

3M™ Cold Shrink QT-III Silicone Rubber Three Core Inverted Outdoor Termination

For 3-Conductor Type "G" (Ground Wire), Copper Tape
Shield, Armored Cables

7620-S-INV-3G and 7690-S-INV-3G Series

Instructions

IEEE Std. No. 48

Class I Termination

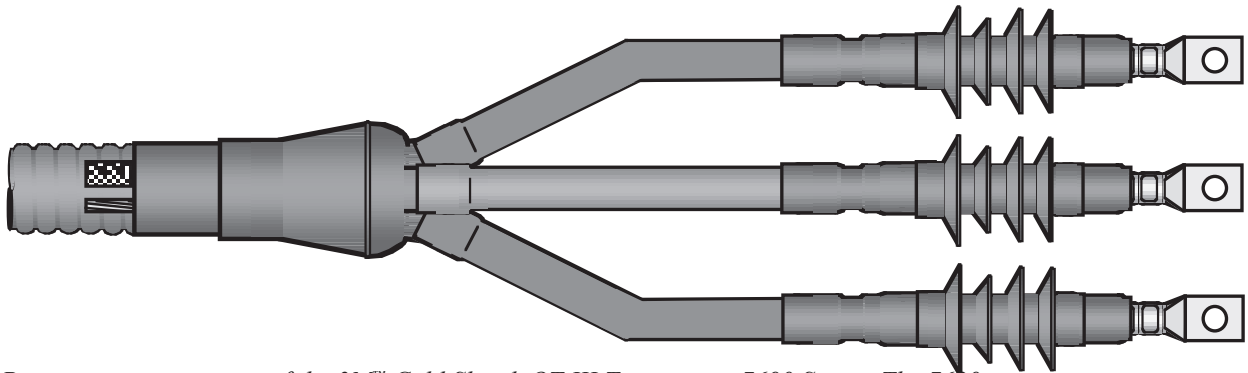
25/28 kV Class Rated

150 kV BIL - 7620-S-INV-3G Series

200 kV BIL - 7690-S-INV-3G Series

CAUTION

Working around energized systems may cause serious injury or death. Installation should be performed by personnel familiar with good safety practice in handling electrical equipment. De-energize and ground all electrical systems before installing product.



**Picture is representative of the 3M™ Cold Shrink QT-III Termination 7690 Series. The 7620 Series terminations will have only 2 skirts.*

1.0 Kit Contents

- 1 Cold Shrink Silicone Rubber Breakout Boot Assembly
- 1 Cold Shrink Silicone Rubber Jacket Seal Assembly
- 3 Silicone Rubber Phase Re-jacketing Sleeve Assemblies
- 3 Cold Shrink Silicone Rubber Tubular Termination Assemblies
- 3 Cold Shrink Silicone Rubber Skirt Assemblies
- 1 Tinned Copper Ground Braid Assembly
- 3 Constant-Force Springs (Small)
- 1 Constant-Force Spring (Large)
- 8 Strips Scotch® Mastic Strip 2230 (2 per termination & 2 per breakout boot bag)
- 1 Roll Scotch® Super 33+™ Vinyl Electrical Tape - 3/4"
- 1 Roll Scotch® Vinyl Electrical Tape Super 88 - 1-1/2"
- 1 Roll Scotch® 24 Electrical Shielding Tape
- 3 3M™ EMI Copper Foil Shielding Tape 1181 Strips - 1/2" x 10"
- 1 3M™ Cable Cleaning Preparation Kit CC-2
- 1 Instruction Sheet

Termination Application Ranges

Note: Final Determining Factor is Cable Insulation Diameter.

| Kit Number | Insulation Range Min -- Max Inch (mm) | Max Cable O. D. Inch (mm) | Conductor Size Range | | | | | | | |
|-----------------|---|---------------------------------|----------------------|------------|------------|------------|-----------|-----------|-----------|-----------|
| | | | 5 kV | | 8 kV | | 15 kV | | 25 kV | |
| | | | 100% | 133% | 100% | 133% | 100% | 133% | 100% | 133% |
| 7693-S-4-INV-3G | 0.92 - 1.18 (23,4 - 30,0) | 3.90 (99,1) | 400 - 500 | 400 - 500 | 400 - 500 | 400 - 500 | 250 - 350 | 4/0 - 350 | 2/0 - 250 | 1 - 4/0 |
| 7695-S-4-INV-3G | 1.18 - 1.52 (30,0 - 38,6) | 4.50 (114,3) | 700 - 1000 | 700 - 1000 | 700 - 1000 | 700 - 1000 | 500 - 750 | 500 - 750 | 350 - 500 | 250 - 500 |
| 7620-S-2-INV-3G | 0.33 - 0.50 (8,4 - 12,7) | 2.20 (55,9) | 8 - 2 | 6 - 4 | 6 - 4 | 6 - 4 | - | - | - | - |
| 7621-S-2-INV-3G | 0.50 - 0.70 (12,7 - 17,8) | 2.80 (71,1) | 1 - 3/0 | 2 - 2/0 | 2 - 2/0 | 2 - 2/0 | - | - | - | - |
| 7622-S-2-INV-3G | 0.70 - 0.92 (17,8 - 23,4) | 3.30 (83,8) | 4/0 - 350 | 3/0 - 350 | 3/0 - 350 | 3/0 - 350 | 1/0 - 4/0 | 2 - 3/0 | - | - |

2.0 Prepare Cable

- 2.1 Determine cable jacket removal length required for correct phase spacing and bolted terminal lug connections ($[A] + [B]$ Figure 1; based on the longest phase to be connected). Allow for dimension $[C]$ as needed.

NOTE: Individual phase length and separation dimensions vary according to specific installation and equipment design requirements. They must, therefore, be determined by the installer and must conform to accepted engineering practices. Max phase length = 4 ft (121,9 cm) + termination length (from Figure 18, page 13).

- 2.2 Remove cable jacket, armor, bedding (inner sheath) and core fillers according to Figure 1 dimensions. Secure copper tape shield ends with temporary bands of vinyl tape (Figure 1).

NOTE: DO NOT DISCARD LEFTOVER JACKET MATERIAL.

