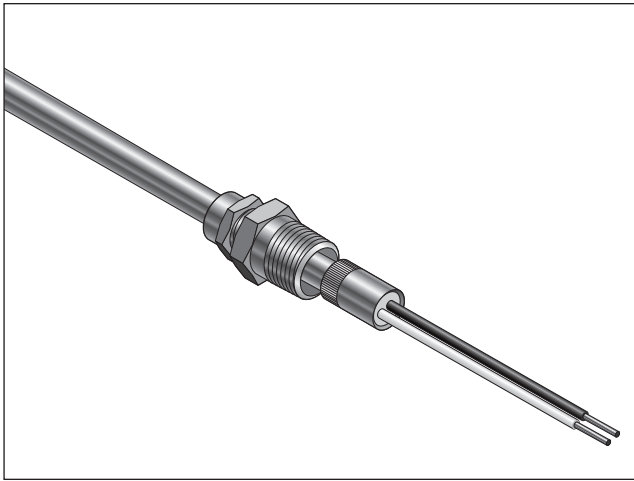




PYROTENAX

Pyropak Termination Kit

Installation Instructions for Terminating Copper Sheathed Mineral Insulated Cables



DESCRIPTION

The nVent PYROTENAX Pyropak termination kit is used to terminate single and multi-conductor nVent PYROTENAX copper sheathed MI cables. The cable end must be sealed using either the mastic sealing compound or the epoxy sealing compound. Determine which sealing compound has been supplied and read the appropriate instruction steps completely before performing the termination procedure.

For technical support contact your local nVent representative or nVent at (800) 545-6258. For a step-by-step demonstration of this procedure, a video "PyroPak Termination Procedure for Multi-conductor MI Power Cables" is available on our YouTube channel.

TOOLS REQUIRED

- nVent PYROTENAX Sheathmaster Stripping Tool for cables up to 3/4 in (1.9 cm) diameter or nVent PRYTENAX Ratchet Type Stripping Tool for cables larger than 0.684 in (1.7 cm) diameter
- Hand-type or screw-type crimping and compression tool (if using mastic sealing compound)
- Oxyacetylene or mapp gas torch
- nVent PYROTENAX Handvise
- Adjustable pliers/vise grips
- Medium grit emery paper
- Clean, dry cloth or rag
- Hacksaw
- Safety glasses and gloves
- Flat file
- Permanent marker
- Scribe or pick
- 500-Vdc megohmmeter
- Tape measure or ruler
- Diagonal (side) cutters
- nVent PYROTENAX Pyropotter Tool
- Multimeter or continuity tester
- Allen key (see Pyropotter tool instruction for size)
- Jumper cable or black electrical tape
- Diagonal (side) cutter and tube cutter (if stripping cable sheath as shown in Appendix C)

APPROVALS

Ordinary Locations

Hazardous Locations



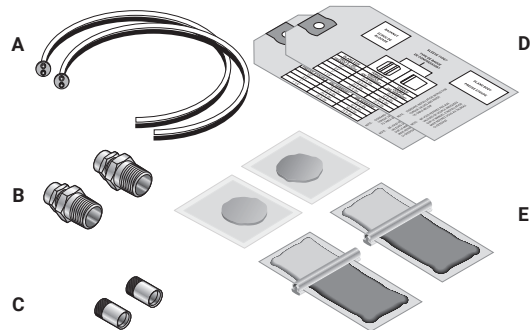
Class I, Div. 1 and 2, Groups A, B, C, D
 Class II, Div. 1 and 2, Groups E, F, G
 Class III, Div. 1 and 2

KIT CONTENTS

The Pyropak kit contains sufficient material to terminate both ends of a cable.

Item	Qty	Description
A	2	Spacer disk and insulating sleeving assembly
B	2	Brass gland connector
C	2	Brass self-threading pot
D	2	Torque tag
E	*	Mastic or epoxy sealing compound

* Quantity depends on pot size



WARNING:

This component is an electrical device that must be installed correctly to ensure proper operation and to prevent shock or fire. Read these important warnings carefully and follow all installation instructions.

- When MI cable is stripped and terminated, cut metal edges can cause cuts and loose

powder can cause eye irritation. To prevent injury, gloves and safety glasses must be worn when carrying out these operations.

- To prevent burns when drying out the cable (Appendix D), allow it to cool until warm to the touch before completing the remaining termination instructions.

CAUTION:

HEALTH HAZARD. Contact your nVent representative or call (800) 545-6258 for safety information regarding the mastic sealing compound or epoxy sealing compound.

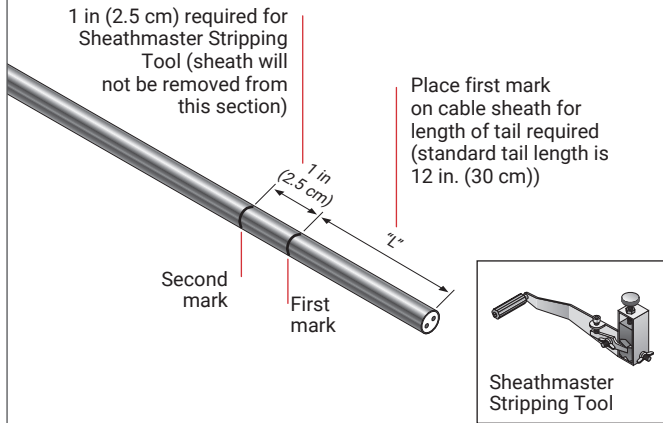
1

- With a hacksaw, cut the end of the MI cable square and file the end smooth.
- Ensure that the end of the MI cable is straight for approximately the tail length "L" required plus 3 in (7.5 cm). Place a mark on the sheath for the tail length required (12 in (30 cm) is standard). This is the length of sheath to remove.
- If using the Sheathmaster Stripping Tool, place a second mark 1 in (2.5 cm) behind this first mark as shown. If using the Ratchet Type Stripping Tool, place the second mark 1-1/2 in

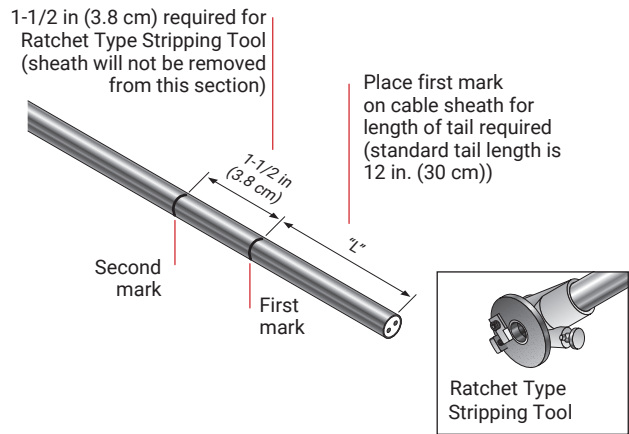
(3.8 cm) behind the first mark. The sheath will only be stripped back to the first mark exposing the solid conductor. The second mark from the end is used to correctly position the handvise as an end-stop for final stripping

- For details on using the Sheathmaster Stripping Tool, refer to instruction H59039 supplied with the tool; for the Ratchet Type Stripping Tool, refer to instruction H57842 supplied with the tool. An alternate method of stripping the cable sheath using a tubing cutter and side cutters is shown in Appendix C.

