

3M™ Cold Shrink QS4 Integrated Splice Kit QS4-35SP-350-1000

for Jacketed Concentric Neutral (JCN), Flat Strap, Tape Shield and Longitudinally Corrugated (LC) Cable Instructions

IEEE Std. 404
35 kV Class
250 kV BIL

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.

Kit Selection Table

Kit Number	Cable Insulation O.D. Range	Min. Cable Jacket O.D.	Conductor Size Range
QS4-35SP-350-1000	1.24"–2.07" (31,5–52,6 mm)	1.78" (45,2 mm)	350-1000 kcmil* (185-500 mm ²)

*Splices (including size transitions) can be made to smaller or larger conductors (but larger conductors may require special neutral handling), provided both cables are within the Insulation O.D. Range and the connector meets the dimensional requirements shown below.

Connector Dimensional Requirements

	Minimum Inches (mm)	Maximum Inches (mm)
Outside Diameter	0.87" (22,1 mm)	2.07" (52,6 mm)
Length Aluminum (Al/Cu) Compression	—	7.50" (191 mm)
Length Copper (Cu) Compression and 3M™ Shearbolt Connectors QCI 350-750 and QCI 500-1000	—	8.25" (210 mm)

1.0 Kit Contents

- a. 3M Cold Shrink QS4 Integrated Splice Body QS4-35SP-350-1000 (1 ea.)
- b. Constant Force Springs (4 ea.)
- c. 3M Red Compound P55/R Tubes (non-silicone grease) (2 ea.)
- d. Scotch® Rubber Mastic Tape 2228 Rolls, 2" x 36" (2 ea.)
- e. Scotch® Mastic Strips 2230, 6" length (9 ea.)
- f. Cold Shrink Adapter Tube (1 ea.)
- g. 3M EMI Copper Foil Shielding Tape 1181 Strips, 1/2" x 10" (2 ea.)
- h. Scotch® Electrical Shielding Tape 24, 1" x 15' (1 ea)
- i. 3M Aluminum Foil Tape Strips 1115B, 10" length (2 ea)
- j. 3M Cable Cleaning Pads CC-3 (1 ea.)
- k. Cut-back Templates (2 ea.)
- l. Wire Brush (1 ea.)
- m. Instruction Booklet (1 ea.)

Note: *Cold Shrink adapter tube may not be included in all kits.*

Note: *Kits contain either 1 or 2 cut-back templates as needed per conductor size.*

Note: *Do not use knives to open plastic bags.*

Note: *Connector not shown, but if included, it is indicated on the packaging label.*

2.0 Prepare Cables

- 2.1 Check to be sure the cable fits within the kit ranges as shown on the cover page.
- 2.2 Prepare cables according to standard procedures. Refer to template provided or illustration below for proper dimensions (*Figure 1*).

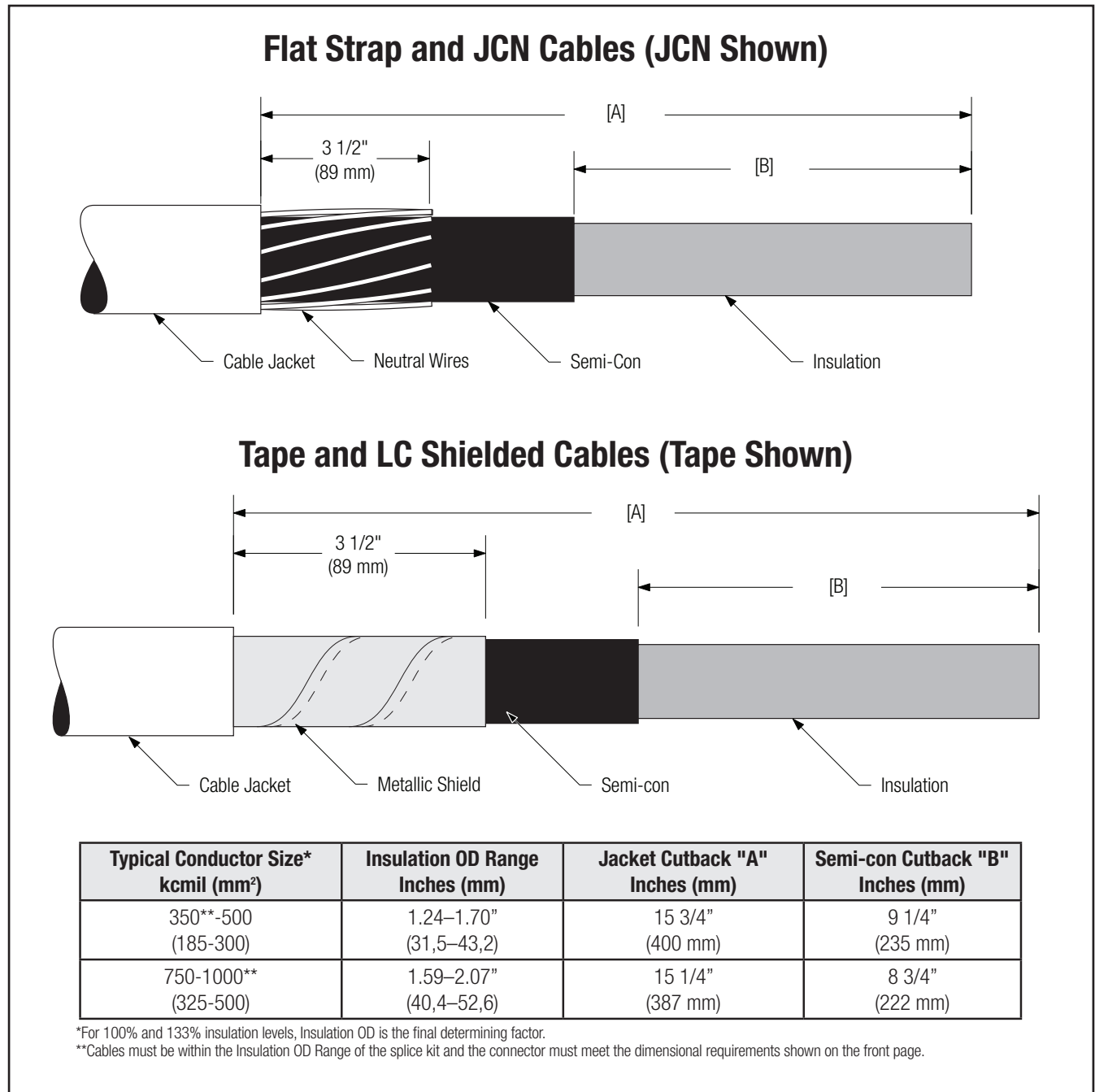


Figure 1

- 2.3 **If using Tape or LC Shielded Cable:** Secure end of each metallic shield with a copper tape strip. Go to Step 2.9.

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- 2.4 If using JCN or Flat Strap Cable:** Carefully bend the cut neutral wires up and away from the cable semi-con as shown. Fold one Scotch® Mastic Strip 2230 in half lengthwise and apply one wrap only at cable jacket edge under the neutral wires (*Figure 2*).

