

Heat Tracing Products Application & Selection Guidelines

INSTRUMENTS • CONTROLS • VALVES

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General Product Summary

This section is designed to assist you in determining the appropriate cable for use in your application.

Step 1 — Collect Required Application Data and Determine Heat Loss

Step 2 — Choose the cable that best meets your specific application parameters based on the summary. Consideration of application temperature, exposure temperature, application requirements and environmental ratings should be made.

Step 3 — Select Heating Cable Wattage Rating

Step 4 — Determine Total Cable Required

Step 5 — Determine Circuits and Circuit Protection

Step 6 — Select Appropriate Accessories

Step 1 — Collect Required Application Data & Determine Heat Loss

Application data required can be split into two categories. The first is the heat loss data. This includes:

- Maintenance Temperature
- Minimum Ambient Temperature
- Pipe Size
- Insulation Type (or K factor)
- Insulation Thickness
- Indoor/Outdoor Installation
- Maximum Expected Wind Speed
- Required Safety Factor.

Refer to the Technical section of this catalog, "Determining Heat Energy Requirements — Pipe & Tank Tracing" for details on

performing heat loss calculations. For Commercial Freeze Protection, please see Cable Selection Tables in this section.

The second category of data required is the application and environmental conditions. This includes:

- Maximum Exposure Temperature (Power Off Condition)
- Circuit Length Considerations
- Available Voltage
- Hazardous Area Requirements
- Type of Pipe (Plastic or Metal)
- Chemical Exposure
- Fire Resistance.

Step 2 — Select the Cable

Choose the cable that best fits your specific application parameters and wattage requirements.

Heat Tracing Product Features

| Features | Industrial | | | | | Commercial | | |
|------------------------------------|--|--------------|-----------------|-------------------|--|--------------|--------------|--------------|
| | SRL | SRP | SRM/E | CWM | Alloy 825 MI | SRF | SRF-RG | HWM |
| Max. Maintenance Temp. (°F) | 150 | 225 | 302 | 320 | 900 | 100 | 50 | 225 |
| Max. Exposure Temp. (°F) Power Off | 185 | 275 | 420 | 400 | 1,100 | 185 | 185 | 275 |
| Max. W/Ft. | 10 | 15 | 20 | 12 | 50 | 8 | 12 | 15 |
| Max. Circuit Length (Ft.) | 95 - 660 | 55-750 | 150 - 600 | 225 - 900 | 330 - 1,000+ | 180 - 660 | 135 - 540 | 500 - 800 |
| Buss Wire Size | 16 | 16 | 14 | 12 | N/A | 16 | 16 | 16 |
| Voltages | 120, 208-277 | 120, 208-270 | 120, 208-277 | 120, 208-277, 480 | Up to 600 | 120, 208-277 | 120, 208-277 | 120, 208-270 |
| Hazardous Ratings | Yes | Yes | Yes | Yes | Yes | No | No | No |
| Usable on Plastic Pipe | Yes | No | No | No | No | Yes | Yes | Yes |
| Cut-to-Length in Field | Yes | Yes | Yes | Yes | No | Yes | Yes | Yes |
| Field Splicable | Yes | Yes | Yes | Yes | No | Yes | Yes | Yes |
| Can be Overlapped | Yes | Yes | Yes | No | No | Yes | Yes | Yes |
| Output Varies with Temp. | Yes | Yes | Yes | No | No | Yes | Yes | Yes |
| Varies Output Along Length | Yes | Yes | Yes | No | No | Yes | Yes | Yes |
| Design of System | Simple | Simple | Simple | Simple | Involved | Simple | Simple | Simple |
| Installation of System | Easiest | Easiest | Easiest | Simple | Involved | Easiest | Easiest | Easiest |
| Fire Resistance | Fair | Fair | Fair | Fair | Excellent | Fair | Fair | Fair |
| Chemical Resistance | See Corrosion Guide, next page | | | | | | | |
| Size (Max. In.) | .435 x .185 | .335 x .160 | 0.5 x 0.2 | .435 x .235 | 0.4 | .435 x .185 | .435 x .185 | .335 x .160 |
| Accessories | DL/EL/U | D/UL | DL/U | DL/EL/U | | DL/EL/U | RG Access. | DL/U |
| Monitor Wire Available | Yes | Yes | Contact Factory | Contact Factory | No | No | No | Yes |
| Applications | FL,PL | FL,FH, PL,PH | FL,FH, PL,PH | FL,FH, PL,PH | FL,FH, PL,PH | FL | RG | HWM |
| | FL = Freeze Protection FH = Freeze Protection, High Exposure Temperature PL = Process Maintenance, Low Temperature | | | | PH = Process Maintenance, High Temperature RG = Roof and Gutter De-icing HWM = Hot Water Maintenance | | | |