Using Sheathmaster Stripping Tool

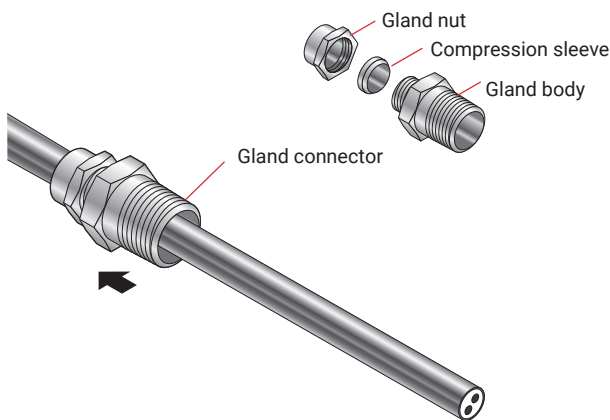


Using Ratchet Type Stripping Tool



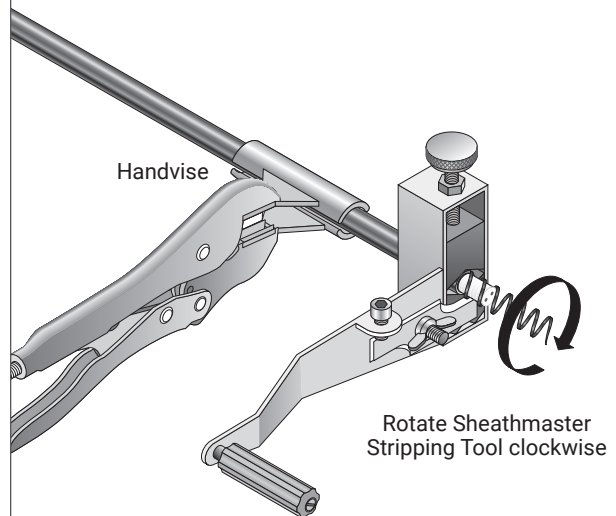
2

- Place the brass gland connector on to the cable. The gland connector is made up of three parts: the gland nut, the compression sleeve and the gland body. It should be placed on to the cable with all three pieces assembled.



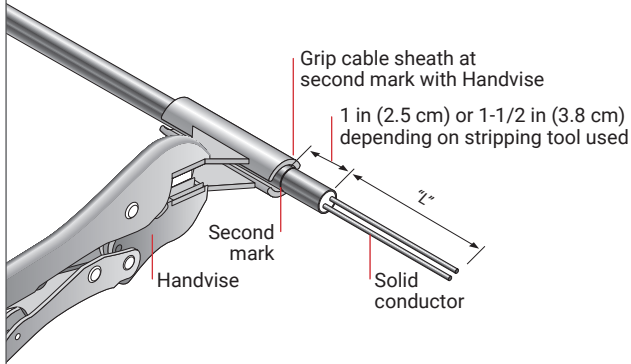
3

- Grip the cable with the Handvise.
- Using the sheath stripping tool (Sheathmaster Stripping Tool shown), begin stripping the copper sheath back towards the first mark.



4

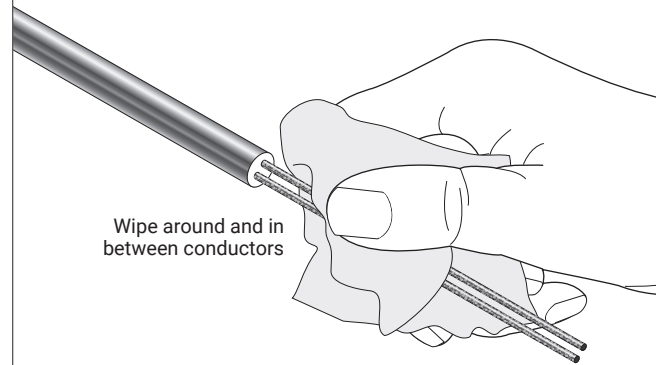
- For final stripping, grip the cable with the Handvise at the second mark. When the stripping tool touches the edge of the Handvise, it will stop and make a clean cut on the cable sheath at the first mark. At this point, the correct length of solid conductor will have been exposed.



5

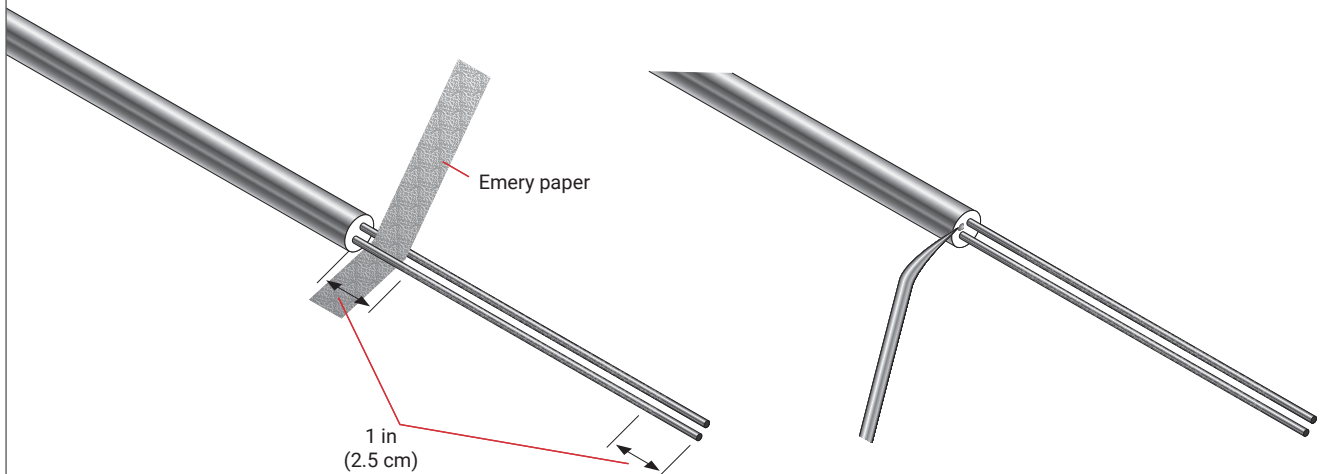
- Straighten the conductors and ensure that they are evenly spaced.
- Wipe around and in between all conductors and end of sheath to remove loose powder.
- Visually inspect the magnesium oxide insulation at the face of the cable for traces of copper filings and burrs. If present, gently remove with a pick or tap them out, but do not blow them out as this can introduce moisture into the end of the cable.

