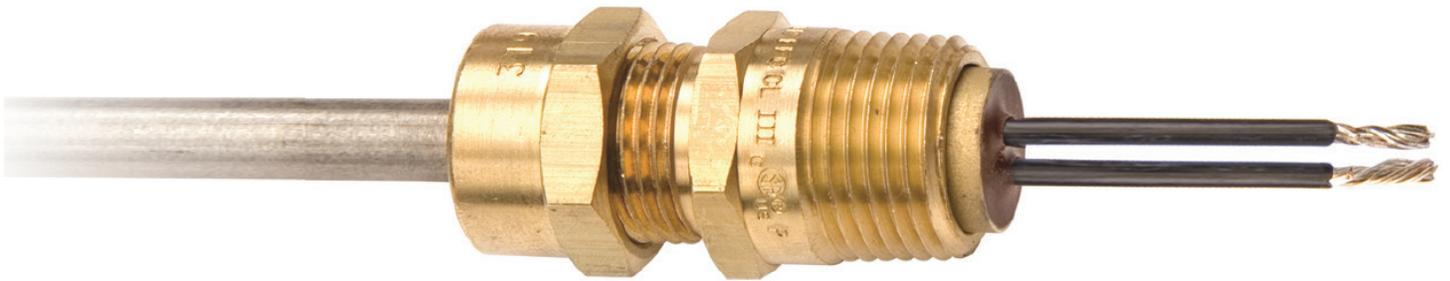


Installation Instructions

Industrial Mineral Insulated Heat Trace



PJ978
057884013
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Table of Contents

- Important Safeguards and Warnings..... 3**
- System Components..... 4**
- General Information 5**
 - Use of Manual 5
 - Storage..... 5
 - Important Installation Notes 5
- Installation..... 6**
- Typical Installation Details..... 11**
- Wiring..... 14**
- Troubleshooting..... 17**
- Installation and Maintenance Log..... 20**

Important Safeguards and Warnings

⚠ WARNING

FIRE HAZARD. Failure to follow these guidelines could result in property damage or personal injury.

- **Disconnect all power sources before installing or servicing heating cable. Failure to do so could result in personal injury or property damage.**
- **Heating cable must be installed by a qualified person in accordance with the National Electrical Code, NFPA 70.**
- **Each heating cable branch circuit must be effectively grounded in accordance with the National Electrical Code to eliminate shock hazard.**
- **Never attempt to use damaged heating cables or connection kits. If cable damage is observed, either replace the complete heating cable, or cut out the damaged section and replace using the proper splice connection kit. Do not attempt to repair damaged heating cable.**
- **Never energize the cable when it is coiled or on a reel. Test only when it is laid out straight.**
- **Handle coils and reels utilizing equipment designed for that purpose.**
- **Do not drop coils or reels, especially from transporting equipment.**
- **Lift or handle reels so that the lifting/handling device does not come in contact with the cable or it's protective covering. Coils should be placed on a skid.**
- **Do not install heating cable on equipment which could become hotter than the heating cable's maximum exposure temperature.**
- **Do not install heating cable in an area or on equipment which contains potentially corrosive materials.**
- **Do not expose cables to temperatures above their specified maximums. See tables provided in this installation manual for details.**

- **Keep bus wires separated to avoid shorting the cable.**
- **Keep cable ends and connection kits dry before and during installation.**
- **Be careful not to break bus wire strands when preparing the cable, as damaged bus wires can overheat and short.**
- **The presence of heating devices must be evident by the posting of caution signs or markings at appropriate locations and/or at frequent intervals along the circuit.**
- **Users should install adequate controls and safety devices with their electric heating equipment. Where the consequences of failure may be severe, back-up controls are essential. Although the safety of the installation is responsibility of the user, Chromalox will be glad to assist in making equipment recommendations**
- **Insulate the pipe immediately after installing the heating cable, using only fire-resistant insulation materials.**
- **Ground fault equipment protection is required for each circuit**
- **Heating cables require a Class A ground-fault circuit-interrupter and any metallic components in contact with the heating device shall be bonded to ground.**

⚠ CAUTION

A ground fault protection device must be used with this heating device.

⚠ ATTENTION

Ce produit doit être utilisé avec une protection de mise à la terre.

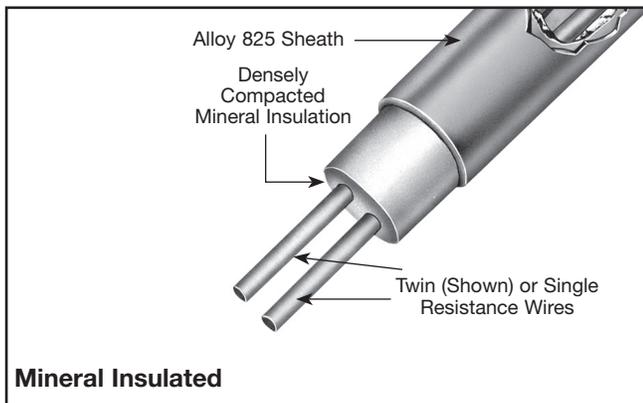
Chromalox Cable Types

Table 1 – Cable Type Overview

	Mineral Insulated
Hazardous ratings available	Yes
Usable on plastic pipe	No
Can be cut to length in field	No
Can be single overlapped	No

Table 2 – Maximum Temperatures

Cable Type	Max. Maintain (Power On)	Max. Exposure (Power Off)	Voltage Rating
MI	1112°F	1200°F	120-600



Approvals

Chromalox heating cables and components approved for use in hazardous and nonhazardous locations. Refer to the specific product data sheets for details.

General Information

Use of Manual

These instructions are to be followed when installing Chromalox MI heating cables. Refer to appropriate application design guide for product selection guidelines. A chart highlighting certain characteristics for Chromalox MI heating cables can be found on page 4.

For customer support, design assistance, or information regarding any other Chromalox products, please contact your local Chromalox representative or use the information below.

Chromalox, Inc.
1347 Heil Quaker Blvd
La Vergne, TN 37086

For Technical Support Call 412-967-3940.

*press 1 to be directed to heat trace support
Email: sales@chromalox.com
www.chromalox.com

Storage

The heating cables should be stored in their shipping cartons or on reels in a dry atmosphere until they are ready to be installed. They should be stored in a clean location, where they are protected from mechanical damage. In preparation for installation, if the coil needs to be unrolled, DO NOT pull out in a spiral. The hot to cold joint should NOT be excessively manipulated to reduce the likelihood of damage. This can be avoided by tying the first loop to the joint.

Storage temperature range: 0°F(-18°C) to 140°F(60°C).



Important Installation Notes

The following notes should be reviewed prior to installation.

