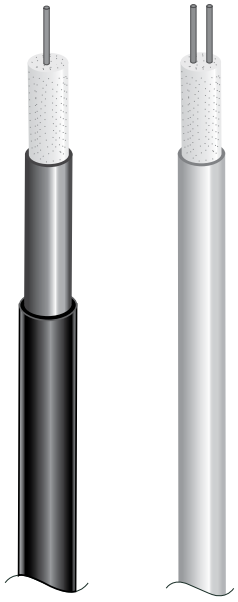
DELTA-THERM CORPORATION®

Installation Instructions
Mineral Insulated (M.I.) Permafrost Prevention Cable Assembly



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Section 1. Overview

1.1 PRECAUTIONS

- Installation must comply with local electrical codes.
- Do not bend cable within 3" of a termination. (Terminations are labeled DO NOT BEND HERE)
- Do not bend cable tighter than 3" inside diameter.
- Do not twist, kink, or spiral the cable.
- Do not pull cable from coil. Roll coil to unreel cable.
- Test the cable before installation with a 500 VDC insulation resistance tester and multimeter (ohm meter).
- Do not overlap heating cable.
- All related components and controls should be properly rated for the specified location classification.
- Do not alter the M.I. cable length in the field, as this will damage the system and void all warranties.

1.2 CABLE AND COMPONENTS

Each M.I. cable assembly is factory terminated. Each M.I. permafrost prevention cable assembly unit includes a base kit. Each base kit includes:

- (1) 3/4" Conduit body (C or T type)
- (1) Bag of Delta-Dry hydroponic powder
- (1) Piece of duct-seal
- Required pressure connector(s)

Each M.I. permafrost prevention cable assembly has a UL label attached to the THWN cold lead within 3" of the brass terminating sleeve stating in order:

1. Cable type prefix
2. Number of conductors
3. Cable resistance
4. Cable length in feet
5. Operating voltage
6. Current draw
7. Total wattage
8. Watts per linear foot

Note: Do not remove the UL label. (Removing the label nullifies the listing)

1.3 GENERAL ACCESSORIES

Accessories

Product Number	Description
CL-S/CL-L	Small And Large Caution Labels
PC1, PC2	Weatherproof 2 Gang Polycarbonate Boxes.

Panels

Product Number	Description
DT-XXPXXX	Enclosed Contactor Panel
GFPE-X-X-X	Power Control Panel w/GFPE
Custom Control/Monitor/Alarm Panels	

Control

Product Number	Description
A19ANC-1C	line sensing
A421ABC-2C	Electronic Temperature Control, NEMA 1
A421AEC-2C	Electronic Temperature Control, NEMA 4X
ETC-1	Electronic Temperature Control, NEMA 4X FRP

Section 1. Overview

1.4 TOOLS REQUIRED

- Basic electrician hand tools
- Fish tape/pull string
- Fastening system (as required): nylon cable ties, pre-punched strapping, or metal ties.
- 500 VDC insulation resistance tester
- Digital multimeter
- Clamp-On Ammeter
- Adjustable wrench

1.5 SITE PLAN

Delta-Therm offers engineered drawing services as outlined in our Price List. If drawings were ordered, please compare the drawing bill of materials to materials supplied with your order and verify that you received all of the Delta-Therm components. Before starting the installation verify the proper location and layout of heating cable(s), control(s), and/or accessories.

1.6 CABLE STORAGE

All M.I. cables should be stored in a cool, dry location. Cables should be protected from damage. Following the cable testing instructions in Section 3, test all cables removed from storage and record the readings on the warranty card. Review the permafrost prevention system design and compare it to the materials received to verify that the proper Delta-Therm heating cable and accessories are available.

1.7 CABLE LABELING

Each M.I. cable has a UL label attached to the THWN cold lead within 3" (76mm) of the brass sleeve. The label states the following information in order: cable type (prefix, number of conductors, and cable resistance), cable length, operating voltage, current draw, total wattage, watts per lineal foot, and cold lead length. Cold leads are sized to current draw. DO NOT REMOVE THIS LABEL. The cable has a standard THWN cold length of 10' (3m).

1.8 CABLE TESTING

Please refer Section 3 for all cable testing procedures.