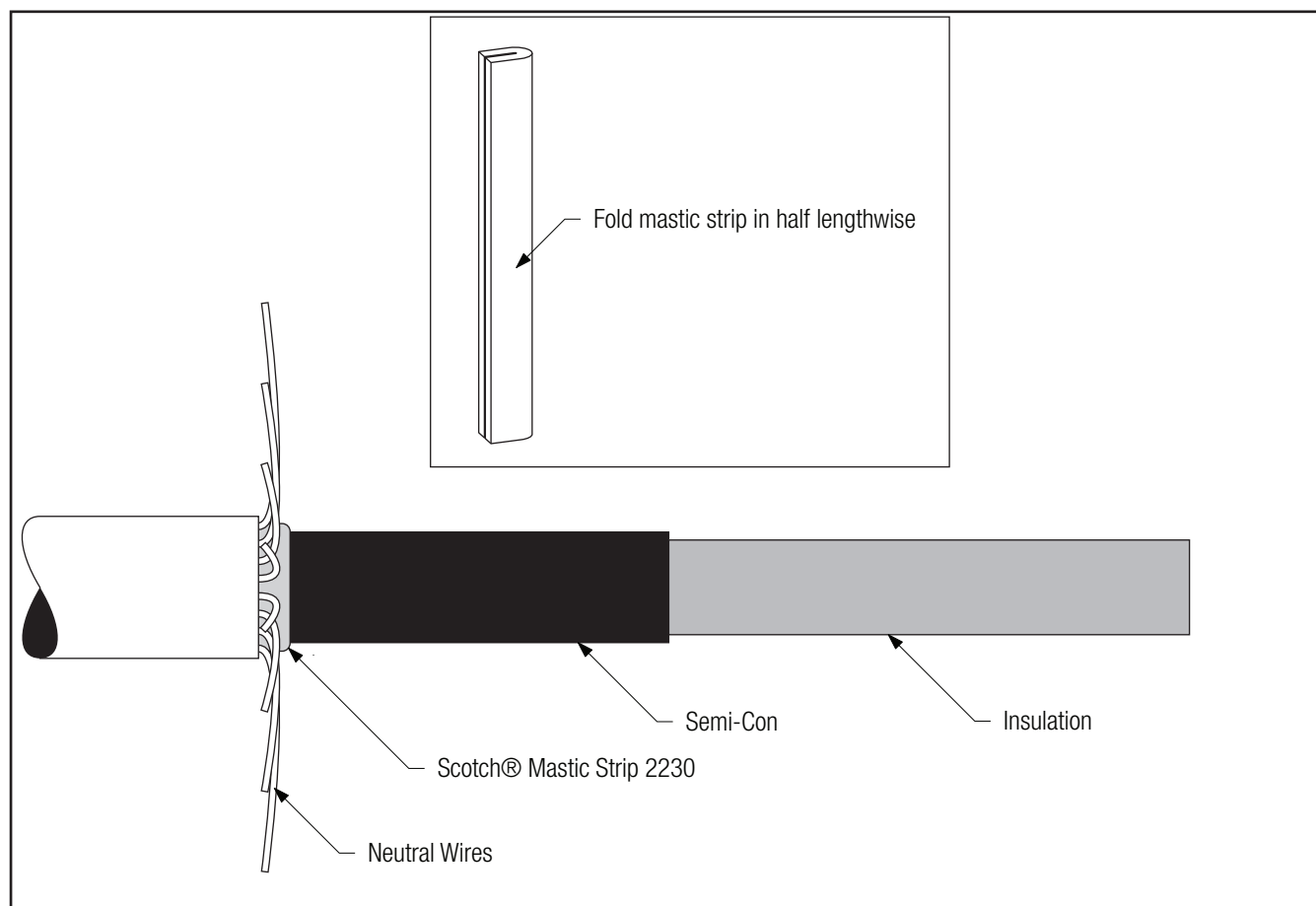


Figure 2

- 2.5 If using JCN or Flat Strap Cable:** Mark the cable semi-con 4" (102 mm) from the cable jacket edge. Apply two half-lapped layers of Scotch® Electrical Shielding Tape 24 over the cable semi-con, starting from the mastic edge out to the mark on the semi-con and back. Half-hitch to tie off (*Figure 3*).

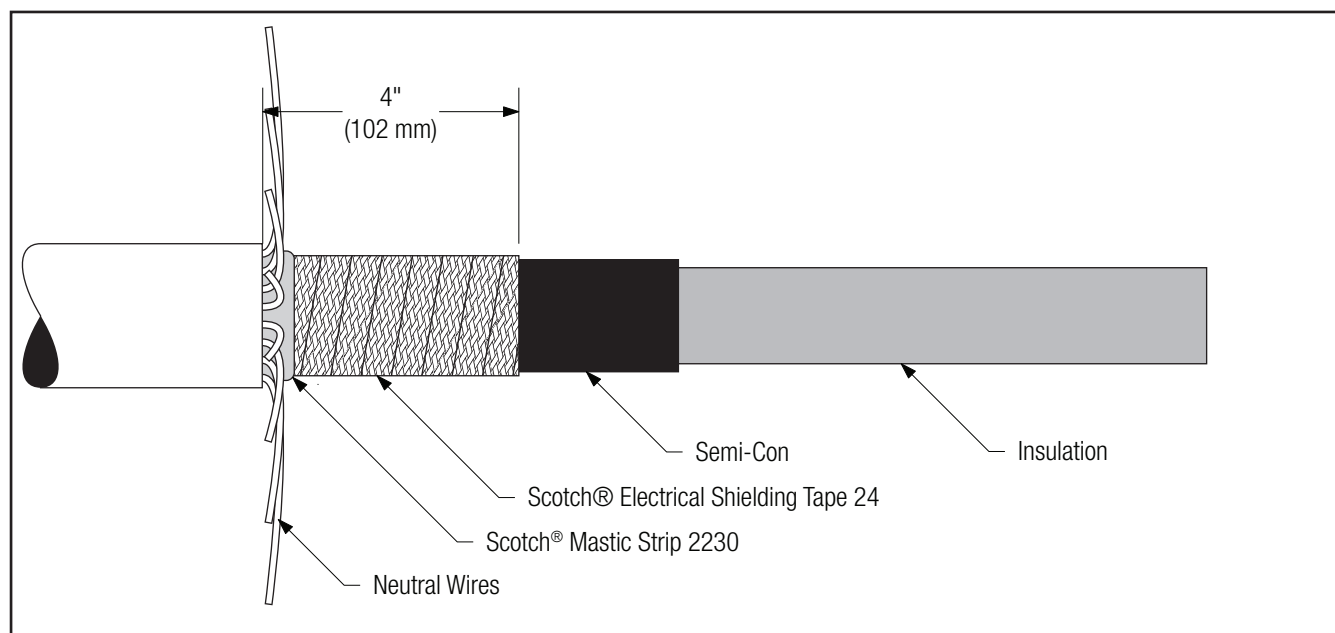


Figure 3

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- 2.6 If using JCN or Flat Strap Cable:** Carefully lay neutral wires back down on top of the shielding tape and press into mastic. Keep wire profile low by following the concentric turn in the cable (*Figure 4*).
- 2.7 If using JCN or Flat Strap Cable:** Remove the liner from one 3M Aluminum Foil Tape Strip 1115B and secure the ends of the neutral wires. Wrap the aluminum tape on top of itself and tightly press down on the edge of the tape toward the end of the electrical shielding tape (*Figure 4*). If preferred, 2 wraps of vinyl tape may be used to temporarily secure the ends of the neutral wires instead of the aluminum tape.