- De-energize all power circuits before installation and servicing.
- Keep ends of the elements and accessories dry before and during installation.
- Do **NOT** bend the element within 7mm of the hot to cold junction.
- Work hardening of the sheath will occur if the element was repeatedly bent and straightened - this should be avoided.
- As a rule, the cable should not be bent below a minimum bend radius of six times the outer diameter. For a **one-off** bend this can be three times the outer diameter
- Do not allow for heating cable to cross or touch as this can cause hotspots with a risk of element failure and invalidation of certification.
- Ensure cables are spaced no closer than 25 mm.
- Install the element in a manner which allows access or removal of serviceable equipment (valves, pumps, access ports, etc) with a minimum of disruption to the element installation.
- The fitting of insulation should be planned to follow the fitting of the heating element elements in order to avoid mechanical damage.
- Always install tracing at the 4 or 8 o'clock position on a pipe.
- Do not attempt to heat trace any piece of equipment which will not be insulated.
- Always install heat tracing on the outside radius of elbows.
- Never install heat tracing over expansion joints without leaving slack in the cable.
- Pumps and small vessels should be heat traced and controlled with the piping on the inflow end. The cable on the pump or vessel should be physically separate to permit disconnection during maintenance or removal.
- Separately controlled circuits should be provided on dead end legs and closed bypasses.
- No heat tracing circuit should extend more than two feet beyond a point where two or more pipes join when such junctions permit optional flow paths. In such cases, separately controlled traces should be used.
- Always ensure that the heating cable load is compatible with the rating of the selected control systems.
- Only install control devices where the electrical conduit has a low-point drain that prevents condensation from entering the thermostat enclosure.

Notes:

1. The maximum withstand temperature of elements with a stainless steel and nickel alloy sheath is 450°C
2. The maximum withstand temperature of elements with a cupro-nickel alloy sheath is 400°C
3. The maximum withstands and surface temperature of elements with a copper sheath is 200°C
4. The minimum installation temperature is -20°C
5. Maximum supply voltage between heating element conductor and sheath is 300V and 600V depending on resistance cable employed
6. Maximum exposure for hot-to-cold joints as follows: brazed joints must not exceed 752F (400°C) and laser welded joints must not exceed 1652F (900°C)

Installation

Pre-Installation Guidelines

Before attempting to install the heating cable, read this instruction sheet and those enclosed with the accessories to familiarize yourself with the products. Complete the following pre-installation steps:

- Verify that the selection of heating cable type and rating is in accordance with the procedures located in the applicable application design guide.
- Ensure that the voltage rating of the heating cable is acceptable for the available service voltage.
- Walk along the pipe segment that is to be traced and plan out the path for the heating cable on the pipe.
- Remove any obstacles or sharp edges that are present along the pipe segment.
- Open package and visually check for breaks or nicks in the cable jacket. File claim with carrier if any damage is found.
- See Table 4 for acceptable minimum insulation resistance readings and page 21 for a detailed explanation on how to conduct the insulation resistance test.
- Ensure the correct drawings or schedules are available to determine where the elements are to be installed.
- If junction boxes and other anchillaries are heated ensure their fixing arrangements are installed prior to heating element installation to avoid interference.
- Compare heating element tag information with information in 6.1. above and confirm length and type. Note the label attached to the element will specify the maximum pipe temperature, operating voltage, and temperature class (T rating) - check this label carefully!
- Inspect the heating element and accessories for damage.*
- Check the insulation resistance of each heating element using a 500V insulation resistance tester (Megger). Minimum acceptable insulation resistance shall be 20Mohms, per Table 4 and page 15.*
- Measure and check the series resistance against the schedule and heating tag label of each heating element using a resistance meter, per Table 4 and page 15.*
- **WARNING**
Elements failing any tests marked with an * MUST be returned to Chromalox Isopad GmbH. for repair.
- Ensure that all metal joining processes on the installation surface have been completed.
- Check before installation that actual pipe lengths and actual heating element lengths are comparable.

⚠ WARNING

ELECTRIC SHOCK HAZARD. Any cable with an insulation resistance reading less than 20 megohms before installation should not be installed. Contact your local Chromalox representative.

- Ensure all pipes, tanks etc. have been hydrostatically tested prior to the installation of the heating cable.
- Ensure all cable ends, connections, and surfaces are dry prior to installation.

⚠ WARNING

ELECTRIC SHOCK HAZARD. Disconnect all power before installing or servicing heating cable. Failure to do so could result in personal injury or property damage. Heaters must be installed by a qualified person in accordance with IEC 62086-2:2001.

Any installation involving electric heating must be effectively grounded in accordance with IEC 62086-2:2001 to eliminate shock hazard.

Installation Guide: Overview

1. If possible, uncoil the heating element and lay it next to the surface to be heated.
2. Where the element is to be installed in the form of a return loop uncoil about half of the element, have someone hold the middle and then uncoil the rest of the element back to the starting point.
3. Where this is not possible lay the cable against the surface to be heated securing with loose securing straps as the element is uncoiled.
4. For either case temporarily secure the element using 1mm diameter stainless steel tie wire starting at the hot to cold joint.
5. Heating elements should, ideally, be installed around the bottom of the surface to be heated avoiding the very bottom (where moisture/chemical spills collect). If this is not possible run the cable at a higher location but try to avoid areas where mechanical impact damage may occur.
6. The hot to cold joint should be supported with stainless bands at 150 mm either side of the joint.
7. The radii of any curves should be left as large as possible to allow for any subsequent adjustments.
8. Any heat conduction to the glanding carried along the cold lead cable should not exceed 70 deg C. If it is in excess of this value, where the cable exits the insulation covering heat sinks should be affixed to dissipate the conducted heat.
9. After the element has been installed it may be necessary to adjust for excess or shortage of element length by redistribution on the installed surface – usually allowances in length are made for valves. Severe mismatch should have been checked before installation but, if necessary, the E&I engineer responsible should be informed so an appropriate decision can be taken.
10. After adjustment, if necessary, the element should be secured at 300 mm intervals using stainless fixing strips and bands. Cable loops at process fittings should be finalised. DO NOT over tension straps – the element should be able to be repositioned but should not move under its own weight. This ‘tension’ check allows thermal movement of the element during power application and is essential to avoid heat cycle fatigue failure.
11. The metal sheath of the trace heater must be connected to the suitable earthing terminal. Elements supplied with flexible cold tails are supplied with an optional flexible earth lead and tag. This should be installed inside the termination box where earthing of the gland to the termination box does not provide a low resistance path of the cold lead-in sheath to ground in accordance with local and/or national regulations. The tag should be secured to the body of the gland with a suitable gland nut.
12. Where units have been supplied with the ‘on-pot’ gland, the gland may be installed in the junction box prior to terminating the element to the junction box. The element can be passed through this gland and the pot is positioned inside the gland. The back-nut of the gland should be tightened to hand tight + half to $\frac{3}{4}$ of turn using a suitable spanner. The gland should be held using a spanner on the gland body during this operation to prevent the gland from turning.
13. The presence of the trace heating elements shall be made evident by the posting of caution signs or markings at appropriate location and/or at frequent intervals along each circuit.