1.9 SITE PREPARATION

Review installation, engineering, electrical, and or architectural drawings prior to installation. Verify that available voltage is the same as the cable operating voltage indicated on the UL label. Install conduit from the cable feed points to an indoor or dry junction box, continuing to the power panel per site plan. Install appropriate grounding system per prevailing electrical code.

Cable spacing is the distance between each cable run and is provided on the sales information and/or drawings. Delta-Therm recommends 4' spacing between cable runs.

Before installing the M.I. cable, ensure that all surfaces which the cable may come in contact with are free from sharp edges and protect cable from items that may cut or cause damage.

M.I. cable can be installed inside of conduit or directly buried below the freezer floor insulation in sand, concrete or asphalt. When installing M.I. cable in conduit, verify the length of conduit matches the length of the M.I. cable and that all diameters of conduit and components will accommodate the diameters of all of the M.I. cable components.

1.10 PROPER CABLE HANDLING

Always unroll the coil of M.I. cable. Do not pull the cable in a helix fashion.

1.11 NEC CODE

Follow standard electrical code recommendations for power wiring.

1.12 CONDUIT AND CIRCUIT WIRE

The cable assemblies require a permanently wired and grounded conduit system. Use only UL Listed (CSA Certified) weatherproof junction boxes.

Section 2. Installation

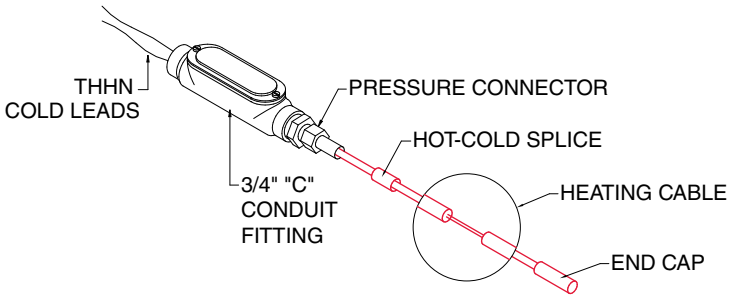
2.1 GENERAL INFORMATION

Before starting the installation please refer to Section 1.5 Site Plan, Section 1.9 Site Preparation, and test cables following the directions in Section 3.1 Pre-Installation Testing. Please refer to Detail 1 and Detail 2 to review single and dual conductor cable finished assembly and base kit components.

M.I. cable can be installed in conduit or directly buried in the subsoil below freezer floor thermal insulation. Install Dual Conductor M.I. cable in straight conduit runs in the subsoil below thermal insulation. Single conductor M.I. cable can not be installed in conduit. It can be installed directly in the subsoil below thermal insulation.

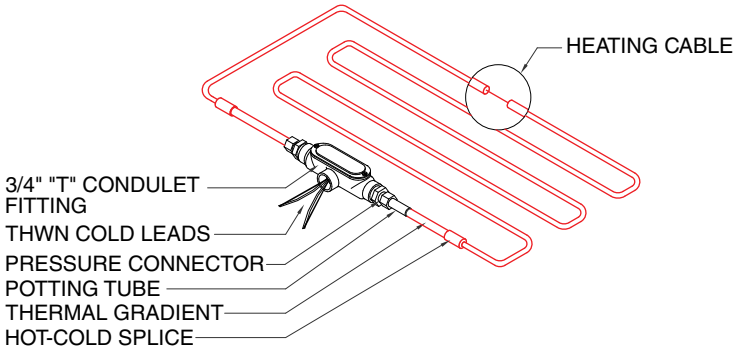
Refer to the thermostat installation instructions to determine the proper conduit size. Refer to drawings to locate the position of the sensor. Delta-Therm recommends placing the sensor inside conduit centered between two runs of heating cable on the same horizontal plane below the insulation. After the proper electrical box(es) has (have) been installed, install conduit. Locate the control sensor in conduit between two heating runs in the subsoil. The sensor should be at the same elevation as the cable, and below insulation.

FOR IN-CONDUIT AND DIRECT BURY



Detail 1. Dual conductor M.I. permafrost prevention heating cable assembly : Heating cable is typically installed in 1 1/4" rigid metal conduit below the insulation in concrete, asphalt or sand. The assembly is factory terminated and includes a base kit as described in section 1.2.

