directly on the fitting or support. In this case, install the excess heating cable on the pipe, on either side of the fitting or support, or eliminate the additional heater length from your length calculation if a lower local temperature is acceptable. This constraint may be difficult for small pipes and/or multiple cable runs. If required, contact Tyco Thermal Controls for assistance.

WORKSHEET TO DETERMINE TOTAL HEATING CABLE LENGTH

Example input from Steps 1 and 2.

#	___"	Valves	@	___ft	=	_____	ft
#	___"	Supports	@	___ft	=	_____	ft
#	___"	Supports	@	___ft	=	_____	ft
		Other heat sinks		___ft	=	_____	ft
		Sum of the above			=	83.6	ft
		Multiply by no. of runs of heating cable		1 x	=	83.6	ft
		Equals total heating cable length (L), rounded:				**84**	ft

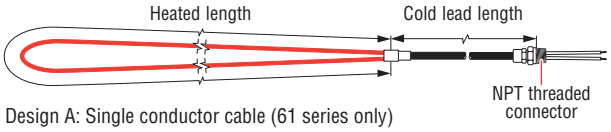
* Field variance from Table 2

Heating Cable Selection
1. Gather information
2. Determine pipe heat loss and total heating cable length
3. Select heating cable design configuration
4. Select heating cable type, reference, and cold lead

Step 3 Select the heating cable design configuration

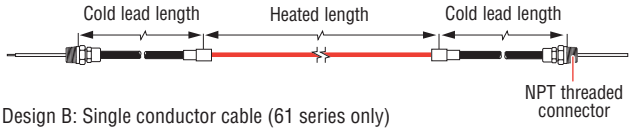
The MI heating cable sets are factory terminated in the four design configurations shown below. They are supplied with the heated section joined to a length of nonheating cold lead section, preterminated and ready to fasten in a junction box with an NPT-threaded connector.

Design A



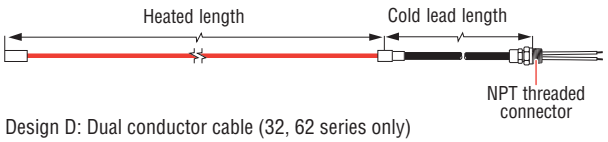
Design A: Single conductor cable (61 series only)

Design B



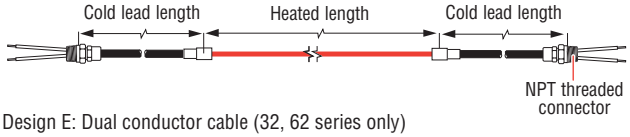
Design B: Single conductor cable (61 series only)

Design D



Design D: Dual conductor cable (32, 62 series only)

Design E



Design E: Dual conductor cable (32, 62 series only)

Fig. 4 Heating cable design configurations

For a single run of heating cable, Design D is the most economical solution.

Example: Select Design D for a single run of dual conductor cable.

Heating Cable Selection
1. Gather information
2. Determine pipe heat loss and total heating cable length
3. Select heating cable design configuration
4. Select heating cable type, reference, and cold lead

Step 4 Select the heating cable type, reference, and cold lead

Heating cable types are listed in Table 3.

Table 3 MI Heating Cable Types

Specifications	Series 61	Series 32	Series 62
Number of conductors	1 – single	2 – dual	2 – dual
Maximum operating voltage	600 V	300 V	600 V
Reference table	3.5	3.6	3.7

Tables 5, 6, and 7 list the resistances available for the heating cable types.

The naming convention of the heating cables is described in Table 4.

Table 4 Heating Cable Reference

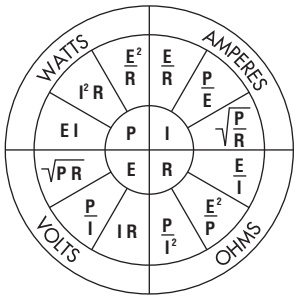
Digit number	Description	
1	Maximum voltage rating	3 = 300 V, 6 = 600 V
2	Number of conductors	1 or 2
3	Sheath material	S = Alloy 825
4	Conductor material	A, B, C, F, P, Q, or T
5	Move decimal point to left indicated number of places	1, 2, 3, 4, 5, or 6 places
6 to 8	Cable resistance to three whole numbers (use with digit 5)	2200 = 2.00 Ω/cable foot at 20°C

Sample reference:

6 2 S F 2 2 0 0

Digit 1 2 3 4 5 6 7 8

Copper-sheathed MI heating cables for low temperature applications are available upon request.