Installation Guide: Single Run of Cable

If installing a single run of heating cable on a pipe, follow the steps below:

1. Mount the reel of cable on a holder and place near one end of the pipe run to be traced. Choose the end from which it will be the easiest to pay out the cable.
2. Pay out the cable from the reel and loosely string along the piping, making sure the cable is always next to the pipe when crossing obstacles. For example, if the heater is on the wrong side of a crossing pipe, you will have to restring the cable or cut and splice it.

⚠ CAUTION

To prevent damage to cable, avoid such things as:

- **Pulling the cable over sharp edges.**
 - **Forcibly pulling the cable free if it snags while being paid out.**
 - **Walking on or subjecting the cable to other abuse which could cause mechanical damage.**
3. When you reach the end of the circuit, secure the heating cable to the pipe using glass tape or plastic cable tie with a temperature rating compatible with the heater cable. If this end is to have an end seal installed, remember to leave about a foot of extra cable. If it is a power connection, leave about two feet of extra heater cable.
 4. Begin attaching the cable to the pipe about every foot (0.3 meters). Place the cable on the bottom half of the pipe at the 4 or 8 o'clock position. Refer to installation detail AD1. Go to step 5.

5. At a heat sink (pipe supports, valves, pumps, reducers, gauges, bucket strainers, etc.), attach the heater cable to the pipe just before the heat sink. Refer to the design specs or Table 3 to determine the amount of heater cable you need to install on the heat sink. Pull this amount of cable into a loop, attach the heater cable on the other side of the heat sink and continue attaching the cable down the pipe as before.
6. When you reach the heater cable reel, you should have the heater cable attached all along the pipe, with the correct amount of heater cable pulled in loops at all heat sinks. Attach the cable to the pipe, (leave an extra foot if at an end seal, two feet if at a power connection) and cut the heater cable from the reel.
7. Install the heater cable loops on the heat sinks. Refer to the proper installation detail AD5-AD12 for a general idea of how to install the cable, but remember:
 - It is important to get the proper amount of heater cable on the heat sink, rather than exactly as the detail shows. The detail is just a guide.
 - By having the cable installed this way, it can be removed easily from the heat sink without cutting of access to, or removal of the heat sink is required.

Note: If a tee is designed into the system, or if you are using two or more short cable lengths to complete a circuit, allow two or three feet of each cable to overlap. This will allow flexibility in assembling the connection kit and locating it on the pipe.

⚠ WARNING

FIRE HAZARD. Do not overlap constant wattage heating cables.

Installation Guide: Multiple Cable Runs

There are two cases where you will need to install more than one heater cable on a pipe:

- When the design calls for more than one cable.
- When the lines being heat traced are considered important enough to install a backup (redundant) heat tracing system.

The installation requirements are different for these cases.

Installing Multiple Heater Cables for Design Requirement

The most common multiple cable requirement is two cables on a pipe. Below are the recommended techniques for the two cable systems. They also apply to installations where three or more cables are to be installed on a pipe.

There are two ways of paying out two heater cables along a pipe. The first is to locate two reels of heater cable and supply one cable from each. This method works for all types of piping runs. However, it may increase material waste by leaving unusable lengths from two reels. The second way is to supply both cables from one reel. This method is generally the easiest for relatively straight, simple piping runs. For each circuit, decide which method to use and then go to the appropriate part below.

1. Supplying cable from two reels

The general procedure here is the same as given earlier, but there are a few things to do to make sure the system is correctly done.

- a. At each heat sink, the easiest thing to do is supply the extra heater called for by the design drawing from only one heater cable. This avoids having to measure out half of the requirement from each cable.
- b. When doing the previous step, temporarily attach the other cable at equipment which may be serviced, such as pumps, valves, instruments, etc. This is so both heater cables may be removed enough for future access.

2. Supplying cable from one reel

The general procedure is the same as given earlier, but there are a few things to do to make sure the system is correctly done.

- a. With this method, a loop is pulled for the entire circuit. To do this, attach the end of the heater cable to the pipe near the heater cable reel. Remember to leave enough extra cable for the type of connection to be installed.

- b. Begin pulling the cable off the reel in a large loop down the piping run. Be sure to keep the cable next to the pipe. Moving down the run, continue attaching the cable to the pipe, leaving the side of the loop going back to the reel unattached.
- c. You will want both sides of the loop to be about the same length to avoid future problems. Also, it is easier to install the extra cable required at each heat sink from only one cable. Therefore, pull the right amount of extra heater cable needed at every second heat sink from the side of the loop you are attaching to the pipe. At the remaining serviceable heat sinks (pumps, valves, instruments, etc.) do not forget to leave a short loop of cable for slack when access to the equipment is needed.
- d. When the end of the piping run is reached, pull the proper amount of extra cable for the connection to be installed.
- e. Now, begin working the remaining side of the loop back toward the reel, installing it on the pipe and heat sinks as required.

Installing Backup (Redundant) Systems

The purpose of a backup system is to provide the proper amount of heat from the second heater cable if there are problems with the first. Therefore, each cable must be installed so it can do the job alone. The simplest way to do this is to install the first heater cable as described in the Installation Guide: Single Run of Cable section. Then, go back and install the backup heater cable the same way.

There are several things to keep in mind:

- The power connections and end seals for the two cables are often designed to be at opposite ends of the run in a redundant system. Remember to leave the proper amount of extra cable for the connection to be installed on each cable at that end.
- On piping one inch IPS or smaller, it can be difficult to apply both heater cables with good contact at all places. The main thing is to get the correct amount of cable installed. However, try to get as much contact with the piping and heat sinks from both cables as possible.

Other Installation Considerations

Pipe Hanger

When using a pipe hanger, ensure that the heating cable is not pinched between the pipe and the hanger. Damage to the cable can result in electrical arcing, arc faults, and arc flashes.



Heat Sinks

Refer to the design specs or Table 3 to determine the amount of heater cable you need to install on each heat sink. Install the heater cable on the heat sinks as explained in installation details AD5-AD12. However, remember that the detail is just a guide. It is important to get the proper amount of heater cable on the heat sink, rather than exactly as the detail shows.

