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Installation and Operation Instructions

AccuTrace™ Heat Tracing Systems

6/97

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AccuTrace™ Installation Instructions

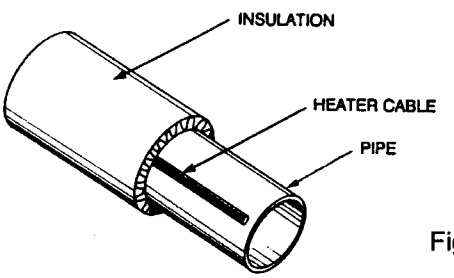
Self Regulating Heater Cables

I. General Information

This manual is designed for use with AccuTrace™ self regulating heater products. For applications not specifiable addressed, please contact Accurate Gas Control Systems.

Purpose

Heat tracing cable has many uses ranging from preventing condensation by heating gas delivery lines to freeze protection of water pipes. The AccuTraec™ family of heat trace cables contains a tinned copper braid, covering the innerjacket with a fluoropolymer overjacket for use in hazardous areas. The self-regulating effect allows the cable to be overlapped without creating hot spots or burnout. The AccuTrace™ system eliminates process variables and gives greater process control.



Figue 1

Product Selection

Check and verify that the proper heaters are being installed on each pipe and vessel. If no design/ installation documents exist check AccuTrace™ Design and Selection Guides to determine the proper equipment for the application.

Receipt and Storage

Receipt

• Compare the materials against the shipping bill to verify receipt of proper materials.

• Inspect heating cable and components for transit damage. Insulation resistance tests on each spool of cable are recommended.

• If design documents (line lists or per circuit bills of material) exist, check the received materials against the lists to verify receipt of all needed materials. If no design documents exist, keep a receipt log of all materials received.

Storage

Cables and system components should be stored in a clean, dry area. The equipment should be protected from mechanical damage during storage. The storage temperature range is -40°F to +140°F.

Withdrawal from Storage

It is recommended that a check out record be kept (in conjunction with the receipt records) on equipment as it is removed from storage. This will serve to identify developing material shortages before they happen - since project additions often cause the use of material for other than designated piping.

Approvals:

FM	CSA
Ordinary Locations-	Ordinary Locations
Basic Cable	Basic Cable
Hazardous (Classified) Locations	Hazardous (Classified) Locations
Class 1: Division 2: Groups B.C.D	Class 1: Division 2: Groups B.C.D
Class II: Division 2 Group G	Class II: Division 2 Group E,F, G
Class III: Division 2	Class III: Division 2

All listed products when installed according to AccuTrace™ Instructions with tinned-copper braiding and approved components are approved by Factory Mutual and CSA for the listed classified hazardous area.

The G Series Heater Cable meets the NEC Code 427-22 and 427-33

II. WARNINGS

While there are many acceptable ways of installing AccuTrace™ electric heating equipment, certain actions can be dangerous to personnel and your installations. Please take care to avoid the following problems:

• DO NOT TWIST THE BUS WIRES TOGETHER AT EITHER END OF THE CABLE. Each of these wires has a voltage or neutral applied to it; twisting them together will cause a short circuit.

• INSULATE BLACK POLYMER SURROUNDING BUS WIRES. The black compound extruded around the bus wires is electrically conductive and should be treated as a conductor.

•ALL ELECTRICAL CONNECTIONS IN THE SYSTEM SHOULD BE SEALED AGAINST MOISTURE. To prevent electrical arcing and fire hazard, all cable connections and electrical wiring connections should be sealed against moisture. This includes the use of proper cable sealing kits and the moisture proofing of all wire connections.

• DO NOT EXPOSE HEATER CABLES TO TEMPERATURES ABOVE THE MAXIMUM RATINGS. Higher temperatures can greatly shorten the life of the heater.

• IMMEDIATELY REPLACE ANY DAMAGED HEATER CABLE OR COMPONENTS. Failure to replace any damaged components (heater cable, components, or thermal insulation) will result in system failure.

• CLASSIFIED AREAS (EXPLOSIVE DUST OR GAS) REQUIRE THE USE OF SPECIAL ELECTRICAL COMPONENTS.. Any area having explosive gases (such as chemical/petrochemical installations) or explosive dusts (such as coal handling or granaries) requires special cable, connection components and control components that are approved for use in these areas. Installation of non-approved products can result in fires or explosions.

• INSTALLATION ON PLASTIC PIPE REQUIRES SPECIAL CONSIDERATIONS IN SELECTION AND INSTALLATION. (See AccuTrace Design Guide for details in design and selection.)

III. Guide to Installation

Scheduling

The installation of the electric heat tracing needs to be coordinated with the piping, insulation, electrical and instrument groups. It should begin only after the majority of mechanical construction is complete.

Pressure testing of the pipe and installation of the instruments should be complete prior to the start of the heater cable installation.

Pre-Installation

- Walk the piping system and plan the routing of the heater cable. Use this check to verify completion of instrumentation and mechanical work.
- All coatings (paint, etc.) must be dry before attempting the heater cable installation.
- Use a reel holder to pay out the heater cable.
- Keep the cable strung loosely, but close to the pipe being traced. This will avoid interference with supports and other equipment.
- Leave extra cable (12" - 18") at all power connections, tee splices and end seal connections to facilitate easy working of the connections.
- Additional heater cable is required on valves, pipe supports and other equipment. See installation detail section for exact lengths and method of installation.
- When handling the heater cable, avoid pulling it over or installing against sharp edges.
- Do not kink or crush the cable, including walking on it or driving over it with equipment.

Location

The heating cable may be installed in either single or multiple straight runs or spiraled around the pipe. Greater heat outputs can be attained by using more than one pass of heat cable. Straight runs are recommended in most cases for ease of installation.

Straight Tracing: When straight tracing is used, install the heating cable on the lower quadrant of the pipe. This helps prevent physical damage to the heater cable from falling objects and being walked on. (See Figure 2)

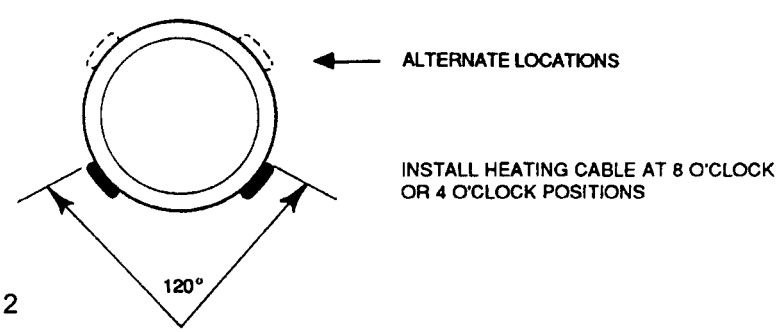


Figure 2

Installation Procedure

1. Begin tape installation at the power input point of the tracing circuit.
2. A single run of heat cable should be attached to the bottom side of the pipe.
3. Attach temperature sensor, if required, to top side of the pipe (on the opposite side of the pipe form the heater) or as far away as is practical. This will allow the controller to sense the actual pipe temperature and not be influenced by the heater temperature. Mount the t/c (junction) sensor at least three feet from the closest heat sink if possible.. The location along the pipe should be at the point of greatest ambient variation.
4. Attach heating cable to pipe with fiberglass tape at one foot intervals.. (See Figure 3) The cable should fit snugly against the pipe.