Ohm's Law Formulas

P = Power (W)
I = Current (A)
E = Electromotive Force (V)
R = Resistance (Ω)

To select the heating cable reference, calculate the maximum resistance that the cable can have in order to supply the required power using Ohms law:

$R_{max} = V^2/(P_{min} \times L^2)$

R_{max} : Maximum cable resistance to meet power requirement [Ω/ft or Ω/m]

V : Voltage across heating element [V]

P_{min} : Required power output [W/ft or W/m]

L : Total heating cable length [ft or m]

The minimum required power output (P_{min}) must be at least equal to the heat loss (P) determined in Step 2.

Example: P_{min} = P = 2.8 W/ft *(from Step 2)*
$R_{max} = (120\ V)^2 / (2.8\ W/ft \times (84\ ft)^2) = 0.7289\ \Omega/ft\ (2.39\ \Omega/m)$

Now select a heating cable with a nominal resistance lower or equal to this maximum resistance from Tables 5 to 7. Start by using a 300 V dual conductor cable (32 series) for the most economical solution.

Example: From Table 6 select cable 32SB3700 R_{nom} = 0.700 Ω/ft (2.30 Ω/m)

Note: Tables 5 to 7 show the nominal conductor resistance; tolerance is ± 10%.

Table 5 Series 61 MI Heating Cable Specifications (600 V, single conductor)

Heating cable reference	Nominal cable resistance at 20°C		Approximate cable diameter		Maximum unjointed cable length		Nominal weight	
	Ω/ft	Ω/m	in	mm	ft	m	lb/1000 ft	kg/1000 m
61SA2200	2.00	6.56	0.146	3.7	1719	524	35.5	52.8
61SA2160	1.60	5.25	0.163	4.1	1400	427	45.2	67.3
61SA2130	1.30	4.27	0.160	4.1	1200	366	45.4	67.6
61SA2100	1.00	3.28	0.157	4.0	1475	450	45.7	68.0
61SA3850	0.850	2.79	0.170	4.3	1166	355	51.8	77.1
61SA3700	0.700	2.30	0.160	4.1	1475	450	46.4	69.1
61SA3500	0.500	1.64	0.177	4.5	1160	354	59.2	88.1
61ST3280	0.280	0.919	0.183	4.6	1142	348	58.5	87.1
61SB3200	0.200	0.656	0.180	4.6	1160	354	59.6	88.7
61SB3150	0.150	0.492	0.180	4.6	1160	354	60.9	90.6
61SQ3118	0.118	0.387	0.185	4.7	1060	323	58.1	86.5
61SQ4732	0.0732	0.240	0.184	4.7	1070	326	59.4	88.4
61SQ4581	0.0581	0.191	0.181	4.6	1100	335	59.9	89.1
61SP4467	0.0467	0.153	0.185	4.7	1010	308	58.5	87.1
61SP4366	0.0366	0.120	0.184	4.7	1020	311	59.4	88.4
61SP4290	0.0290	0.0951	0.184	4.7	1040	317	59.9	89.1
61SP4231	0.0231	0.0758	0.181	4.6	1122	342	60.4	89.9
61SP4183	0.0183	0.0600	0.184	4.7	1080	329	61.2	91.1
61SP4145	0.0145	0.0476	0.184	4.7	1122	342	61.9	92.1
61SP4113	0.0113	0.0371	0.186	4.7	1008	307	64.5	96.0
61SC5651	0.00651	0.0214	0.193	4.9	1002	305	68.7	102.2
61SC5409	0.00409	0.0134	0.201	5.1	962	293	72.1	107.3
61SC5258	0.00258	0.00846	0.220	5.6	805	245	89.9	133.8
61SC5162	0.00162	0.00531	0.273	6.9	502	153	144.2	214.6
61SC5102	0.00102	0.00335	0.253	6.4	592	180	132.8	197.6
61SC6640	0.00064	0.00210	0.319	8.1	376	115	209.0	311.0