HEAT TRACING
PRODUCTS

Heating Cable

Heat Tracing Products

Application & Selection Guidelines *(cont'd.)*

Agency Approvals

| Area | SRL-C | SRL-CR | SRL-CT | HSRL | SRM/E-C | SRM/E-CT | SRP | HSRM | CWM-C | CWM-CT | MI | SRF-C | SRF-CR | SRF-RG | HWM |
|------------------------------------|-------|--------|--------|------|---------|----------|-----|------|-------|--------|----|-------|--------|--------|-----|
| Ordinary Area | | | | | | | | | | | | | | | |
| UL | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | * | ✓ | ✓ | ✓ | ✓ |
| Factory Mutual | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| CSA | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ATEX | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | * | | | | |
| Class 1 Div 2, Groups B,C,D | | | | | | | | | | | | | | | |
| UL | | | | | | | | | | | * | | | | |
| Factory Mutual | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | |
| CSA | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | |
| ATEX | | | | | | | | | | | * | | | | |
| Class II Div 2, Groups FG | | | | | | | | | | | | | | | |
| UL | | | | | | | | | | | * | | | | |
| Factory Mutual | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | |
| CSA | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | |
| ATEX | | | | | | | | | | | * | | | | |
| Class III Div 2 | | | | | | | | | | | | | | | |
| UL | | | | | | | | | | | * | | | | |
| Factory Mutual | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | |
| CSA | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | |
| ATEX | | | | | | | | | | | * | | | | |
| Class 1 Div 1, Groups B,C,D | | | | | | | | | | | | | | | |
| UL | | | | | | | | | | | * | | | | |
| Factory Mutual | | | | ✓ | | | | ✓ | | | * | | | | |
| CSA | | | | ✓ | | | | ✓ | | | * | | | | |
| ATEX | | | | | | | | | | | * | | | | |
| Class II Div 1, Groups FG | | | | | | | | | | | | | | | |
| UL | | | | | | | | | | | * | | | | |
| Factory Mutual | | | | ✓ | | | | ✓ | | | * | | | | |
| CSA | | | | ✓ | | | | ✓ | | | * | | | | |
| ATEX | | | | | | | | | | | * | | | | |
| Class III Div 1 | | | | | | | | | | | | | | | |
| UL | | | | | | | | | | | * | | | | |
| Factory Mutual | | | | ✓ | | | | ✓ | | | * | | | | |
| CSA | | | | ✓ | | | | ✓ | | | * | | | | |
| ATEX | | | | | | | | | | | * | | | | |
| Zone 2 and Zone 22 | | | | | | | | | | | | | | | |
| Factory Mutual | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | * | | | | |
| CSA | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | * | | | | |
| ATEX | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | * | | | | |
| Zone 1 and Zone 21 | | | | | | | | | | | | | | | |
| Factory Mutual | | | | ✓ | | | | ✓ | | | * | | | | |
| CSA | | | | ✓ | | | | ✓ | | | * | | | | |
| ATEX | | | | ✓ | | | | ✓ | | | * | | | | |

*Class I, Division I, Groups B,C & D - UL, CSA, FM - Contact your Local Chromalox Sales office for design assistance.

Corrosion Guide to Select Proper Cable Construction

| Exposure To | Industrial | | | | | | | Commercial | | |
|--|------------|-------|-------|------|------|-------|--------------|------------|--------|-------|
| | SRL | SRM/E | SRP | HSRL | HSRM | CWM | Alloy 825 MI | SRF | SRF-RG | HWM |
| Moisture | C, CR, CT | C, CT | C, CT | CT | CT | C, CT | Yes | C, CR | Yes | C, CT |
| Aqueous Solutions of Inorganic Compounds | CR, CT | CT | CT | CT | CT | CT | No | No | No | CT |
| Liquids Organic Chemicals | CT | CT | CT | CT | CT | CT | Yes | No | No | CT |
| Acids or Bases | CT | CT | CT | CT | CT | CT | No | No | No | CT |

Note — This is a recommendation guide. Chromalox cannot warrant any Electric Heat Trace against failure by sheath degradation if such failure is the result of operating conditions beyond the control of the heater manufacturer. It is the responsibility of the purchaser to make the ultimate choice of sheath material based on knowledge of the chemical composition of the corrosive solution, character of materials entering the solution, and controls which maintains the process.