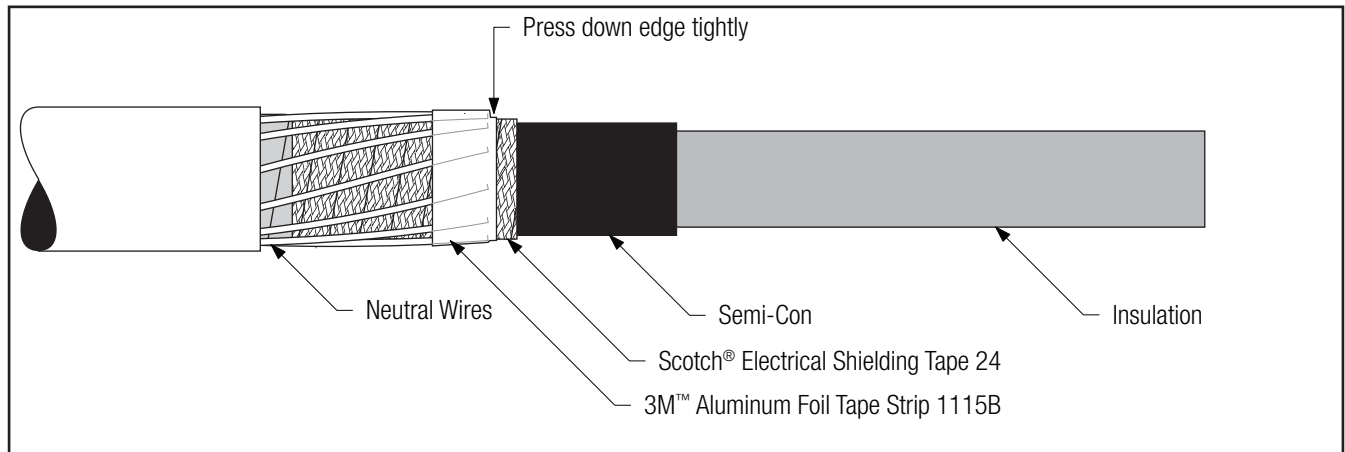


Figure 4

- 2.8 If using JCN or Flat Strap Cable:** Apply a Scotch® Mastic Strip 2230 over the previously applied mastic strip and overlapping onto the cable jacket. Knead mastic around neutral wires. Overwrap mastic with vinyl tape, taking care not to extend tape along neutral wires (*Figure 5*).

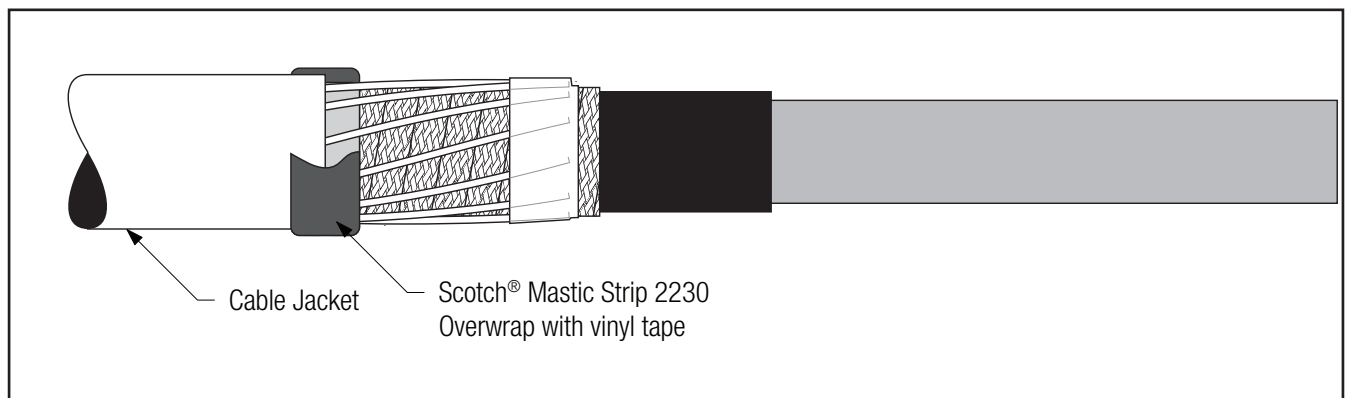


Figure 5

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- 2.9 Clean or cover cable jacket 30" (760 mm) from jacket edge on side where splice body will be parked.
- 2.10 Slide integrated splice body onto clean cable jacket, ensuring that the long ground strap is on the side of the splice where the external grounding will be located (*Figure 6*). The ground strap may or may not be covered with heat shrink.

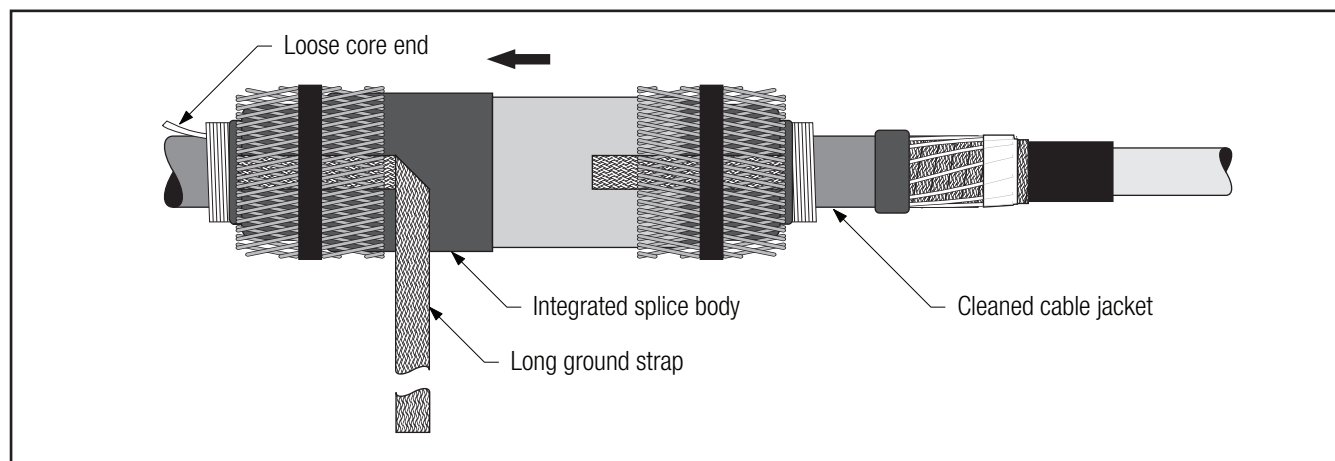


Figure 6

3.0 Install Connector

Note: *If using a crimp-type connector, go to step (3.3).*

- 3.1 If using a 3M Shearbolt Connector QCI 350-750 or QCI 500-1000, refer to the instructions included with the connector for insulation cut-back dimension. Insulation removal length shall not exceed 3 3/4" (95 mm) from conductor end (*Figure 7*).

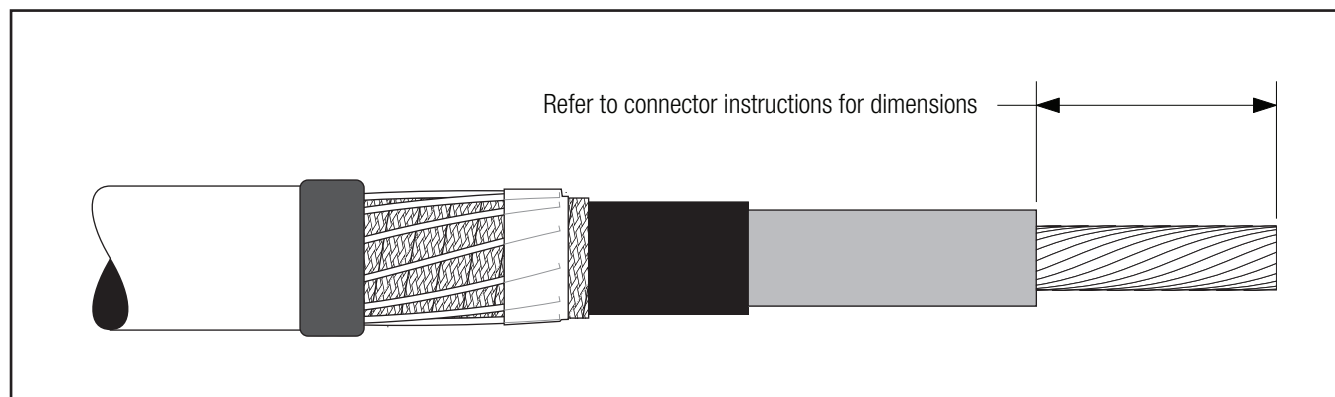


Figure 7

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- 3.2 Install 3M Shearbolt Connector QCI 350-750 or QCI 500-1000 according to the instructions included with the connector (*Figure 8*).