Table 6 Series 32 MI Heating Cable Specifications (300 V, dual conductor)

Heating cable reference	Nominal cable resistance at 20°C		Approximate cable diameter		Maximum unjointed cable length		Nominal weight	
	Ω/ft	Ω/m	in	mm	ft	m	lb/1000 ft	kg/1000 m
32SF1110	11.0	36.1	0.126	3.2	2170	661	30.3	45.1
32SF2900	9.00	29.5	0.140	3.6	1900	579	35.1	52.2
32SF2750	7.50	24.6	0.154	3.9	1510	460	44.2	65.8
32SA2600	6.00	19.7	0.135	3.4	2040	622	33.1	49.3
32SA2400	4.00	13.1	0.146	3.7	1775	541	38.3	57.0
32SA2275	2.75	9.02	0.146	3.7	1775	541	38.9	57.9
32SA2200	2.00	6.56	0.180	4.6	1160	354	59.3	88.2
32SA2170	1.70	5.58	0.177	4.5	1010	308	51.0	75.9
32SB2114	1.14	3.74	0.184	4.7	1147	350	59.0	87.8
32SB3700	0.700	2.30	0.160	4.1	1475	450	48.0	71.4
32SQ3472	0.472	1.55	0.185	4.7	1125	343	57.5	85.6
32SQ3374	0.374	1.23	0.185	4.7	1125	343	57.7	85.9
32SQ3293	0.293	0.961	0.185	4.7	1122	342	58.7	87.4
32SQ3200	0.200	0.656	0.146	3.7	1775	541	39.4	58.6
32SQ3150	0.150	0.492	0.160	4.1	1458	444	47.9	71.3
32SQ3100	0.100	0.328	0.180	4.6	1160	354	61.6	91.7
32SP4734	0.0734	0.241	0.181	4.6	1122	342	60.4	89.9
32SP4583	0.0583	0.191	0.184	4.7	1122	342	61.3	91.2
32SP4458	0.0458	0.150	0.185	4.7	1110	338	63.2	94.1
32SC4324	0.0324	0.106	0.181	4.6	1060	323	58.8	87.5

Table 7 Series 62 MI Heating Cable Specifications (600 V, dual conductor)

Heating cable reference	Nominal cable resistance at 20°C		Approximate cable diameter		Maximum unjointed cable length		Nominal weight	
	Ω/ft	Ω/m	in	mm	ft	m	lb/1000 ft	kg/1000 m
62SF1110	11.0	36.1	0.205	5.2	718	219	80.0	119.1
62SF2900	9.00	29.5	0.215	5.5	820	250	80.2	119.4
62SF2600	6.00	19.7	0.215	5.5	820	250	80.6	119.9
62SA2414	4.14	13.6	0.228	5.8	665	203	88.9	132.3
62SF2200	2.00	6.56	0.248	6.3	580	177	106.7	158.8
62ST2115	1.15	3.77	0.224	5.7	665	203	89.5	133.2
62SB3700	0.700	2.30	0.268	6.8	535	163	125.6	186.9
62SQ3505	0.505	1.66	0.224	5.7	640	195	85.5	127.2
62SQ3286	0.286	0.938	0.236	6.0	628	191	95.1	141.5
62SQ3200	0.200	0.656	0.248	6.3	615	187	106.0	157.7
62SQ3150	0.150	0.492	0.248	6.3	630	192	107.0	159.2
62SQ3100	0.100	0.328	0.265	6.7	520	158	127.3	189.4
62SP4775	0.0775	0.254	0.252	6.4	540	165	111.6	166.1
62SP4561	0.0561	0.184	0.264	6.7	480	146	123.5	183.8
62SP4402	0.0402	0.132	0.280	7.1	443	135	138.7	206.4
62SP4281	0.0281	0.0922	0.295	7.5	390	119	158.7	236.2
62SC4200	0.0200	0.0656	0.295	7.5	460	140	146.1	217.4
62SC4130	0.0130	0.0427	0.311	7.9	370	113	169.4	252.1
62SC5818	0.00818	0.0268	0.343	8.7	345	105	199.7	297.2
62SC5516	0.00516	0.0169	0.364	9.2	270	82	246.8	367.3
62SC5324	0.00324	0.0106	0.402	10.2	228	69	314.5	468.0
62SC5204	0.00204	0.00669	0.496	12.6	151	46	474.8	706.6
62SC5128	0.00128	0.00420	0.543	13.8	125	38	562.5	837.1