Heat Tracing Products

Application & Selection Guidelines (cont'd.)

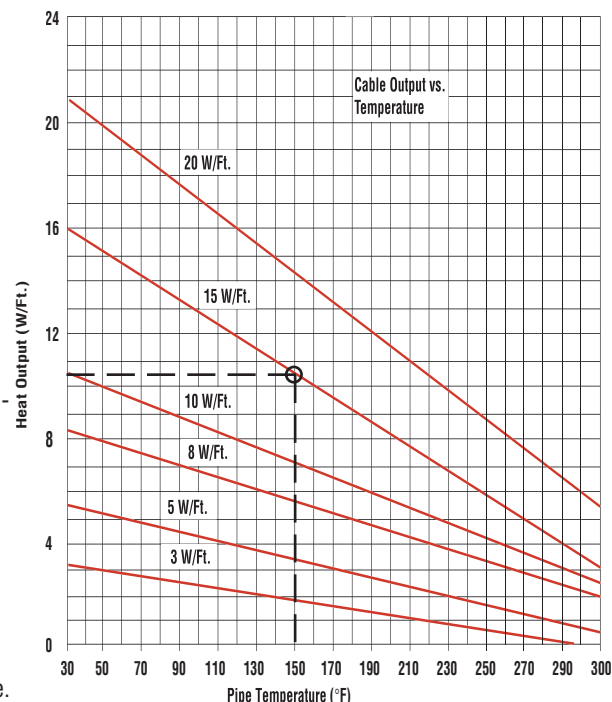
Required Jacket Material

Select the appropriate jacket configuration for the desired level of mechanical and corrosive chemical protection. The CR over-jacket option can be used when additional mechanical protection is desired. The CR over-jacket option is required when the cable can be exposed to aqueous inorganic chemicals. The CT over-jacket option is required when the cable can be exposed to organic chemicals or strong corrosives. Use Corrosion Guide above to determine the correct jacket material option for the cable type selected.

Step 3 — Select Heating Cable Wattage Rating

After calculating the heat loss in the pipe and adjusting for any application deviations, you may determine which cable rating to use. If you have selected a self-regulating cable you must adjust the output based on maintenance temperatures, using the Thermal Output Rating Graphs shown on the individual product pages, select the lowest cable rating that will provide the pipe maintenance temperature. **For Example:** A 15 W/Ft. SRM/E cable @ 150°F will output approximately 10 W/Ft. Multiple passes or runs of cable may be required to provide sufficient output per foot calculated in Step 1. This is accomplished with parallel runs of cable or spiraling. Contact your Local Chromalox Sales office.

Cable Output vs. Temperature



Step 4 — Determine Total Length of Cable Required

The total amount of heating cable is determined by adding the total footage of pipe to be traced and adding for allowances for the components such as flanges, valves, pipe supports; then, multiply by the total number of runs or Wrap Factor determined in Step 3.

(Total Feet of Traced Pipe + Cable Allowance for Components) x # of Runs = Total Cable Length

Step 5 — Determine Circuits & Circuit Protection

Circuit protection depends on the breaker size being used and the start-up temperature. The National Electric Code (NEC 1996) requires the use of ground fault protection breakers for heating cable. Refer to the specific data of the individual heat trace cable to determine maximum circuit lengths. To determine the number of circuits required for each pipe, divide the total cable length found in Step 4 by the maximum circuit length found in the individual cable data charts. Round up to the next higher number.

$$\text{Number of Circuits} = \frac{\text{Cable Length}}{\text{Maximum Circuit Length}}$$

