

M.I. Coax™ and M.I. Biax™ Heater Cable

INTRODUCTION AND TECHNICAL REFERENCE

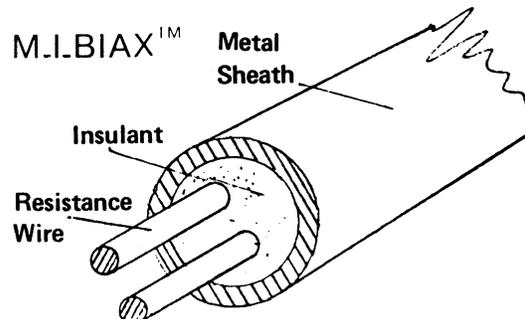
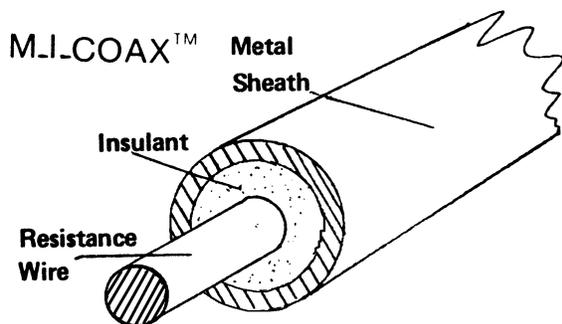
The construction of the bulk heater material follows normal **mineral insulated** cable practice, with a conductor, or conductors, embedded in a highly compressed mineral insulant which is, in turn covered by malleable metal sheath.

Standard AKINSUN bulk heater material contains as conductors 80% Ni-20% Cr. Alloy and Incoloy 600 sheath. Other sheath and conductor metals are selected according to the application requirements of the cable concerned. The cable is furnished in the fully annealed state.

In order for AKINSUN engineering staff to assist with heater design, it is important to obtain as much information on the intended application as possible. Sufficient information must be provided to define the environment, peak temperature (of the sheath), temperature cycles, instrumentation required (if any), physical dimensions, lead-in (and terminal), arrangements, and the electrical power system capabilities (volts, ampere, phases). This may seem to be an inordinate amount of information but all of these factors are involved in the application of M.I. cable heaters and AKINSUN is ready to assist you as required.

Features

- **High Watt Density**
Up to 150 watts/sq.(23.34 watts/sq. cm.) can be obtained.
- **Exceptional Flexibility**
Can be coiled on a mandrel twice its own diameter. Also allows close fit over pipes and couplings.
- **Corrosion Resistant**
To most liquids and acids.
- **Long Life, Vibration Safe**
The inorganic material provides a Stable non-aging element.
- **Application Temperatures**
To 800°C (1472°F).
- **Heat Resistant**
Can be easily welded, flame sprayed, or brazed to products. Heater can be cast in or imbedded into materials.
- **To The Researcher**
It gives a tool for solving unique heating problems.
- **Proof Against Fire**
Because these elements are made from inorganic materials they will neither burn nor support combustion and may be operated continuously at temperatures that would be harmful to other systems.



M.I. Cable Heater Specifications

DESIGN GUIDE

M.I. COAX SINGLE CONDUCTOR

TABLE 1

CATALOG NUMBER	OHMS ± 10% PER		SHEATH DIAMETER		WIRE DIAMETER		MAX VOLTAGE	MAX. AMPS	OPERATING LIMITS WATTS/ FT.	MINIMUM BEND RADIUS
	FEET	METER	INCH	MM	INCH	MM				
MC040N - 16.3	16.3	53.70	.040	1.00	.006	.15	90V	3.50	100	.063 (1/16")
MC062N - 6.5	6.5	21.40	.062	1.59	.010	.25	120V	10.00	155	.125 (1/8")
MC093N - 3.0	3.0	9.90	.093	2.36	.015	.38	220V	17.40	190	.118 (3/16")
MC125N - 1.6	1.6	5.30	.125	3.18	.020	.51	240V	23.50	280	.250 (1/4")
MC188N - 0.70	0.7	2.31	.188	4.78	.032	.81	240V	30.00	420	.375 (3/8")