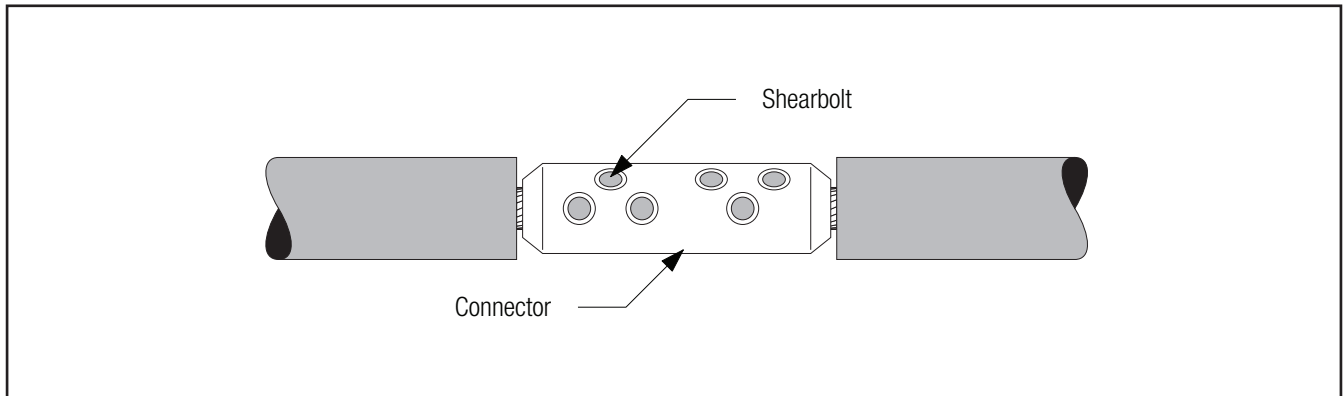


Figure 8

Go to section 4.0 “Install Splice.”

- 3.3 If using a crimp type connector,** remove cable insulation for 1/2 connector length plus an allowance* for increases in connector length due to crimping. Insulation removal length shall not exceed 4 1/8" (105 mm) from conductor end. **Do not install connector now** (*Figure 9*).

****Note:*** This assumes that the installer has determined the increased length of an aluminum connector crimped with a specific tool and die.

Aluminum (Al/Cu) Crimp Connector Growth Chart

Conductor Size	Typical growth allowance (per end)
350-500 kcmil	1/4" (6 mm)
750-1000 kcmil	3/8" (10 mm)

Note: 1) Copper connectors do not require a length change allowance.
2) Maximum aluminum connector crimped length allowed is 8.25" (210 mm).

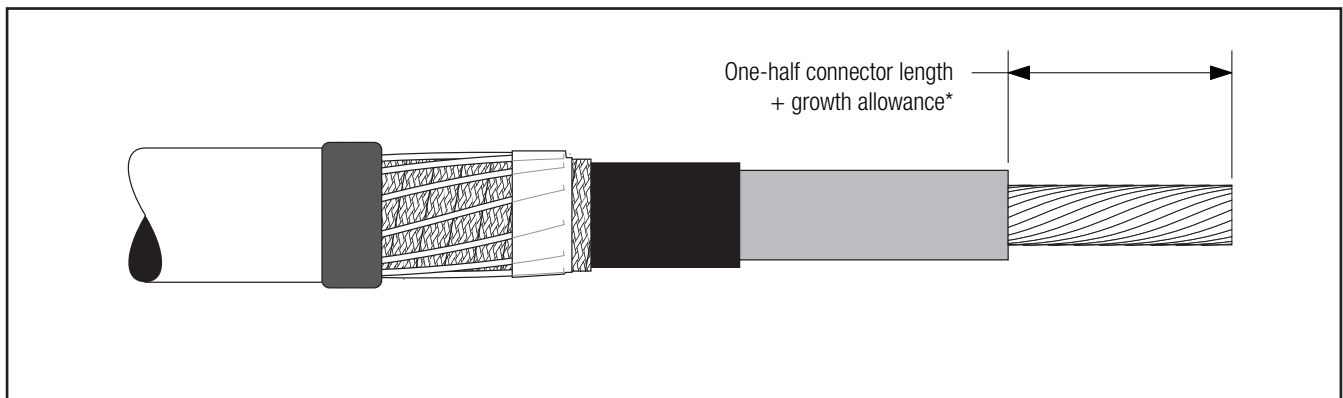


Figure 9

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- 3.4 For 350 through 1000 kcmil copper connectors, 350 through 750 kcmil aluminum connectors, or connectors with an O.D. between 0.87-1.60" (22,1-40,6 mm): Park cold shrink adapter tube on cable insulation (Figure 10).

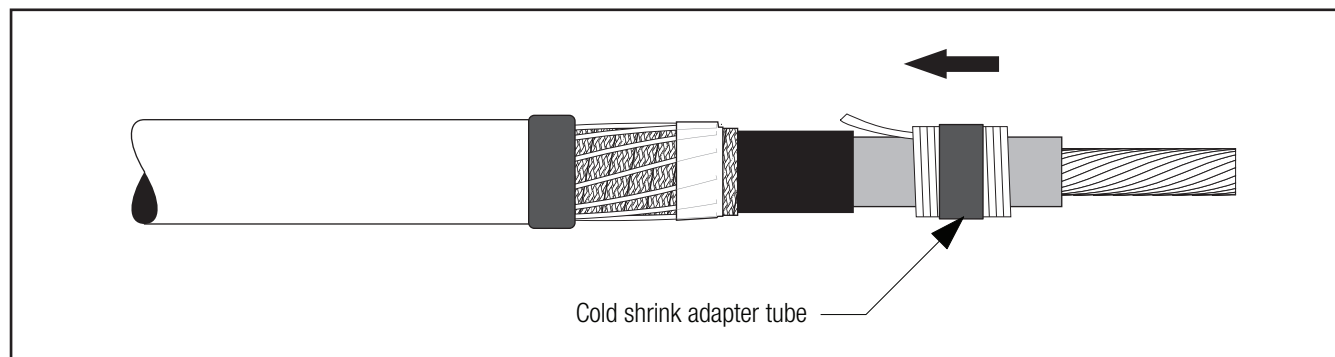


Figure 10

- 3.5 Install connector. See table (on cover) for proper connector dimensions. (For standard 3M Connectors, refer to table at the end of this instruction for crimping information). If using an aluminum conductor, wire brush aluminum strands and then insert into connector. Remove excess inhibitor compound and remove conductor from connector. Wire brush aluminum strands again. Insert into connector and crimp. Remove any excess oxidation inhibitor from connector ends (Figures 11 and 12). File sharp connector flashing, if necessary, taking care to remove all metal filings from splice area.