Slab Penetrations

Before installing heating cables on a pipe that penetrates a concrete floor or wall, be sure that the hole comfortably fits both the pipe, cable, and insulation. Do not damage or cut the heating cable during installation. Make sure that the cable is not pinched between the pipe and the concrete floor and wall when the hole is sealed. When fire stopping around floor and wall penetrations, avoid damaging or cutting the heating cable. The heating cable should be protected by a tube or conduit and should not be installed directly into the sealing material.

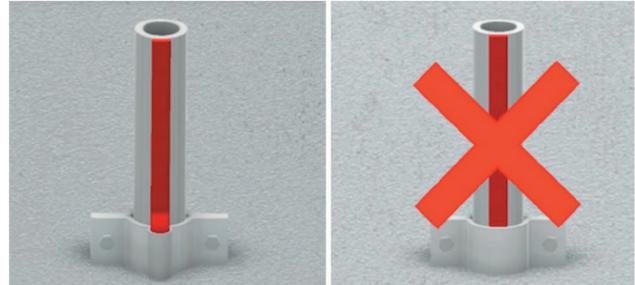
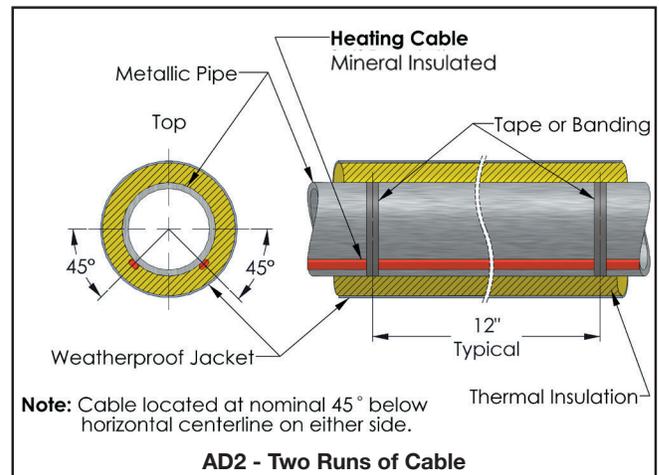
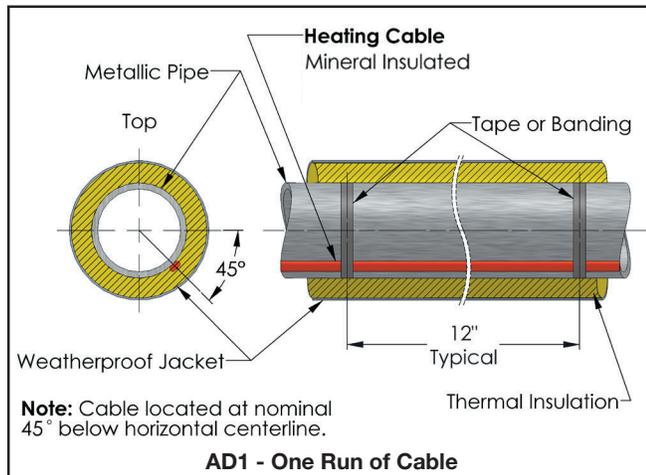
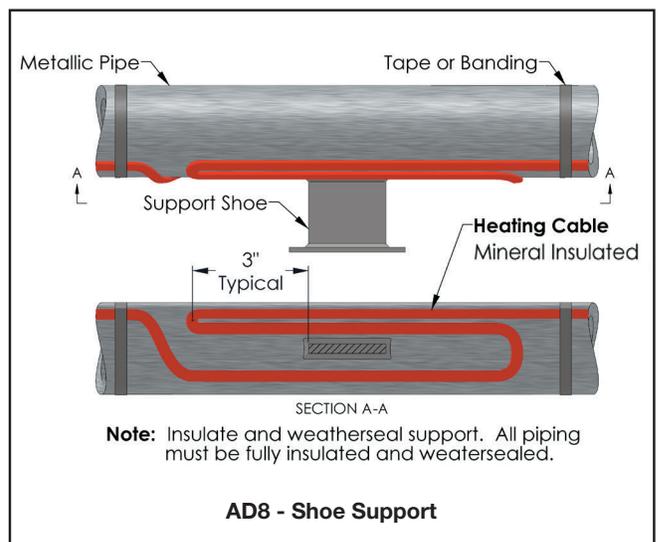
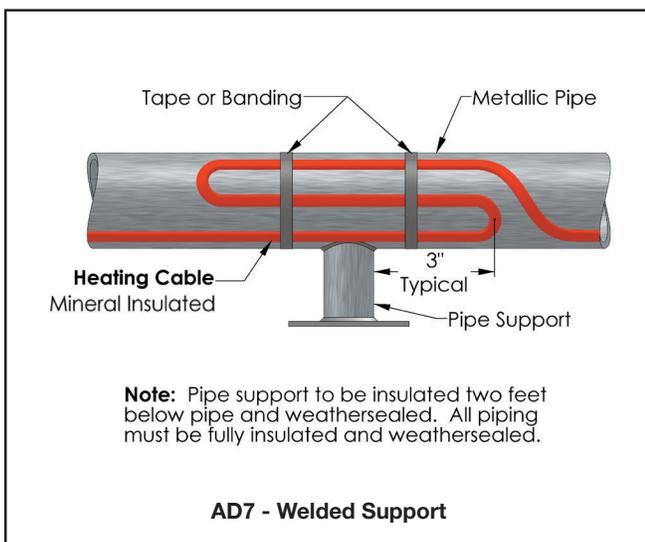
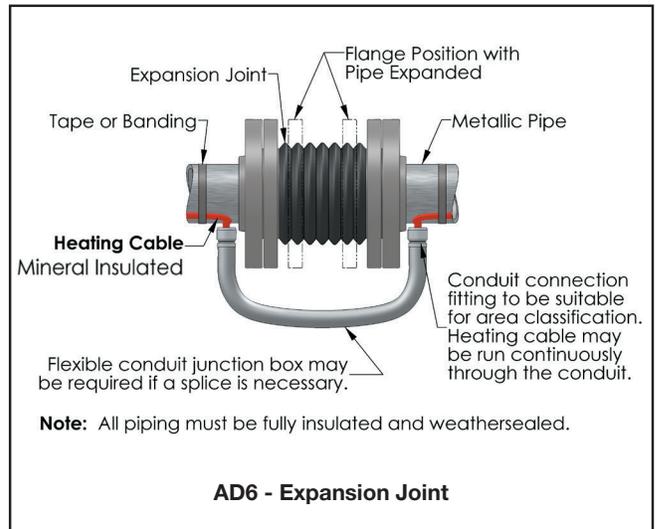
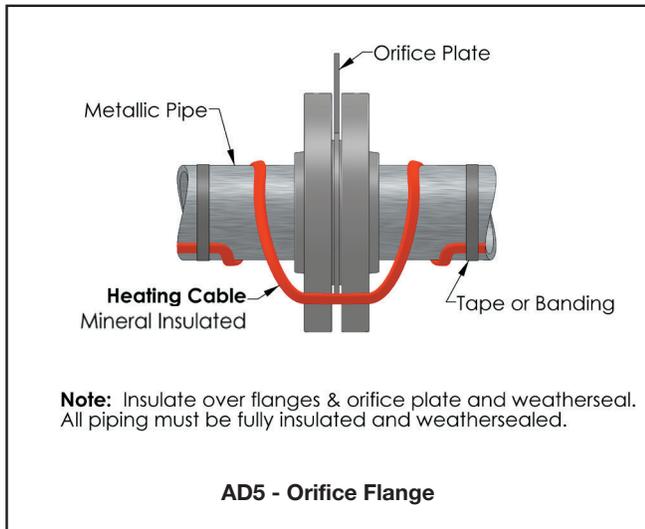
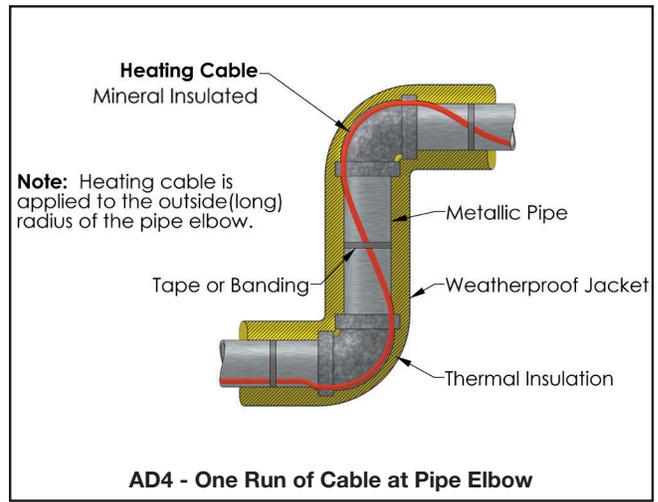
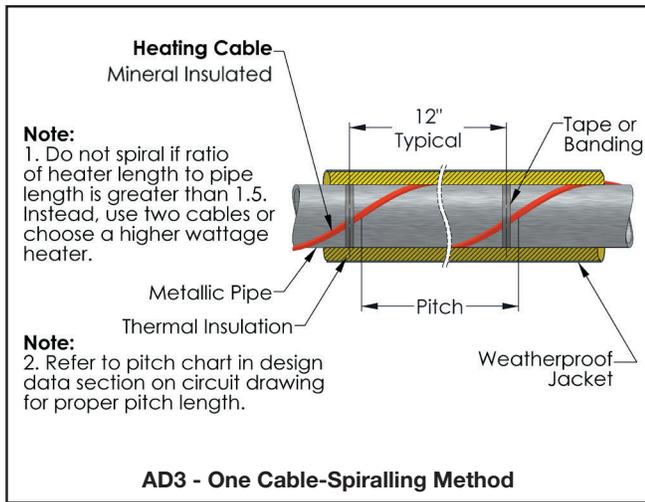