 **Note:** Do not remove more powder from the face of the cable than is necessary.



6

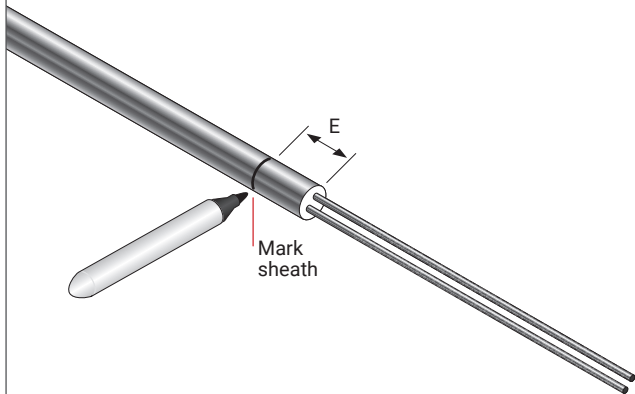
- Using emery paper, lightly sand around and in between all conductors for a length of 1 in (2.5 cm) from the face of the cable and the ends of the conductors.
- Avoid contaminating the magnesium oxide powder in the exposed cable end with the metal filings; if contaminated, remove with a pick.



7

- Place a mark at a length "E" (refer to table below) from end of sheath. You will screw the pot on to the sheath so that the back of the pot aligns with the mark.

Pot Size	Length "E" to mark
1/2 in (13 mm)	5/16 in (8 mm)
3/4 in (19 mm)	7/16 in (11 mm)
1 in (25 mm)	9/16 in (14 mm)
1-1/4 in (32 mm)	5/8 in (16 mm)

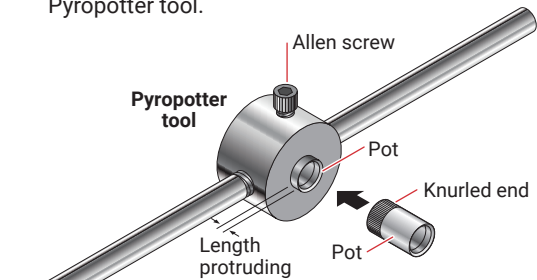


8

- Place the self-threading pot into the non-threaded end of the Pyropotter tool with the larger hole of the pot facing outwards and protruding past the end of the tool by the length shown in the table. Refer to Pyropotter tool instruction H59038 for details on using the tool.

Pyropotter Size	Length of pot protruding
1/2 in	1/16 in (1.5 mm)
3/4 in	3/8 in (9.5 mm)
1 in	3/8 in (9.5 mm)
1-1/4 in	5/8 in (16 mm)

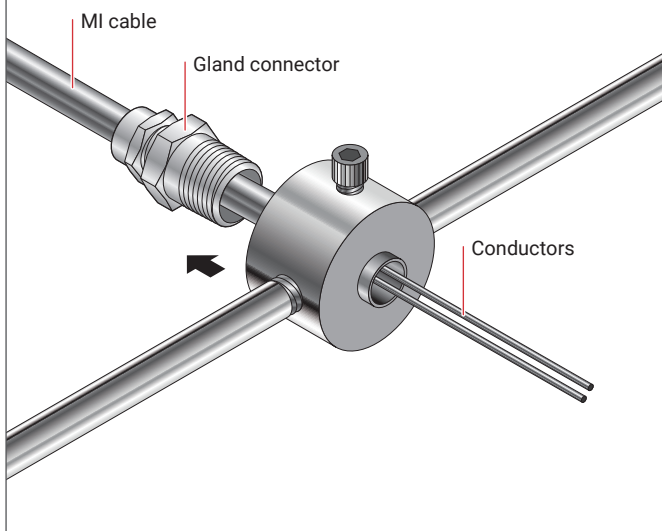
- Next, tighten the Allen screw on to the pot. Use a 3/16" Allen key for the 1/2 in and 3/4 in Pyropotter tool and a 5/16 in Allen key for the 1 in and 1-1/4 in Pyropotter tool.



Note: Ensure that the Allen screw is tightened onto the knurled end of the pot.

9

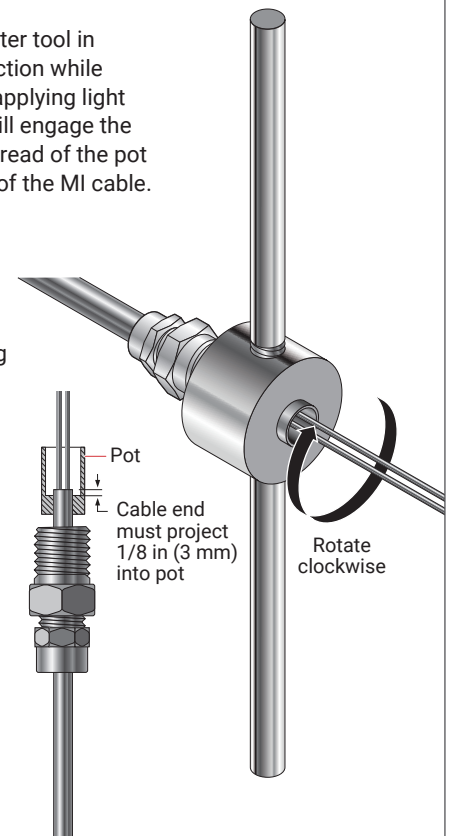
- Slide the assembly over the exposed conductors, threaded end of Pyropotter first, until it stops at the face of the cable.
- Screw the gland connector (already on the cable) all the way into the threaded end of the Pyropotter tool - finger tight is sufficient.



10

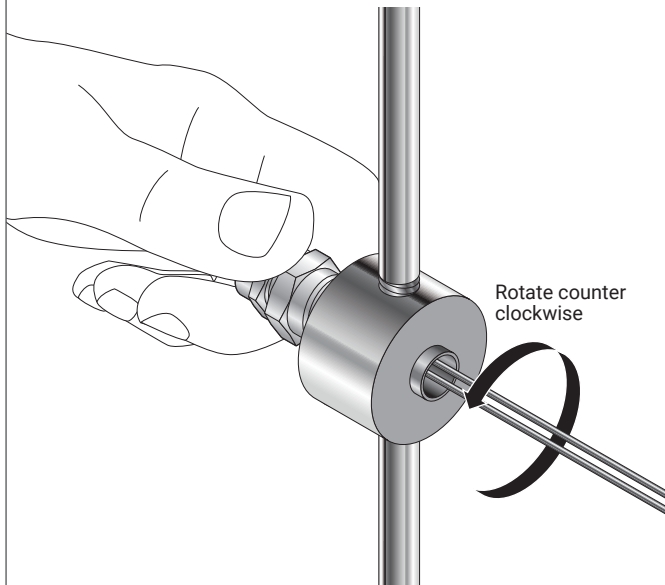
- Turn the Pyropotter tool in a clockwise direction while simultaneously applying light pressure. This will engage the internal screw thread of the pot onto the sheath of the MI cable.