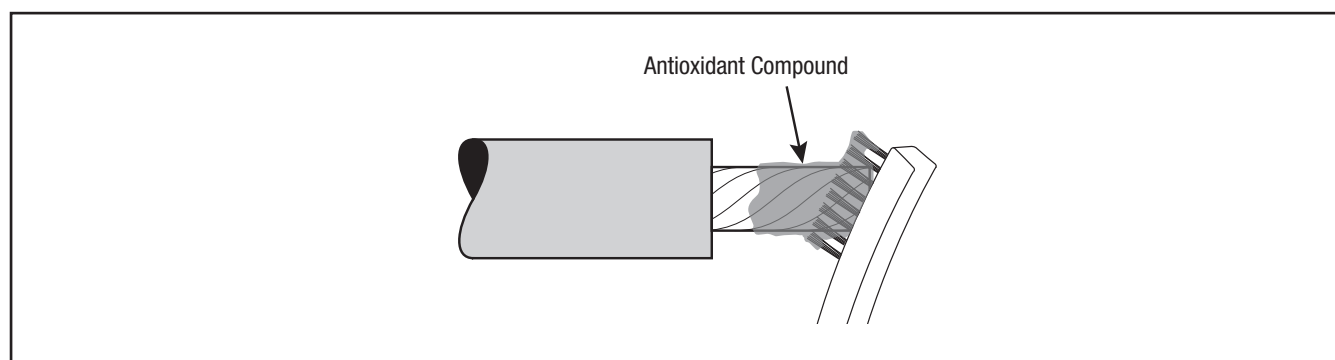


Figure 11

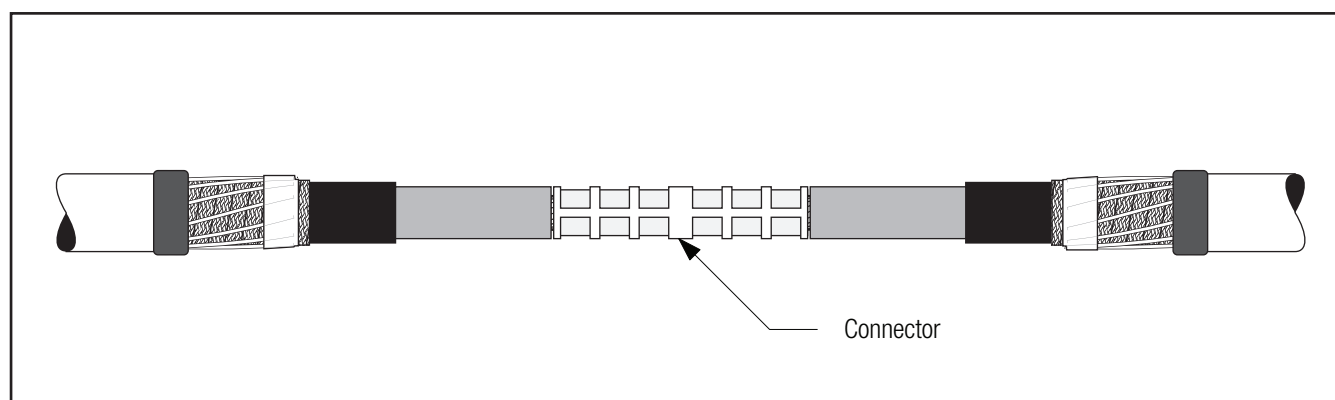


Figure 12

4.0 Install Splice

- 4.1 Apply a tape marker to semi-con insulation shield on cable which does not contain splice. Measure 11 1/4" (286 mm) from center of connector (*Figure 13*).

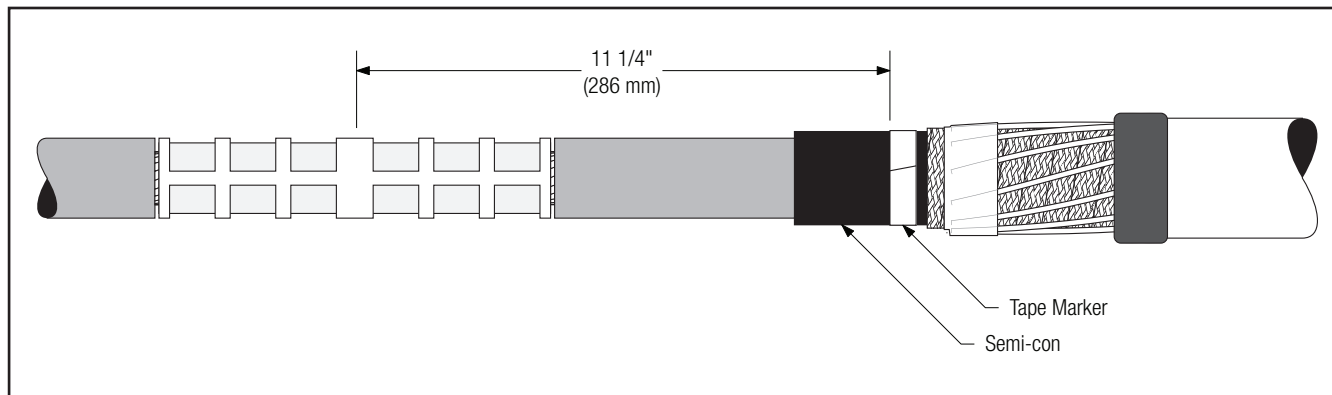


Figure 13

- 4.2 **If using cold shrink adapter tube:** Position adapter tube over the connector. Shrink adapter near the center of connector by pulling and unwinding the loose core end in a counter-clockwise direction (*Figure 14*).

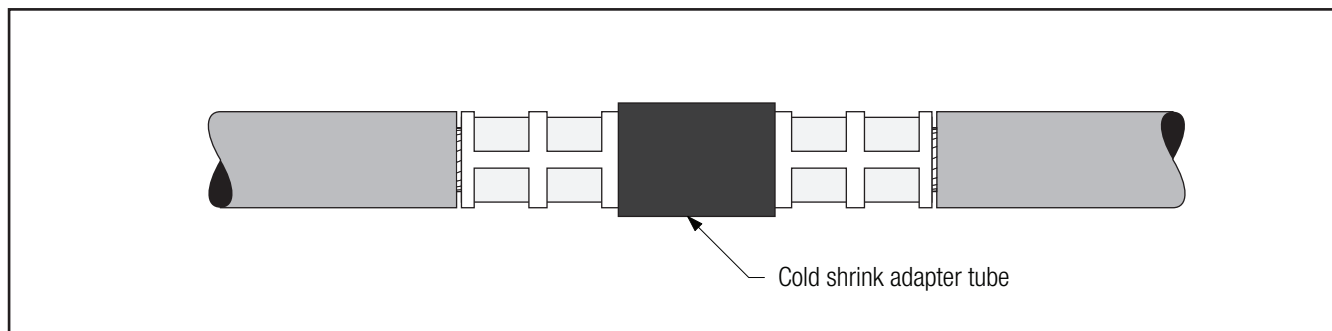


Figure 14

- 4.3 Clean cables using standard practice:
- Do not allow solvent or abrasive to contact the cable semi-conductive insulation shield.
 - Do not reduce cable insulation diameter below 1.24" (31,5 mm) specified for the splice.
 - The insulation surface must be round, smooth and free of cuts/voids. Sanding may be necessary, finish sanding should be done with a 120 grit or higher electrical grade abrasive.
 - Make certain that the cable insulation is smooth, clean and dry before continuing.

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- 4.4 Apply 3M Red Compound P55/R on cable insulations, making certain to fill in edge of cable semi-con. **Do not use silicone grease** (Figure 15).

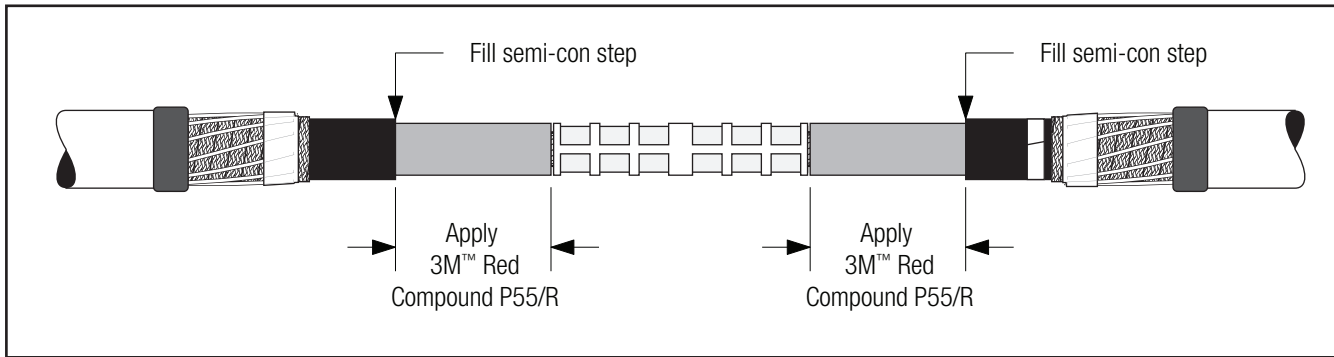


Figure 15

Note: *This core installs differently than other cold shrink products.*

- 4.5 Position the splice body over connector area, aligning end of the splice body (not the core) at the center of the tape marker. **Slowly** start to remove the splice core by pulling and unwinding the loose core end counterclockwise, allowing only 1/4" (6 mm) of the splice to shrink onto the tape marker. Carefully slide the splice body off the tape marker by pulling and twisting until the entire tape marker is exposed. Continue removing the core to complete the splice body installation (Figure 16).