   To prevent possible damage of the heating cable, do not fasten with metal straps, wire, vinyl electrical tape or duct tape.

5. Secure cable using aluminum tape as shown in Figure 4 or by spiral wrapping. Apply the aluminum tape by spiral wrapping the tape around the prepared tubing while removing the release paper. Press the tape firmly in place. At fittings, valves, tees and elbows, cut strips and adhere firmly onto the objects insuring the heat tape make good contact with the pipe.

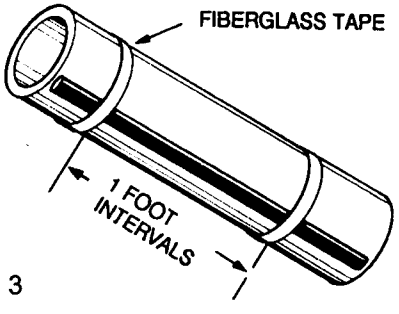


Figure 3

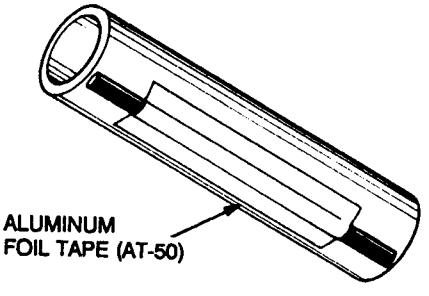


Figure 4

Cut cable ONLY after it is attached to the pipe. Confirm the allowances for terminations, connections and heat sinks (valves, supports, etc.) before cutting the cable. Heating cable power is not affected by cutting to length.

Protect all heating cable ends from moisture or mechanical damage if exposed for long periods of time.

6. On pipes 1" i.d. or larger position the heat tape on the outside of piping elbow. See Figure 6

7. Attach heat tape to valves, pumps, flanges and pipe supports.

Heating cables should be applied in a manner to facilitate the easy removal of valves and small in-line devices without the removal of excessive thermal insulation or having to cut the cable. The best way to accomplish this is to loop the heater. See Figures 5-9). The amount of heating cable installed on each valve, hanger, etc. varies with the pipe size and type of device. Table 10 shows the correct additional cable to be installed on each device.

Heat Loss Adder

PIPE FITTING TYPE

Pipe Size	Standard Flange	Blind Flange	Pipe Support	Screwed or Welded Valve	Flanged Valve	Butterfly Valve
.50	.3	.5	1.0	1.0	1.0	1.0
.75	.3	.5	1.5	1.0	1.5	1.0
1.00	.3	.5	1.5	1.0	2.0	1.0
1.50	.3	.5	1.5	1.5	2.5	1.5
2.00	.3	.5	2.0	2.0	2.5	2.0
3.00	.5	.75	2.0	2.5	3.0	2.5
4.00	.5	.75	2.5	3.0	4.0	3.0

Figure 10

It is recommended that all heating cables be tagged as they are installed with a discrete circuit number. This will facilitate identification, components needed and electrical wiring during later phases of the installation.

Figures 5-9 show installation details for various typical situations.