- Continue rotating the assembly until the end of the copper sheath projects 1/8 inch (3 mm) inside the pot.



11

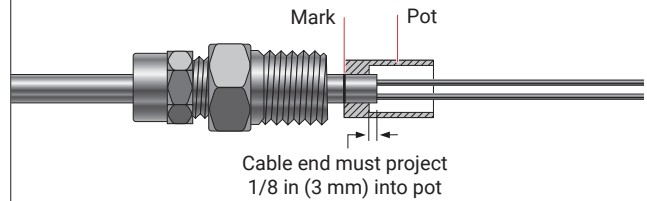
- To remove the tool, hold the gland connector firmly in one hand and rotate the tool in a counter-clockwise direction. This unlocks the Pyropotter tool from the gland/pot assembly and permits the easy removal of the tool from the cable.



12

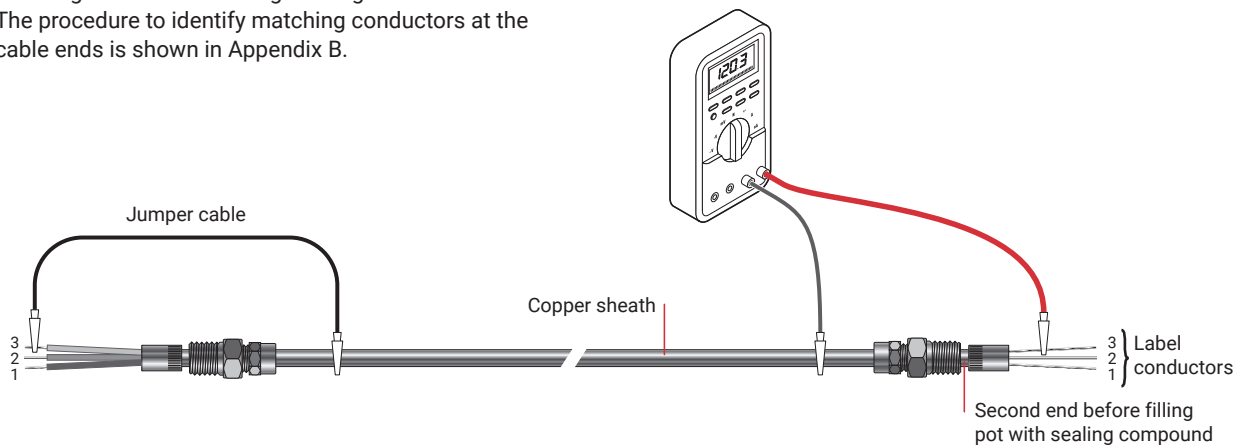
- Verify that the back of the pot aligns with the mark made on the copper sheath in Step 7. If the pot is behind the mark on the cable, vise grips may be used to screw the pot to the mark.

Important: Cable end must project 1/8 in (3 mm) into pot in order to make an effective seal.



13

- If terminating a single conductor cable or the first end of a multiconductor cable, go to Step 14. If terminating the second end of a multiconductor cable, you must first test the end-to-end continuity of the conductors with a continuity tester or multimeter to ensure that each conductor will be terminated with the same color sleeving at both ends. For cables with 3 or more conductors, the sleeving assemblies are identified with a red tag for one end and a green tag for the other end. The procedure to identify matching conductors at the cable ends is shown in Appendix B.

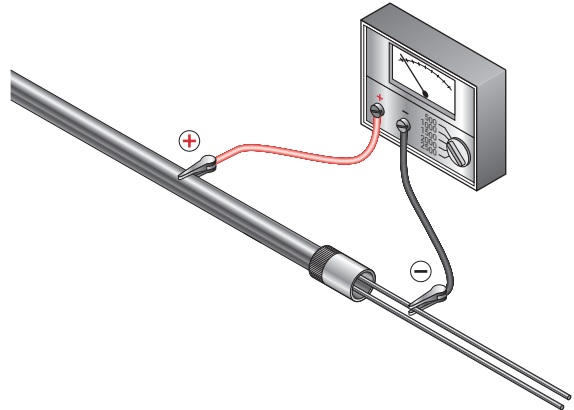


- Using a 500-Vdc megohmmeter, check the insulation resistance (IR) of the cable to ensure it is free of grounds and shorts. Check IR between conductor(s) and sheath, and between each pair of conductors. See Appendix A for detailed test procedure and IR test criteria.

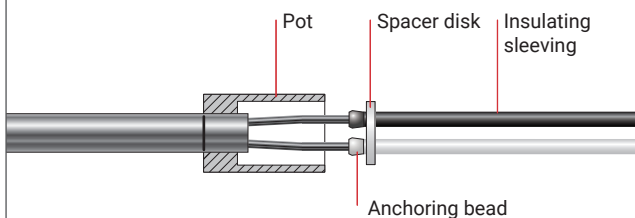
Note: Low IR results indicate that moisture is present in the end of the MI cable and must be removed before finishing the termination. If neither cable end has yet been terminated and IR readings are low, dry out both ends following the procedure in Appendix D or cut off shorted end and re-test. Once IR readings are satisfactory, apply a temporary moisture resistant seal, such as hot melt glue or adhesive lined heat-shrink tubing, to opposite cable end to prevent further moisture absorption.

Note: Opposite end of cable must also be dry and free of grounds and shorts to obtain an acceptable IR reading. Low IR readings should be expected if the opposite end has already been terminated with epoxy sealing compound which has not fully cured (IR will increase once the epoxy has cured).

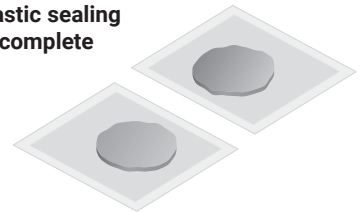
- If moisture was removed from the end of the cable using the procedure in Appendix D, allow the cable to cool until warm to the touch and continue with the steps to seal the end of the cable.
- Once IR readings are satisfactory, immediately apply the appropriate sealing compound as described in the steps following. A delay will cause the IR to drop and the cable must be retested prior to sealing the end.