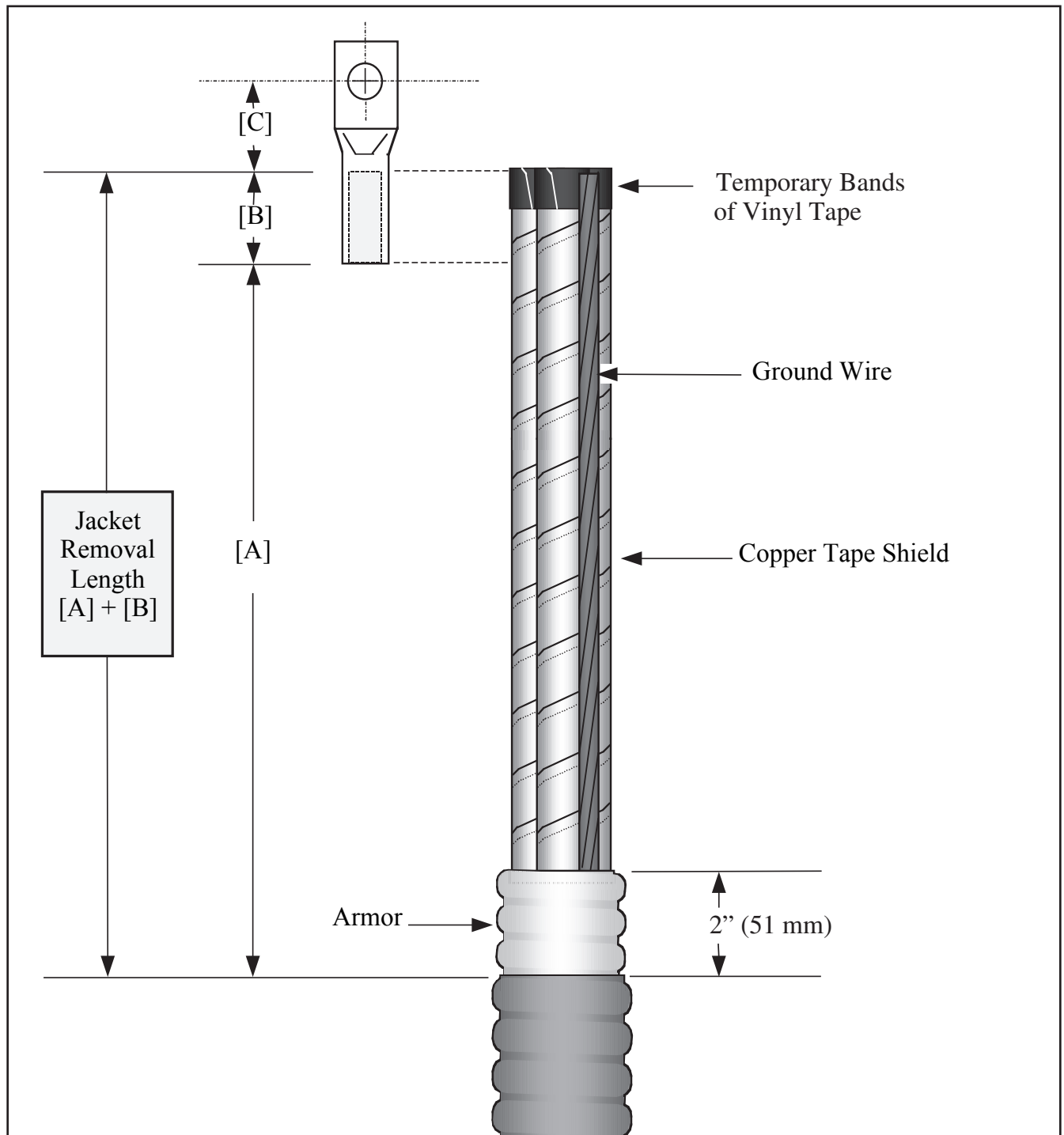


Figure 1

3.0 Install Shield Grounding Braid Assembly & Re-route Cable Ground Wire(s)

3.1 Position ground braid assembly over cable with assembly connector aligned to edge of armor (Figure 2).

Note: For single ground wire cables, apply assembly to side opposite cable ground wire. Assembly connector should not overlap armor.

Hint: Use temporary vinyl tape wraps as needed to assist in holding braid assembly to cable (Figure 2).

3.2 Attach Ground Braid Assembly Legs to Cable Phase Metallic Shields

(a.) Short (Center) Braid Tail – Position ground braid assembly as shown (Figure 2). Wrap short, center ground braid tail around metallic shield of first cable core. Trim excess braid length to prevent overlap (Figure 2). Secure ground braid to cable metallic shield using small constant-force spring (Figure 2). Spring and braid leg should be wrapped in the same direction. Cinch (twist with hand) constant-force springs to tighten.

(b.) Install Second & Third Ground Braid Tails-Wrap the second and third ground braids around core legs to adjust length. Position ground braid tails so all constant force springs are equal distance from the cable armor.

3.3 Apply two highly-stretched half-lapped layers of electrical grade vinyl tape over constant-force springs (Figure 2).

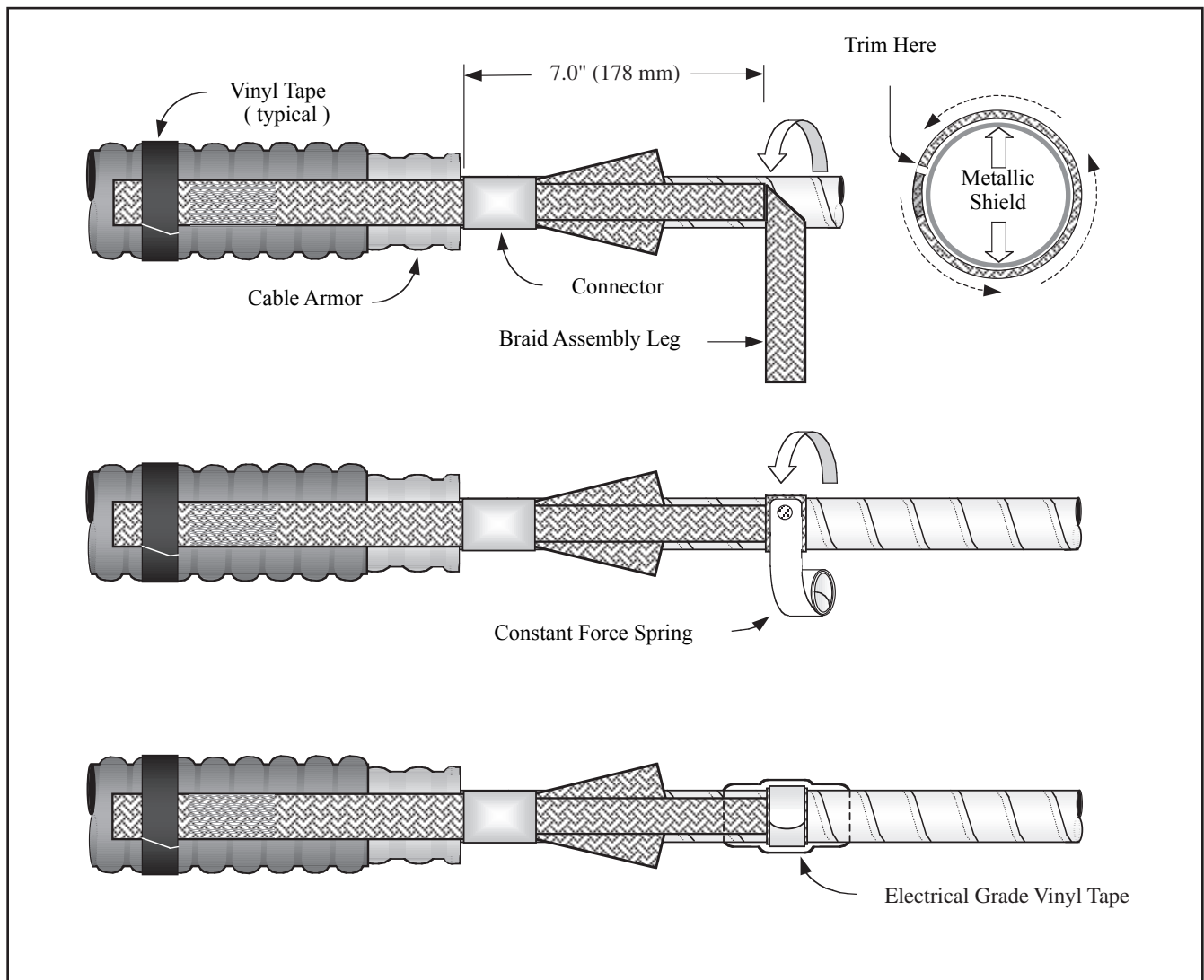


Figure 2

3.4 Measure distance [J] (Figure 3). Retrieve previously removed cable jacket material. Cut a straight piece to dimension [J] and wrap it around cable phases beneath ground strap assembly and cable ground wire. Secure jacket section in place using Scotch® Super Vinyl Electrical Tape 88 (wide vinyl tape) (Figure 3).

Note: Temporarily remove vinyl tape wrap on ground braid.

