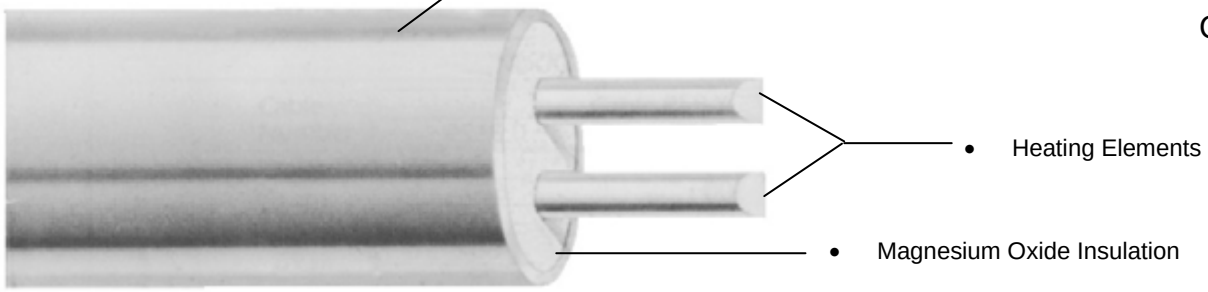
NELSON™

MINERAL INSULATED CABLE

SPECIFICATION / APPLICATION INFORMATION



Description:

Mineral insulated cable is a metal sheathed cable that uses a metallic conductor as the heating element. The conductor is electrically insulated from the metal sheath with magnesium oxide (MgO). Mineral insulated cable is a series resistance heater that generates heat by passing current through the electrical conductor. Power output per unit length of the cable therefore varies with the applied voltage and the resistance of the conductor.

Mineral Insulated Cables are available with either one or two conductors. The one conductor cable is available in the "E" Form where a cold splice is provided at both cable ends for electrical connection. The two-conductor cable is available in two forms. The "A" Form provides an out-and-back circuit with a single cold splice connection at one end. The "E" Form provides cold splices at both ends of the cable.

Outer sheath construction is Alloy 825, a high temperature corrosion resistant alloy with superior flexibility. Two cable diameters are available. The "K" cable diameter is 0.187" and the "B" cable diameter is 0.312". A unique manufacturing process provides for a thin wall construction which improves flexibility and ease of installation. This process also allows the use of high performance alloy conductors for high temperature applications.

Principle of Operation:

The series conductor generates heat when voltage is applied as a result of current passing through the conductor. Power output per unit length varies with the applied voltage and circuit resistance. The circuit resistance, in turn, varies with cable length. MI cables are available with a wide selection of conductor resistances. Based on voltage and desired cable length, a specific conductor is selected with a cable resistance that provides the desired power output.

Application:

Nelson MI Cable is a high performance, industrial grade hear tracing cable used for applications requiring:

- High Temperature Exposure
- High Maintain Temperature
- High Power Output
- Rugged Cable Construction
- Constant Power Output Over Entire Heater Length
- Extended Heater Life
- Immunity to Stress Corrosion
- Snow Melt Systems
- Floor Warming Systems
- Undertank Heating (Cryogenic Tanks)

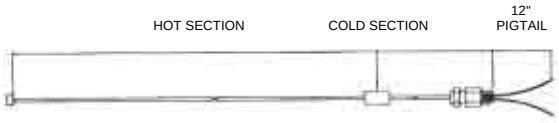
MI Cable is custom designed and fabricated for specific applications.

Cable Ratings:

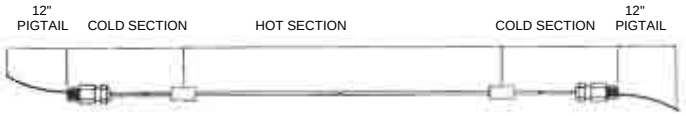
MI Cable

CABLE TYPE	K	K	B
SHEATH MATERIAL	ALLOY 825		
CABLE DIAMETER (INCHES)	0.1875	0.1875	0.3125
NUMBER OF CONDUCTORS	1	2	2
MAXIMUM VOLTS	600	300	600
MAXIMUM EXPOSURE	1100°F (593°C)		
MAXIMUM POWER W/FT	62	62	88
WEIGHT LB/FT	.07	.07	.22
FORMS	E	A,E	A,E
STD COLD LEAD FT	7.0		

