

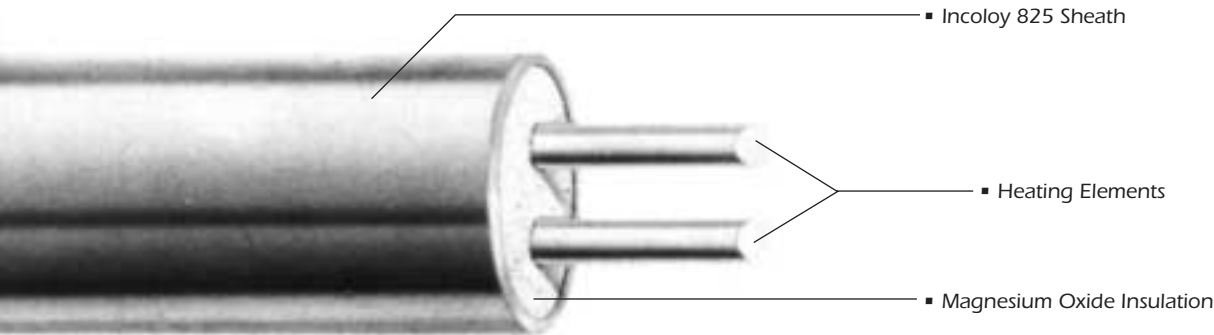
# SERGE BARIL MIC

## MINERAL INSULATED CABLE

# SPECIFICATION/APPLICATION

## INFORMATION

**Custom MIC**



### 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.

Serge Baril MIC 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 Incoloy 825, a high temperature corrosion resistant alloy with superior flexibility. Two cable diameters are available. The "K" cable diameter is 0.187" (4.76 mm) and the "B" cable diameter is 0.312" (7.94 mm). 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. Serge Baril MIC 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:

Serge Baril MIC Cable is a high performance, industrial grade heat 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
- Under tank Heating (Cryogenic Tanks)

Custom MIC Cable is designed and fabricated for specific applications.

### Cable ratings:

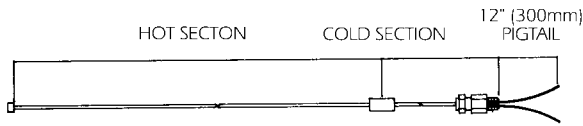
CABLE TYPE	K	K	B
SHEATH MATERIAL	INCOLOY 825		
CABLE DIAMETER INCHES (mm)	0.1875 (4.76)		0.3125 (7.94)
NUMBER OF CONDUCTORS	1	2	2
MAXIMUM VOLTS	600	300	600
MAXIMUM EXPOSURE TEMPERATURE °F (°C)	1100 (590)		
MAXIMUM POWER W/ft (W/m)	62 (203.36)	62 (203.36)	88 (288.64)
WEIGHT lb/ft (kg/m)	.07 (.10)		.22 (.33)
FORMS	E	A,E	A,E
STD COLD LEAD ft (m)	7.0 (2.13)		

# SERGE BARIL MIC

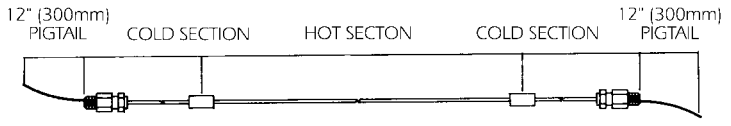
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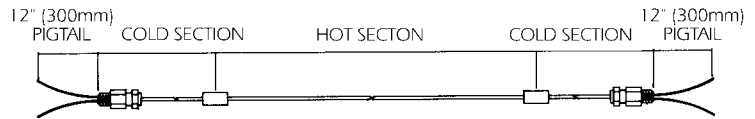
### Form A



### Form E (1 Conductor)



### Form E (2 Conductor)



## Catalog Ordering System:

Catalog Number (\*) A 670 B 150 07(\*)

(*)	A	670	B	150	07
Optional Construction	From A or E	Conductor selection from table	Cable diameter K or B	Hot section length in feet	Cold section length in feet

### MIC Accessories:

- HTA** 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, (315°C) and cable wattage above 20 W/ft (66 W/m).
- VA** VOLTAGE ADJUSTOR provides solid state voltage adjustment when the desired voltage is below 120 V. It is primarily used when cable length is below 20 ft (6 m).