- Slide spacer disk and insulating sleeving sub-assembly over conductors, anchoring bead end first.



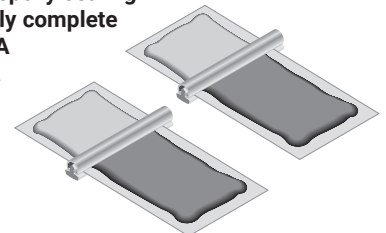
For kits supplied with mastic sealing compound, immediately complete Steps 17 through 20 (beginning on page 7).



CAUTION: Health Hazard.

Contact your nVent representative or call (800) 545-6258 for safety information regarding the mastic sealing compound.

For kits supplied with epoxy sealing compound, immediately complete Steps 17A through 20A (beginning on page 8).



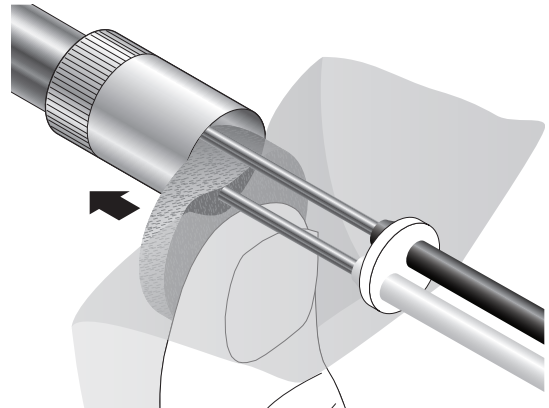
CAUTION: Health Hazard.

Contact your nVent representative or call (800) 545-6258 for safety information regarding the epoxy sealing compound.

17 (for kits with Mastic Sealing Compound)

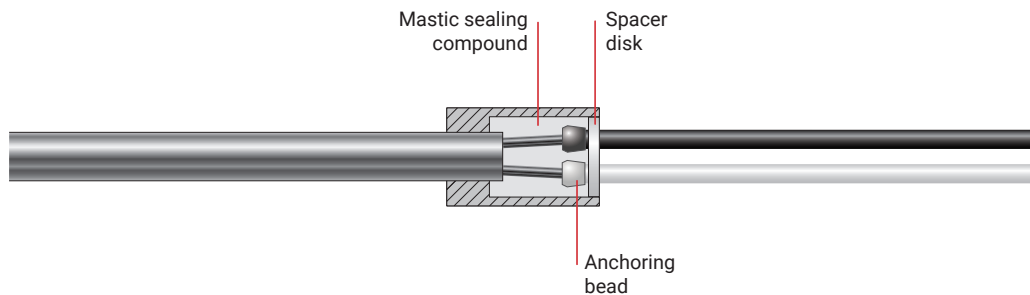
- Withdraw spacer disk and sleeving sub-assembly slightly to allow sealing compound to be packed into the pot.
- Ensure conductors are spaced an equal distance apart from each other and the inside of the pot.
- The pot should still be warm following the drying out procedure, if not, heat the cable and then the pot with the torch until just warm to the touch before filling with mastic sealing compound.
- Do not allow compound to become contaminated with any foreign matter once package is opened. Press mastic sealing compound into pot with thumb behind the wrapper to ensure cleanliness. Slightly overfill pot with sealing compound, pressing from one side only to prevent air pockets from forming. Sealing compound will come out the opposite side of the pot when full.

 **Note:** Store mastic sealing compound at room temperature or an inside shirt pocket until ready to use. Mastic compound may be installed as low as 14°F (-10°C) providing compound is kept warm prior to use.



18 (for kits with Mastic Sealing Compound)

- Using a screwdriver or other tool, push spacer disk into open end of the pot. Pull gently on the sleeving to ensure the anchoring beads are snug against inside face of the spacer disk. Do not push on the sleeving as it may be forced back through the cap and butt against the end of the cable, preventing the compound from making an effective seal.




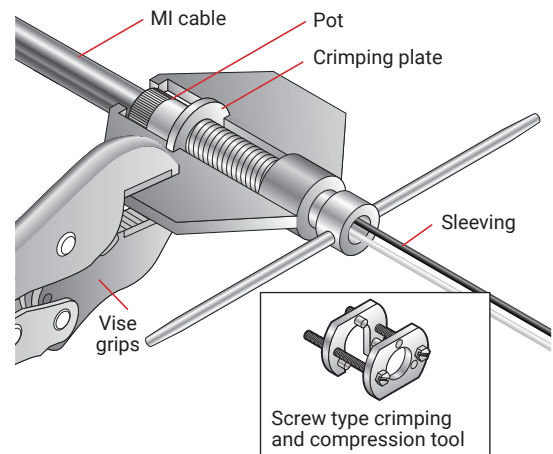
19 (for kits with Mastic Sealing Compound)

- Place the pot into the body of the crimping and compression tool (hand adjustable type shown) making sure that the sleeving is inserted through the center of the MI crimping tool. The end of the pot with the spacer disk must fit inside the three cone shaped points on the crimping plate of the MI Crimp tool.

 **Note:** Hold the tool firmly, with vise grips if needed, to prevent the tool from turning the pot.

- Apply even pressure on the spacer disk by tightening the tool until the spacer disk is snugly seated inside the opening of the pot and the cone-shaped points have crimped the side of the pot. This will retain the spacer disk in position. The termination is now complete.

 **Note:** It is normal for the mastic sealing compound to squeeze out the side of the pot as pressure is applied with the crimping and compression tool.

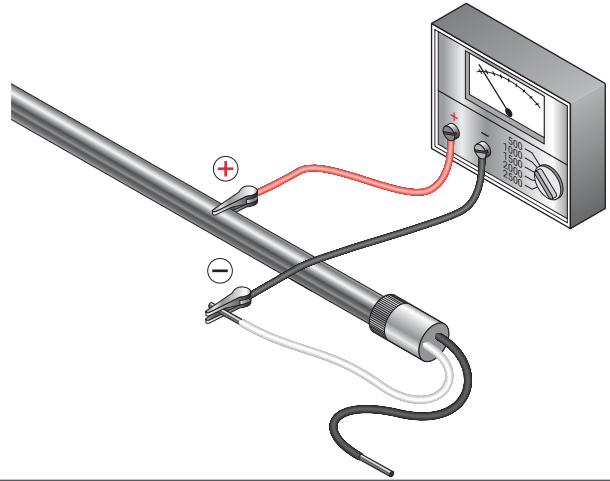


20 (for kits with Mastic Sealing Compound)

- On completion of the termination, check the IR again with the 500-Vdc megohmmeter (see Appendix A).

Note: Under adverse weather conditions, IR readings may be lower than the values shown in Appendix A.

- If the other end of the cable has not yet been terminated, complete the termination following the same procedure.