Heating Cable Selection
1. Gather information
2. Determine pipe heat loss and total heating cable length
3. Select heating cable design configuration
4. Select heating cable type, reference, and cold lead

The cold lead cable is available in the following sizes:

Table 8 Alloy 825 Sheathed Cold Leads

Cold lead code for catalog number	Maximum voltage (V)	Maximum current (A)	Gland size (NPT)	Gland size reference for catalog number	Tail size (AWG)
Design A, D, E					
S25A	600	25	1/2"	N12	14
LS23A	300	23	1/2"	N12	14
S34A	600	34	3/4"	N34	10
S49A	600	49	3/4"	N34	8
S65A	600	65	3/4"	N34	6
Design B					
S29A	600	29	1/2"	N12	12
S40A	600	40	1/2"	N12	10
S48A	600	48	1/2"	N12	8
S66A	600	66	1/2"	N12	6
S86A	600	86	1/2"	N12	4

Note: All Alloy 825 cold leads are terminated with stainless steel glands and 12-inch tails unless otherwise specified. Other configurations available on request.

ADDITIONAL CONSIDERATIONS

Various materials used in the conductors behave differently. In particular, for heating cables with low resistances, conductor materials may show a significant increase in resistance for increasing maintain temperatures. Use the graph below to adjust resistance as a function of the maintain temperature. For detailed design, use TraceCalc Pro design software or contact Tyco Thermal Controls.

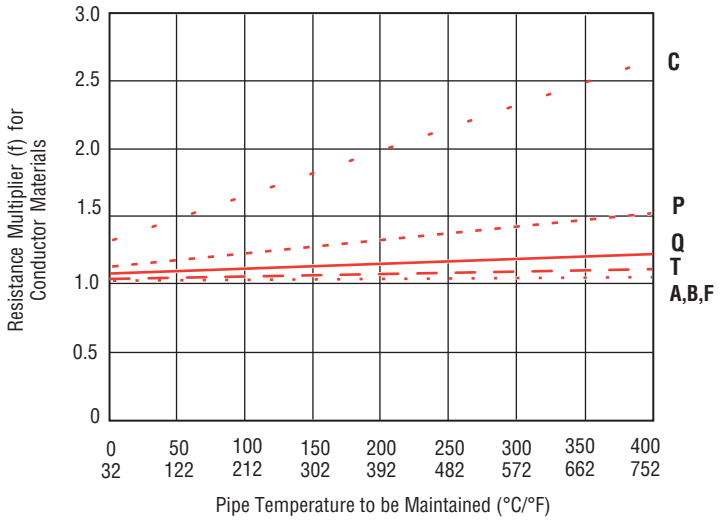


Fig. 5 Resistance correction factor

As the graph shows, the change of resistance can be significant at high temperatures and must not be neglected for cables using conductor materials with a large temperature dependency (see in particular conductor material C).

Adjust the nominal resistance (R_{nom}) with the resistance multiplier (f) based on the graph.

$R_{adj} = R_{nom} \times f$

Example:

Cable reference 32SB3700 uses conductor material B

The graph shows that the resistance change factor is negligible for this cable at a maintain temperature of 40°F (5°C). Therefore, R_{adj} = 0.700 Ω/ft x 1.0 = 0.700 Ω/ft (2.30 Ω/m).

Now calculate the adjusted power output (P_{adj}) of the heating cable using the following formula:

$P_{adj} = V^2 / (R_{adj} \times L)$, $P_{lin} = P/L$

Example:

$P_{adj} = (120\ V)^2 / (0.7\ \Omega/ft \times 84\ ft) = 245\ W$, $P_{lin} = 2.9\ W/ft\ (9.5\ W/m)$

Check that the installed linear power, P_{lin} (W/ft or W/m), is equal to or greater than the pipe heat loss (P) determined in Step 2. Adjust formula for multiple runs as required.