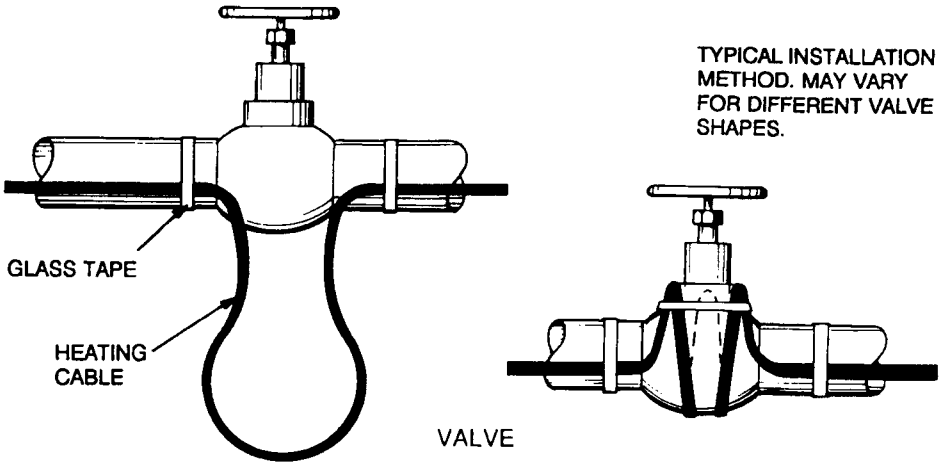


Figure 5

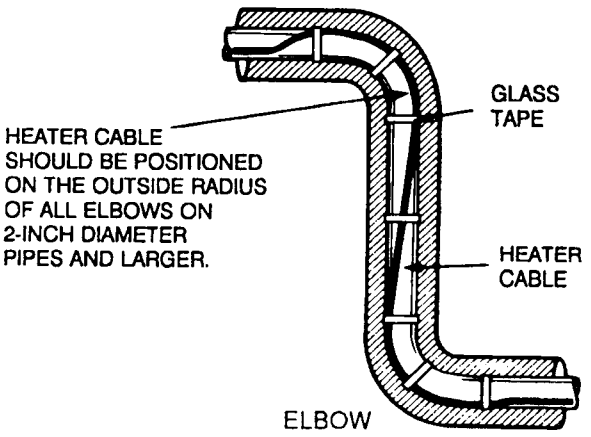


Figure 6

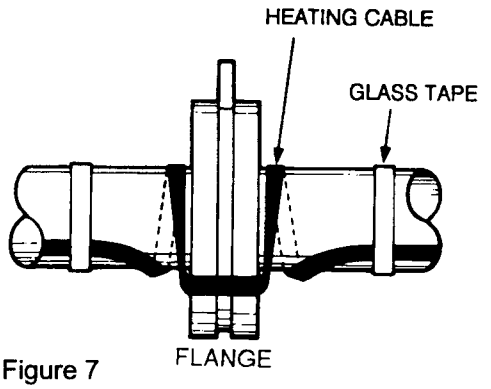


Figure 7

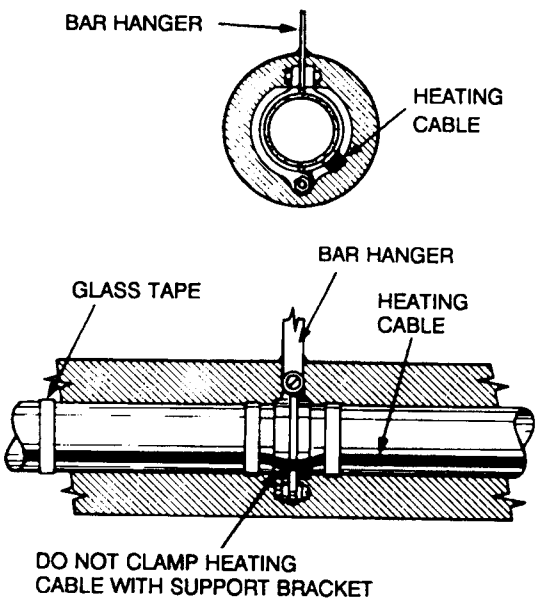


Figure 8

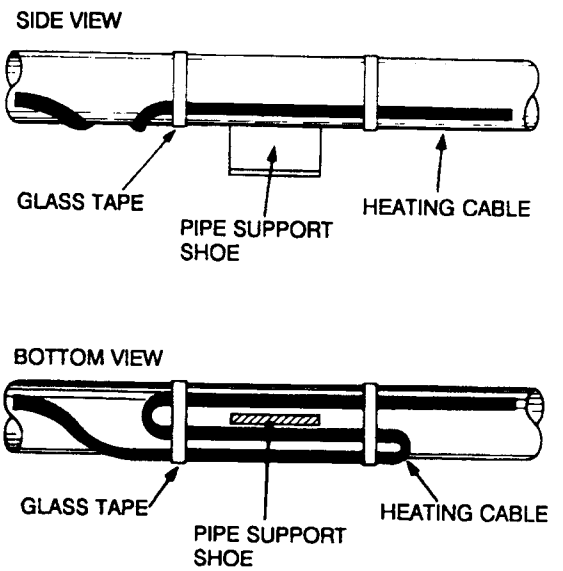


Figure 9

System Components

Only AccuTrace™ approved termination, connection and splice kits should be used. Failure to do so will negate warranties and agency approvals.

Make end seal (termination) and splice connections before making the power connection.

Warning! Connecting bus wires together creates an electrical short!

See individual component kit instructions for detailed installation instructions.

Section V **AT-IKG AccuTrace™ Installation Kit**

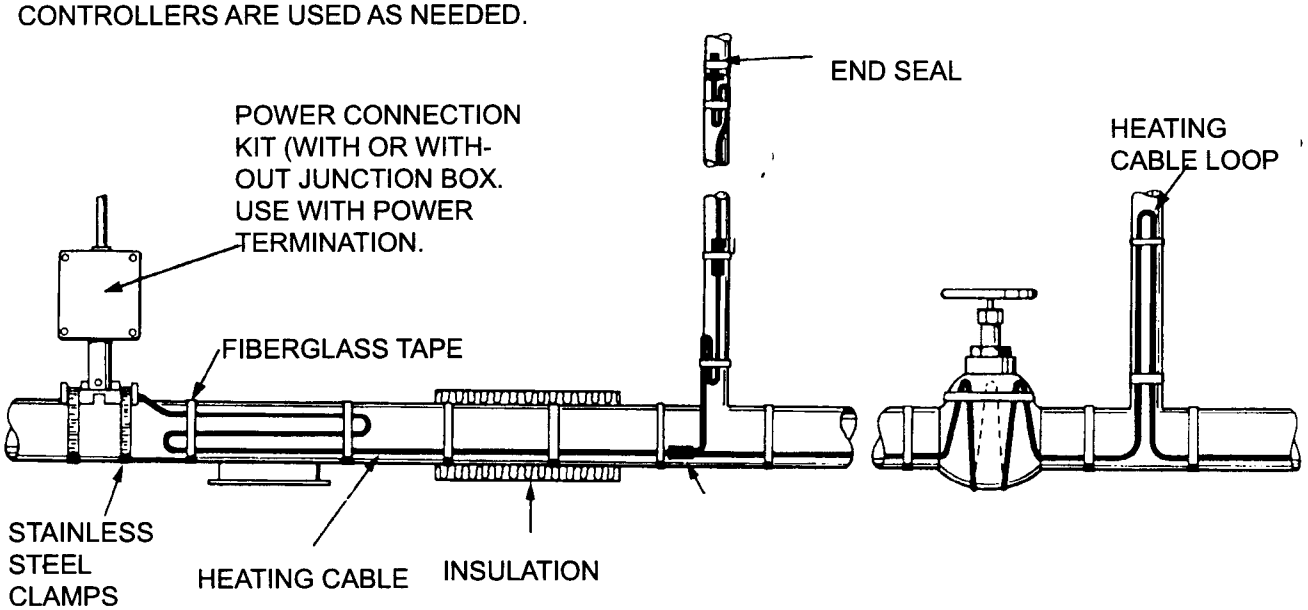
AT-PCK Power Connection Kit

AT-PSK AccuTrace Splice Kit

AT-NEA/MODEA Controller Assembly Installation

Instructions in each component kit should be followed regarding cable preparation and assembly.

HEATING CABLE POWER CONNECTIONS AND END SEALS ARE REQUIRED FOR EACH HEATER. HEATING CABLE SPLICES, TEES AND CONTROLLERS ARE USED AS NEEDED.



Thermal Insulation

1. Pre -Installation Checks

Inspect the heating cable and components for correct installation and possible damage. Verify that:

• The proper extra amount of heater cable has been installed at each valve, flange, pipe support, etc. and that it is free from physical nicks, tears or gouging. Additional cable beyond the specified amount at a heat sink is not a problem due to the self regulation effect of the heating cable.

Thermal Insulation Continued

- Connections, splices and end seals are correctly installed, including cable seals at power connection enclosures.
- Check the thermal insulation type and thickness against the design criteria. Changes in insulation type or thickness may require a different wattage heater cable.
- Verify that all pipework including wall penetrations, fittings, etc. has been completely insulated.

Warning: All thermal insulation must be dry for the proper functioning of the heat trace system.

