3M™ Cold Shrink Three Conductor Transition Splice Kit QS2013-3T-3C

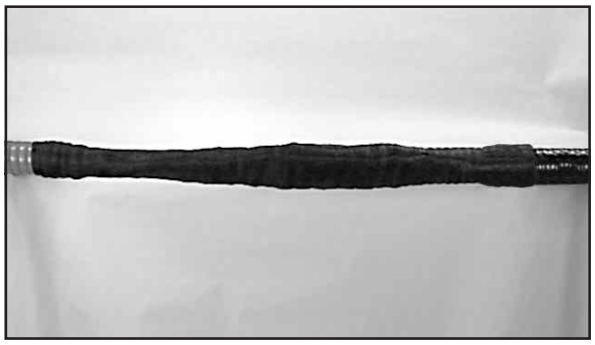
Instructions

for Three Conductor Shielded or Belted PILC to Three Conductor Shielded Poly/EPR Insulated Cable

IEEE Std. 404
15 kV Class
110 kV BIL

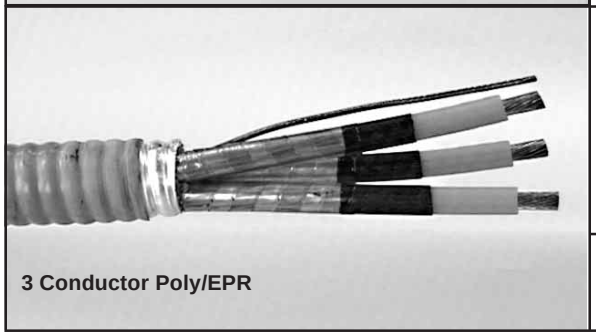
For Three Conductor PILC cable, a minimum of 42" (107 cm) of exposed lead is required for splice.

For Three Conductor Poly/EPR cable, a minimum of 54" (137 cm) of exposed jacket is required for splice.



3 Conductor PILC (Belted)

3 Conductor PILC



3 Conductor Poly/EPR

Cable Size Range Requirements

PILC Conductor Size	400 - 800 kcmil (200 - 400 mm^2)
Poly/EPR Conductor Size	500 - 750 kcmil (240 - 375 mm^2)
Poly/EPR Insulation O.D.	1.12" to 1.70" (28,0 - 43,0 mm)

Connector Dimensional Requirements

	Minimum inches (mm)	Maximum inches (mm)
Outside Diameter	1.10" (28 mm)	1.66" (42 mm)
Length Aluminum (Al/Cu)	2.0" (51 mm)	6.5" (165 mm)
Length Copper (Cu)	2.0" (51 mm)	7.5" (190 mm)

3M Cold Shrink Three Conductor Transition Splice Kit QS2013-3T-3C

78-8121-1000-1-D

Contents:

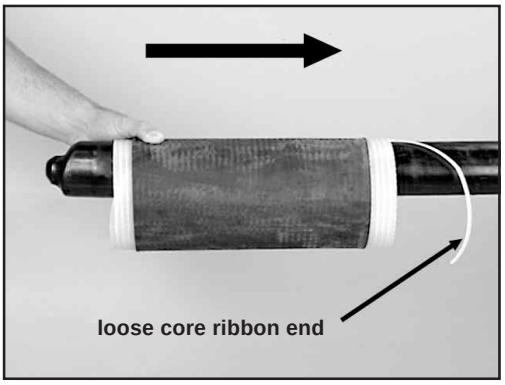
1.0 Prepare PILC Cable

Note: ***Use Components From Bag #1.***

1 - large Cold Shrink sheath seal jacket tube
1 - plastic sheath seal mold
1 - Cold Shrink oil stop tube for lead
1 - *roll Scotch® Super 33+ Tape*
2 - 1 1/2" x 1 3/4" (38 mm x 44 mm) mastic pads
1 - folded inner sheath seal

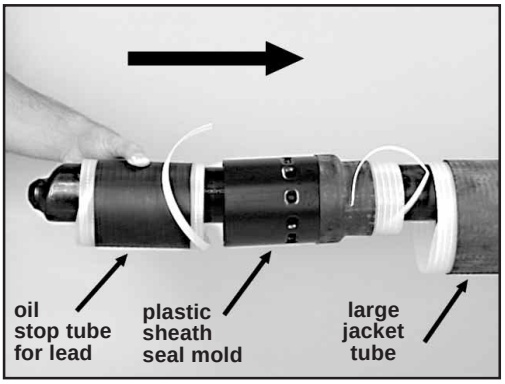
1.1 Train the PILC cable end into splice position.