Note: If the selected resistance is much lower than the calculated maximum resistance, it can result in a significantly higher power output than required for the application.

The startup current (I) can be calculated using the nominal resistance (R_{nom}) from Tables 5–7:

$I = V / (R_{nom} \times L)$

We typically recommend using a safety factor of 10%.

Example: $I = 120\ V / (0.700\ \Omega/ft \times 84) = 2\ A$ (add 10% ≥ 2.2 A)

Canadian and U.S. National Electrical Codes require that circuit breakers must not be loaded above 80% of their nominal rating.

Be sure to also consider the maximum sheath temperature when using MI heating cables. The maximum sheath temperature depends on the power output of the cable, as well as the pipe temperature. It must not exceed the maximum rated temperature of the MI heating cable or the hot-to-cold joint, and must not be in conflict with hazardous area requirements. Sheath temperature calculations can be complex. Use TraceCalc Pro design software or contact your Tyco Thermal Controls representative for assistance.

Bill of Materials

Heating Cable Set Catalog Number

To order an MI heating cable set, it is important to understand the format of our catalog number:

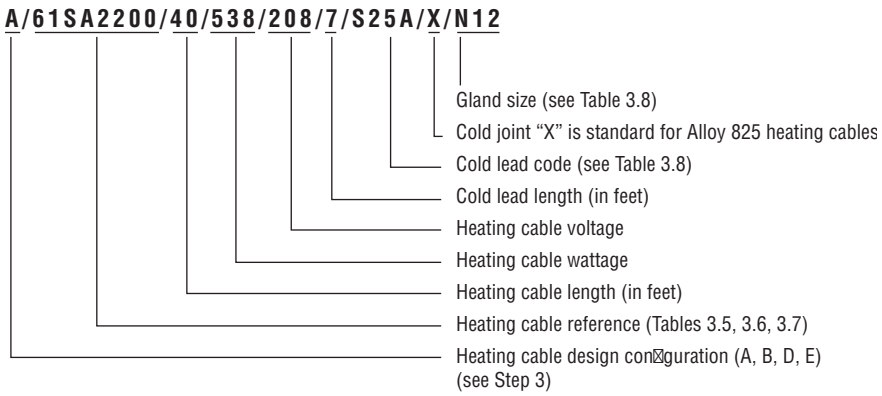


Fig. 6 MI heating cable set catalog number

In the previous heating cable catalog number, the length of the heated section and the cold lead is in feet. For metric lengths, the heating cable catalog number would include a suffix "M" after the length, as follows: A/61SA2200/12.2M/538/208/2.1M/S25A/X/N12

Conversion from English to Metric units is: L(ft) x 0.3048 = L(m)
Conversion from Metric to English units is: L(m) x 3.2808 = L(ft)

Options

Add suffix "/PE" at the end of the catalog number for pulling eye (Design D cables only).

Add suffix "/RG1" at the end of the catalog number for 1" reverse gland (used to make a watertight seal) for Designs A and D cables. Design D cables also available with 1/2" or 3/4" reverse gland ("/RG34" for 3/4" or "/RG12" for 1/2").

Example:

The catalog number for our simple example would be:

MI heating cable set: D/32SB3700/84/245/120/7/S25A/X/N12

More examples:

D/62SQ3100/200/9920/480/3/S25A/X/N12

- Heating cable configuration is Design D
- 600-V rated dual conductor cable, resistance at 20°C is 0.100 Ω/ft (0.328 Ω/m)
- Heating cable length is 200 ft (61 m)
- Heating cable wattage is 9920 W at 480 V
- Cold lead length is 3 ft (0.9 m)
- Cold lead code is S25A
- 1/2-in NPT gland connector

E/32SQ3200/25.0M/870/120/2.1M/LS23A/X/N12

- Heating cable configuration is Design E
- 300-V rated dual conductor cable, resistance at 20°C is 0.200 Ω/ft (0.656 Ω/m)
- Heating cable length is 25 m (82 ft)
- Heating cable wattage is 870 W at 120 V
- Cold lead length is 2.1 m (7 ft)
- Cold lead code is LS23A
- 1/2-in NPT gland connector