Note: *The splice body ends must overlap onto the semi-con of each cable by at least 1/2" (13 mm).*

Note: *Do not push the splice body toward the tape marker as this may cause the end to roll under. If the end does roll under, DO NOT use sharp-edged tools to pull it out as this could cut and damage the splice.*

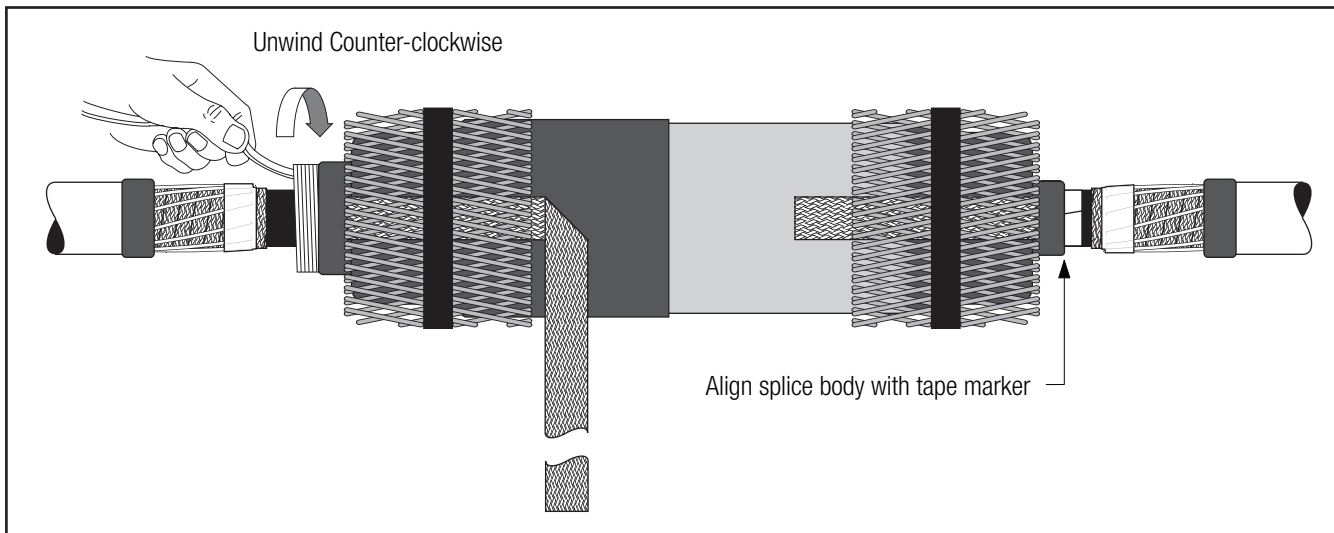


Figure 16

5.0 Connect Shielding

- 5.1 Remove the vinyl tape holding the shield sleeve on the re-jacketing tube, and spread the shield sleeve out toward the cable jacket.

Note: *If vinyl tape was used in Step 2.7 to temporarily secure the ends of the neutral wires, remove it and use the 3M Aluminium Foil Tape Strips 1115B to secure the ends of the neutral wires. Remove the liner from the aluminum tape. Wrap the tape on top of itself and tightly press down on the edges of the tape.*

Note: *The 3M Cold Shrink Integrated Splice Body includes a pre-installed ground braid for external grounding. If not using the ground braid to externally ground, it may be cut off and tied into the ground system with the shield sleeve, using constant force springs.*

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- 5.2 Hand-tighten the shield sleeve outward and secure it, along with the ground braid, to the neutral wires, tape or LC shields on either side of the splice using two constant force springs on each end between the vinyl tape at the jacket edge and the aluminum foil tape or copper foil tape as shown (*Figure 17*).
- 5.3 If shield sleeve extends beyond neutral wires, it may be interwoven with the constant force springs. Trim excess ground braid if needed. Cinch (tighten) the spring after wrapping the final winding (*Figure 17*).

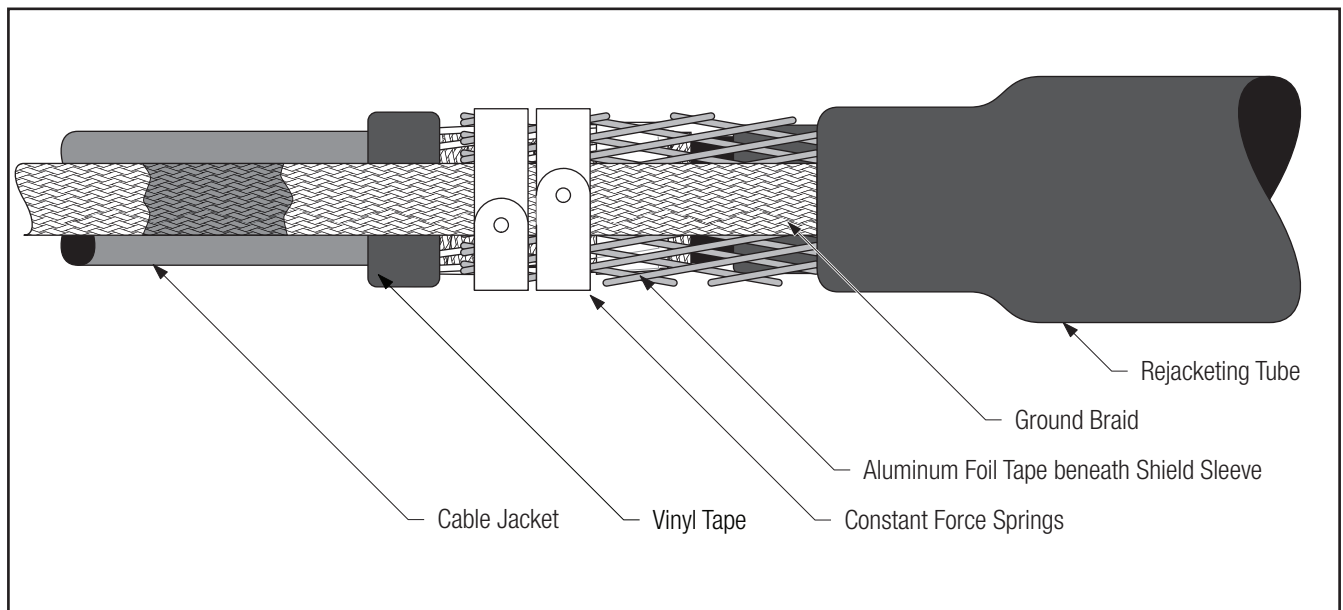


Figure 17

- 5.4 Place one mastic sealing strip on the cable jacket under the solder block of the ground strap no farther than 1/2" (13 mm) from the edge of the vinyl tape from the water block (*Figure 18*).