- Verify that insulation is not wet from rainfall prior to the application of waterproofing.
- Lap joints on vertical piping are properly overlapped - higher piece lapped over the top of lower piece.
- Band seals are used at lap joints to prevent the ingress of water.
- All penetrations of the lagging (valve stems, hanger rods, etc. are properly water proofed.
- Irregular shaped items (pumps, etc.) are properly waterproofed.
- To minimize potential damage to the heater cable, install the insulation as soon as possible.
- It is recommended that another insulation resistance (megger) test be done after the insulation has been installed to verify that the heating cable was not damaged during the insulation installation

Marking

Install *Electric Heat Tracing Caution!* signs on alternate sides of the piping at 10 foot intervals as a warning to maintenance personnel.

Permanently mark the outside of the insulation lagging with the location of heater cable components. This will facilitate maintenance in the event of a problem.

Controller Systems

Temperature sensitive applications will require a controller assembly system.

The AccuTrace™ AT-MODEAX-X and the AT-NEMAX-X Controller Assemblies are recommended for use with AccuTrace™ Heat Trace Cable. See the individual instructions for connecting the controller assemblies.

Locate the controller assembly as close to the power connection kit as possible.

Moisture inside the enclosure will cause both corrosion and electrical shorting problem. The potential for this type of problem can be greatly reduced by:

- Proper sealing of all enclosure openings
- Keeping enclosure cover closed and secured as much as possible during installation sequence.
- Proper closing and sealing of the cover to prevent leaking into the housing.
- Use of a moisture proofing/electrical spray sealant on all electrical connections at completion of installation.

Electrical Requirements

Voltage Rating

Verify that the heating cable voltage rating is suitable for the service being used. 240 volt rated cables may be used from 208 to 277 volts, with an accompanying change in power output. Voltage and wattage ratings are printed on the cable.

Electrical Loading

Size over current protective devices according to AccuTrace Design and Selection Guide. If devices are other than standard thermal magnetic circuit breakers, consult factory.

Ground Fault Protection

Ground fault circuit breakers are not required on theAccuTrace G Series heat trace cable. (AT-BTXG and AT-UTXG)

In addition it may be desirable to use Ground Fault Circuit Breakers on all cables in certain areas, depending on the degree of risk involved - abuse, immersion, workmanship, etc.

Typically, 30 mA trip devices are required due to the capacitive leakage of the heating cable construction.

Waterproofing

Moisture penetration of the electrical system is the single largest source of problems in a heater cable system installation. Therefore, particular care must be given to the proper sealing of all electrical connections and splices. Heating cable sealing kits will provide a proper seal for the heating cable itself, when used per kit instructions. All other electrical connections (heater to power wiring, controller connections, panel and breaker connections, etc.) should be sealed or moisture proofed in some fashion. Either mastic shrink tube or an aerosol electrical insulative sealant should be used on all connections to reduce any moisture penetration.

Testing

Recommendations:

Electrical tests are recommended at specific points in the receipt and installation of the heater cable. This periodical testing is designed to prevent the expenditure of wasted labor in the event of damage to the product. Installation costs of the cable and thermal insulation are much greater than the heater cable. Quick identification of any heating cable damage is the most economic approach to an installation.

An insulation resistance test is recommended at the following points of the installation process:

- Upon receipt of the heating cable
- Before thermal insulation installation
- Immediately after thermal insulation installation
- As part of a periodic maintenance program.

Test Procedure

The insulation resistance test is used to check for damage to extruded jackets. Connections for the megger are made as shown in Figure11

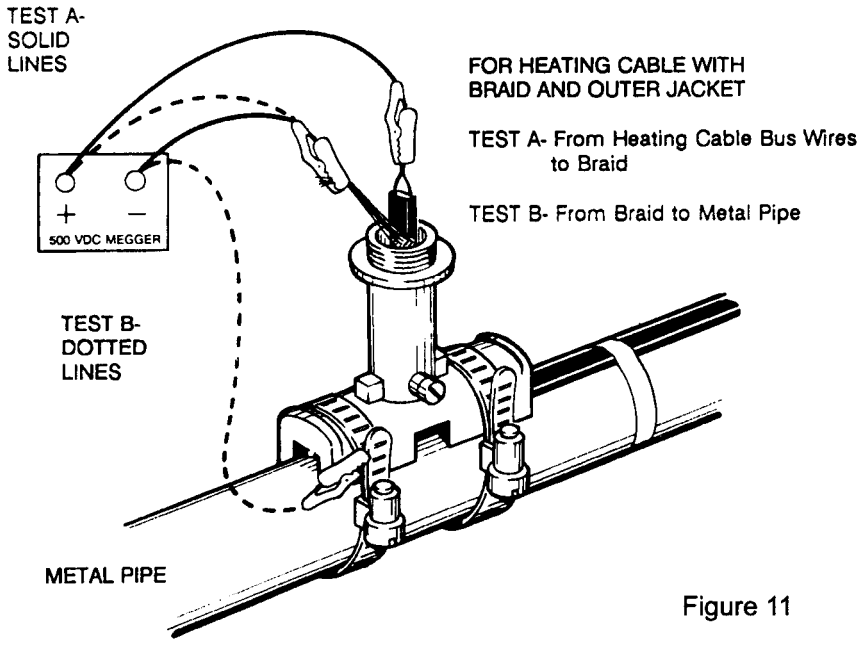


Figure 11

A record should be kept of the readings taken from the time the cable is first installed on the pipe. A history of the insulation resistance reading can be helpful in spotting moisture ingress into the electrical system (be seeing a gradual decline in the insulation resistance) or physical damage to the heating cable (sharp decline in the insulation resistance). A sample record form is shown on page 20.

Startup

Heatup Time

Heat up capacity (the ability to heat the pipe and its contents rapidly) is not normally designed into the system. Cold start ups should allow adequate time for the pipe to come up to temperature..

Diversity Factor

If the electrical supply capabilities limited, then a diversity factor may be used in a cold start situation (trying to start the entire system up in very cold weather). This is accomplished by staggering the initial turn on the heater cable circuits to allow the inrush currents to occur in a sequential fashion rather than all at once.

IV. Operation and Maintenance

System Design, Installation and Documentation

The heating cable system must be properly designed, installed and documented. This documentation should at least include line lists and location identification documentation. As built installation drawings provide the optimum maintenance tool. Test records should also be considered as part of the system documentation requirements.

Preventive Maintenance

A preventive maintenance program is needed which will encompass both visual and electrical checks of the system. These should be done not only before initial operation of the system, but also on a scheduled basis. The checks should also be done after any maintenance has been performed.

Visual Inspections

Thermal insulation - check weatherproofing for damage, missing seals, cracks or gaps in caulking and mastic coatings, damaged or missing lagging. When damage does exist, the insulation will need to be repaired or replaced, and then resealed. Wet insulation has poor insulating properties, therefore the insulation must be kept dry. If insulation has been damaged, check the heater cable for damage - replace the damaged section.