Tyco Thermal Controls will need the following information to prepare the reference tag supplied with each MI heating cable set:

- Supply voltage and wattage
- Circuit ID (optional, for customer reference only)

For hazardous locations, also include:

- Area classification (Class, Division, Group)
- Temperature identification number (T-rating) or autoignition temperature (AIT) of flammables handled in the hazardous area
- Appendix I must be completed and returned to Tyco Thermal Controls for Class I, Division 1 applications
- Maximum sheath temperature of heating cable

The maximum sheath temperature of the MI heating cable depends on the specific application. Contact your Tyco Thermal Controls representative to provide you with an optimized design for your application.

Selection of Connection Kits and Accessories

Pyrotenax MI heating cables are approved as a complete system only when used with Tyco Thermal Controls connection kits or any Nationally Recognized Testing Lab (NRTL) enclosure. Any non-approved connection kits may compromise the reliability of the system and will invalidate approvals and warranties.

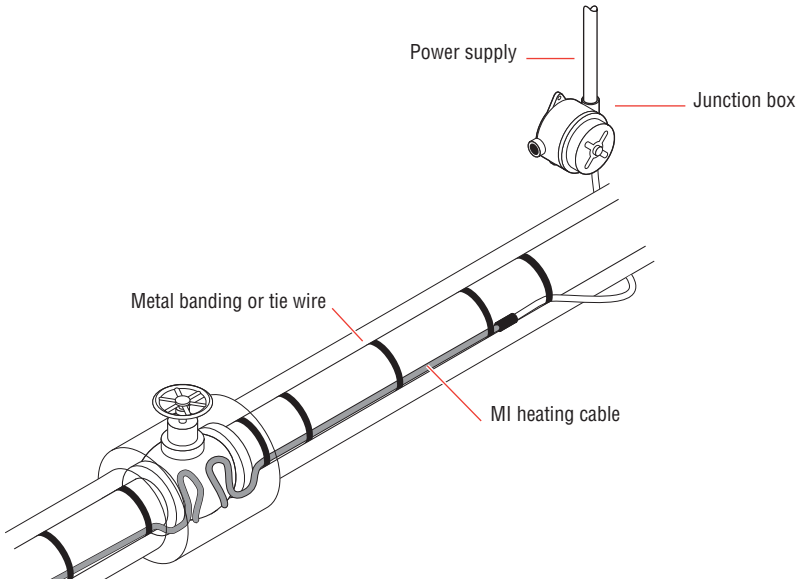


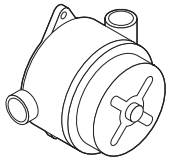
Fig. 7 Typical MI heating system

Table 9 Connection Kits and Accessory Selection

Description		Catalog number	Quantity required
Components			
❶ Power connection		RMI-JB3, 1–2 heating cables	1 per circuit
	or	PT-JB	1 per circuit
	or	D1297TERM4 + D1297BRACK	1 per circuit
	or	JBS-100-ECP-A + MI-GROUND-KIT (nonhazardous locations only)	1 per circuit
	or	JBS-100-ECW-A + MI-GROUND-KIT (nonhazardous locations only)	1 per circuit
Accessories			
❷ Attachment material			
Metal banding		PB… (see Table 10)	1 every foot
Tie wire	*or*	051Cupron	See Table11
Prepunched strapping		107826-000	See Table 11
Electric traced labels		ETL	Every 10 feet
Identification label		LBLSS	Optional
Temperature controls — see Control and Monitoring			

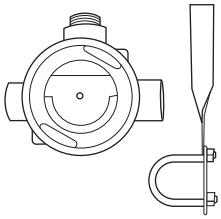
SYSTEM COMPONENTS

Power Connection Kits



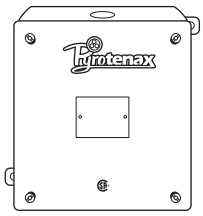
RMI-JB3

RMI-JB3 Copper-free aluminum alloy box with three entries for use with MI heating cables. Includes terminal block (500 Vac, 50 A, 2 x 6 AWG) and three 3/4" x 1/2" reducers and two 3/4" NPT plugs. FM and CSA approved for: Class I, Div. 1 & 2, Groups B, C, D; Class II, Div. 1 & 2, Groups E, F, G; and Class III.
Enclosure dimensions: 6.1" x 5.2" x 3.9" (156 mm x 133 mm x 98 mm).