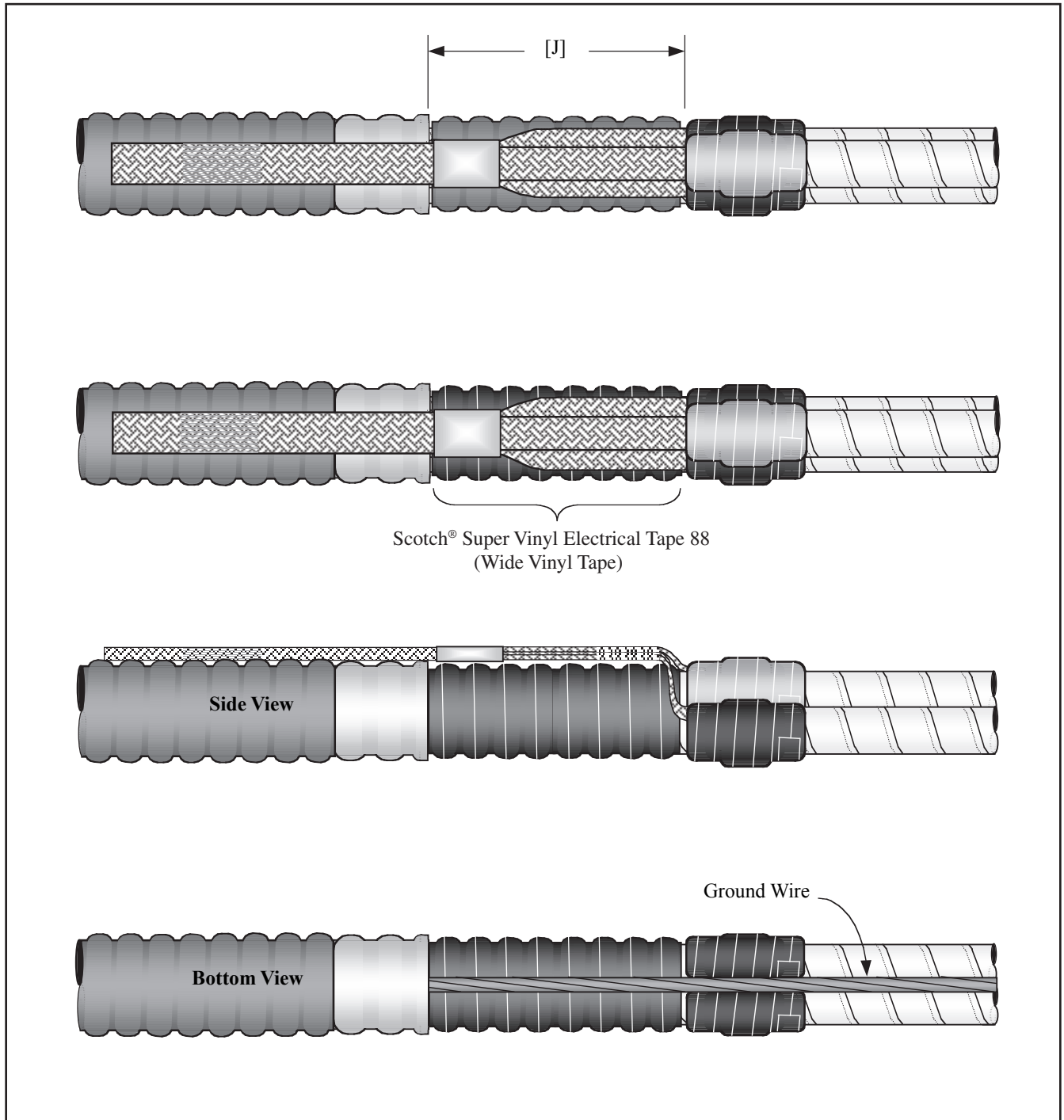


Figure 3

- 3.5 Fill one armor valley section with tightly-wrapped layers of Scotch® 24 Electrical Shielding Tape (Figure 4).
- 3.6 Secure ground braid assembly to cable armor using large constant-force spring (Figure 4). Once spring has been applied, cinch (twist with hand) to tighten.
- 3.7 Apply one half-lapped layer vinyl tape over large constant-force spring and cable armor (Figure 4).

Note: Apply vinyl tape to hold down ground strap (Figure 4).

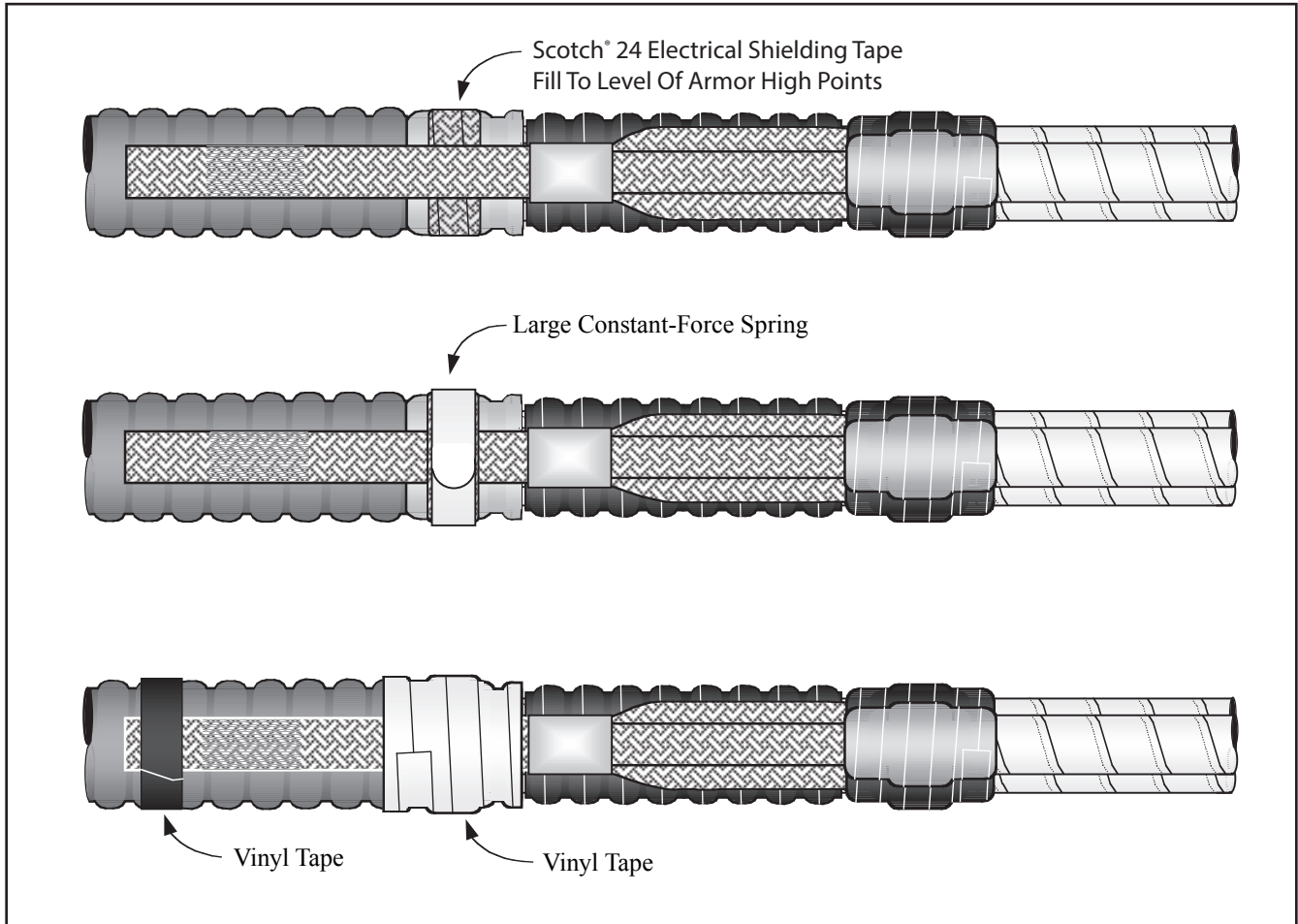


Figure 4

- 3.8 Bind cable ground wire with four half-lapped layers of Scotch® Super Vinyl Electrical Tape 88 (wide vinyl tape) (Figure 5). Limit width of tape wrapping to approximately 2-1/2" (63,5 mm).

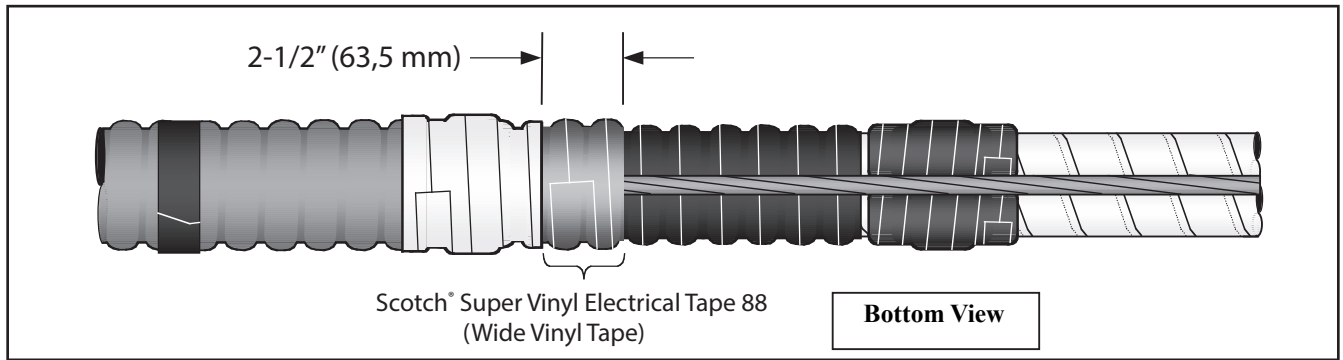


Figure 5

- 3.9 Loop cable ground wire back over armor (Figure 6). Adjust ground wire position over cable jacket to run parallel with tail of ground braid assembly.

Note: Do not make sharp or tight bends in ground wire. Ground wire loop should not extend beyond edge of protective jacket section as shown.

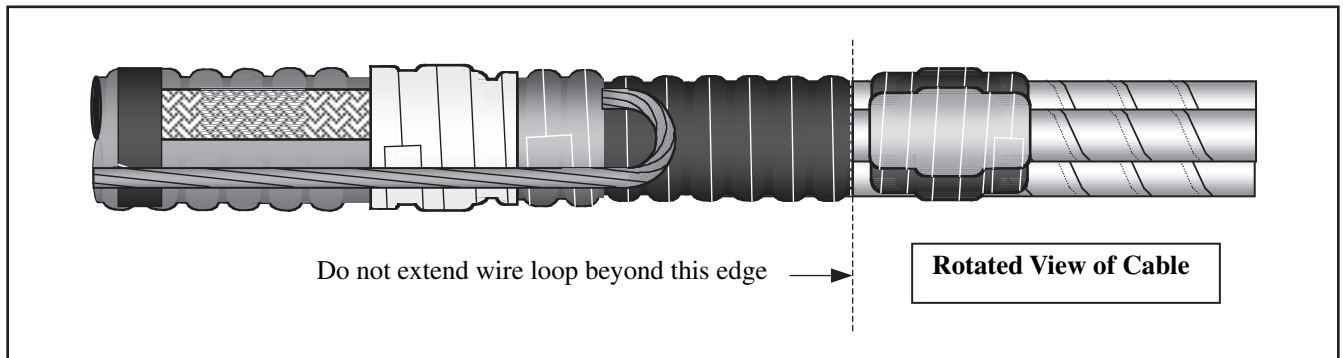


Figure 6

- 3.10 Apply two half-lapped layers of Scotch® Super Vinyl Electrical Tape 88 (wide vinyl tape) over looped ground wire area (Figure 7).

