

Summary of Features and Limits – Constant Wattage Cable

Features: Parallel circuit construction
Corrosion Resistant FEP jacket
Standard 120V, 240V and 480V operation
Maintain up to 250°F, Exposure to 400°F
Constant output wattage, easy system designs
Cut-to-length in field, simplifies installation
No start-up current

Limits: Output limited to 16 W/Ft
Excess heat output may overheat pipe contents
Cannot be used on plastic pipes
Lower temperature limits than MI cable

A New Generation – Self Regulating Cable. When energized, MI and CW cables provide the same output regardless of pipe or ambient temperatures. In applications where the heat loss is low compared to the cable output, excess cable wattage is absorbed by the pipe system and may overheat the pipe contents.

To overcome the problem of excess heat, self regulating (SR) cable was developed. Rather than using a metal heating element, SR cables utilize carbon black powder which is electrically conductive. The carbon black is mixed with polymers and extruded in a strip between two parallel bus wires. The polymers respond to temperature changes by microscopically expanding or contracting as temperatures rise and fall. As the polymers expand and contract, the carbon black particles make or break contact with each other. The result is seemingly infinite parallel paths of conductance from one bus wire to the other. The conductive strip, or matrix, is dielectrically insulated with thermoplastic rubber plastic (TPR) or FEP jackets then covered with a ground braid to accommodate current electrical codes.

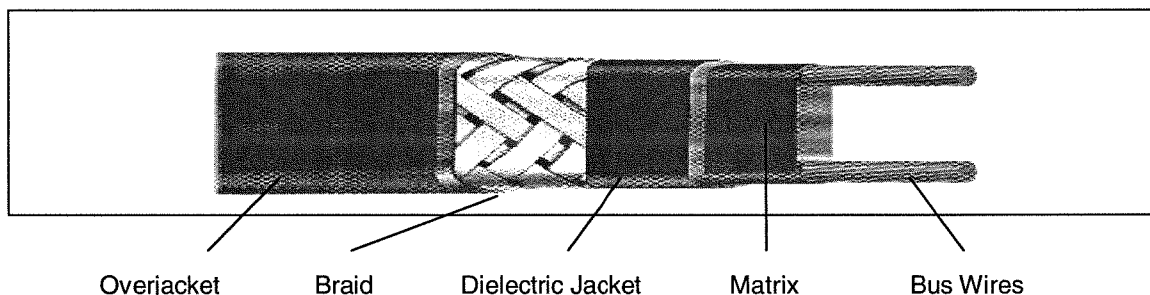


Illustration 15 – Self Regulating Construction

Several benefits emerged with the development of SR cable. The cables' ability to independently respond to local temperatures helps prevent overheating when excess heat is applied. Also, unlike MI and CW cables, SR cable can be overlapped during installation without fear of burnout. Another benefit is the parallel circuitry; the cable can be cut to length in the field without need of factory assistance. Illustration 16 depicts the electrical characteristics of SR cables.

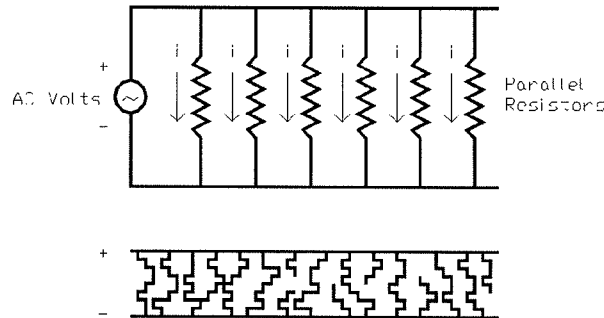
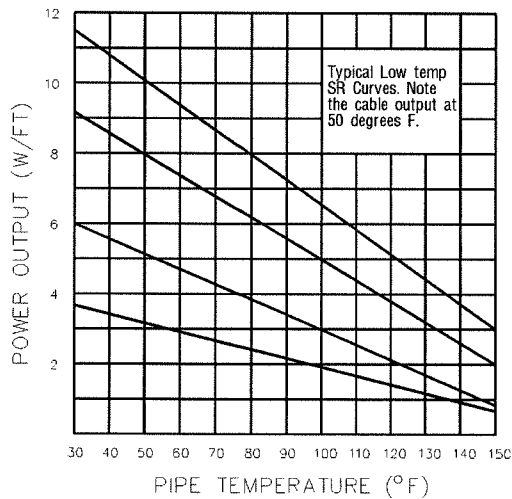


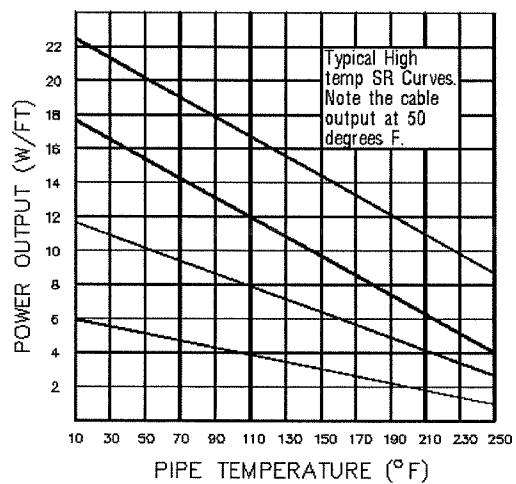
Illustration 16 – SR Cable Electrical Operation

Self regulating output curves have a positive temperature coefficient (PTC) slope. A PTC slope indicates that as the temperature of heating cable increases, the outputs decreases and vice versa. Since SR cable output changes, the industry convention is to designate its nominal output wattage rating at 50°F. Graphical representations of low and medium/high cable output curves are illustrated in Graphs 2 and 3.