Inspect controller assemblies, junction boxes and connection boxes for corrosion, moisture or foreign matter.

Check tightness of electrical connections, proper electrical insulation of heating cable wires, adequacy of moisture seal on electrical connections and that a minimum of one inch of electrically insulated heater extends above the grounding connection. No strand of the grounding braid should extend above this connection.

Verify all controller assemblies, enclosures, connection boxes, etc. are properly closed and that the controller is switching off and on by measuring current flow in the circuit when the unit switches on. Reset the controller to the proper temperature after completion of the test.

Frequency

Process maintenance systems should be checked on a frequent basis, at least twice a year.

Personnel Training

Qualified maintenance personnel must be used to maintain the system. It is recommended that periodic training programs be utilized to assist in keeping maintenance personnel up to date on equipment and procedures.

Maintenance

The heater cables will not require any maintenance.

Piping Repairs

Disconnect the electrical connection for the heating cable and protect it from mechanical or thermal damage during the repair.

Check a cable installation after the repairs per established procedures. Replace and water seal the thermal insulation system.

Damaged Products

Do not attempt to repair a damaged heater cable - replace the entire section. Fault currents will often destroy the bus wire/core material interface between the damaged portion and the voltage supply end of the circuit.

Replace the damaged cable immediately. Moisture migration into the good section of the cable may cause electrical short in that cable after repair of the damaged section.

Any product exposed to fire or flame should be removed from service immediately and replace. Further fire damage could result if energized.

Trouble Shooting Guide

Symptoms	Probable Cause	Connection
A. Circuit breaker Trips (Standard)	1. Circuit Breaker undersized	1/2/3. Reestablish what the current loads are going to be and resize the breakers*.
	2. Circuit oversized	
	3. Start-up at too low a temperature	
	4. Defective Circuit Breaker	4. Replace Circuit Breaker.
	5. Connections and/or splices may be shorting out	5/6. Locate and repair incorrect connections, splices, or damaged sections of heater. ** Megger per installation instructions.
	6. Physical damage to the cable may be causing a short	
	7. Wires connected at end seal	7. Disconnect wires and perform a current check for possible other damage.
B. Circuit Breaker Trips (Ground Leakage Type)	1. All of Section A.	1. All of section A.
	2. Excessive moisture in connection boxes or splices.	2. Dry out and reseal connections and splices. Megger per installation Instructions (20 megohoms min.). Work on connections outside the thermal insulation connections and seals after the others have been eliminated.
	3. Nick or cut in heater or power feed wire with mositure present.	3. Locate and repair or replace damaged heater or power feed wire.**

Trouble Shooting continued...

Symptoms	Probable Cause	Connection
C. Power output is zero or lower than it was rated for ***.	1. Low or no input voltage	1. Repair electrical supply lines and equipment.
	2. Circuit is shorter than design shows	2. Check routing and length of heater (use "as builts"), and recalculate power requirements.
	a. Splices or tees may not have been connected	a. Connect and recheck the power.
	b. Heater may have been severed	b. Locate and repair the damaged heater. Recheck the power.
	3. Improper crimping causing a high resistance connection.	3. Recrimp using correct procedure.
	4. High Alarm is activated	4. Check Hi Alarm setting and reset above process set point temperature.
	5. Pipe is at an elevated temperature.	5. Check pipe temperature and recalculate the output. ***
	6. Heater has been exposed to excessive moisture.	6/7. Replace the heater.
	7. Heater has been exposed to excessive temperatures	
D. Power output appears correct but pipe temperature are below design value.	1. Insulation is wet.	1. Remove and replace with dry insulation and insure proper weatherproofing.
	2. Insufficient heater was used on valves, supports and other heat sinks	2. Splice in additional heater but do not go over maximum circuit length
	3. Controller set incorrectly.	3. Reset the controller.
	4. There are thermal design inconsistencies	4. Check with the local or factory representatives for design conditions. Modify as recommended.

Trouble Shooting continued...

* Check to see if existing power wire sizing is compatible with larger sized breakers.

** To locate shorting problems, follow these steps:

1. Visually inspect the power connections and splices that are outside of the thermal insulation for proper installation.

2. check around the valves, pumps, and any area where there may have been maintenance work done, for visual indications of damage.

3. Look for crushed or damaged insulation lagging along the pipe.

4. Inspect heater cable splices and end seals under the thermal insulation.

5. If you have not located the problem by now, you will have to isolate one section of heater at a time until you determine the general area of damage. First isolate by disconnection any tees or splices, then remove insulation from that area until the specific damage is found. For long runs of cable, it may be necessary to cut the cable in 5 to isolate the shortest section.

*** The power output is temperature sensitive and requires a special procedure to determine it's value.

1. Check the pipe temperature under the thermal insulation.

2. Allow heater to stabilize for 10 minutes and then measure the current.

3. Calculate the power (watts/ft.) of the heater by multiplying the current by the input voltage and dividing by the actual circuit length 1 x V/ft. = Watts/Ft.

4.Compare this measured value to the power output curves for the heater cable at the measured pipe temperature. If the cable's actual output is substantially below the theoretical output, the bus wire interface with the core has been damaged by the fault current and the cable must be replaced. This is not a highly accurate method of analysis, so use discretion in comparing theoretical and actual values.

HEAT TRACE INSTALLATION RECORD

1. Circuit No. _____

2. Receiving Documentation
   Item

	DESIGN	ACTUAL
A. Cable Type	_____	_____
B. Cable Length	_____	_____

3. Receiving Testing — Date _____

   A. Check for physical damage. — O.K. _____ Damage _____

   B. Continuity Check
   Check for continuity between power leads. — O.K. _____ Open _____

   C. 500VDC megger check between leads and sheath, 20 megohm minimum. — Megohms _____

   D. Lot No. — No. _____

4. Post Installation Testing — Date _____

   A. Continuity Check
   Check for continuity between cold leads. — O.K. _____ Open _____

   B. 500VDC megger check between leads and sheath, 20 megohm minimum. — Megohms _____

   C. Visually Check Cable Installation Prior to Release for Thermal Insulation. — Visual Check O.K. _____

5. Final Testing and Commissioning — Date _____

   A. Circuit approved for testing by client. — Approved _____

   B. 500 VDC megger check between leads and sheath, 20 megohm minimum reading. — Megohms _____

   C. Energized Testing
   (All test data to be within 10% of design data)

	DESIGN	ACTUAL
1. Circuit Voltage	_____	_____
2. Initial Current	_____	_____
3. Current After 15 Minutes of Operation.	_____	_____
4. Current After 30 Minutes of Operation	_____	_____
5. Pipe Temperature		

6. Circuit Acceptance — _____ _____

This circuit has been tested and documented in accordance with the above itemized data. This circuit approved by:

Contractor _____ Date _____

Client _____ Date _____

AccuTrace™ Heat Tracing Systems

Circuit Number	
Heater Type	
Circuit Length	

Periodic Inspection Record

Freeze Protection Circuits —
Perform these checks as season requiring use approaches.