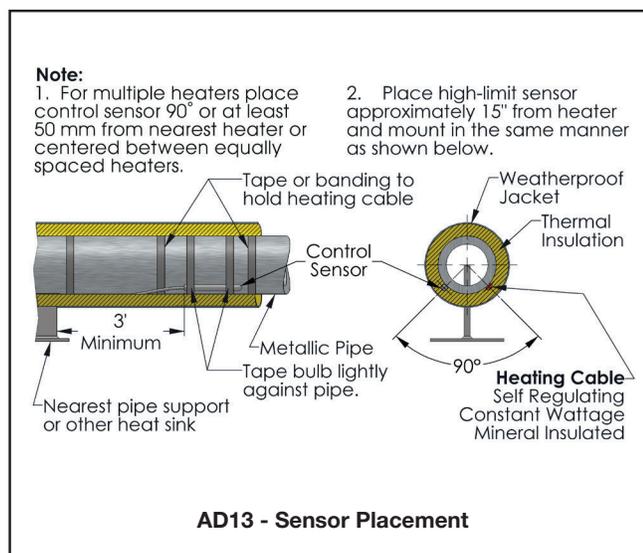
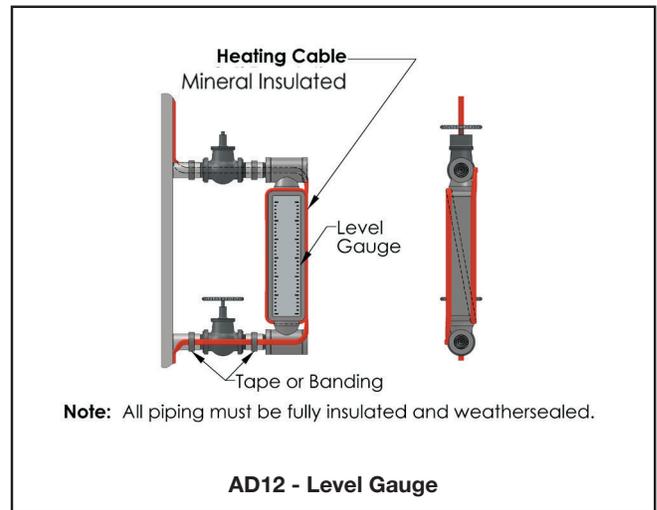
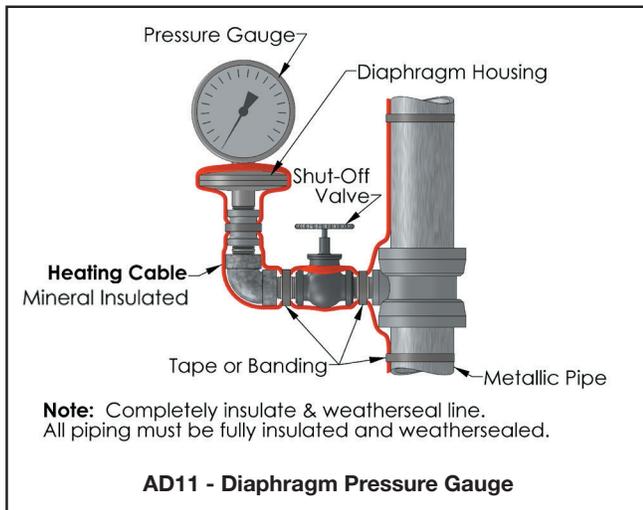
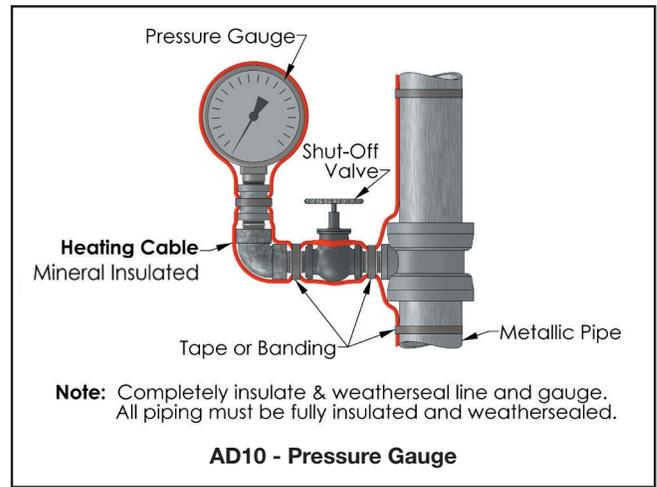
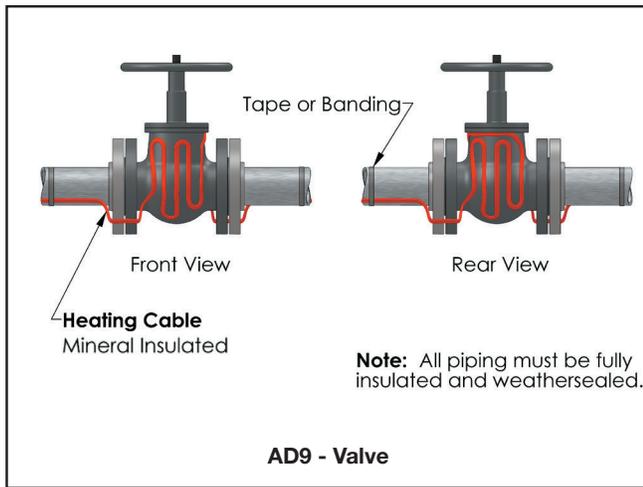
Table 3 – Additional Cable Lengths Required for In-Line Components (Based on Iron Pipe Size)