FOR DIRECT BURY ONLY



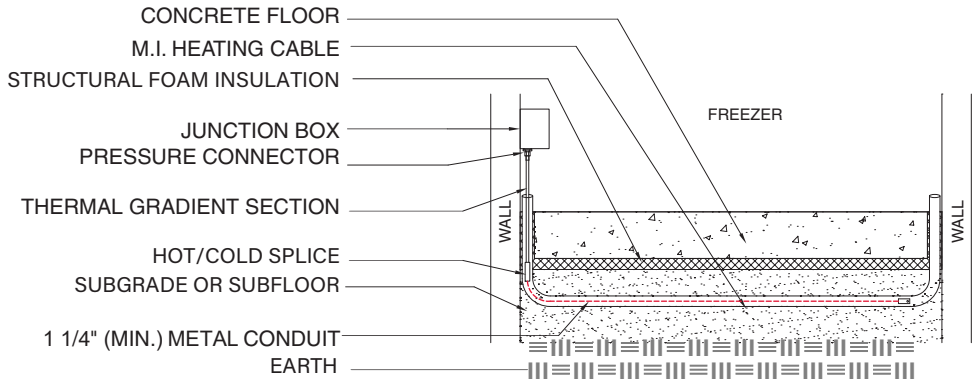
Detail 2. Single conductor M.I. permafrost prevention cable assembly is typically directly buried in the subsoil below the insulation. The assembly is factory terminated and ships with a base kit as described in section 1.2.

Section 2. Installation

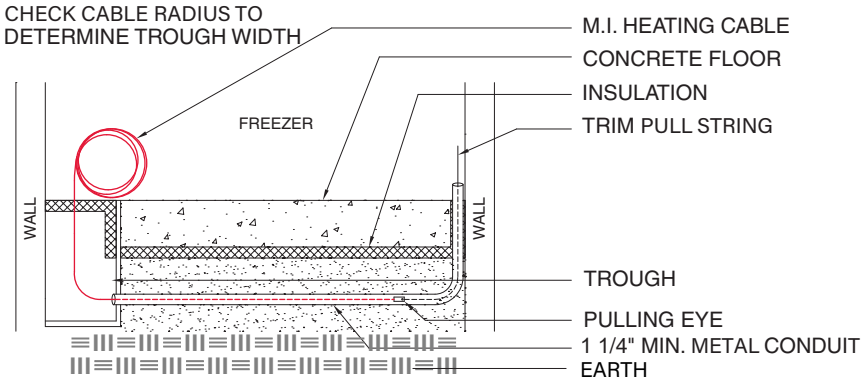
2.2 INSTALLING IN CONDUIT (2-Conductor M.I. Cable only)

Install per site plan at the required depth and cable spacing. Install dual conductor M.I. cable in straight conduit runs only. Please contact Delta-Therm technical support at 1-800-526-7887 if you have conduit bends.

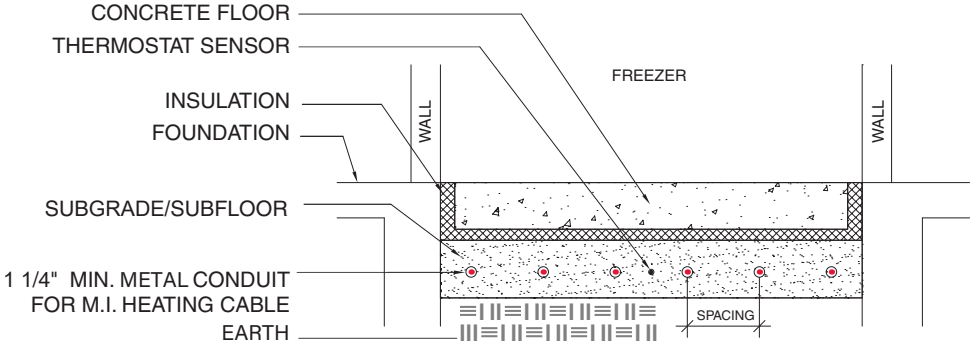
1. Attach fish tape to a pull string and verify the length of conduit matches the length of the M.I. cable. Verify that all diameters of conduit and components will accommodate the diameters of all of the M.I. cable components.
2. Attach pull string to the M.I. cable pulling eye and pull the cable through the straight conduit run.
3. When installing the M.I. pressure connector to a conduit, install rigid metal conduit to ground the conduit body to the electrical system. When installing the M.I. pressure connector directly to a junction box, ensure the junction box is grounded. DO NOT USE PVC CONDUIT.
4. Conduit bends must be wide radius. Do not pull M.I. cable through more than 90° in bends.