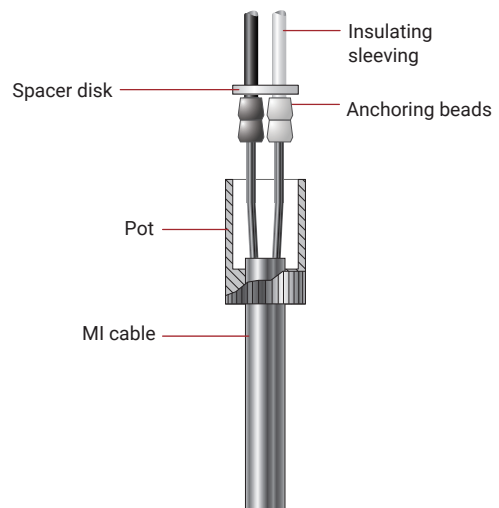
17A (for kits with Epoxy Sealing Compound)

- Withdraw the spacer disk and sleeving sub-assembly slightly to allow space to fill the pot with epoxy.
- Ensure conductors are spaced an equal distance apart from each other and the inside of the pot.
- Prepare epoxy sealing compound in accordance with the instructions on the epoxy package.

Note: Use epoxy within 10 minutes after mixing.

- The pot should still be warm following the drying out procedure, if not, heat the cable and then the pot with the torch until just warm to the touch before filling with epoxy.

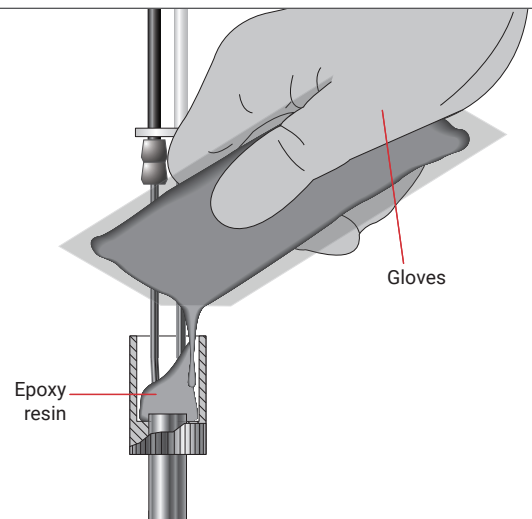
Important: To avoid forming bubbles in the epoxy, do not apply heat to the cable or the pot during or after filling with epoxy.



18A (for kits with Epoxy Sealing Compound)

- Cut one corner of plastic package containing epoxy to make an opening of 1/8 in (3 mm).
- Maintaining cable end vertically, squeeze the epoxy into the pot. Pour it down one side of the pot until it is completely filled.

Note: Store epoxy sealing compound between 65°F and 77°F (18°C and 25°C) until ready to use. The minimum installation temperature for the epoxy sealing compound is 65°F (18°C).



19A (for kits with Epoxy Sealing Compound)

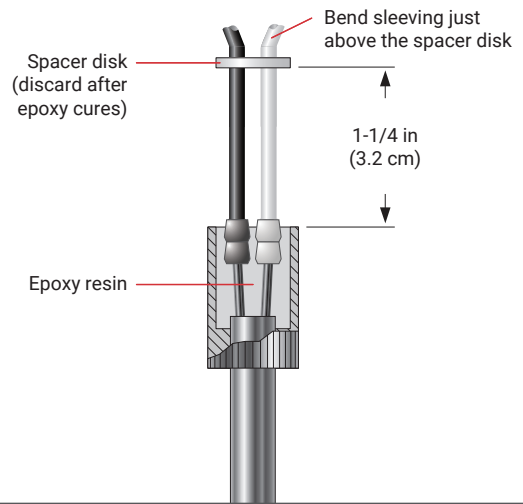
- Slide sleeving towards pot and adjust its position so that the bottom anchoring beads and half of the upper beads are immersed in the epoxy. For multi-conductor cable, maintain proper spacing of conductors with spacer disk and keep disk about 1-1/4 in (3.2 cm) above the pot.

 **Note:** Bend the conductors slightly so that the sleeving does not slide down into the epoxy.

- Allow the epoxy to cure for at least 16 hours, at 65°F (18°C) minimum, before moving the termination from the vertical position.

 **Note:** Discard spacer disk after the epoxy cures.

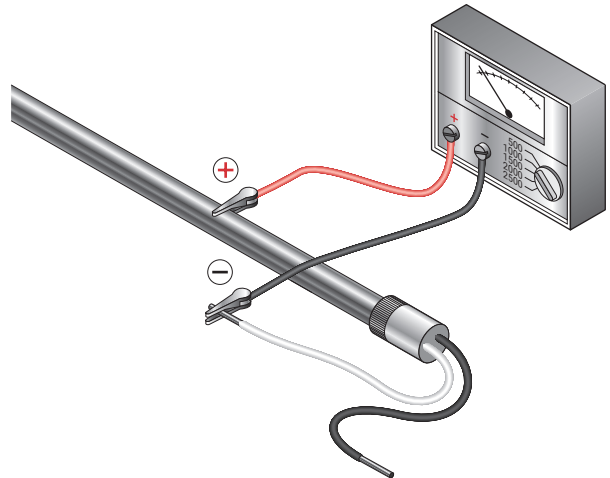
- If the other end of the cable has not yet been terminated, complete the termination following the same procedure.



20A (for kits with Epoxy Sealing Compound)

- After the epoxy compound at both ends has fully cured (16 hours), check the IR again with the 500-Vdc megohmmeter (see Appendix A).

 **Note:** Under adverse weather conditions, IR readings may be lower than the values shown in Appendix A.



Appendix A: Insulation Resistance (IR) Test

Test Equipment

500-Vdc Megohmmeter

IR Testing

IR testing is conducted using a megohmmeter and tests the integrity of the cable between the conductor and the copper sheath and between conductor pairs.

Test Criteria

When received:

- Check cable on reel. Note that ends may need to be prepared to allow insulation resistance (IR) readings to be taken. IR readings must not be less than 200 M Ω under any conditions.

After installing termination kit:

- In a warm, dry environment, IR readings should be 200 M Ω or higher.
- In an outdoor environment or indoors in wet or humid conditions, IR readings should all be above 100 M Ω .
- Similar cables exposed to similar conditions should all have IR readings in the same general range. Where a large difference in readings is encountered, high readings can be accepted; low readings (below 100 M Ω) should be checked as described below.

Note: Under some installation conditions it may not be possible to obtain IR readings above 100 M Ω . If IR readings are between 25 M Ω and 100 M Ω , wait 24 hours and recheck the IR using the same equipment. If the IR reading has not decreased, the termination is good - a constant low IR reading can result from moisture entrained in the cable while making a good seal; this moisture will not increase. If the IR reading has decreased, the cable must be re-terminated - a low IR reading can result from a poorly made seal which will allow continuing moisture ingress, requiring that the termination be redone.