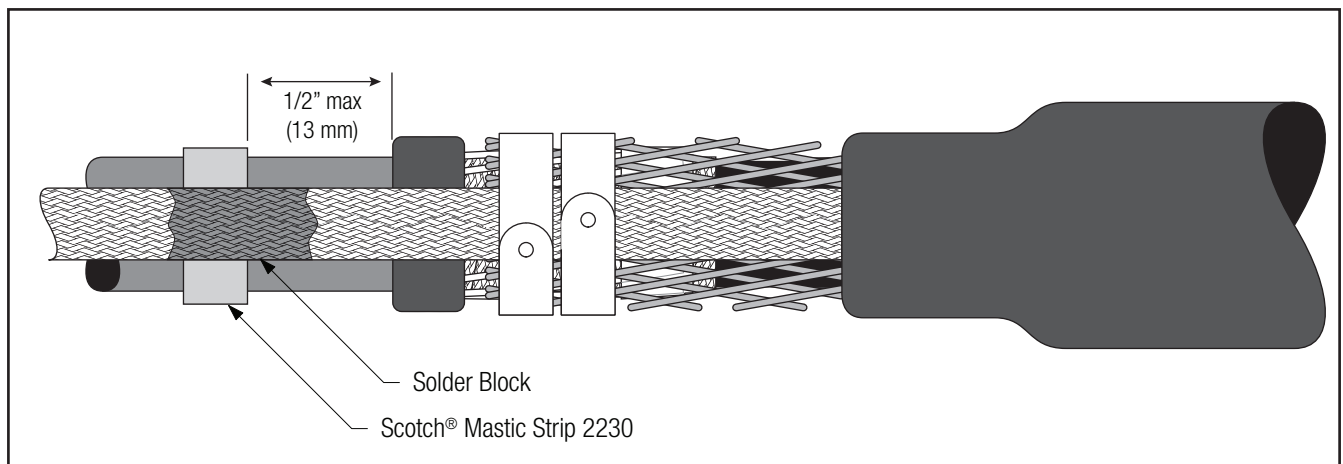


Figure 18

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- 5.5 Place another mastic strip over the solder block. Press the mastic strips around the solder block and to the cable jacket (*Figure 19*).

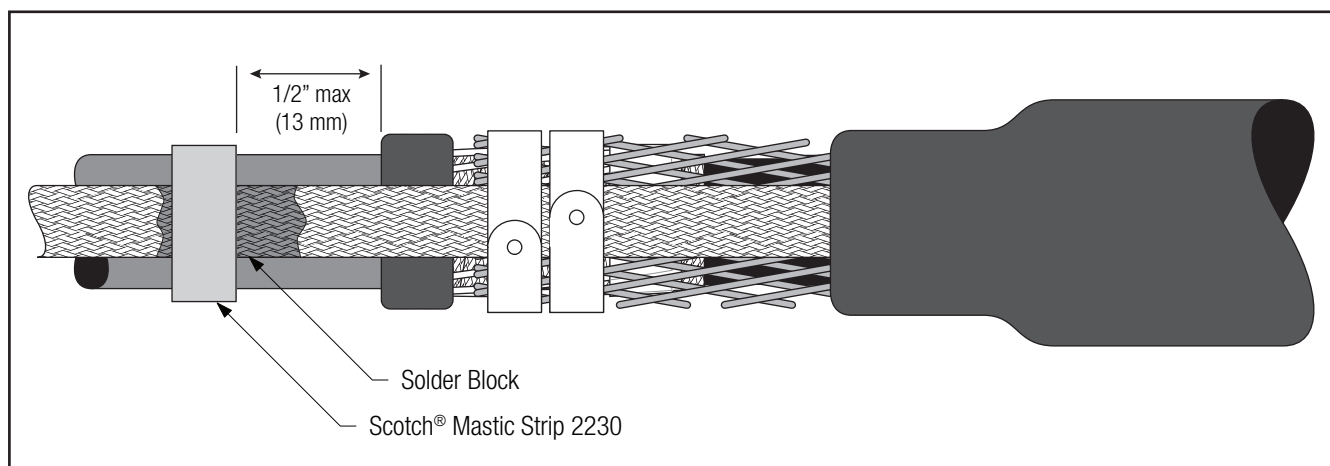


Figure 19

- 5.6 Wrap two half-lapped layers of vinyl tape over all constant force springs (*Figure 20*).

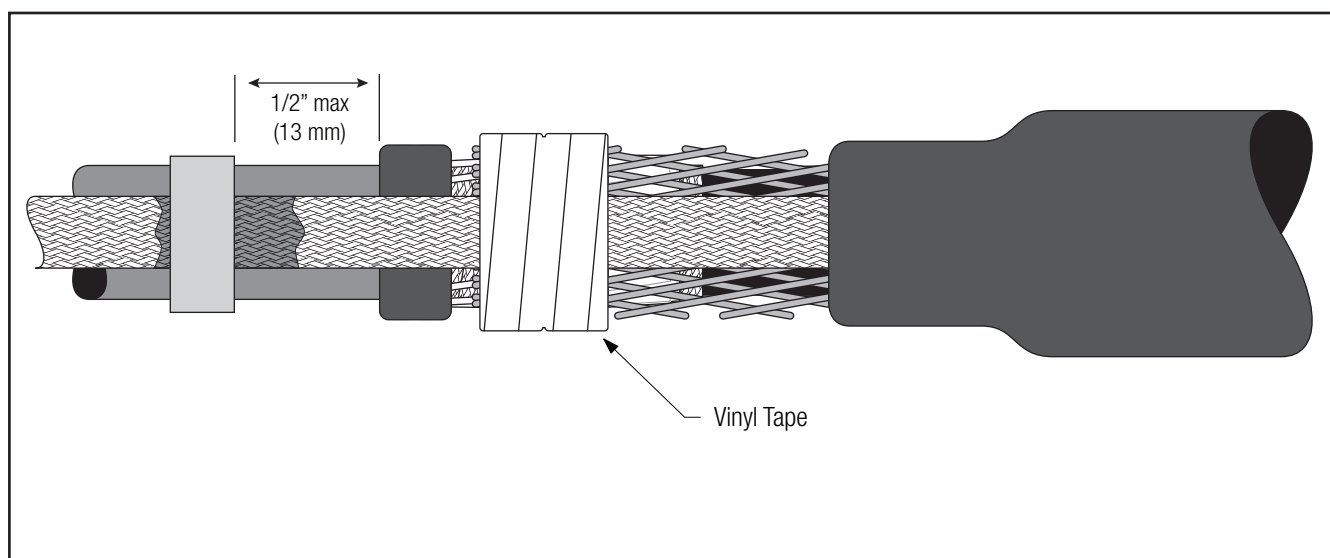


Figure 20

6.0 Install Jacket

Note: *Jacketing is not optional.*

- 6.1 Wrap a roll of slightly stretched Scotch® Rubber Mastic Tape 2228, 2" x 36" around cable jacket ends (tacky side toward cable) (*Figure 21*). If grounding was applied, apply tape over mastic strips at solder block. Stretch and tear off last 1–2" (25–50 mm) of mastic (*Figure 22*).