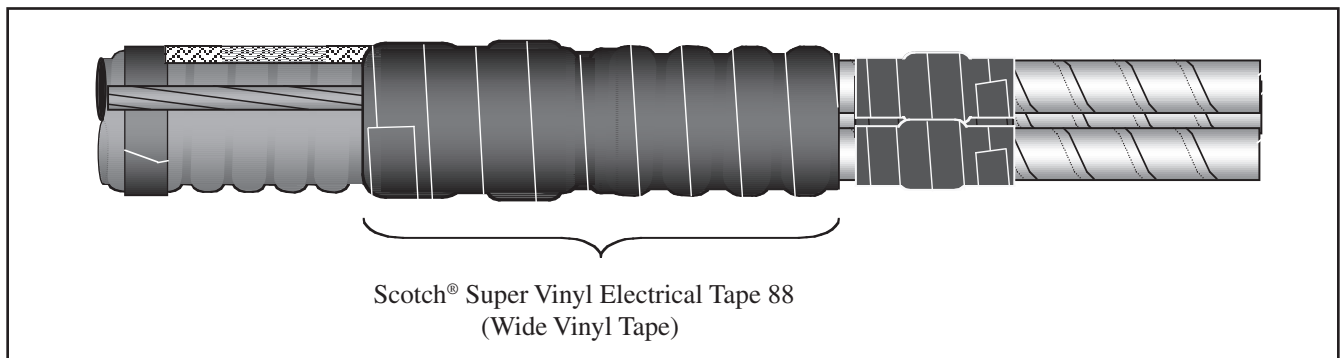


Figure 7

3.11 Wrap two strips of Scotch® Mastic Strip 2230 (one on top the other) over cable jacket. Locate the mastic strip directly under the shield braid solder block and ground wire (Figure 8).

Note: It will be necessary to temporarily remove vinyl tape over ground braid tail to complete this step.

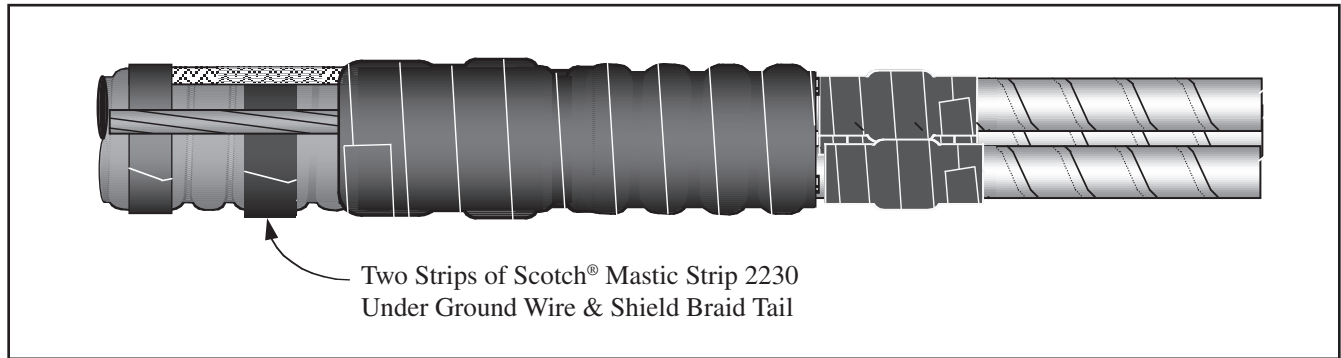


Figure 8

3.12 Separate ground wire strands over strips of Scotch® Mastic Strip 2230 as shown in Figure 9.

Hint: Directly over the mastic seal strips, lift and bend the ground wire 90°. Reverse twist the ground conductor to open strands. Use a screwdriver to aid in separating the strands. On 19 strand wire with reverse twist innerconductors, twist ground wire in the opposite direction to aid in separating the inner-conductors. Flatten, straighten and re-position the separated ground conductors. Be careful not to damage ground wire.

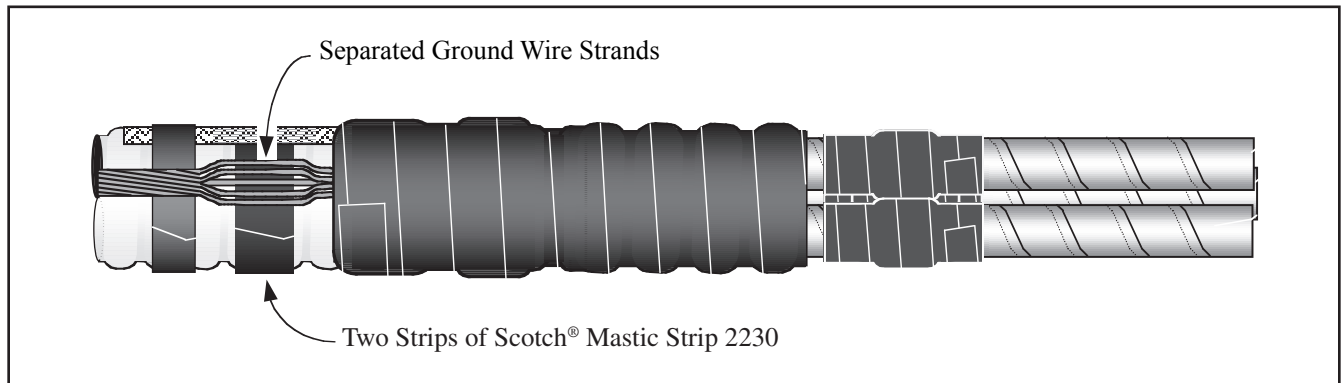


Figure 9

3.13 Apply one strip of Scotch® Mastic Strip 2230 around ground wire strands (Figure 10). Apply one mastic seal strip around solder block section of ground braid tail. Align seal strip wraps with previously applied mastic band around cable jacket.

Note: Avoid crossing individual wires at mastic seal location.