A minimum of 42" (107 cm) of exposed PILC is required.



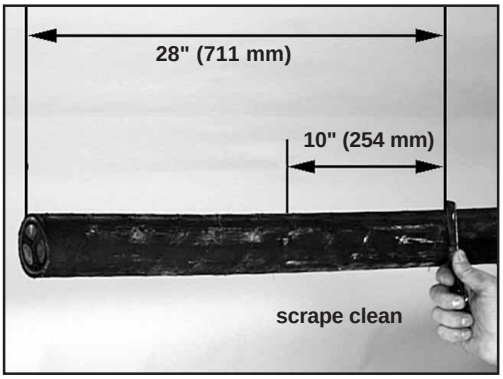
1.2 Slide large Cold Shrink jacket tube onto PILC cable with the loose core ribbon end going on first.

1.3 Slide plastic sheath seal mold and Cold Shrink oil stop tube for lead onto PILC cable with loose core ribbon ends going on first.



1.4 If PILC cable has a jacket, remove 28" (711 mm) from cable end.

1.5 If surface irregularities can be seen on the surface of the exposed lead, scape the surface of the lead smooth for a distance of 10" (254 mm) from the 28" (711 mm) dimension toward cable end.

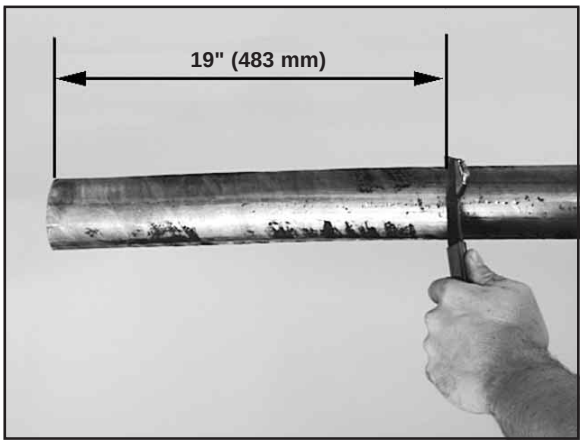


Note: ***Completely remove any surface irregularities from lead surface (grooves, nicks and etc.)***

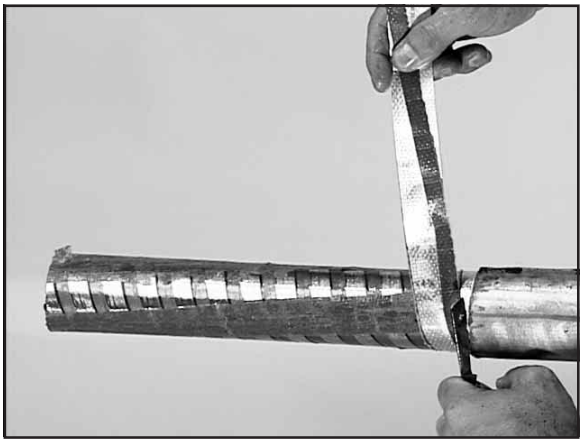
1.6 Ring Score the lead 19” (483 mm) from cable end.

1.7 Remove 19” (483 mm) of lead from cable end.

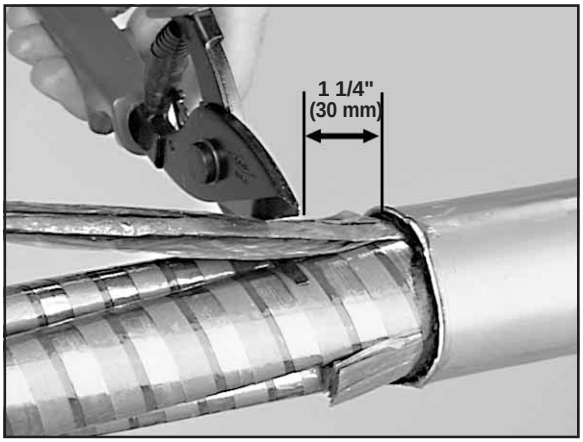
Note: ***Do not bell the end of the lead. Remove any sharp edges at end of lead.***