M.I. BIAX DOUBLE (2) CONDUCTOR

TABLE 2

MB040N - 32.0	32	105	.040	1.00	.006	.15	60V	3.50	75	.063 (1/16")
MB062N - 13.0	13	43	.062	1.59	.010	.25	120V	6.00	185	.125 (1/8")
MB093N - 6.0	6	19.7	.093	2.36	.015	.38	120V	10.00	225	.118 (3/16")
MB125N - 3.2	3.2	10.5	.125	3.18	.020	.51	240V	15.00	310	.250 (1/4")
MB188N - 1.4	1.4	4.6	.188	4.78	.032	.81	240V	23.50	390	.375 (3/8")

WATT DENSITY VS SURFACE TEMPERATURE °F

WATT DENSITY - WATTS/ SQ. INCH.	10	20	30	40	50	60	70	80	90	100
SURFACE TEMPERATURE ON CABLE	500	800	975	1070	1200	1300	1400	1500	1560	1630

Temperature measured in still air at 70° F ambient on straight lengths at 120 volts

General Guidelines for Better Heater Designs

1. The peak operating temperature of the heating element should be at least 100°C (212°F) below its melting point.
2. Design for a resistance greater than one ohm to keep the conductors at reasonable temperature.
3. The heating element should have a very low temperature coefficient of resistivity. Pure metals do not usually make good heating elements because of the high temperature coefficients of resistivity.
4. The heating element should be as husky as practical.
5. The insulation thickness should be at least 0.020" in the radial direction.
6. Uniformity of insulation resistance and thermal conductivity will occur only when the insulation density is very high.
7. The smaller the inner diameter of the heating element, the higher the peak internal temperature.
8. A thermal profile should be made for every high performance heater.
9. While multiple thermocouples can be provided, circumferential spacing between units should be 1/8" minimum.
10. Most of the electrical resistance is provided by the outer few mil. (0.001") of the insulation.
11. The external surface area of the heating element should be as large as possible.

M.I. Heater Selection Guide

Standard Watts at 120V for given Cable

HEATED LENGTH 'H'	CABLE DIAMETER											
	in		mm		in		mm		in		mm	
	.040	1.00	.062	1.59	.093	2.36	.125	3.18	.188	4.78		
115"	--	--	--	--	--	--	--	--	--	1010		
110"	--	--	--	--	--	--	--	--	--	1055		
105"	--	--	--	--	--	--	--	--	--	1105		
100"	--	--	--	--	255	485	1160					
95"	--	--	--	--	270	510	1220					
90"	--	--	--	--	300	565	1290					
85"	--	--	--	--	320	600	1365					
80"	--	--	155	--	340	635	1450					
75"	--	--	165	--	360	675	1545					
70"	--	--	175	--	385	725	1660					
65"	--	--	205	--	415	780	1785					
60"	--	--	210	--	450	845	1935					
55"	--	--	230	--	490	925	2110					
50"	110	--	250	--	540	1015	2320					
45"	120	--	275	--	600	5530	2580					
40"	135	--	310	--	675	1270	2900					
35"	255	--	355	--	775	1450	3315					
30"	280	--	425	--	900	1695	--					
25"	215	--	500	--	1080	--	--					
20"	270	--	625	--	--	--	--					

Heater Selection in shaded area needs cold section and the heater selection has to be "Q" or "S" style because of higher watt densities

For lengths or voltage other than listed, use the following formula:

$$\begin{aligned}
 \text{WATTS} &= \frac{\text{VOLTS}^2 \times 11.28}{\text{HEATED LENGTH} \times \text{OHMS/FT. OF CABLE (TABLE)}} \\
 &= \frac{\text{VOLTS}^2 \times 11.28}{\text{H} \times \text{OHMS/FT. CABLE}}
 \end{aligned}$$

EXAMPLE: FOR .093 CABLE SELECTION

$$\text{WATTS} = \frac{120^2 \times 11.28}{48" \times 6.00 \text{ (FROM TABLE 2)}}$$

WATTS= 564