### (\*)Optional Construction

Prefix	Suffix	Description
P		Pulling Eyes 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 / 315°C).
	HTA	Factory mounting of HTA adaptor
	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.

## RESISTANCE CHARACTERISTICS:

2 CONDUCTOR CABLE, 0.1875" (4.76 mm) DIAMETER 300 VOLTS					
Cable Number	Cable res. Ω/ft	Cable res. Ω/m	Max. exposure Temp. Rating	Resistance Curve	
556K	.043	.141	600°F (315°C)	1	
658K	.058	.190		1	
674K	.074	.243		1	
693K	.093	.305		1	
712K	.117	.384		1	
715K	.147	.482		1	
721K	.213	.699		1	
722K	.213	.699		3	
732K	.319	1.05		1100°F (590°C)	N/A
742K	.416	1.36			
752K	.520	1.71			
766K	.660	2.17			
774K	.740	2.43			
810K	1.00	3.28			
813K	1.30	4.26			
818K	1.80	5.90			
824K	2.34	7.68			
830K	2.96	9.71			
838K	3.70	12.14			
846K	4.72	15.48			
860K	5.60	18.37			
866K	6.60	21.65			
894K	9.00	29.52			
919K	18.00	59.04			

2 CONDUCTOR CABLE, 0.325" (7.94 mm) DIAMETER 600 VOLTS				
Cable Number	Cable res. Ω/ft	Cable res. Ω/m	Max. exposure Temp. Rating	Resistance Curve
588B	.007	.023	600°F (315°C)	1
614B	.015	.049		1
627B	.027	.089		2
640B	.040	.131		3
670B	.065	.213	1100°F (590°C)	N/A
710B	.104	.341		
715B	.162	.531		
720B	.205	.672		
732B	.325	1.07		
750B	.500	1.64		
774B	.735	2.41		
810B	1.16	3.80		
819B	1.87	6.13		
830B	2.97	9.74		
840B	4.30	14.10		
859B	5.98	19.61		

1 CONDUCTOR CABLE, 0.1875" (4.76 mm) DIAMETER 600 VOLTS				
Cable Number	Cable res. Ω/ft	Cable res. Ω/m	Max. exposure Temp. Rating	Resistance Curve
145K	.0046	.015	600°F (315°C)	1
189K	.0090	.030		1
216K	.0165	.054		2
239K	.039	.128	1100°F (590°C)	N/A
250K	.050	.164		
279K	.079	.259		
310K	.095	.312		
316K	.157	.515		
326K	.260	.853		
333K	.330	1.08		
346K	.457	1.50		
372K	.730	2.39		
412K	1.17	3.84		
415K	1.48	4.85		
423K	2.36	7.74		
430K	2.80	9.18		
447K	4.50	14.76		

**Note:** Factory design is required for the following applications:

1. Power output greater than 45 W/ft (148 W/m).
2. Exposure temperature greater than 1100°F (590°C).
3. Maintain temperature greater than 400°F (204°C).