Temperature Maintenance Circuits —
Perform these checks at least twice per year.

Maintenance Checks for _____ **Month** _____ **Year** _____								
Visual inspection inside connection box for corrosion, moisture, etc.	Initial Date							
Damage or cracks (leaks) in insulation seals at valves, hangers, pumps, etc.	Initial Date							
Heating cable properly connected and grounded. Heating cable and connections insulated from connection box.	Initial Date							
Thermocouple connection making proper contact. Controller Check	Set Point Initial Date							
Megger tests performed at power connection, with both bus wires disconnected from power wiring.	Reading Initial Date							
Circuit voltage at power connection.	Reading							
Circuit amperage after 10 minutes	Reading							
Pipe temperature at time amps were measured.	Reading							
Watts/Ft. Volts x Amps = w/ft. feet	Initial Date							
All connections, boxes and thermo-stats have been resealed.	Initial Date							
End seals, covered splices and tees marked on insulation cladding.	Initial Date							

REMARKS & COMMENTS							

Periodic Inspection Record

The Periodic Inspection Record Form may be used in one of two ways:

1. *One sheet per circuit.* The results of periodic tests of a single circuit are posted in vertical columns, beginning on the left and working toward the right. This allows easy comparison of test values for up to seven test sequences on an individual circuit.
2. *One circuit per column.* Test data for a single test sequence on as many as seven circuits can be recorded on a single sheet.

V. System Components

Installation Kits

Only AccuTrace™ approved termination, connection and splice kits should be used with AccuTrace™ cable. Failure to do so will negate warranties and agency approvals.

The AT-IKG AccuTrace™ Installation Kit includes basic items needed for installation and power connection of AccuTrace™ Heater Cable.

Individual component kits are used when multiple connections, splices or terminations are needed.

AT-IKG AccuTrace Installatoin Kit includes:

1- Power Connection Kit with Junction Box
1-Foam Insulation Tape
1- Aluminum Tape
2- Insulated splice connectors
2- 1.2 oz. RTV Sealant
Installation Instructions

AT-PCKG Power Connection Kit with/ Junction Box

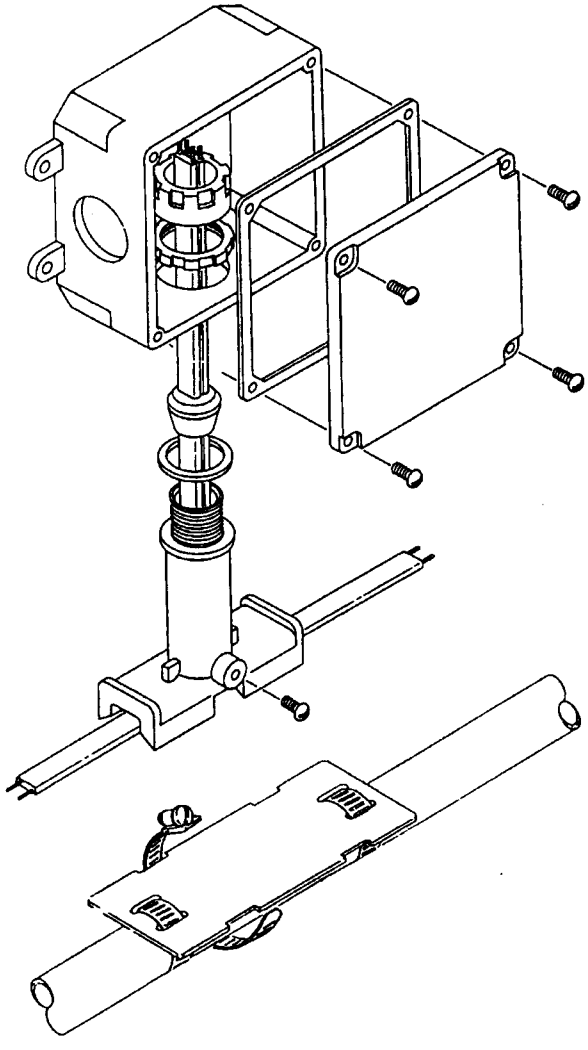
1-Universal Base Tee Standoff with Cap, Sealing Gasket, O-ring and Locknut
1- Adaptor Plate with/ 2 clamps
1- Sealing Grommet
1-Power Termination and End Seal with sealant
1- 3 Point Terminal Block
2-Pipe Clamps

AT-TSKG Splice Kits

1- Universal Base Tee with Cap, Sealing Gasket, O-Ring and Locknut
1- Adaptor Plate
1- Junction Box with Sealing Gasket and Cover
1- Sealing Grommet (Specify size for number of cables)
2- Power Terminations with Adhesive Sealant
1-3 Point Floating Terminal Block
1-Ground Connection Splice
2-Stainless Steel Pipe Clamps

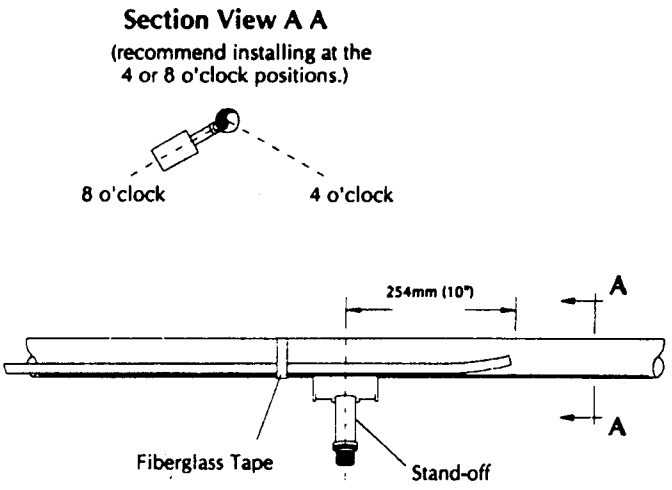
ADAPTOR PLATE

The Adaptor Plate is for use with AccuTrace™ Connection Kits to mount to small diameter pipes or tubes. Covers size range up to 3/4" tubing and 1/2" pipe.