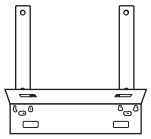
PT-JB

PT-JB A smaller junction box with three entries for use with MI heating cables. Three 3/4" NPT entries. Provided with one plug and two 3/4" x 1/2" reducers. Includes 4 pole terminal block (CSA-600 Vac, 65 A, 18–6 AWG / UL-300 Vac, 65 A, 18–6 AWG) and stainless steel support bracket (U-clamp). UL and CSA approved for: Class I, Div. 1 & 2, Groups A, B, C, D; Class II, Div. 1 & 2, Groups E, F, G.
Enclosure dimensions: 5.5" x 4.75" x 3" (140 mm x 121 mm x 76 mm).



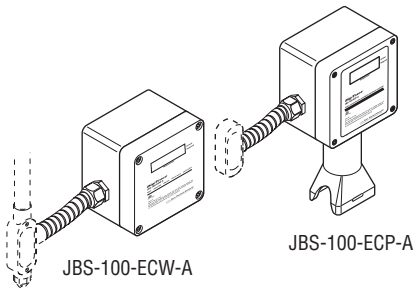
D1297TERM4

D1297TERM4 A large cast aluminum junction box (NEMA 3R) for installation in nonhazardous and CID2 areas. Three 1/2" NPT entries on bottom, provided with plugs. Includes 4 pole terminal block (CSA-600 Vac, 65 A, 18–6 AWG / UL-300 Vac, 65 A, 18–6 AWG). External mounting feet. CSA approved for Class I, Div 2, Groups A, B, C, and D.
Enclosure dimensions: 6" x 6" x 4" (152 mm x 152 mm x 101 mm).



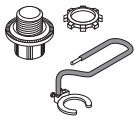
D1297BRACK

D1297BRACK Optional stainless steel mounting bracket for junction box type D1297TERM4. To be strapped on metal cladding of pipe insulation using metal banding or pipe straps (based on outer dimension of insulation).



JBS-100-ECW-A JBS-100-ECP-A

JBS-100-ECP-A and JBS-100-ECW-A Electronic temperature controllers that provide accurate control of a heating circuit using a RTD sensor. The JBS-100-ECP-A is pipe mounted and serves as a power connection kit for both Raychem self-regulating and Pyrotenax mineral insulated heating cables. The JBS-100-ECW-A is wall mounted and may be used with all types of heating cables. It can also be used as a power connection kit with Pyrotenax MI cables. Adjustable set points between 32°F to 425°F (0°C to 218°C), power input of 120 Vac to 277 Vac and current switching up to 30 A. c-CSA-us (certified to U.S. and Canadian Standards) for use in nonhazardous locations. Requires MI grounding kit.



MI-GROUND-KIT

MI-GROUND-KIT Required grounding kit for use with the JBS-100-ECP-A and JBS-100-ECW-A. Allows for a direct connection to a Pyrotenax MI heating cable, eliminating the need for a separate junction box.

ACCESSORIES

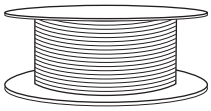
Attachment Materials

PB

PB Stainless steel straps for holding MI heating cables onto pipe. Pliers are the only tool required to pull the pipe strap tight. Allow one pipe strap per foot of pipe (3.3 pipe straps per meter of pipe).