Detail 3. Dual conductor M.I. cable in conduit. M.I. cable is being pulled through a 90 ° elbow.



Detail 4. Dual conductor M.I. cable in conduit. M.I. cable is not being pulled through a 90° elbow.



Detail 5. Install dual conductor M.I. cable and thermostat sensor in subgrade below thermal insulation.

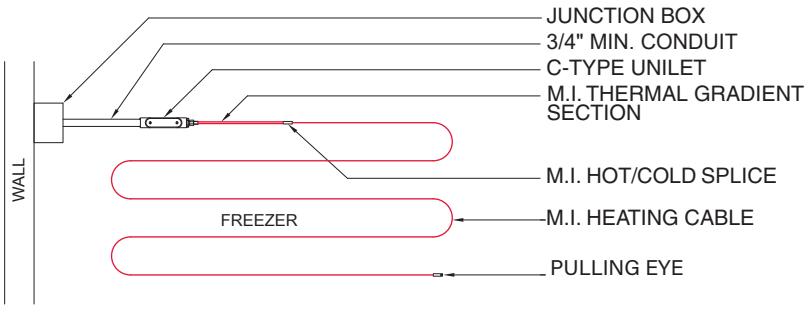
Section 2. Installation

2.3 DIRECTLY BURYING CABLE

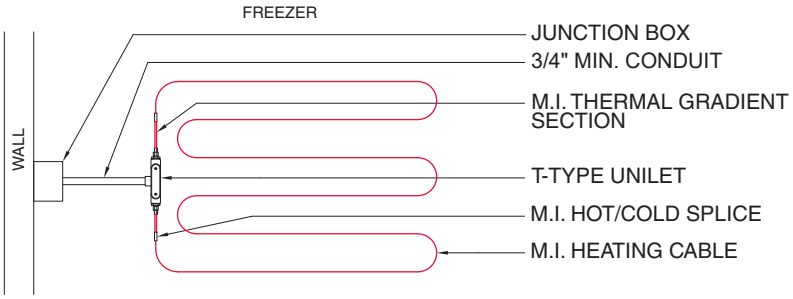
Install per site plan at the required depth and cable spacing.

Note: Do not pull single conductor M.I. cable by cold lead wire.

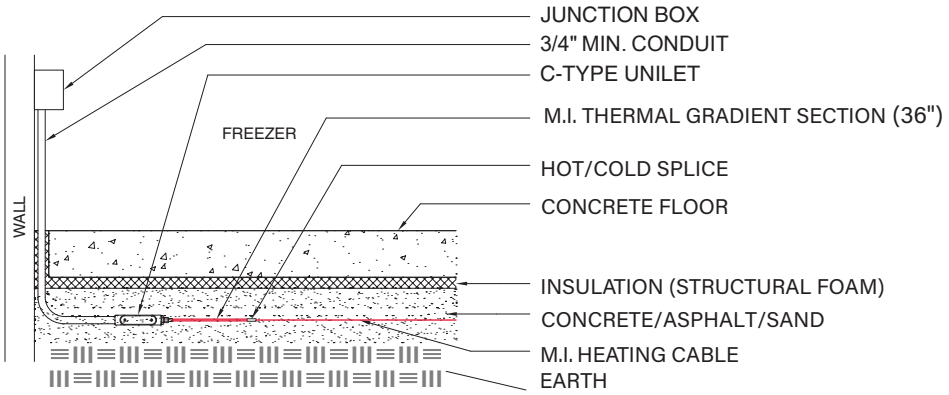
1. Run a 3/4" conduit to the supplied conduit located in the subgrade.*
2. Install both pressure connectors on the conduit.
3. Take one of the brass terminating sleeves (typically with orange wire) and run it half way through one of the pressure connectors and tighten.
4. Unroll the M.I. cable and lay cable per drawings or sales information.
5. Upon return to the conduit insert cold lead thru pressure connector until the brass terminating sleeve is 1/2 way through pressure connector and tighten.
6. Pull cold lead through conduit, and install duct seal at conduit entrance of conduit.
7. Fill the conduit body with Delta Dry powder, and install gasket and cover



Detail 6. Plan view of Installing dual conductor M.I. cable in subgrade below thermal insulation.