Piping Size	Gate Valve	Globe Valve	Ball Valve	Butterfly Valve	Shoe Support	Hanger Support	Sleeper Support	Flange Pair
Dimensions in Feet (Ft.)								
1/2 in.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.30
3/4 in.	1.50	1.00	1.00	1.00	1.50	1.00	1.00	0.30
1 in.	2.00	1.00	1.00	1.00	1.50	1.00	1.00	0.30
1-1/2 in.	2.50	1.50	1.50	1.50	2.00	2.00	2.00	0.30
2 in.	2.50	2.00	2.00	2.00	2.00	2.00	2.00	0.30
2-1/2 in.	2.50	2.00	2.00	2.00	2.00	2.00	2.00	0.30
3 in.	3.00	2.50	2.50	2.50	2.00	2.00	2.00	0.50
4 in.	4.00	3.00	3.00	3.00	2.50	2.50	2.50	0.50
6 in.	5.00	3.50	3.50	3.50	2.50	2.50	2.50	0.80
8 in.	7.00	4.00	4.00	4.00	2.50	2.50	2.50	0.80
10 in.	8.00	4.50	4.50	4.50	3.00	3.00	3.00	0.80
12 in.	9.00	5.00	5.00	5.00	3.00	3.00	3.00	0.80
14 in.	10.00	5.50	5.50	5.50	3.00	3.00	3.00	1.00
16 in.	11.00	6.00	6.00	6.00	3.50	3.50	3.50	1.00
18 in.	12.00	7.00	7.00	7.00	3.50	3.50	3.50	1.00
20 in.	13.00	7.50	7.50	7.50	3.50	3.50	3.50	1.00
22 in.	13.00	7.50	7.50	7.50	3.50	3.50	3.50	1.00
24 in.	15.00	8.00	8.00	8.00	4.00	4.00	4.00	1.00

Typical Installation Detail







Wiring

⚠ WARNING

ELECTRIC SHOCK HAZARD. Disconnect all power before installing or servicing heating cable. Failure to do so could result in personal injury or property damage. Heater must be installed by a qualified person in accordance with the National Electrical Code, NFPA 70.

⚠ WARNING

ELECTRIC SHOCK HAZARD. Any installation involving electric heating cables must be performed by a qualified person and must be effectively grounded in accordance with the National Electrical Code to eliminate shock hazard.

ACCESSORIES:

- Selection of installation accessories should be in accordance with ChromaTrace 4 design software program. Ensure accessories are rated for the area where they are located. If Chromalox accessories are not used with cable, all third-party approvals are voided.
- Only use Chromalox installation kits and use them only for the operations for which they are designed.
- The instructions included in the Chromalox installation accessories must be followed for the third-party approvals (UL, FM, CSA, ATEX, IECEx, etc.) to apply.
- Junction boxes must be in accordance with the requirements of the area classification.
- All outdoor junction boxes must be located above grade level. Covers should be kept on the boxes at all time when not being worked in.
- All terminations must be protected from the weather and from physical damage by locating them either under the weather-proof insulation or inside an appropriate junction box.
- All equipment must be properly grounded.

- Install installation accessories according to the instructions included in the kits and per installation details AD13 through AD19.

⚠ CAUTION

To prevent equipment damage, Circuits fed from overhead lines should be protected by secondary lighting arrestors.