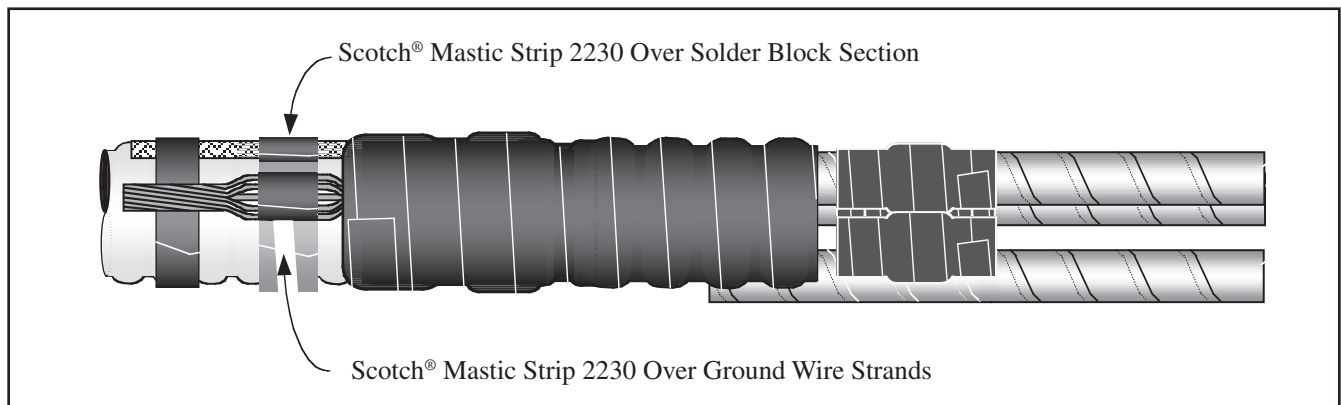


Figure 10

3.14 Wrap two additional strips of Scotch® Mastic Strip 2230 directly over previously applied mastic. (Figure 11).

3.15 Cover mastic seal area with two highly stretched half-lapped layers of wide vinyl tape.

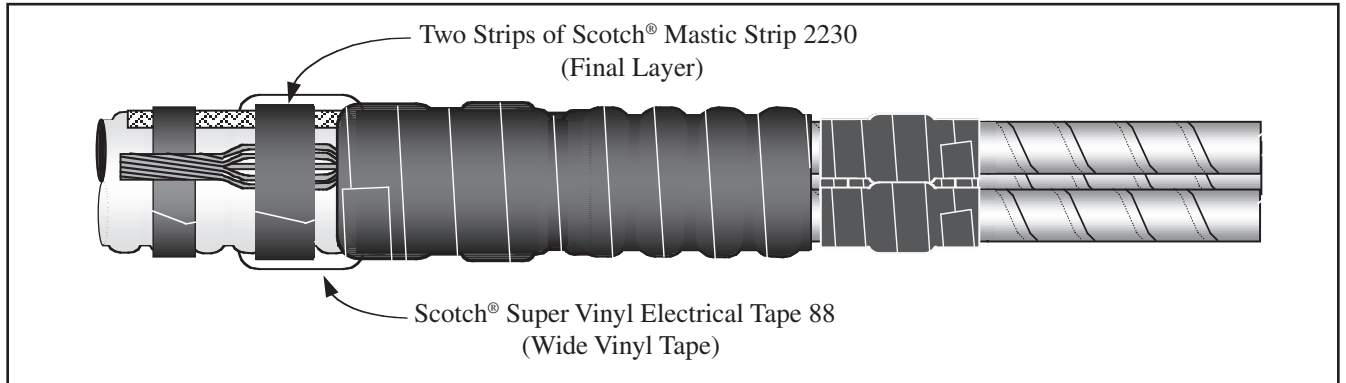


Figure 11

3.16 Install cold shrink jacket extension assembly. Align the jacket seal tube (not the plastic support core) to overlap ground wire seal area by approximately 1/4" (6 mm). To install, pull loose core end, while unwinding counter-clockwise around the cable. (Figure 12).

3.17 Bind cable ground wire and ground braid tail to cable jacket using Scotch® Super Vinyl Electrical Tape 88 (wide vinyl tape) (Figure 12). Apply at least eight tape layers and wrap only to width of tape roll.

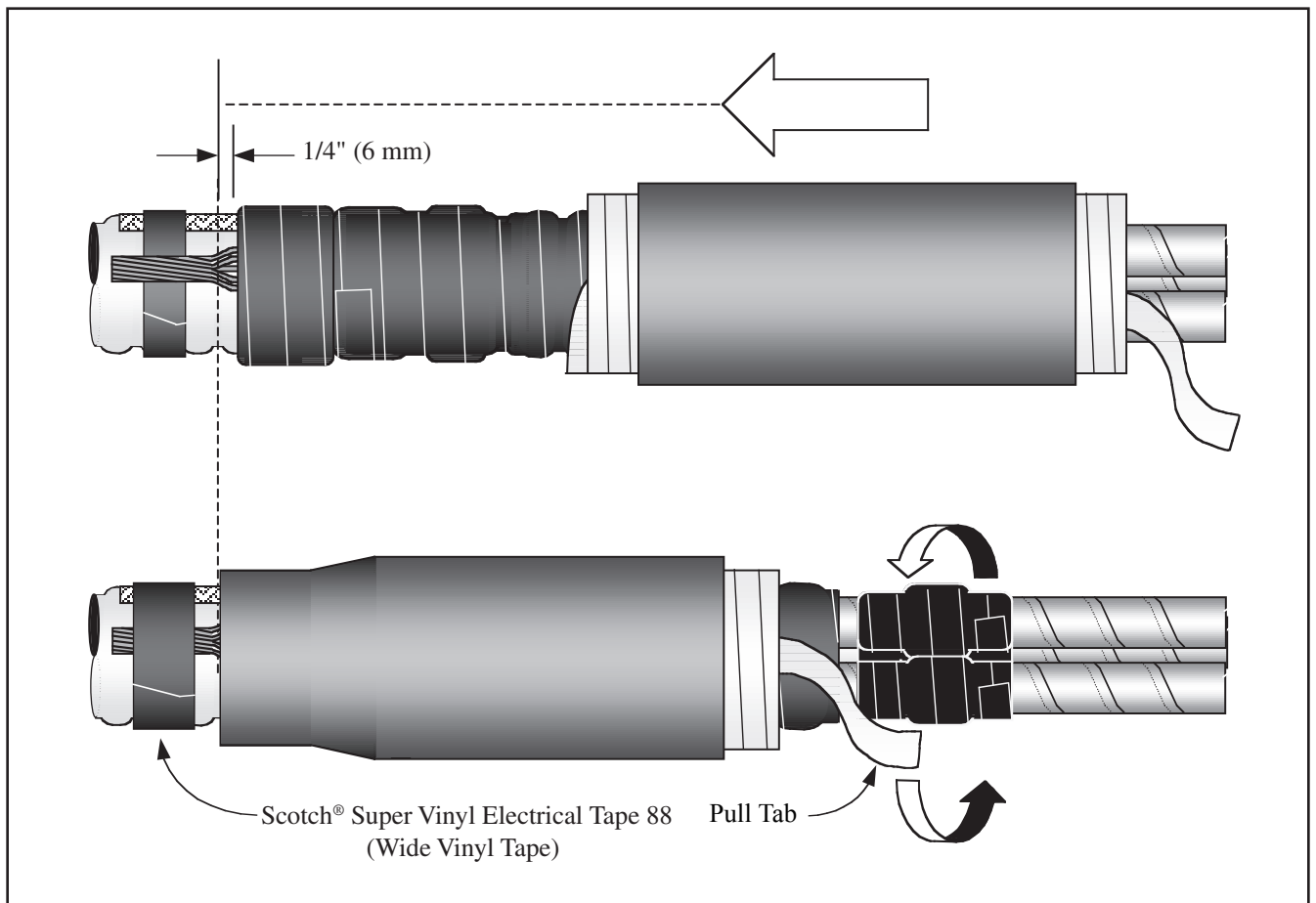


Figure 12

4.0 Install Silicone Rubber Breakout Boot Assembly

4.1 Inspect breakout boot assembly and confirm that all loose plastic core ends are free as shown (Figure 13).

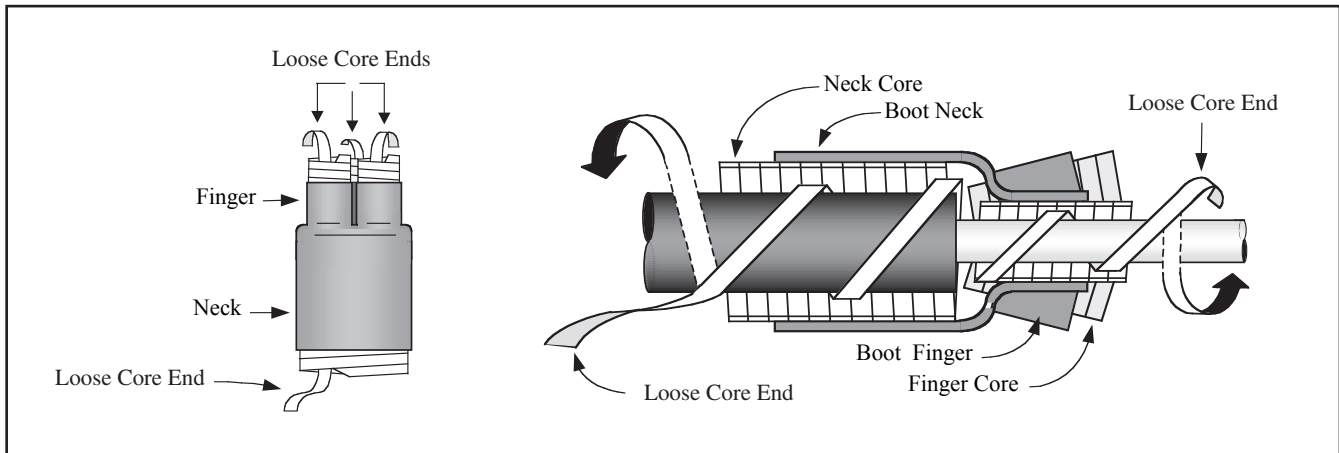


Figure 13

4.2 To ensure that the breakout boot can be fully seated into the breakout area of the cable, it will be necessary to unwind a few turns of each finger core.

Caution: Do not unwind too far such that boot fingers begin to collapse.

4.3 Hold loose neck-end core ribbon to one side so that it can not become trapped between cable phases. Slide boot assembly over cable end; guiding individual cable cores through boot assembly fingers.

Hint: View end of cable through finger cores to ease cable phase insertion.

4.4 Slide breakout boot assembly onto cable as far as it will go. Large neck-end should fully extend over previously-installed jacket sealing assembly tube.