Graph 2: Low Temp Output



Graph 3: Medium/High Temp Output



Industrial SR Cable, Low Temperature. Generally, low temperature SR cable uses 16AWG bus wires, is offered in nominal watt outputs up to 10 W/Ft and is available in 120V and 240V formulations. The maximum operating temperatures are usually 150°F maintenance and 185°F exposure. The inner dielectric jacket is comprised of TPR insulation. Outer jackets include both TPR for mildly corrosive to FEP for highly corrosive applications. *It is the user's responsibility to determine the correct jacket for the application.*

Industrial SR Cable, Medium/High Temperature. Generally, medium/high temperature SR cable uses 14AWG, is offered in nominal watt outputs up to 20 W/Ft and is available in 120V and 240V formulations. A 14AWG bus wire is used to accommodate higher output and subsequent higher operating ampere capacity. Medium/high SR cable has higher operating temperature limits than its low temperature sister products. Due to the polymers used in the construction, the maximum operating temperatures are generally 250°F maintenance and 375°F exposure. The inner dielectric and outer jackets are comprised of FEP insulation for highly corrosive applications. Again, corrosion is the user's responsibility.

Commercial SR Cable, Freeze Protection. To address commercial freeze protection applications, Chromalox® has expanded the low temperature self regulating products to include a commercial grade SR freeze protection cable for use on commercial pipes used in parking garages, cooling towers and other non-hazardous applications. These products are similar to the industrial grade SR cables except that they are not approved for hazardous area applications.

Commercial SR Cable, Snow Melting. The enormous snowfall amounts in recent winters proved disastrous for building rooftops. Water damage occurs when rooftop snow and ice melts then re-freezes under shingles. Occasionally, structural damage occurs when gutters collapse under the weight of accumulated ice buildup. Consequently, Chromalox® has developed an SR cable to prevent ice buildup in gutters and downspouts.

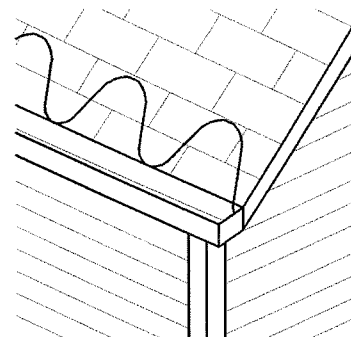


Illustration 17

Snow melting cable is not intended to completely melt the snow and ice from a rooftop. Rather, it is intended to maintain an open path for water to drain during a thaw/re-freeze cycle. Snow melting SR cable uses the same self regulating technology to limit its output to only provide heat when needed. Equipped with UV resistant jackets, SR snow melting cable is designed to provide 5 W/Ft on 120V or 240V when in air at 50°F. When immersed in snow and ice, SR snow melting cable responds by increasing its output to 10+ W/Ft. A typical installation pattern is shown in Illustration 17.

Inrush. A side effect of self regulating cables is inrush current. Inrush current is a transient current draw that dissipates over several minutes. The amount of inrush depends on the temperature of the cable when it is energized. Cold cables have higher inrush than warm cables. Since inrush current lasts for several minutes, circuit breakers must be sized to accommodate the additional draw. Circuit protection will be covered in detail in Chapter 5.

Summary of Features and Limits – Self Regulating Cable

Features: Parallel circuit construction
 Standard 120V and 240V operation
 Corrosion resistant jackets available
 Maintain up to 250°F, exposure up to 375°F
 Variable output, less chance of overheating
 Low temperature SR can be used on plastic pipes and vessels
 Cut-to-length in field, easy installation
 Can be overlapped without burnout

Limits: Inrush current can be high, shorter circuit lengths than MI and CW
 Cannot be used on 480V
 Lower effective operating temperature range
 Nominal output wattage is not as accurate as CW or MI

Summary

Table 3 - Heating Cable Products Comparisons

Characteristics	Snow Melting	Comm Low Temp SR	Ind Low Temp SR	Ind High Temp SR	Ind CW	Ind MI
Circuit Construction	Parallel	Parallel	Parallel	Parallel	Parallel	Series
Bus Wire Size	16AWG	16AWG	16AWG	14AWG	12AWG	N/A
Watt Output Range, W/Ft	5	Up to 8	Up to 10	Up to 20	Up to 12	Up to 80
Operating Voltage, VAC	120, 240	120, 240	120,240	120, 240	120, 240, 480	Up to 600
Max Maintenance Temperature, °F	50	50	150	250	320	1500
Max Exposure Temperature, °F	185	185	185	375	400	1750
Terminations installed in Field	Yes	Yes	Yes	Yes	Yes	No
Hazardous Area Approvals	No	No	Yes	Yes	Yes	Yes
Can be Used on Plastic Pipes	No	Yes	Yes	No	No	No
Can Be Overlapped	Yes	Yes	Yes	Yes	No	No
Layout and Design	Simple	Simple	Simple	Simple	Moderate	Difficult
Cable Installation	Simple	Simple	Simple	Simple	Moderate	Difficult

“Comm” denotes Commercial, “Ind” denotes Industrial