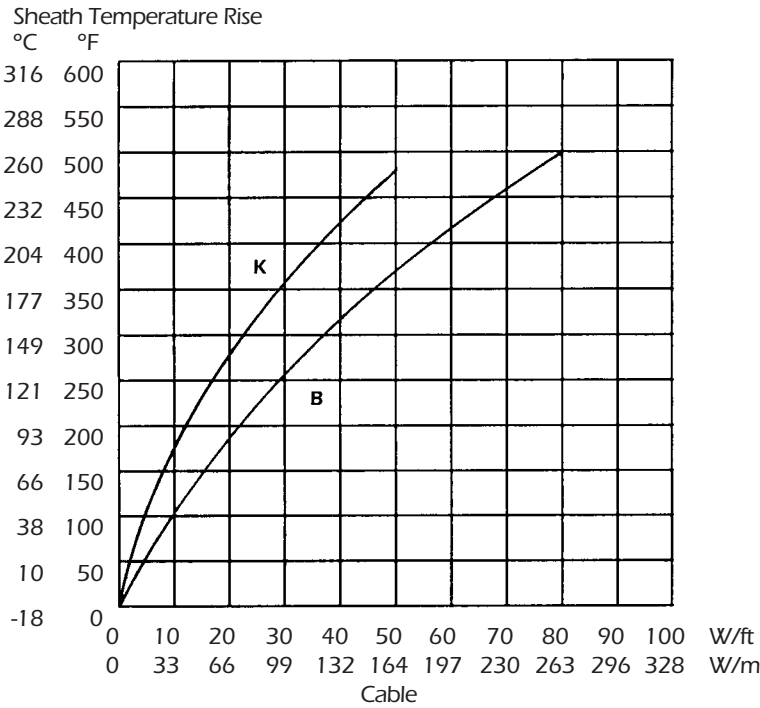
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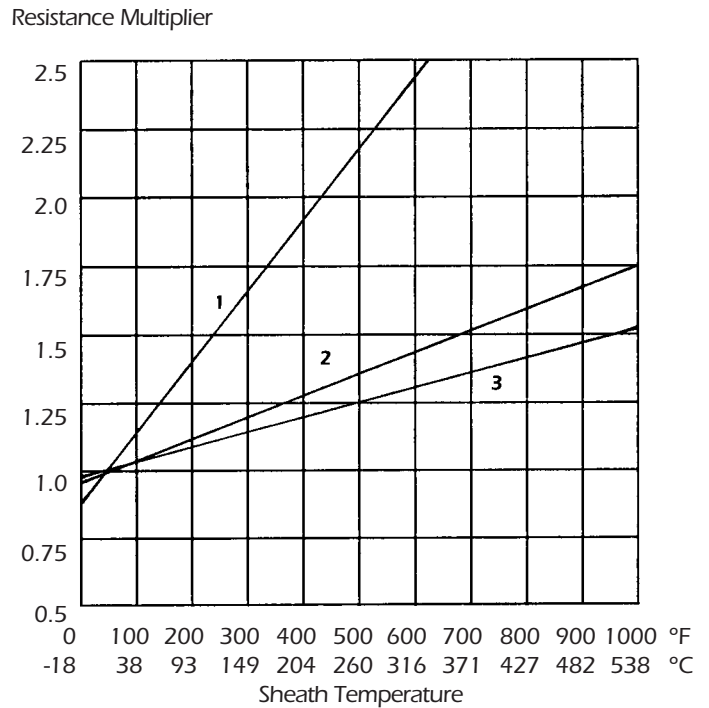
**GRAPH-1**