Hint: Spreading cable phases while sliding the boot assembly can ease the installation.

4.5 Remove large neck-end core. Grasping loose core ribbon end, pull and unwind counter-clockwise around cable.

4.6 Remove each finger core. Grasping loose core ribbon end, pull and unwind counter-clockwise around each cable phase leg.

5.0 Install Silicone Rubber Re-jacketing Sleeves

5.1 Place a vinyl tape marker on each cable phase leg at dimension [X] (Figure 14).

Note: $[X] = A + [B]$. Allow for crimp growth when using aluminum lugs.

5.2 Determine required re-jacketing sleeve length for each phase leg (Distance [S], Figure 14). Be sure to include 1.0" (25 mm) breakout boot finger overlap in measurement.

5.3 From the chart below, determine the correct [A] dimension for the termination being installed.

| Kit Number | Dimension A |
|-----------------|----------------|
| 7620-S-2-INV-3G | 6.25" (159 mm) |
| 7621-S-2-INV-3G | 6.25" (159 mm) |
| 7622-S-2-INV-3G | 8.5" (216 mm) |
| 7693-S-4-INV-3G | 12.0" (305 mm) |
| 7695-S-4-INV-3G | 12.0" (305 mm) |

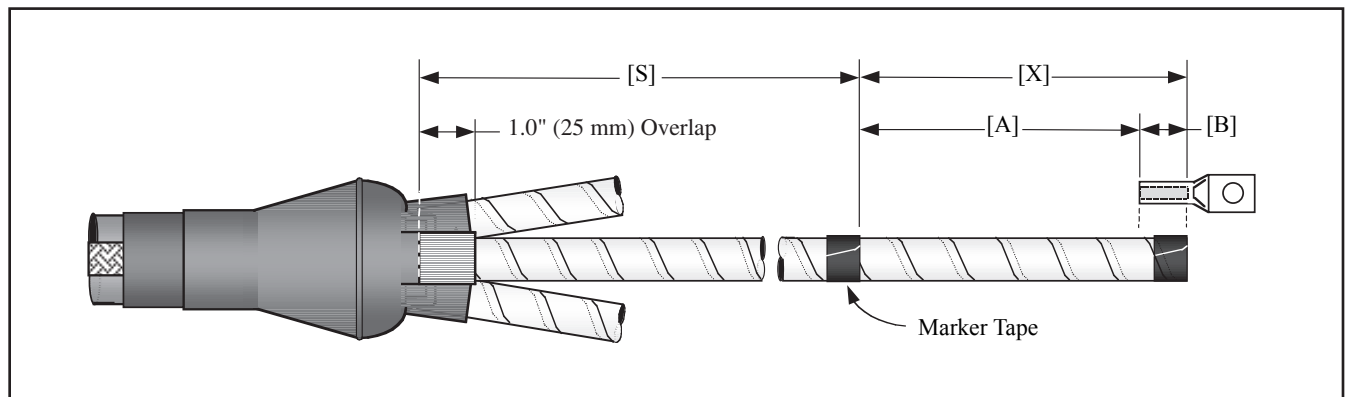


Figure 14

5.4 Using scissors, trim re-jacketing sleeve assembly to length required (Figure 15). Cut tubing and inner braid together.

Note: Inner polyester braid should extend approximately 3.0" (76 mm) beyond re-jacketing tube end before cutting. There is no need for termination-end braid exposure.

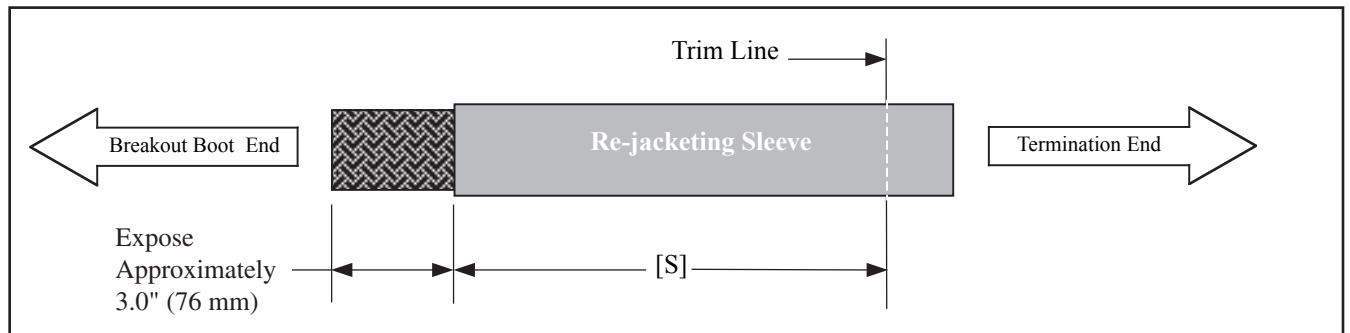


Figure 15

5.5 Guide one re-jacketing sleeve assembly over each cable phase leg (Figure 16). Push sleeve assembly from above. Continuously guide the free end while maintaining sleeve-to-cable-core alignment.

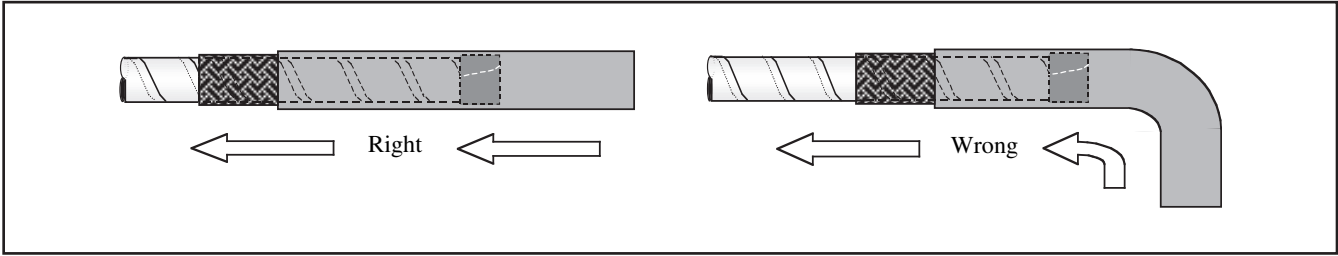


Figure 16

5.6 Slide re-jacketing sleeve until inner polyester braid is adjacent to breakout boot finger (Figure 17).

5.7 Fold outer silicone tubing back on itself for 1.0" (25 mm) (Figure 17) and trim off exposed polyester braid.

Note: Do not damage silicone tubing while cutting. Sleeve assembly may be rotated to ease trimming. When doing so, rotate in the direction of the cable copper tape shield wrap.

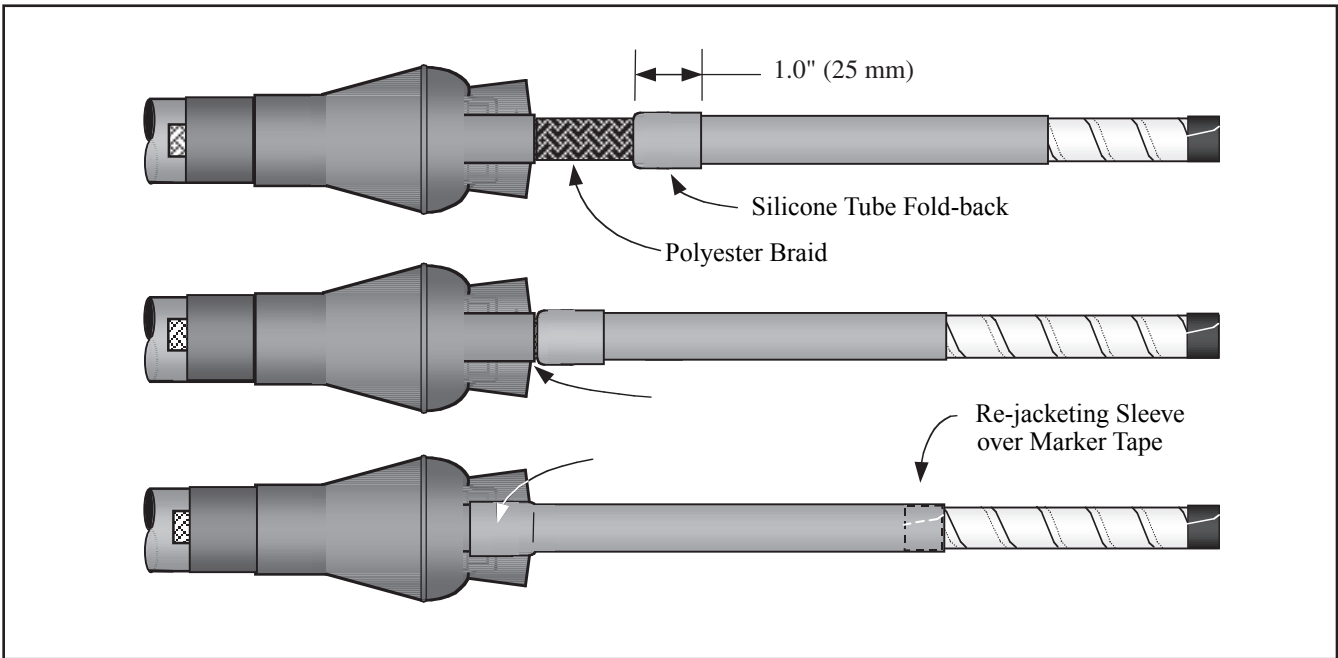


Figure 17

5.8 Slide re-jacketing sleeve assembly down until folded tube contacts edge of breakout boot finger (Figure 17).

5.9 Pull folded silicone tube section down onto breakout boot finger (Figure 17).

Note: Re-jacketing tube end should align with upper edge of installed marker tape (Figure 17). Minor tube adjustments can be made as needed.