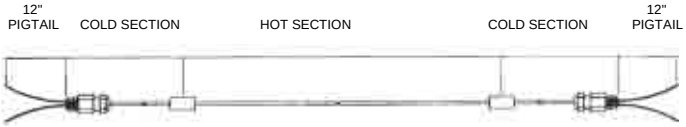
Form A



Form E (1 Conductor)



Form E (2 Conductor)



Catalog Ordering System:

Custom Cables
Catalog Number (*) A 670 B 150 07 (*)

(*)	A	670	B	150	07
Optional Construction	Form A or E	Conductor selection from table	Cable diameter K=.1875" B=.3125"	Hot Section Length in feet	Cold section length in feet

Optional Construction

Prefix	Suffix	Description
P		Pulling Eye for "A" form only
X		Oversized cold section or special feature
	EM	Mounting of hot-cold junction outside thermal insulation (freeze protection of lines over 600°F (316°C)
	QT	Factory mounting of QHT-3 Adapter (High wattage and/or maintain temperature)
	UG	UL listing tag**
	UH	UL hazardous area listing tag**
	FH	FM hazardous listing tag**
	CH	CSA Hazardous listing tag**
	CHB	CSA Group B hazardous listing tag**
	UM	UL snow melting listing tag**

** Requires volts, amps and watts with each cable order.

Accessories:

QHT-3 HIGH TEMPERATURE ADAPTER is used to heat sink the hot section transition as it passes through the thermal insulation when the hot to cold connection must be located outside the thermal insulation due to sheath temperature over 600°F (316°), and cable wattage above 20 w/ft.

SV 2 VOLTAGE ADJUSTOR provides solid state voltage adjustment when desired voltage is below 120 volts. It is primarily used when cable length is below 20 feet.

Custom Cable
Resistance Characteristics:

2-CONDUCTOR CABLE, 0.1875" DIAMETER ALLOY 825, 300 VOLTS			
Cable Number	Cable Res Ohms/Ft	Maximum Exposure Temperature Rating	Resistance Curve
556K	.043		1
658K	.0581		
674K	.0742	600°F (316°C)	
693K	.0926		
712K	.1170		
715K	.1470		
721K	.213		3
732K	.319		
742K	.416		
752K	.520		
766K	.660		
774K	.740		
810K	1.00		
813K	1.30		
818K	1.80	1100°F (593°C)	N/A
824K	2.34		
830K	2 96		
838K	3,70		
846K	4.72		
860K	5.60		
866K	6,60		
894K	9.00		
919K	18.00		

2-CONDUCTOR CABLE, 0.325" DIAMETER ALLOY 825, 600 VOLTS			
Cable Number	Cable Res Ohms/Ft	Maximum Exposure Temperature Rating	Resistance Curve
588B	.0071		1
614B	.0149		1
627B	.027	600°F (316°C)	2
640B	.040		3
670B	.065		
710B	.104		
715B	.162		
720B	.205		
732B	.325		
750B	.500		
774B	.735	1100°F (593°C)	N/A
810B	1.162		
819B	1.87		
830B	2.97		
840B	4.30		
859B	5.98		

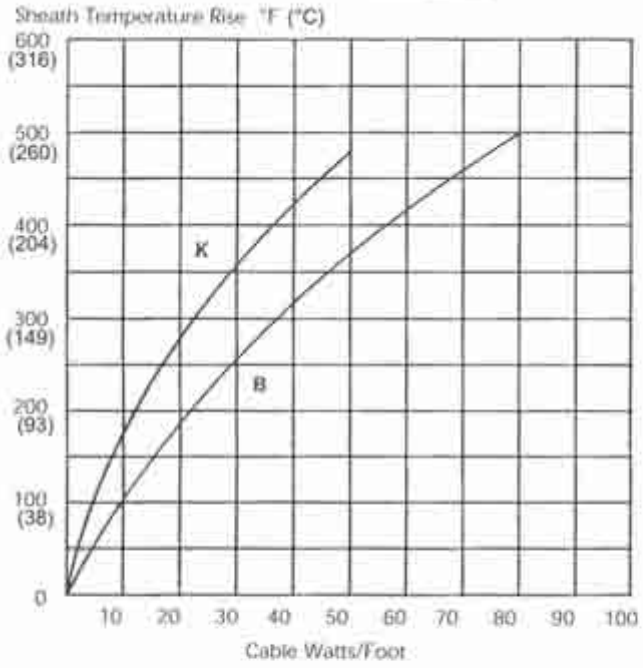
Custom Cable Resistance Characteristics:

1-CONDUCTOR CABLE, 0.1875" DIAMETER ALLOY 825, 600 VOLTS			
Cable Number	Cable Res Ohms/Ft	Maximum Exposure Temperature Rating	Resistance Curve
145K	.0046	600°F (316°C)	1
189K	.0090		1
216K	.0165		2
239K	.039	1100°F (593°C)	N/A
250K	.050		
279K	.079		
310K	.095		
316K	.157		
326K	.260		
333K	.330		
346K	.457		
372K	.730		
412K	1.17		
415K	1.48		
423K	2.36		
430K	2.80		
447K	4.50		

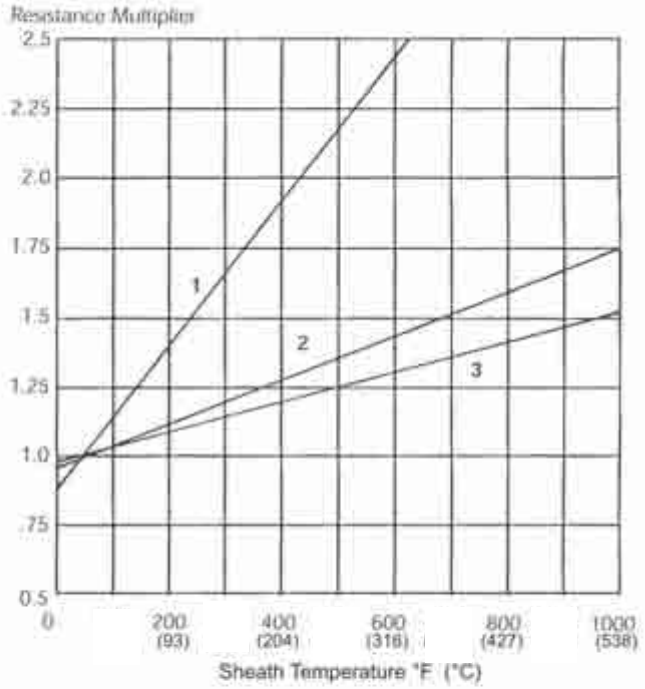
Note: Factory design required for the following applications:

1. Exposure temperature greater than 1100°F (593°C).
2. Maintain temperature greater than 400°F (204°C).

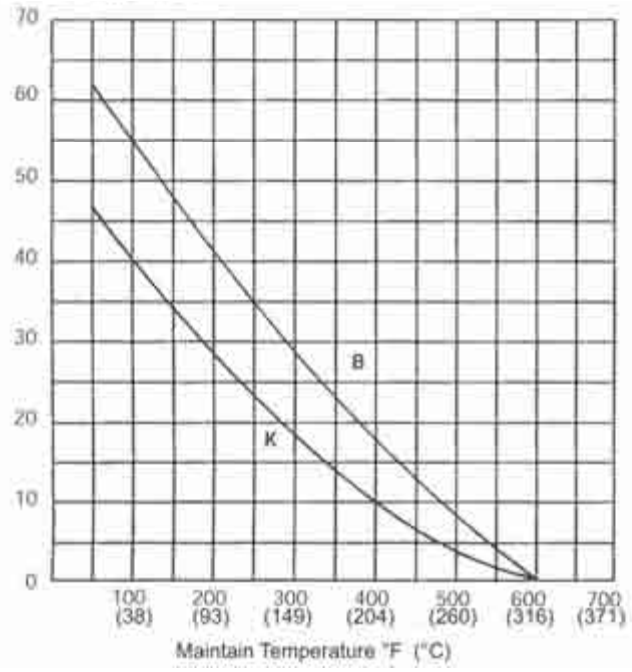
GRAPH-1
CABLE SHEATH TEMPERATURE RISE



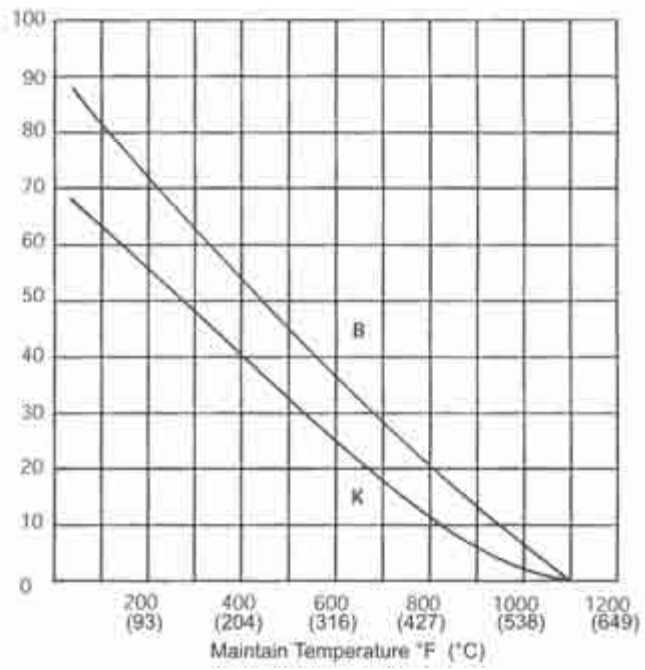
GRAPH-2
CABLE RESISTANCE TEMPERATURE MULTIPLIER