CABLE SHEATH TEMPERATURE RISE



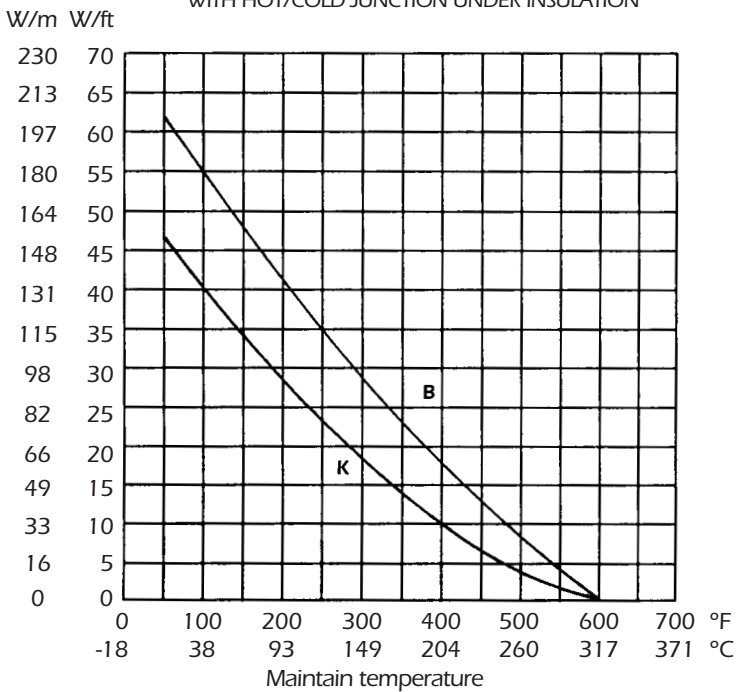
**GRAPH-2**

CABLE RESISTANCE TEMPERATURE MULTIPLIER



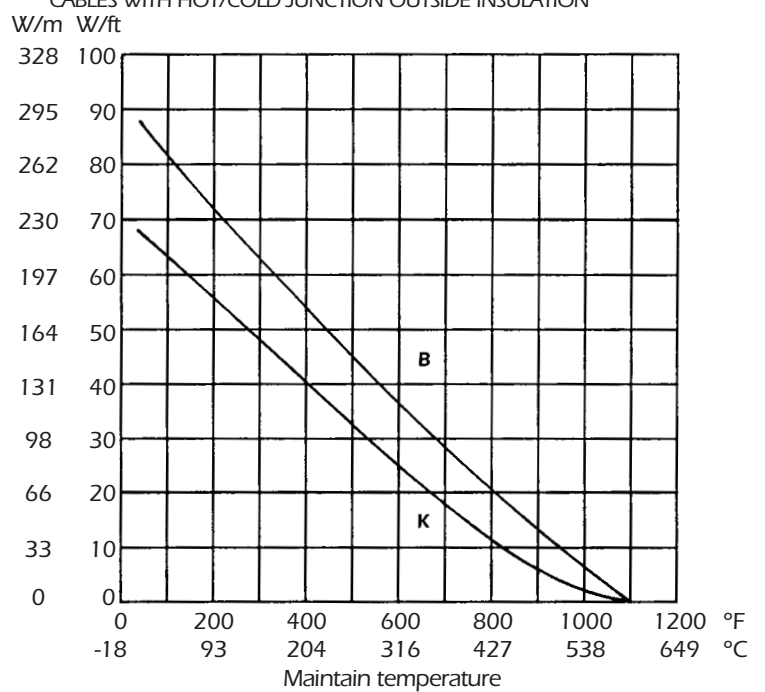
**GRAPH-3**

MAXIMUM WATTAGES - ALL CABLES WITH HOT/COLD JUNCTION UNDER INSULATION



**GRAPH-4**

MAXIMUM WATTAGES - ALL 1100°F (590°C) CABLES WITH HOT/COLD JUNCTION OUTSIDE INSULATION



## Heater Design:

### Select the heater cable construction based on the system requirements.

- Voltage (below or above 300 volts)
- Cable size K or B
- Maximum exposure temperature
- Number of conductors desired (one or two)
- Maximum watts/foot (watts/meter) 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.

### 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 (ohms/meter)
  - V** = Voltage
  - W** = Desired cable power output watts/foot (watts/meter)
  - L** = Required heater cable length (feet or meters)

**Note:** the cable resistance (R) from the equation is based on the operating temperature. Low resistance conductors have a significant increase in resistance as the 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), 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.

### 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:  $W = V^2 / (R \times L^2)$       Current draw in amps:  $I = V / (R \times L)$

**Note:** To comply with Canadian and National Electrical Codes, the circuit breaker must be oversized by a minimum of 25% of the heater amperage and must be of the ground leakage type.

## Approvals:

**FM (FH Suffix)**  
**Ordinary Locations -  
Hazardous (Classified)  
Locations**

Class I; Division 1 & 2;  
Groups B, C, D  
Class I; zone 1&2; Groupe IIC  
Class II; Division 1 & 2  
Group E, F, G



**CSA (CH Suffix)**  
**Ordinary Locations  
Hazardous (Classified)  
Locations**

Class I; Division 2  
Groups B, C, D  
Class II; Division 2;  
Groups E, F, G

**(CHB Suffix) Hazardous  
(Classified) Location**

Class I; Division 1;  
Group B  
(Consult Factory)



**UL**  
**Ordinary Locations (UG  
Suffix)  
Hazardous (Classified)  
Locations (UH Suffix)**  
Class I; Division 2;  
Group D  
**Snow Melting (UM Suffix)**



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

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