6.0 Install 3M™ Cold Shrink QT-III Termination Assemblies

6.1 Prepare cable phase legs according to dimensions shown (Figure 18).

NOTE: It is imperative to remove all remnants of the semi-con layer, even if the semi-con layer comes off as one layer. There should not be any remaining black areas, or particles, on the cable insulation layer.

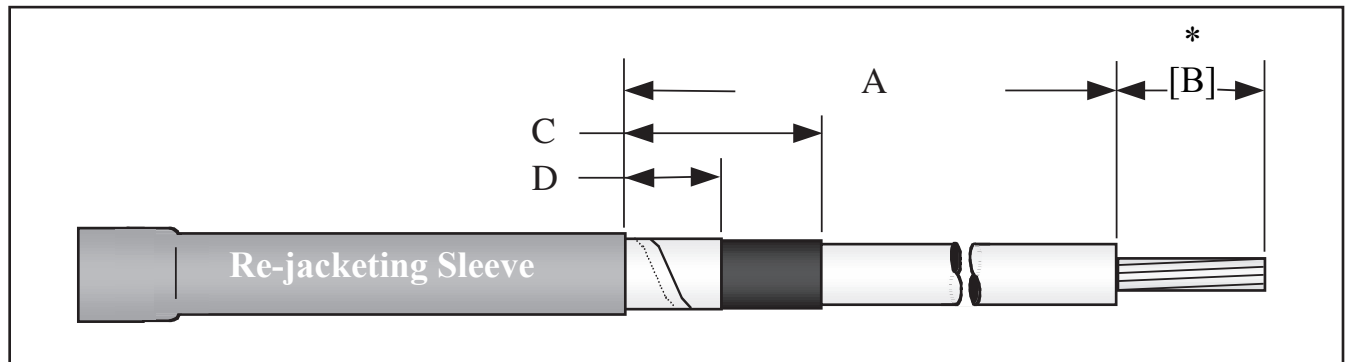


Figure 18

| Kit Number | Dimension A | Dimension B* | Dimension C | Dimension D |
|-----------------|----------------|--------------|--------------|---------------|
| 7620-S-2-INV-3G | 6.25" (159 mm) | Lug + growth | 1.5" (38 mm) | 0.75" (19 mm) |
| 7621-S-2-INV-3G | 6.25" (159 mm) | Lug + growth | 2.5" (64 mm) | 1.25" (32 mm) |
| 7622-S-2-INV-3G | 8.5" (216 mm) | Lug + growth | 2.5" (64 mm) | 1.25" (32 mm) |
| 7693-S-4-INV-3G | 12.0" (305 mm) | Lug + growth | 2.5" (64 mm) | 1.25" (32 mm) |
| 7695-S-4-INV-3G | 12.0" (305 mm) | Lug + growth | 2.5" (64 mm) | 1.25" (32 mm) |

* [B] = Lug or connector barrel depth. Allow for crimp growth when using aluminum lugs or connectors.

6.2 Secure cable copper shield ends with 3M™ EMI Copper Foil Shielding Tape 1181 strip (Figure 19).

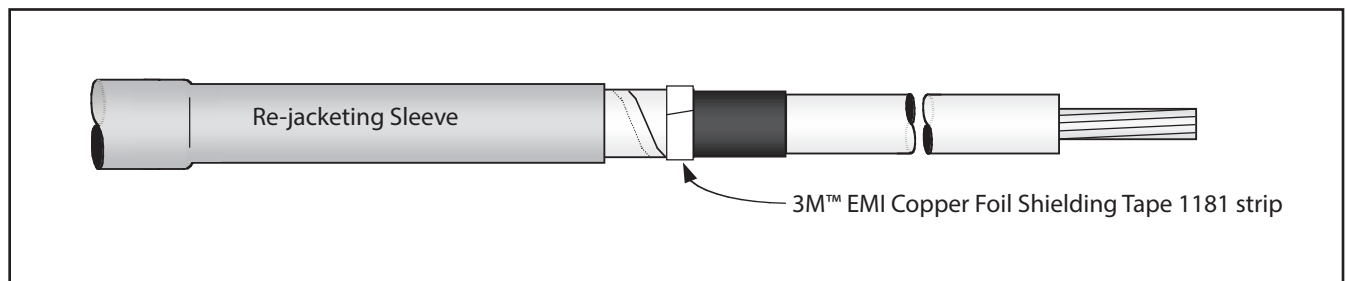


Figure 19

6.3 Secure re-jacketing sleeve with two half-lapped layers of electrical grade vinyl tape (Figure 20). Start taping 0.75" (19 mm) over re-jacketing sleeve, extend 0.25" (6 mm) over cable metallic shield and return to starting point.

Note: Do not exceed 0.25" (6 mm) overlap on 3M™ EMI Copper Foil Shielding Tape 1181 strip.

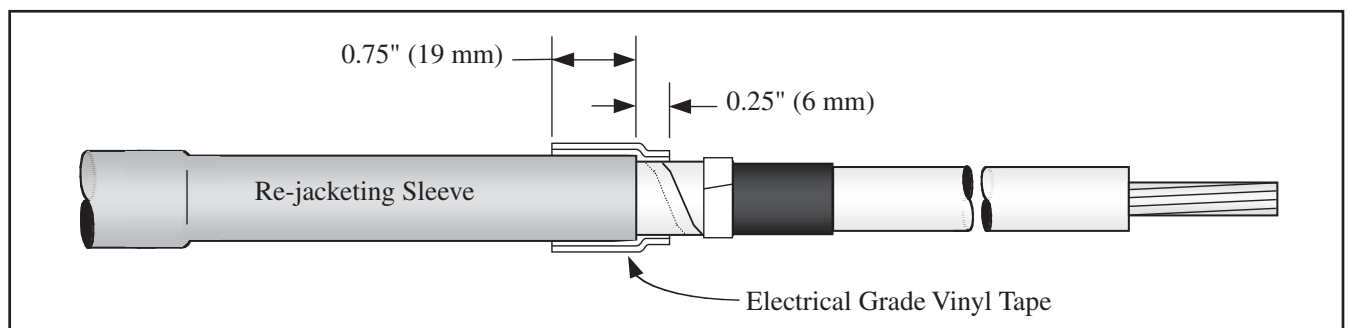


Figure 20

6.4 Place a termination installation marker tape at Dimension [M] measured from semi-con leading edge as shown (Figure 21).

| Kit Number | Dimension M |
|-----------------|---------------|
| 7620-S-2-INV-3G | 4.0" (102 mm) |
| 7621-S-2-INV-3G | 5.0" (127 mm) |
| 7622-S-2-INV-3G | 5.0" (127 mm) |
| 7693-S-4-INV-3G | 5.0" (127 mm) |
| 7695-S-4-INV-3G | 5.0" (127 mm) |

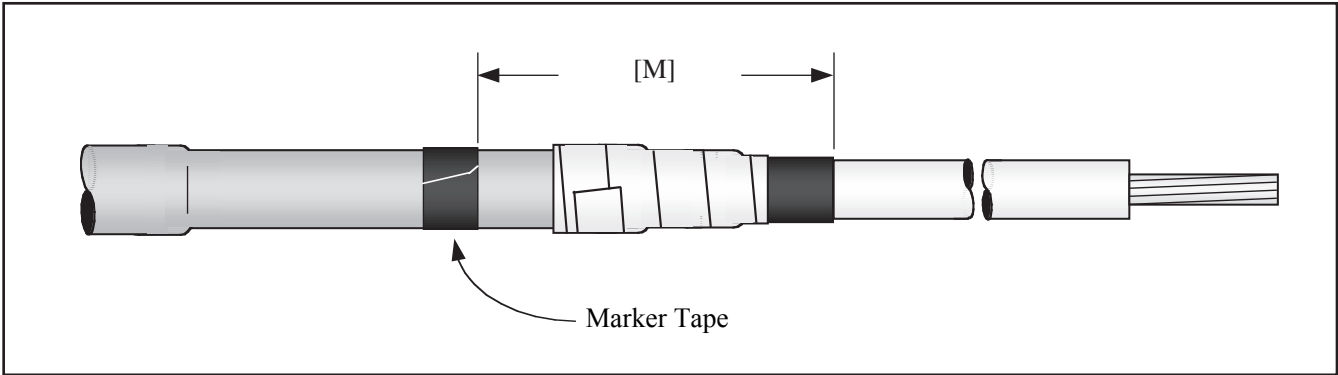


Figure 21

6.5 Install terminal lugs.

NOTE: Special Case – When lug spade dimension is larger than inside diameter of white plastic termination core, position termination assemblies over cable phase legs prior to installing lugs.