GRAPH-3
MAXIMUM WATTAGES – ALL CABLES
WITH HOT/COLD JUNCTION OUTSIDE INSULATION



GRAPH-4
MAXIMUM WATTAGES – ALL 1100° F (593°C) MAXIMUM TEMPERATURE
CABLES WITH HOT/COLD JUNCTION OUTSIDE INSULATION



Heater Design:

Nelson Mineral Insulated Cables

Step 1: Determine the pipe heat loss at minimum ambient temperature. This represents the minimum heater power output you require.

Step 2: Determine the heater length in feet by adding the required heater footage for heat sinks to the pipe length.

Step 3: Determine system voltage. Nelson cables are rated for either 300 or 600 volts maximum.

Step 4: Select the heater cable construction based on system requirements.

Voltage (below 300 volts or above)
Cable size (.1875" or .312" diameter)
Maximum exposure temperature
Number of conductors desired (one or two)
Maximum watts/foot required

Generally, you will want to use the smallest diameter, two conductor "A" form cable that meets your requirements. Two conductor cable provides an out-and-back circuit that simplifies electrical wiring. Smaller diameter cables are easier to install. As maintain temperatures, watt requirements, voltage, and heater length increase, you may require the larger diameter cable.

Step 5: Select the correct heater cable. This is done by calculating the optimum resistance needed and then selecting the closest actual resistance available from one of the resistance tables. The optimum resistance is calculated as follows:

$$R = V^2/(W \times L^2)$$

Where
R = Required Cable resistance (ohms/foot)
V = Voltage
W = Desired cable power output (watts/foot)
L = Required heater cable length (feet)

Note: Cable resistance (R) from the equation is based on the operating temperature. Low resistance conductors have a significant increase in resistance as operating temperature increases. The cable resistance given in the resistance tables must be modified for these cables by the following procedure.

a. Based on the desired power output (W) in watts/foot, use the GRAPH-1 to determine the SHEATH TEMPERATURE RISE for the particular cable diameter you select.

b. Add the sheath temperature rise to the desired maintain temperature to determine the SHEATH TEMPERATURE.

c. From GRAPH-2, determine the cable resistance multiplier for your application. Multiply the resistance value given in the resistance tables by this multiplier to determine the cable resistance at operating conditions.

Heater Design:

Step 6: Determine electrical and thermal conditions. Once the cable resistance has been selected, you will want to verify performance of the cable you have selected from GRAPHS 3 and 4.

Actual Power Output: $\mathbf{W = V^2/(R \times L^2)}$

Current draw in amps: $\mathbf{I = V/(R \times L)}$

Note: To comply with Canadian and National Electrical Codes, the circuit breaker must be oversized by a minimum of 125% of heater amperage.

Approvals:

Note: Cable voltage, amps and watts must be provided for approval tags.

FM
Ordinary Locations
Hazardous (Classified) Locations
(FH Suffix)
Class I, Division 1 and 2
Groups A, B, C, D
Class II, Divisions 1 and 2
Groups E, F, G
Class III, Divisions 1 and 2

FM APPROVED

CSA
Ordinary Locations
Hazardous (Classified) Locations
(CH Suffix)
Class I, Division 1 and 2
Groups B, C, D
Class II, Divisions 1 and 2
Groups E, F, G
Class III, Divisions 1 and 2
Class I, Zone 1 and 2
Group IIB + H2
Zone 1, Ex de IIB + H2 T1-T6

UL
Ordinary Locations
Hazardous (Classified) Locations
(UH Suffix)
Class I, Division 1 and 2
Groups B, C, D
Class II, Divisions 1 and 2
Groups E, F, G
Class I, Zone 1 and 2
Group IIB + H2

UL US LISTED

Nelson Heat Tracing Systems products are supplied with a limited warranty. Complete Terms and Conditions may be found on Nelson's website at www.nelsonheaters.com.