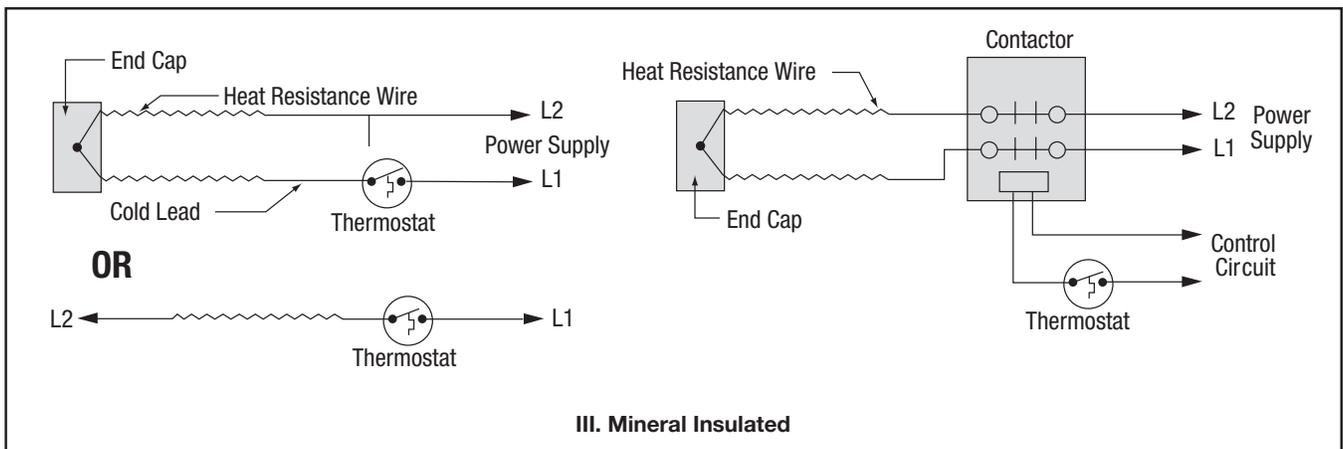
CONTROLS:

- All heating circuits should have temperature controls. Temperature control of the pipeline can be obtained through various Chromalox temperature controls.
- The temperature control should be mounted in a location where it will not be subjected to excessive shock or vibration.
- Line sensing temperature sensors should be mounted in accordance with installation detail AD13.
- Ambient sensing temperature sensors should be located at a point where the lowest ambient temperature is expected.

⚠ CAUTION

To prevent equipment damage, handle and secure temperature sensors, especially thermostat bulbs and capillaries with care to avoid distortion or crimping which might impair control accuracy.

- Exposed thermostat capillaries should have mechanical protection.



Installation Testing

To identify potential damage, installation testing should be completed at the following times:

- Prior to installing the heating cable
- Prior to installing the connection kits
- Prior to insulating the pipe
- After insulating the pipe
- Prior to energizing the cable
- During periodic system check-ups
- After maintenance/repair work

As part of the installation testing, complete the following steps:

1. Visually inspect the heater cable and temperature controls for signs of mechanical damage. If damage is seen, either replace the complete heater cable, or cut out the damaged section and replace using the proper splice connection for the area and cable you are using.
2. Inspect all connections to be sure they are correctly assembled. Be sure each heater cable entry to a connection has a grommet and the compression plates and caps are properly tightened.
3. Determine the insulation resistance of the circuit using at least 500 VDC. It is strongly recommended that higher test voltages be used. Always perform this test at the power connection. See Table 4 for minimum insulation resistance readings. Any cable with an in-sulation resistance below the recommended value should be removed and factory should be contacted. See page 31 for a detailed explanation on how to conduct the insulation resistance test.
4. Check voltage at the end of circuit and record in the log on page 33. See page 31 for information on how to complete the end of circuit voltage test.

Table 4 – Minimum Insulation Resistance Readings

	Delivery	Installation Pre-Insulation	Installation Post-Insulation	Maintenance
Chromalox MI	20 MΩ	20 MΩ	5 MΩ	5 MΩ

Thermal Insulation

An installed heating circuit should be thermally insulated immediately to provide protection from damage from ongoing work. Things to remember about insulating:

- Insulate the equipment being heat traced as soon as possible after the heating cable is installed. This will protect the cable from possible physical damage.
- The type and thickness of thermal insulation specified on the design drawing must be used. If you use another type or thickness, the heater cable type or amount may have to be changed.
- Never install wet insulation. Both the piping and the insulation must be dry when thermally insulating a circuit. Wet insulation may cause start-up or operational problems.
- Properly weatherproof the thermal insulation. All places where valve stems, conduits, pipe supports, connection housing, thermal capillary tubes, etc. extend outside the insulation jacketing must be sealed with a suitable compound to keep water out.
- Insulate valves fully up to, and including, the packing gland.
- Heat trace and fully insulate the face of all non-diaphragm pressure instruments.

- Insulation must be covered by a weatherproof barrier, such as an aluminum jacket.
- If you are using metal jacketing and sheet metal screws, be sure the screws are not long enough to penetrate the thermal insulation and damage the heater cable.
- Again, perform the megger test on the circuit immediately after the thermal insulation is installed to detect if any mechanical damage may have occurred.
- When the insulation and the weatherproofing is complete, attach “Electric Traced” labels on the outside of the insulation. These should be installed where they are visible from normal operations, usually on alternating sides about every 10 feet. It is also useful to mark the location of any connections buried under the insulation.

Additional requirements for rigid thermal insulations:

- In the standard single heater cable installation, rigid insulations do not need to be oversized. However, they should be carved so there is no gap in the insulation.
- In case of redundant or multiple heater cables, rigid insulations which are 0.500 inches oversized should be used.

Commission Testing

1. Again, visually inspect the piping, insulation, and connections for the heater cable to make sure no physical damage has occurred since the installation and start-up.
2. Megger the system again to determine if damage not readily visible has occurred.
3. Turn all branch circuit breakers to the OFF position.

For systems controlled by ambient sensing thermostats:

1. If the actual ambient temperature is higher than the desired thermostat setting, turn the thermostat setting up high enough to turn the system ON or (some models) turn the selector switch to the ON position.
2. Turn the main circuit breaker ON.
3. Turn the branch breakers ON one-by-one until all are on.
4. Allow system to run at least four hours in order to let all pipes reach steady-state.
5. Measure the amperage draw, ambient temperature and pipe temperature for each circuit and record in the installation log. This information may be needed for future maintenance and troubleshooting.
6. When the system is completely checked out, reset the thermostat to the proper temperature.

For systems controlled by line sensing thermostats:

1. Set the thermostat to the desired control temperature.
2. Turn the main circuit breaker ON.
3. Turn ON the branch circuit breakers controlled by the thermostat.
4. Allow the pipe temperatures to be raised to the control point. This may take up to four hours for most circuits (large full pipes may take longer).
5. Measure the amperage draw, ambient temperature, and pipe temperature for each circuit and record in the installation log. This information may be needed for future maintenance and troubleshooting.

For redundant systems:

Follow the procedure above for the type of control system you have, but commission the systems one at a time. Start up the primary system, qualify it and shut it down. Then start up the backup system, qualify it and shut it down.