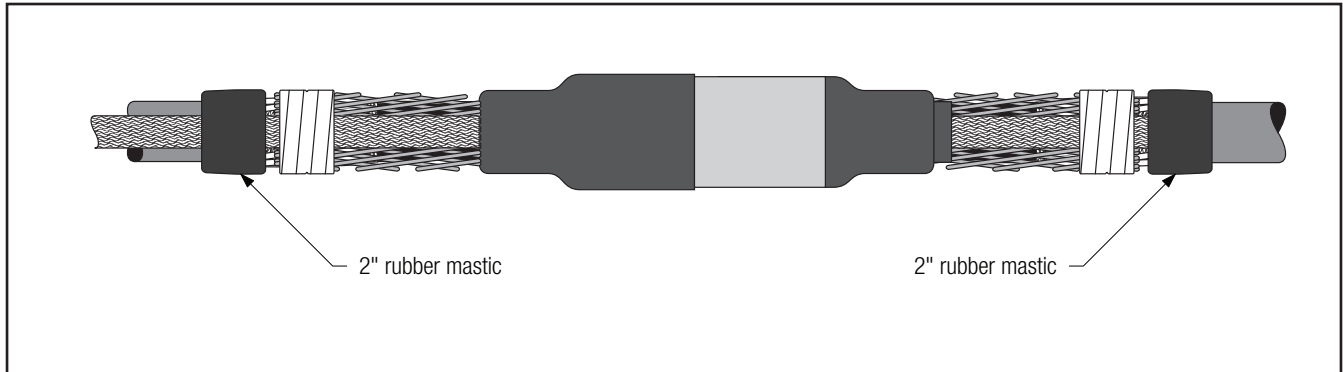


Figure 21

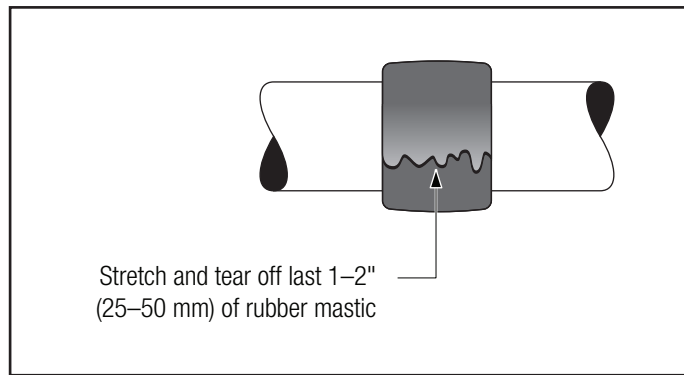


Figure 22

- 6.2 Install the re-jacketing tube by twisting the tube (not the liner) from side to side to start the movement. Then slide and unroll the tube over the constant force springs and rubber mastic. (*Figure 23*). Repeat on other side.

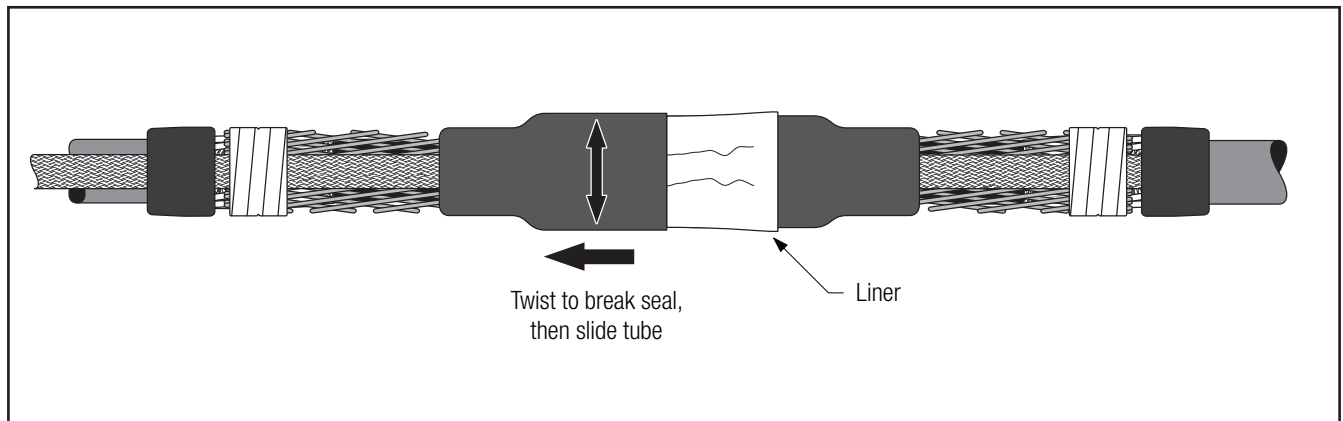


Figure 23

6.3 Remove the liners and discard.

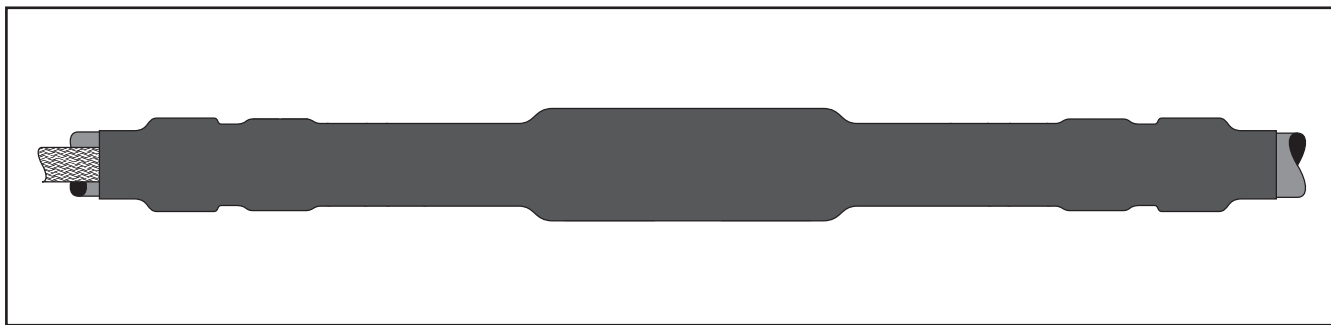


Figure 24

6.4 Connect optional grounding.

Note: *In applications where the splice is regularly exposed to high levels of ultra-violet radiation (i.e. direct sunlight), wrap two half-lapped layers of Scotch® Super 33+™ Vinyl Electrical Tape or Scotch® Vinyl Electrical Tape Super 88 over the re-jacketing tube.*

Crimping Tool - Die Sets (number of crimps/end)

3M™ Connector Number	Conductor Size (kcmil)	Burndy			Thomas & Betts Corp.			Square D Co. Anderson Div.	
		Y34A	Y35, &39 Y45*, Y46*	Y1000**	TBM 8	TBM 12	TBM 15	VC6-3** VC6-FT**	VC8C**
10011 (Cu)	350	A31R (2)	U31RT (2)	—	Red (3)	—	71H (3)	(2)	—
20011 (Al/Cu)	350	—	U31ART (2)	(1)	—	87H (3)	87H (3)	(2)	—
11011 (Cu)	350	A31R (2)	U31RT (3)	—	Red (4)	—	71H (4)	(3)	—
CI-350 (Al/Cu)	350	—	U31ART (2)	—	—	87H (2)	87H (2)	(3)	—
20012 (Al/Cu)	400	—	U32ART (4)	(1)	—	94H (4)	94H (4)	(2)	(2)
10014 (Cu)	500	A34R (2)	U34RT (2)	—	Brown (3)	—	87H (3)	(2)	—
20014 (Al/Cu)	500	—	U34ART (4)	(1)	—	106H (3)	106H (4)	(2)	(2)
11014 (Cu)	500	A34R (2)	U34RT (3)	—	Brown (4)	—	87H (4)	(3)	—
CI-500 (Al/Cu)	500	—	U34ART (3)	—	—	—	106H (3)	(3)	—
20016 (Al/Cu)	600	—	U36ART (4)	(1)	—	—	115H (3)	(3)	(3)
10019 (Cu)	750	—	U39RT (3)	—	—	—	106H (3)	—	—
20019 (Al/Cu)	750	—	U39ART (4)	—	—	—	125H (5)	(3)	(3)
11019 (Cu)	750	—	U39RT (5)	—	—	—	106H (4)	—	—
CI-750 (Al/Cu)	750	—	S39ART (3)	—	—	—	140H (3)	(3)	—
10024 (Cu)	1000	—	S44RT, P44RT (4)	—	—	—	125H (3)	—	—
20024 (Al/Cu)	1000	—	S44ART, P44ART (4)	—	—	—	140H (4)	—	—
11024 (Cu)	1000	—	S44RT, P44RT (4)	—	—	—	125H (4)	—	—

*Y45 and Y46 accept all Y35 dies ("U Series"). For Y45, use PT6515 adapter. For Y46, use PUADP adapter.

**Anderson VC6-3, VC6-FT, VC8C and Burndy Y1000 require no die set.

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Electrical Markets Division

6801 River Place Blvd.
Austin, TX 78726-9000
800.245.3573
Fax 800.245.0329
www.3M.com/electrical

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78-8141-6313-1 Rev B