Pipe Component Cable Allowance Estimation

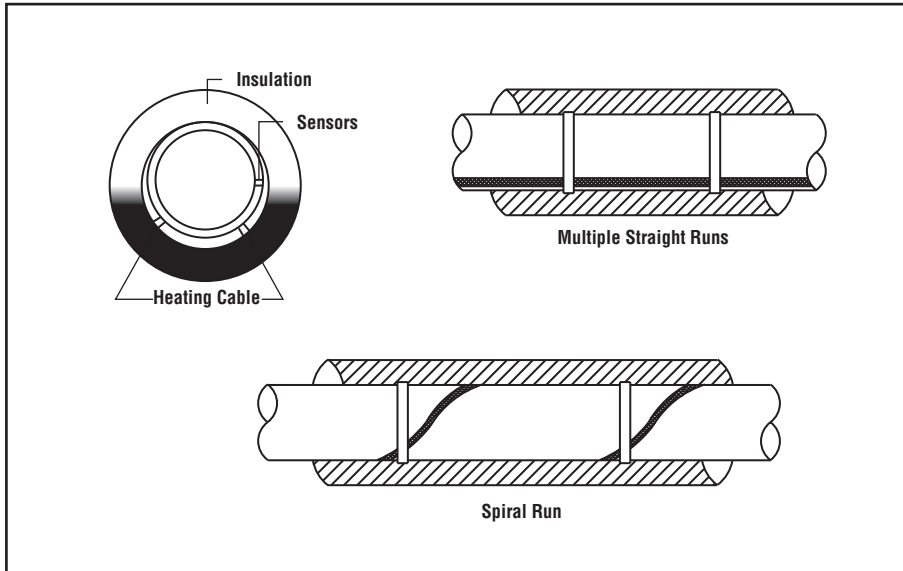
| Component | Cable Allowance Factor (Ft.) | x | # Components | Total Additional Cable |
|-----------------|------------------------------|---|--------------|------------------------|
| Flange Pair | 1.5 | x | | |
| Pipe Support | 2.0 | x | | |
| Butterfly Valve | 2.5 | x | | |
| Ball Valve | 2.7 | x | | |
| Globe Valve | 4.0 | x | | |
| Gate Valve | 5.0 | x | | |

Example: Pipe: 150 feet
 Valves: 1 globe valve
 Pipe Supports: 2
 Flanges: 2
 Total Cable Length = [150 + (1 x 4) + (2 x 2) + (2 x 1.5)] x 2 runs
 = 161 feet x 2 runs
 = 322 feet

Heat Tracing Products

Application & Selection Guidelines *(cont'd.)*

Design of Multiple Runs when Heat Requirements Exceed Cable Output Ratings



Step 6 — Select Controls & General Application Accessories

Chromalox provides a wide range of termination accessory and control options for your heat tracing systems needs.

Accessory options range from ordinary area under the insulation kits in our EL series all the way through connections and terminations for Division 1 hazardous areas in our HL series. The accessories carry a full complement of third party approvals from UL, Factory Mutual, Canadian Standards, ATEX and IECex.

Controls range from Thermostats for both ambient air and pipe/tank sensing applications to WeatherTrace power distribution and controls panels through our IntelliTrace line of distribution, monitoring and control panels. Whether your project is a few lines of freeze protection or a few hundred lines of process piping we have the right control option for your needs.



*More Information
is Available Online
on Heat Trace.*

*Bookmark Your Browser to
www.chromalox.com
and Select Manuals.*

Accessory Descriptions

U Series

- Designed for Ordinary and Hazardous Area use in Industrial applications
- Integrated design allows for quick cable termination
- Line carries worldwide approvals including ATEX and IECex
- Reduced parts count results in fast installation times
- Line includes:
 - Power Connection
 - Multi Entry Connection (for splice, tee or multiple power to 3 cables)
 - Above Insulation End Seal
 - Below Insulation End Seal
 - Lighted End Seal
 - Ambient Thermostat
 - Line Sensing Thermostat
- Thermostats also serve as power connection for cable - eliminating need for extra power connection box.

DL Series

- Designed for Ordinary and Hazardous Area use in Industrial Applications
- Integrated design allows for fast installation
- Box design allows easy access for field wiring, maintenance and trouble shooting
- CSA, Factory Mutual and UL approved for ordinary and Hazardous area use (Div. 2)
- Line Includes
 - Power Connection
 - Splice and Tee (connect up to 3 cables)
 - Below Insulation End Seal
 - Lighted End Seal (ordinary area use only)
 - Ambient Thermostat
 - Line Sensing Thermostat
- Thermostats also serve as power connection for cable - eliminating need for extra power connection box.