Troubleshooting

Table 5 – Troubleshooting Guide

Observed Problem	Potential Causes	Corrective Actions
Pipe temperature is too low	Incorrect installation of thermostat/thermocouple	Reinstall thermostat on an appropriate pipe segment. Ensure thermocouple is fully contacting the pipe.
	Damaged, missing, or wet insulation	Remove damaged or wet insulation and install new, dry insulation. Ensure new insulation is weatherproofed.
	Improper installation of heating cable on heat sinks	Additional heating cable can be added, as long as the proper connection kits are used, and the new heating cable length does not exceed the maximum circuit length.
	Error in thermal design	Contact a Chromalox representative and modify design as needed.
	Incorrect voltage applied	Apply voltage as specified. Check/repair electrical supply lines.
Power output is too low	Damaged heating cable	Replace damaged cable. Check pipe temperature and cable power output.
	Incorrect circuit length due to uninstalled connections (splice/tee) or severed heating cable	Ensure length and heat trace path matches drawings.
	High-resistant connection due to improper installation of connection kits	Connect all splices and tees as per design specifications.
	Thermostat is wired in “Normally Open” position	Rewire to “Normally Closed” position
	The pipe temperature is too high	Lower pipe temperature if possible. Ensure correct heater selection and design. Contact a Chromalox representative and modify design if pipe temperature cannot be reduced.
	Incorrect voltage applied	Apply voltage as specified. Check/repair electrical supply lines.
Insulation resistance is low or inconsistent	Damaged heating cable	Replace damaged cable using the proper splice connection kits.
	Shorted circuit	Ensure all connection kits are installed properly and inspect them for damage. Replace if necessary.
		For uninsulated heating cable: Check the heating cable for damage, especially around heat sinks. Replace damaged cable using the proper connection kits.
		For insulated heating cable: Check the heating cable for damage piecewise at each connection kit to determine the damaged segment.
	Moisture	The Locating Faults section on page 30 can be used to estimate fault location.
		Excessive moisture on heating cable core or bus wires: Replace cable.
		Moisture on connection kits: Retest after drying out all components. Ensure all conduit entries are properly sealed during reinstallation.
Pipe temperature is too high	Retest at ambient conditions	
Test leads are in contact with junction box	Retest after moving test leads	

Observed Problem	Potential Causes	Corrective Actions
Circuit breaker trips	Undersized circuit breaker	Check design to ensure startup temperature, current loads, and maximum circuit length are not exceeded, and that the power wire size is compatible with the circuit breaker. Replace circuit breaker if necessary.
	Startup temperature is too low	Start up when temperature is higher than -76°F (-60°C).
	Damaged heating cable	Replace damaged cable using the proper connection kits.
	Bus wires touching and shorting out	Check for proper termination at end seal. Note that the heating cable could be permanently damaged and may need to be replaced.
	Moisture	Excessive moisture on heating cable core or bus wires: Replace cable. Moisture on connection kits: Retest after drying out all components. Ensure all conduit entries are properly sealed during reinstallation.
	Undersized GFPD	Replace with appropriately sized GFPD.

Insulation Resistance (Megger) Test

The insulation resistance test detects potential damage that could result in the cable shorting out. A megohmmeter is used to measure the insulation resistance between the conductive core and the grounding braid, and the reading is compared to the allowable minimum resistance reading (See Table 4). The megohmmeter should be a minimum of 1000 Vdc, but the use of 2500 Vdc is preferred. If possible, the meter should be battery-operated, though digital or analog meters can also be used.

1. De-energize the circuit.
2. Open the cover on the power termination kit.
3. Disconnect the bus wires and braid from the terminals.
4. Set the test voltage to 0 Vdc.
5. Connect the negative lead to the ground braid and the positive lead to the bus wires.
6. Turn on the megohmmeter and perform insulation resistance test for one minute, until the needle on the meter stops moving.
7. Check the reading and ensure it is above the allowable minimum resistance reading.
8. Record the tested value in the log.
9. Turn off the megohmmeter and discharge it with an appropriate grounding rod (if the meter does not self-discharge).
10. Reconnect the wires and close the power termination kit.

For additional information about this test, please watch the “Heat Trace Megger Testing Procedure” video in the Chromalox video library:

<https://www.chromalox.com/en/Resources-and-Support/Technical-Resources/Video-Library/Video-Library>

Stabilized Current Test

The stabilized current test determines the cable current at full voltage. It ensures that the cable power output is correct for design and that it is stable. To perform this test, a standard multimeter with an Amp clamp or an all-in-one unit is required. Ensure the meter has an auto-range up to 100A. If possible, the meter should be battery-operated, though digital or analog meters can also be used.

1. De-energize the circuit.
2. Open the cover on the power termination kit.
3. Disconnect the bus wires from the terminals.
4. Clamp the meter onto one bus wire.
5. Energize the circuit.
6. Allow the circuit to run for at least 20 minutes.
7. Take the current reading and record in the log.
8. De-energize the circuit.
9. Disconnect and turn off the meter.
10. Reconnect the bus wires and close the termination kit.

To determine the thermal output, complete the calculation below:

Thermal output = (Current Reading / Circuit Length) x Voltage

Compare the result to the charted output temperature in the “Chromalox Design Guide for Heat Tracing Products”.

For additional information about this test, please watch the “Stabilized Current Test” video in the Chromalox video library:

<https://www.chromalox.com/en/Resources-and-Support/Technical-Resources/Video-Library/Video-Library>

Maintenance

Recommended maintenance for Chromalox heat tracing systems consists of performing the steps involved in the commission testing on a regular basis. For those systems controlled by line sensing thermostats, Chromalox recommends checking the system at least twice per year. Systems controlled by an ambient-sensing thermostat should be checked when the season requiring their use is approaching.

Repair or replace all damaged heater cable, connections, thermal insulation and weatherproofing using only Chromalox connections and methods before testing the system.

Record all repairs made and measurements taken in the installation and maintenance log.

Installation and Maintenance Log

Reference Information

Circuit Number							
Circuit Breaker Number							
Drawing Number							
Circuit Length							

Heat Tracing Visual Checks

No Signs of Moisture, Corrosion or Damage	Initial						
	Date						
Proper Electrical Connection	Initial						
	Date						
Proper Grounding of the Braid	Initial						
	Date						

Heat Tracing Electrical Checks

Megger Test (500 VDC) (Bypass Controls)	Meg Ohms						
	Date						
Amperage Draw Test Compare to design Amperage Draw	Amperage						
	Amp. Temp						
	Date						

Accessories/Control Checks

Temperature Control Properly Set	Setpoint						
	Date						
Sensors Protected and Undamaged	Initial						
	Date						
All Enclosures and Kits Closed and Sealed	Initial						
	Date						

Thermal Insulation Checks

Location of Kits Visible on Outside of Insulation	Initial						
	Date						
Insulation is Complete, Dry and Weatherproof	Initial						
	Date						

Limited Warranty:

Please refer to the Chromalox limited warranty applicable to this product at
<http://www.chromalox.com/customer-service/policies/termsofsale.aspx>.

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