NOTE: For Aluminum Conductors - Thoroughly wire brush conductor strands to remove aluminum oxide layer. Immediately insert conductor into lug or connector barrel as far as it will go.

Remove inner red shipping core from each termination assembly by pulling and unwinding the loose red core ribbon. Position one termination over each cable phase leg. Each termination assembly must be positioned with its loose white core ribbon end directed toward the open (cut) end of the cable. Continue with lug installations.

(a.) For Aluminum Conductors - Thoroughly wire brush conductor strands to remove aluminum oxide layer. Immediately insert conductor into terminal lug barrel as far as it will go.

(b.) Ensure that each lug face is parallel to equipment bushing or lug connection interface (Figure 22).

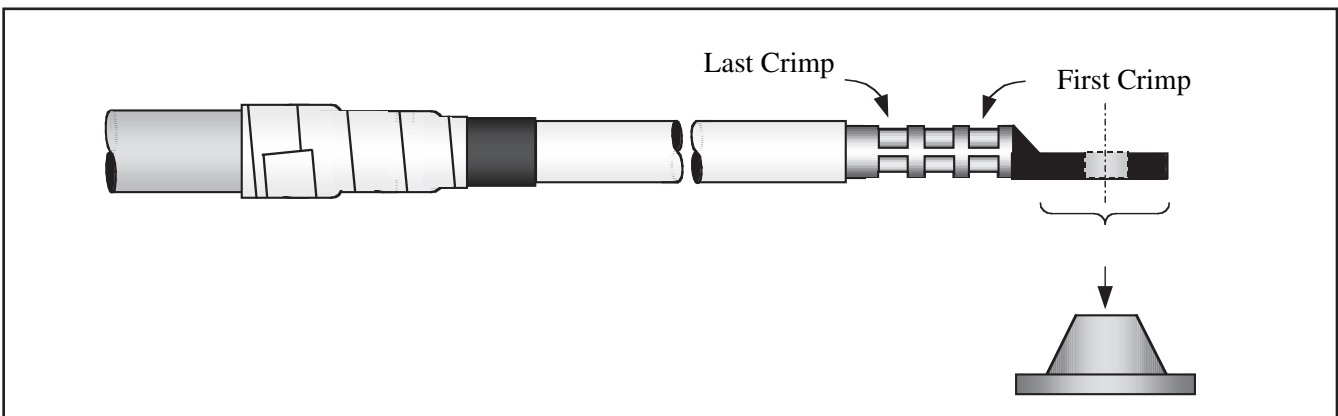


Figure 22

(c.) Crimp terminal lug according to manufacturer recommendations. Start at the upper end as shown (Figure 22). Remove all traces of oxide inhibitor that may have come out of lug barrel during crimping.

(d.) Thoroughly clean primary insulation and lug barrel area using solvent wipe from supplied 3M™ Cable Cleaning Preparation Kit CC-2.

NOTE: DO NOT ALLOW SOLVENT CONTACT WITH CABLE SEMI-CONDUCTIVE SHIELD.

6.6 Install Tubular 3M™ Cold Shrink QT-III Silicone Rubber Termination assemblies.

- (a.) Remove the inner red shipping core from the termination assembly by pulling and unwinding the loose red core end.
- (b.) Position the termination assembly with the loose white core ribbon directed toward the terminal lug.
- (c.) Align the base of the termination (not the plastic core) with the installation marker tape as shown (Figure 23).
- (d.) Grasp the loose white core ribbon. Pull and unwind counter-clockwise around cable end (Figure 23).

Note: After the silicone rubber termination makes adequate contact (approximately 1.0" (25 mm)), release the assembly and continue unwinding the core. **DO NOT PULL OR PUSH ON THE ASSEMBLY WHILE UNWINDING.**

- (e.) Remove the installation marker tape.

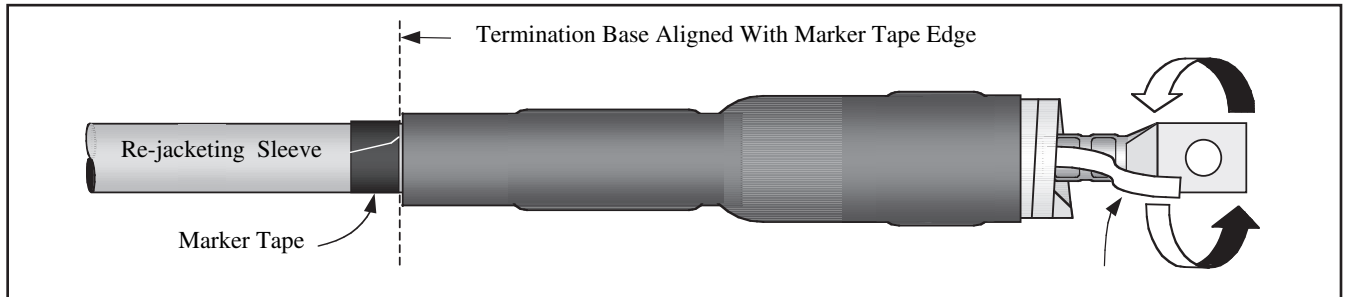


Figure 23

6.7 Install Cold Shrink skirted insulators.

- (a) Position skirted insulator over previously installed tubular termination as shown (Figure 24).
- (b) Align skirted insulator body (not the core) to install Dimension [M] from base of tubular termination (Figure 24).
- (c) Grasp the loose white core ribbon (Figure 24). Pull and unwind, counter-clockwise, around cable phase end.

Note: After skirted insulator makes adequate contact (approximately 1.0" (25 mm)), release the assembly and continue unwinding the core. **DO NOT PULL OR PUSH ON THE ASSEMBLY WHILE UNWINDING.**

| Kit Number | Dimension M |
|-----------------|----------------|
| 7620-S-2-INV-3G | .5" (12,7 mm) |
| 7621-S-2-INV-3G | .5" (12,7 mm) |
| 7622-S-2-INV-3G | 3.5" (88,9 mm) |
| 7693-S-4-INV-3G | 3.5" (88,9 mm) |
| 7695-S-4-INV-3G | 3.5" (88,9 mm) |

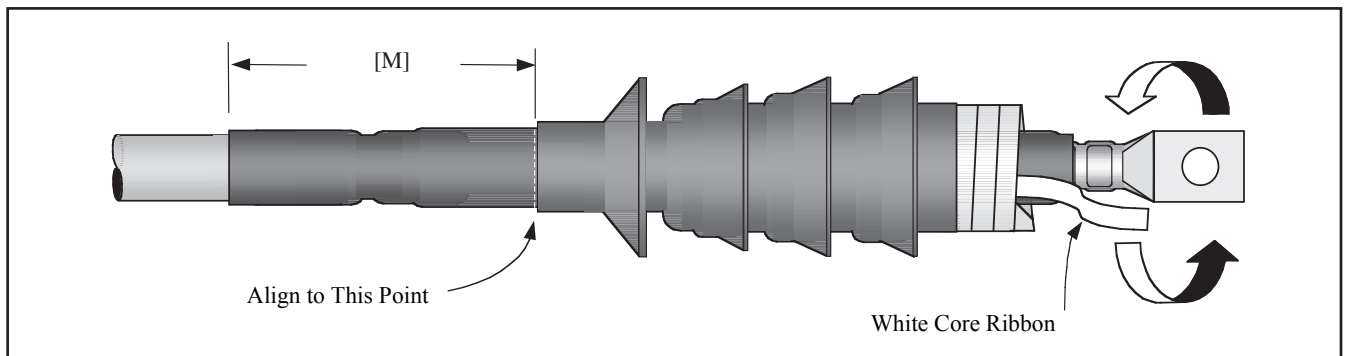


Figure 24

***Picture is representative of the 3M Cold Shrink QT-III Termination 7690 Series. The 7620 Series terminations will have only 2 skirts.**

6.8 Connect shield braid tail and cable ground to system ground (earth) according to normal practice.

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