If the IR reading is less than 25 M Ω , the cable must be re-terminated following the "drying out" procedure in Appendix D.

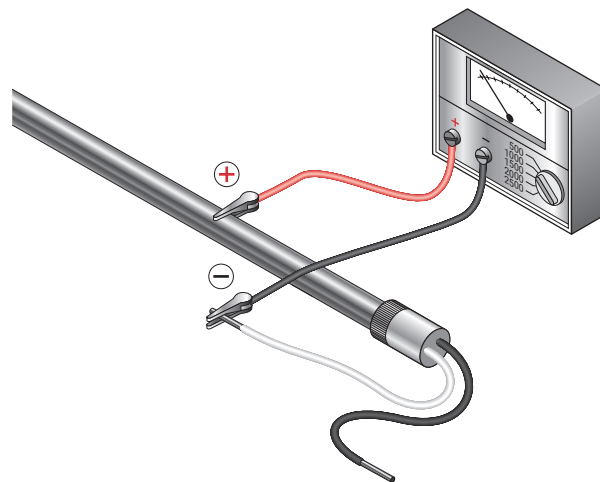
Test Procedure

1. Set megohmmeter test voltage at 0 Vdc or off.
2. Connect the positive (+) (earth) lead to the cable sheath.
3. Connect the negative (-) (line) lead to the conductor.
4. Turn on the megohmmeter and set the voltage to 500 Vdc; apply the voltage for one minute. Meter needle should stop moving. Rapid deflection indicates a short. Note the insulation resistance value. It should correspond to the values shown under Test Criteria.
5. Turn off the megohmmeter

⚠ WARNING: Shock Hazard. The MI cable can store a large electrical charge after the insulation resistance test is performed. To prevent personal injury from electrical shock, fully discharge the cable prior to disconnecting the megohmmeter. Many meters will discharge automatically. However, it may be necessary to short the cable leads. Contact your supervisor or the instrument manufacturer to verify the safest practice.

6. If the megohmmeter does not self-discharge, discharge phase connection to ground with a suitable grounding rod. Disconnect the megohmmeter.

Note: Depending on the type of cable being tested, you will need to repeat the steps in this procedure for each of the conductors present in the MI cable. Also repeat testing for all conductor pair combinations (i.e. connect the leads from the megohmmeter to each conductor pair). If IR readings are low, follow the drying out procedure in Appendix D.



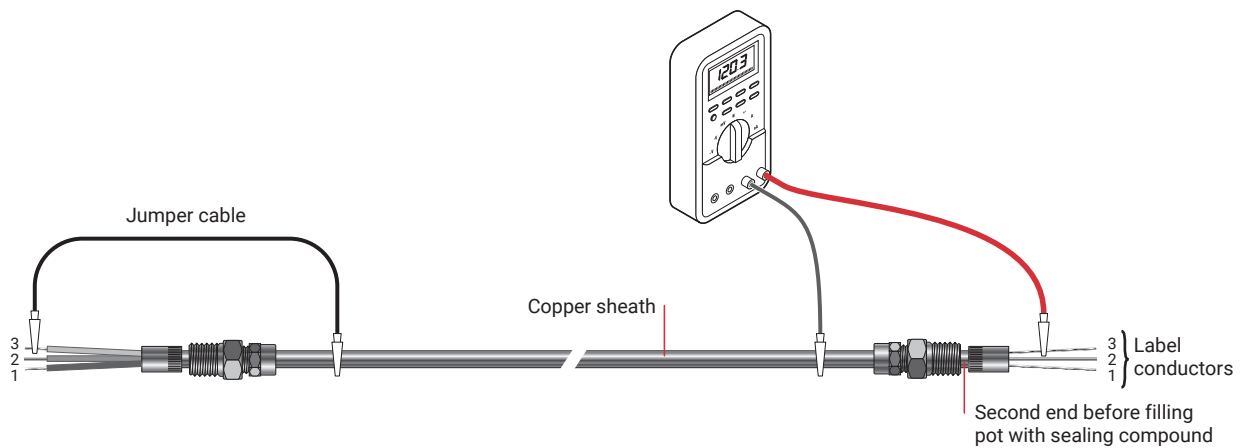
Appendix B: Identifying Conductors

Note: If one end of the cable has been terminated, the conductors should be rung out with a multimeter (or continuity tester) to ensure that each conductor has the same colored sleeving at both ends.

- 1 Start with the end of MI cable which has just been terminated. Connect one end of a jumper cable to one of the conductors and the other end to the outer copper sheath of the cable as shown below. Alternately, electrical tape may be used to hold the bare conductor to the cable sheath.
- 2 Ensure that the test leads are placed into the correct terminals on the multimeter; the black test lead connects into the common or black terminal and the red test lead into volts/ohms terminal.
- 3 Turn the multi-meter on. If your multi-meter does not automatically change settings, set it to the lowest "Ohms" setting.
- 4 On the other end of the MI cable which has not been sealed, clip the black lead to the outer copper sheath of the MI cable. Now, alternately touch the red lead from the multi-meter to each conductor.
- 5 When you touch the matching conductor (i.e. the conductor shorted to the sheath on the other end), the multimeter will indicate a low "Ohms" reading. The resistance of all other conductors should show infinity or "OL" (overlimit).

Label the conductor on both ends to identify them when making the second termination. This is necessary so that each conductor is terminated with the same colored sleeving on both ends.

- 6 Repeat the above procedure to identify all of the conductors in the MI cable (i.e. move the jumper cable to the next conductor and repeat the procedure to identify the same conductor on the other end).

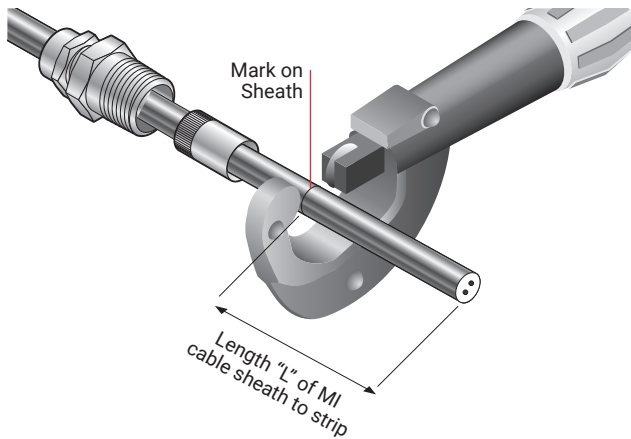


Appendix C: Stripping Copper Sheathed MI Cable

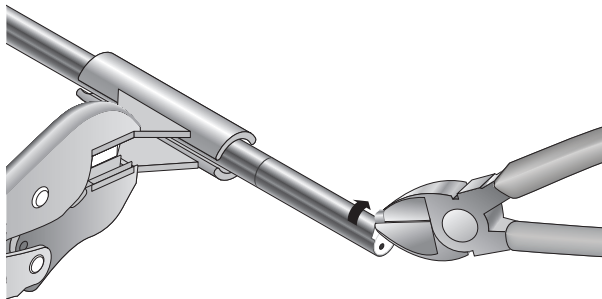
Using diagonal cutters

Measure, from cable end, length of cable sheath to strip and mark sheath with marking pen. Use a tube cutter to score around the sheath at the mark. This will cause the sheath to peel away at the score providing a smooth end when the sheath is stripped. The correct depth of score is half the thickness of the sheath.