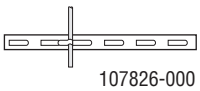
Table 10 Available Pipe Straps

Part number	Pipe diameter	Package quantity
PB 125	To 1-1/4"	50 pc
PB 300	1-1/2" to 3"	35 pc
PB 600	3-1/2" to 6"	25 pc
PB 1000	6" to 10"	1 pc
PB 1200	To 12"	1 pc
PB 2400	To 24"	1 pc
PB 3600	To 36"	1 pc



051CUPRON

051Cupron 16 AWG tie wire for fastening Alloy 825 MI heating cables on pipes. Do not use with copper-sheathed MI heating cables; use PB pipe straps. Particularly good for irregular shaped objects like valves and pumps. Order quantity as required (in ft) as per Table 11.



107826-000

HARD-SPACER-SS-25MM-25M Stainless steel prepunched strapping to hold MI heating cable in place. Supplied in 82 ft (25.0 m) rolls.

Use on large pipes to simplify installation of multiple heating cables. For quantities, see Table 3.11 (installation every 1 ft = 0.328 m).

Table 11 Allowance for Tie Wire and Prepunched Banding on Pipes

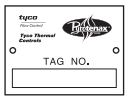
Pipe size (inches)	1	1.5	2	4	6	8	10	12	14	16	18	20	24	30	36	48
Required length (ft) per ft of pipe	0.8	1.1	1.2	1.6	2.1	2.8	3.5	4.2	4.6	5.2	5.9	6.5	7.9	9.8	11.8	15.7
Required length (m) per m of pipe	0.8	1.1	1.2	1.6	2.1	2.8	3.5	4.2	4.6	5.2	5.9	6.5	7.9	9.8	11.8	15.7

Electric Traced Label

ETL

ETL Attach the label to the outside of the thermal insulation weather barrier to indicate presence of electrical heat tracing. Use one label for every 10 feet (3 m) of pipe, alternating on either side of the pipe. Also install at equipment requiring periodic maintenance (control valves, pumps, instruments, etc.).

Identification Label

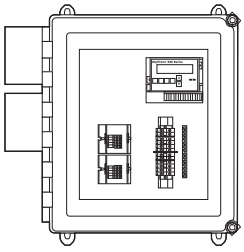


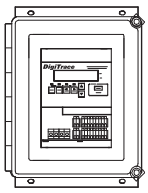
LBLSS

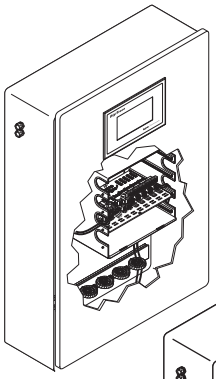
LBLSS Stainless steel identification label for identifying junction boxes, thermostats, contactors, and heating sets.
Dimensions: 2.5" x 1.5" (63 mm x 38 mm).

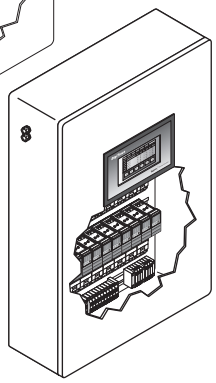
Temperature Controls

For a complete selection of control and monitoring products, including line-sensing thermostats, see Control and Monitoring.


DigiTrace 920


DigiTrace 910


NGC-30 system


NGC-40 system

Worldwide Headquarters
Tyco Thermal Controls
7433 Harwin Drive
Houston, TX 77036
USA
Tel: 800-545-6258
Tel: 650-216-1526
Fax: 800-527-5703
Fax: 650-474-7711
info@tycothermal.com
www.tycothermal.com

Canada
Tyco Thermal Controls
250 West St.
Trenton, Ontario
Canada K8V 5S2
Tel: 800-545-6258
Fax: 800-527-5703

Europe, Middle East, Africa (EMEA)
Tyco Thermal Controls
Romeinse Straat 14
3001 Leuven
België / Belgique
Tel: +32 16 213 511
Fax: +32 16 213 603

Latin America
Tyco Thermal Controls
7433 Harwin Drive
Houston, TX 77036
United States
Tel: 713-868-4800
Tel: 713-735-8645
Fax: 713-868-2333

Asia Pacific
Tyco Thermal Controls
20F, Innovation Building,
1009 Yi Shan Rd,
Shanghai 200233,
P.R.China
Tel: +86 21 2412 1688
Fax: +86 21 5426 2937 / 5426 3167

tyco
Thermal Controls