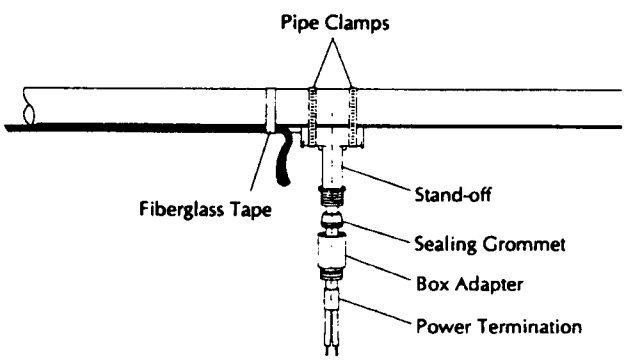


1. Install pipe adaptor with small pipe clamps.
2. Mount standoff with materials supplied in connection kit.

STAND-OFF POSITIONING

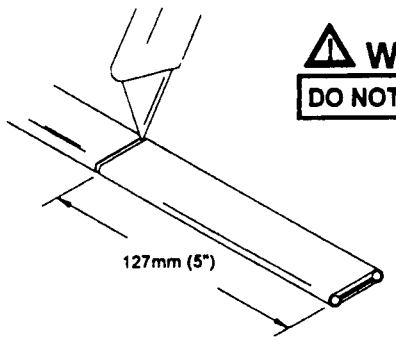


⚠ WARNING:
Do not place pipe clamps over the heater cable.



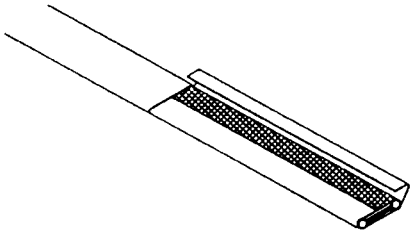
1. Mark pipe where standoff will be mounted.
2. Attach Pipe adaptor if necessary (Step 1)
2. Push heater cable through the bottom opening of standoff.
3. Place standoff on the pipe and fasten with pipe clamps.
4. Slide the sealing grommet over the heater cable and position inside standoff opening.
5. Apply silicone around the heater cable on top of the sealing grommet and fill any voids in sealing grommet.
6. Slide the box adapter over the heater cable and tighten securely to standoff.
7. Prepare heater cable for power termination (Step 4)
8. Terminate heater cable (Step 5)

OVERJACKET PREPARATION

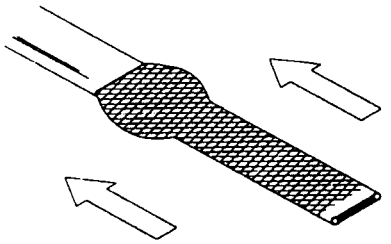


❶ Lightly cut around heater overjacket 127mm (5") from the end. Bend cable to break the overjacket.

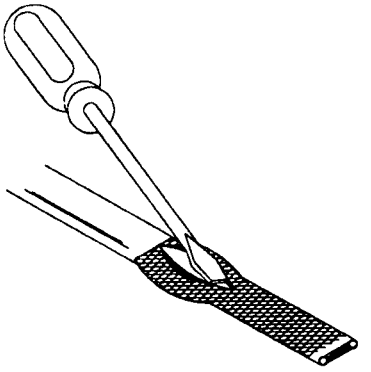
❷ Lightly cut overjacket up the center between first cut mark and the cable end. Bend cable to break the overjacket.



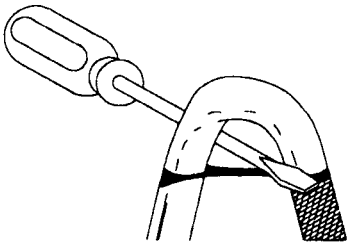
❸ Remove overjacket from heater cable.



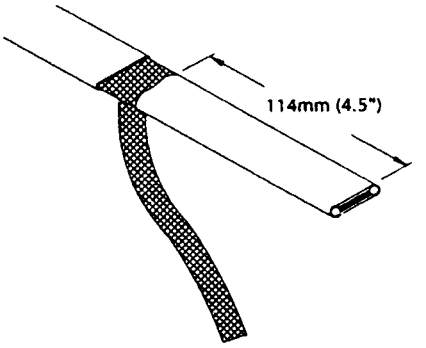
❹ Move braid back toward the overjacket, creating a bulge.



❺ At the bulge, separate the braid to make an opening.



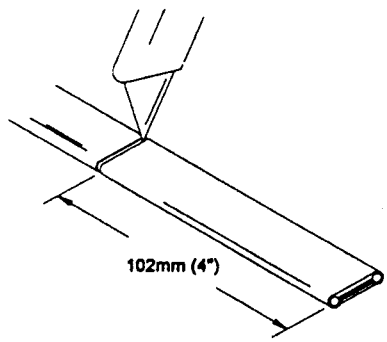
❻ While bending the heater cable, work it through the braid opening.



❼ Pull the braid tight.

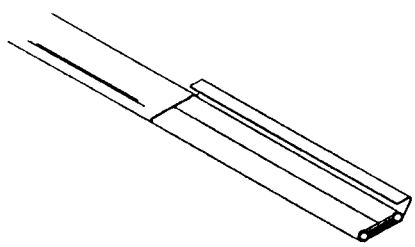
❽ Proceed to "Power Termination", Step 4

CABLE CORE PREPARATION

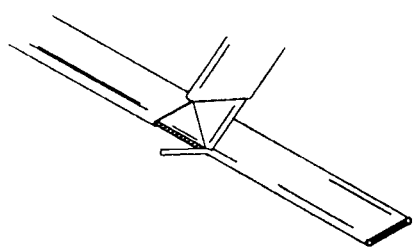


❶ Lightly cut around heater outer jacket 102mm (4") from the end. Bend cable to break outer jacket.

❷ Lightly cut the outer jacket up the center between the first cut mark & the cable end. Bend cable to break outer jacket.

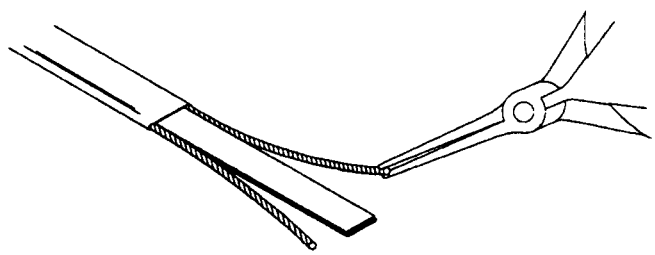


❸ Remove the jacket from the heater cable.