Heat Tracing Products

Application & Selection Guidelines *(cont'd.)*

EL Series

- Designed for use in ordinary areas for both commercial and industrial applications
- Low profile designs allow for ease of insulation around connections
- Kits include standard electrical terminations and heat shrink products familiar to most installers
- Low parts count allows fast termination of cables
- Third Party Approvals through UL, Factory Mutual and CSA.
- Line Includes
 - Junction Box
 - Pipe Stand off with sealing grommets and cable boots
 - Heat shrink splice and tee kits
 - Heat Shrink end caps

HL Series

- Specifically designed for use in Division 1 hazardous areas
- Corrosion Resistant housing made of high strength cast aluminum
- Reduced parts count for fast installation
- Small profiles for ease of insulation
- Line Includes
 - Power Connection
 - Splice Kit
 - Tee Kit
 - End Seal Kit
 - Add on Signal lights for End Seal and Power Connection

Controls Descriptions

DL Controls

The DL Series temperature controls are available in four models to handle a broad range of applications. Models include two ambient sensing and two line sensing thermostats. These high quality models combine On/Off temperature control and cable power connection in one affordable, convenient easy to install package. The line includes two 22 amp capable models for Ordinary Area installations and two 11 amp capable hermetically sealed models for Division 2 hazardous area applications. Products carry UL, Factory Mutual and CSA approvals.

EL Controls

The EL controls line contains ambient and line sensing controllers for use in Division 1 and Division 2 areas. All products switch 22 amps and come in NEMA 4x and NEMA 7 rated enclosures. Two models are available in dual output form. All capillaries are nontoxic oil filled available in 8 and 10 foot lengths. Products carry UL, Factory Mutual and CSA approvals.

WeatherTrace Control and Distribution Panels

The Chromalox FPAS, FPASM, FPLS, and FPLSM series panels offer power distribution, ground fault protection, individual circuit alarming, with options for both line sensing and ambient sensing control. Line sensing is accomplished in conjunction with U SERIES, DL SERIES or EL SERIES thermostats. Ambient sensing can be accomplished with thermostats or optional Chromalox solid state 1604 series temperature controllers. The panels are housed in NEMA 4 enclosures for indoor/outdoor applications. NEMA 4X 304 stainless steel enclosures may be selected as an option for more harsh environments. The standard models are available in 12,18,20,30 and 42 position panel boards with 100 and 225 amp bus ratings in single and three phase configurations. Branch circuit breakers are available in 20, 25, 30 and 40 amp single pole and two pole configurations with 30mA ground-fault equipment protection. Options for Z-purge systems for hazardous area installation are available. Sentinel monitoring system is available for alarm indication when a circuit loses power. Common alarm available for interface to building management systems. Panels are built in a UL 508 certified manufacturing plant and carry UL and cUL approvals.

IntelliTrace Control, Monitoring and Distribution Panels

The Chromalox HTLS series panels are microprocessor based temperature control and monitoring units for both freeze protection and process temperature control applications. These units are housed in NEMA 4X enclosures and are available in single, dual, three and four loop controllers. Panels are designed for ordinary or hazardous area locations. Controllers are programmable for on/off or PID control and contain features such as process temp display, high and low temperature alarms, current alarm, and sensor failure indication. Each loop switches 30 amps rated at 40°C with solid state relay or optional two pole contactor. Controller handles universal thermocouple sensor inputs or 100 ohm platinum RTD. Panels are built in a UL508 certified manufacturing plant and carry UL and cUL approvals.

The Chromalox HTLS and HTAS 8, 12, 24 loop panels are micro-processor based control/monitoring and power management / distribution panels for ordinary and hazardous area freeze protection and process maintenance applications. The system provides alarms for high and low temperature, continuity, ground fault leakage, and sensor faults. Each system contains a color touch screen operator interface that provides simple programming with no keyboards or cryptic labels. The panel displays loop status, alarm conditions and graphics on process temperature, set points, and currents. Built in power distribution reduces material, labor, installation and maintenance costs. The load management feature eliminates the need for expensive ground fault breakers, limits in rush current and systematically interrogates all circuits for continuity, ground leakage, sensor faults, and temperature alarms. Circuits switch 30 amps, and are on/off controlled with standard two pole contactors. Sensor inputs are 100 ohm platinum RTD and communications are accomplished by RS-485 modbus. The panels are built in a UL508 certified manufacturing plant and carry UL and cUL approvals.