Detail 7. Plan view of Installing single conductor M.I. cable in subgrade below thermal insulation.

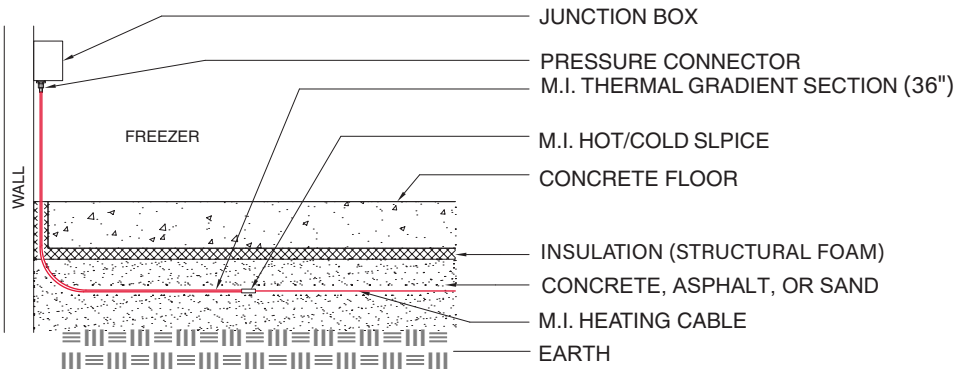


Detail 8. Side view of Installing conductor M.I. cable in subgrade below thermal insulation. M.I. cable is attached to a conduit system and conduit is attached to junction box.

* Subgrade is the space below the foundation and insulation. Delta-Therm's recommended subgrade is concrete, asphalt or sand.

Section 2. Installation

2.3 DIRECTLY BURYING CABLE



Detail 9. Side view of Installing M.I. cable in subgrade below thermal insulation.

NOTE: INSTALLING M.I. CABLE IN SAND (DIRECT AND IN-CONDUIT INSTALLATIONS)

1. Sand depth should be 12" minimum.
2. M.I. cable must be centered in the sand 6" above subgrade and 6" below insulation.
3. Maximum spacing is 48" on center.

Section 3. Testing and Trouble Shooting

3.1 PRE-INSTALLATION TESTING

Unpack the M.I. cable and test each cable for insulation resistance (IR), and total resistance (TR).

To test TR, connect each lead of the ohmmeter to each M.I. cable cold lead conductor. Test in accordance with the meter manufacturer's instructions. Compare TR reading from ohmmeter to calculated TR (multiply the heated length of cable by the cable resistance value found on UL/CSA label). The ohmmeter reading should be within 10% of the calculated TR.

To test IR, connect one lead of the 500 VDC insulation resistance tester to one cold lead conductor and the other lead to the M.I. cable metal sheath. Test in accordance with the meter manufacturer's instructions. IR reading should be greater than 10 megohms.

Please enter the TR and IR readings on the warranty card.

3.2 MONITORING CABLE DURING INSTALLATION

Repeat the steps as described in Section 3.1 and enter the information on the warranty card. If there is a change in the meter reading, please check the cable for damage, as well as any power connections, splices, and end terminations.

3.3 FINAL TESTING

Repeat the IR test steps as described in Section 3.1. To test TR, connect each lead from the ohmmeter to the two cold leads that will be attached to power. Enter the information on the warranty card. If there is a change in the meter reading, please check the cable for damage, as well as any power connections, splices, and end terminations.

3.4 MAINTENANCE

Annually check system for loose or damaged cable.

3.5 TROUBLE-SHOOTING AND TECHNICAL SUPPORT

If during any test the meter readings vary by +/- 10% from the previous test, stop the installation and investigate. Please check for pinched or crushed cables, test splices, test power connections, test end terminations, and repair accordingly. Check for water in all junction boxes or conduit. Any faults should be repaired by a qualified electrician or factory technician before the cable is covered.

For additional trouble-shooting and repair procedures, please contact Delta-Therm technical support at 1-800-526-7887. Please be prepared to provide:

- Part numbers for all installed equipment
- IR and TR readings on all installed cables
- Verification that incoming voltage matches design voltage of Delta-Therm equipment
- Verification that you have checked all wiring, junction boxes, etc.
- Digital photos of installed equipment

If you have any questions or comments about these instructions or your installation please call Delta-Therm at 1-800-526-7887.