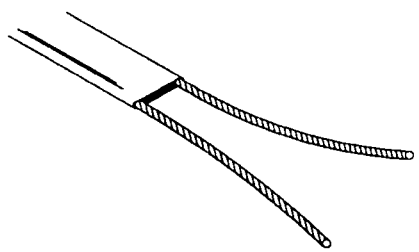
❹ Shave the core material from the outside of each bus wire.

⚠ WARNING:
DO NOT CUT BUS WIRES.



❺ Starting at the end, pull each bus wire away from the core material.

❻ Remove exposed core material.



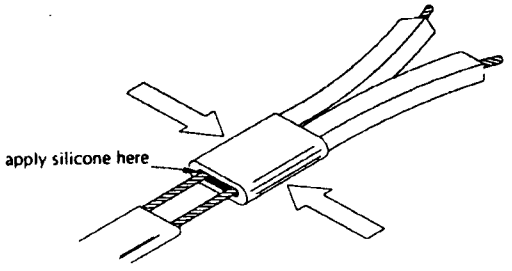
❼ Cut 6mm (0.25") off the end of each bus wire.

❽ Proceed to Power Termination Step 5

POWER TERMINATION

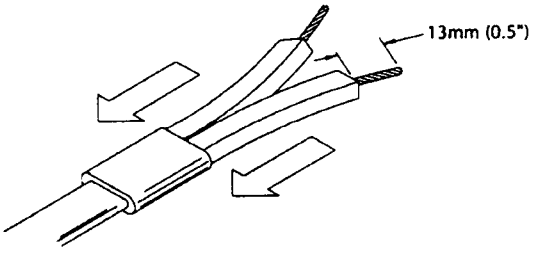
⚠ WARNING:

- **Bus wires must not touch or cross while inserting into power termination / end seal.**
- **Only power terminations / end seals specifically approved for the vendor's style and type of heater cable must be used.**



❶ Insert bus wires into power termination.

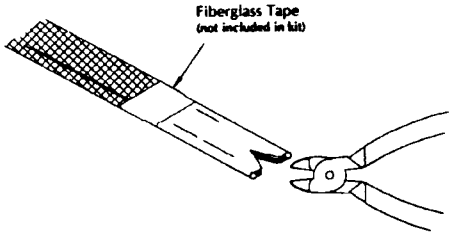
❷ Squeeze power termination opening and fill with silicone.



❸ Push power termination to overlap jacket.

❹ At this point, if you're installing the end seal, see the "End Seal" section below. Otherwise, proceed to "Power Connection",

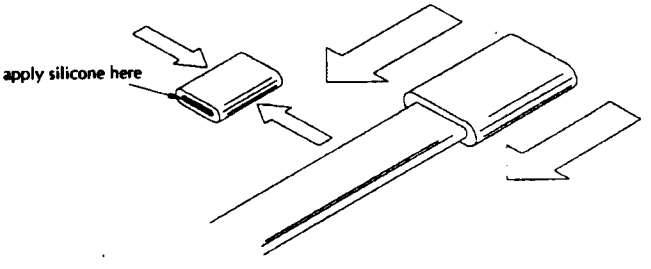
END SEAL



❶ **Braided Products:**
Cut braid back 25mm (1") & tape in place with fiberglass tape (not included in kit).

Overjacket Products:
Remove 13mm (0.5") of overjacket exposing the braid, then remove the 13mm (0.5") of exposed braid.

❷ Make a 10mm (0.4") cut at the end of the heater cable.



❸ Squeeze the end seal and fill with silicone.

❹ Push end seal over the heater cable.

Overjacket Products:
The end seal should overlap the overjacket.

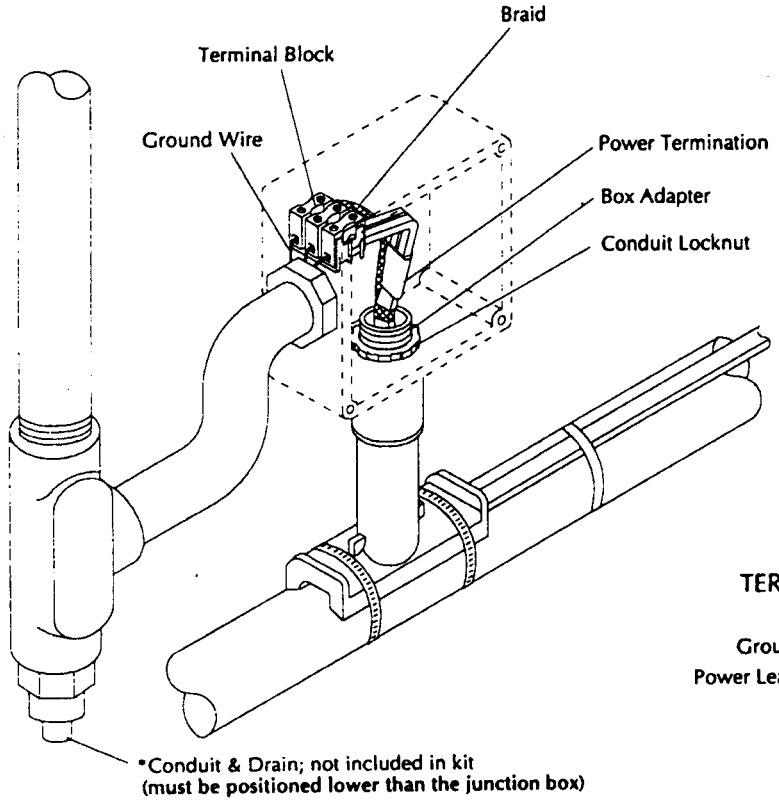
❺ The silicone will set up in about 30 minutes with a complete cure after 24 hours.

❻ Proceed to "Power Connection"

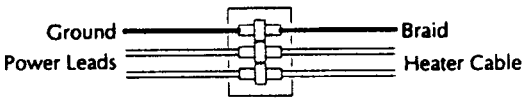
⚠ WARNING:

- **Do not megger or hi-pot until silicone is completely cured.**
- **Braid must be kept away from bus wires or shorting will occur.**

POWER CONNECTION



TERMINAL BLOCK CONNECTION



Note: this detail shows internal grounding of braid.

1. Place gasket on box adapter.
2. Position junction box on box adapter and secure it with the conduit locknut.
3. Connect bus & power wires to terminal block.
4. Ground Connection: (Internal Ground Connected Heaters)
   Connect ground wire to the terminal block. *(See diagram above.)*
   Connect braid to the terminal block. *(See diagram above.)*
5. Apply silicone at point braid leaves the overjacket
6. Push all wires, cable and terminal block inside junction box.
7. Place the box cover and box cover gasket onto the junction box.
8. Fill-in the voltage, catalog number & wattage blocks on the label with the actual filed installed data.