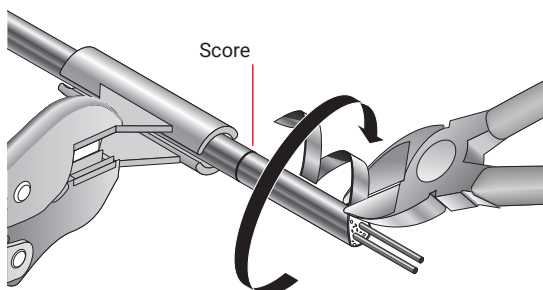
Do not cut completely through the cable sheath as this will cause the sheath to curve inwards toward the conductor(s).



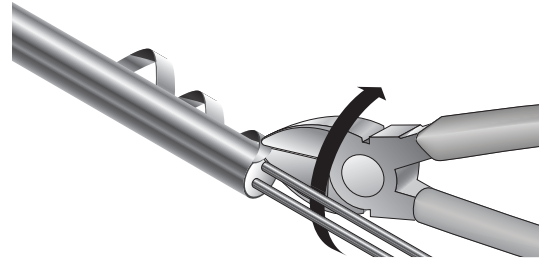
Hold the cable with the hand vise behind the score on the sheath. Grip the edge of the sheath between the jaws of the side cutters and twist clockwise (twist counter-clockwise if left-handed), then take a new grip and rotate through a small angle.



Continue this motion in a series of short "rips", keeping the side cutters at about 45° to the line of the cable, removing sheath spirally. Remove compacted powder insulation to expose conductors.



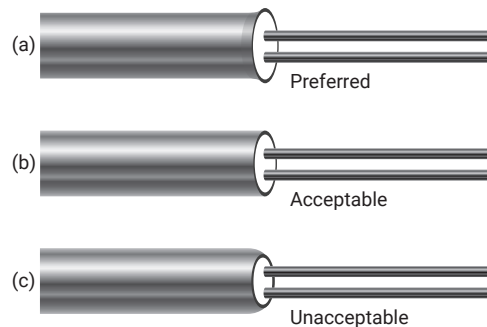
Continue removing the sheath to the score mark. When about to break into the score, bring side cutters to right angle with cable. Finish off with point of side cutters held parallel to the cable. The sheath will peel away leaving a clean cut when the score mark is reached.



The cable sheath is correctly stripped, with the sheath flared slightly outwards, as shown in (a).

In (b) the sheath is neither flared outwards nor beveled inwards, but is acceptable.

Ensure that the sheath is not curved or beveled inward as shown in (c). This will occur if the score made with the tube cutter is too deep. In this case, remove a further 1/4 in (6 mm) of sheath. Cable is now ready to be sealed.



Appendix D: Improving Insulation Resistance

To maintain the high performance of MI cable, the cable must be properly stored and the ends must remain sealed.

Damaged terminations or heat-shrinkable end caps that are damaged, missing, or removed will cause the magnesium oxide insulation (white powder) to absorb moisture, resulting in low IR readings. The cable must be "heated out" to remove the moisture and bring the IR back to an acceptable level. Drying out the MI cable to remove any moisture will normally be unnecessary providing the termination seal is completed within a few minutes of removing the sheath.

If moisture is found in the cable when checking IR, it may be removed using one of the following methods:

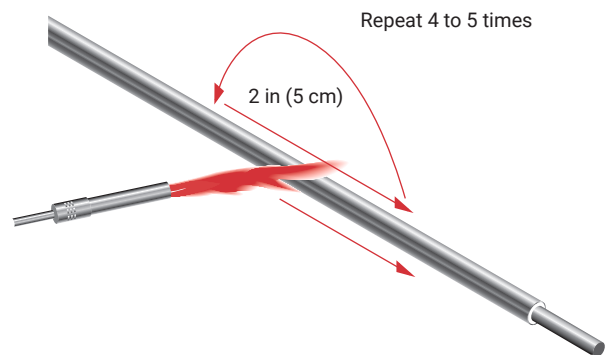
1. If excess cable is available, 6 to 12 in (15 to 30 cm) of cable may be removed from the end before sealing the cable.
2. Apply heat to the cable following the procedure below.

Note: Moisture will not normally penetrate more than 12 in (30 cm) into the cable.

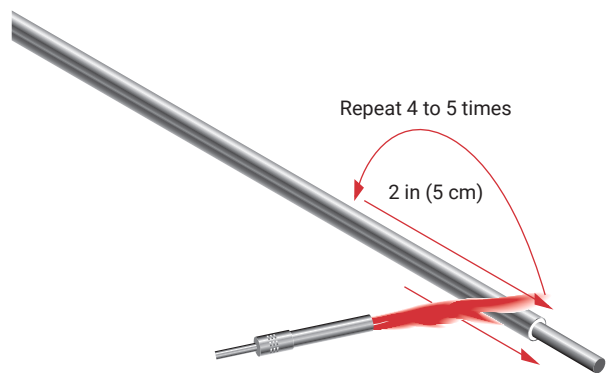
If moisture is detected in the cable, use an oxyacetylene or mapp gas torch with a large flame and "heat out" the cable beginning 12 in (30 cm) back from the end. Gradually move the flame toward and past the cable end. Copper sheathed cables should be heated to a bluish-gray color. Take care not to overheat any one area of the cable sheath as this could damage the cable.

Use a short sweeping motion of the torch and heat about 2 in (5 cm) of cable at a time, repeating 4 to 5 times.

Move the flame towards the cable end as shown. Do not sweep the flame in the opposite direction as this will drive the moisture back into the cable.



Gradually move the flame toward the end while maintaining the short sweeping motion of the torch. If you heat toward the cable end too quickly you may skip over the moisture and drive it further back into the cable.



It may be necessary to repeat the above procedure several times to completely remove all moisture from the cable. Allow the cable to cool before repeating.

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