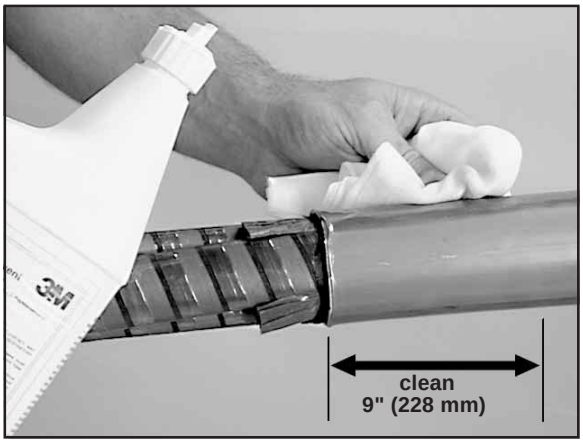
1.8 Remove paper and/or metallic binder from around cable conductors to the end of the lead.



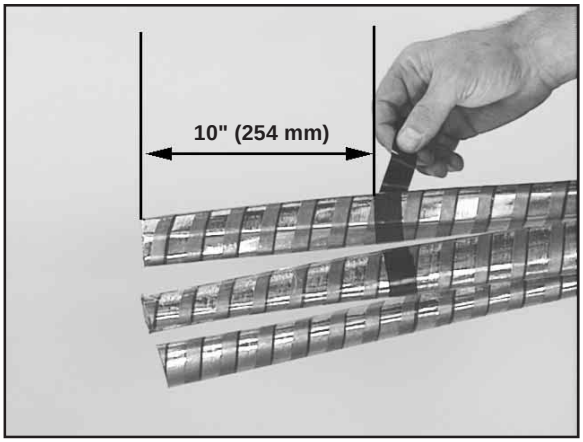
1.9 Separate conductors and remove cable fillers from sides and center of conductors to 1 1/4” (30 mm) from the end of the lead.



1.10 Clean 9” (228 mm) of exposed lead using a solvent cleaner approved for use on power cables.

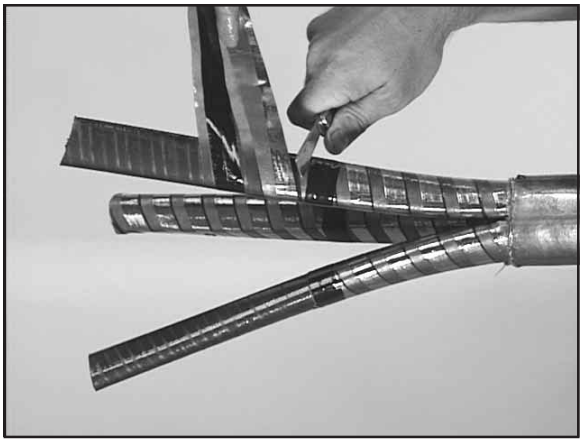


1.11 Bind the metallic shield of each conductor at a point 10” (254 mm) from conductor ends with two wraps of vinyl tape.



1.12 Remove metallic shield and black semi-conductive paper from conductor ends to the vinyl tape binder.

Note: ***If black carbon deposits can be seen on the surface of the exposed cable insulation, remove the top layer(s) of paper insulation to the vinyl tape wrap.***

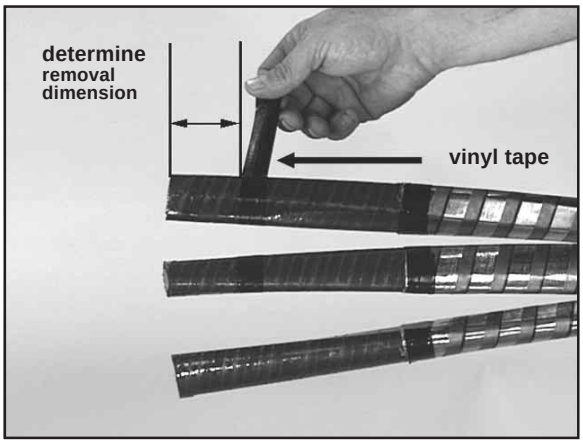


Connector Dimension Table

Connector	Min. Length	Max Length
Copper	2" (51 mm)	7 1/2" (191 mm)
Aluminum	2" (51 mm)	6 1/2" (165 mm)

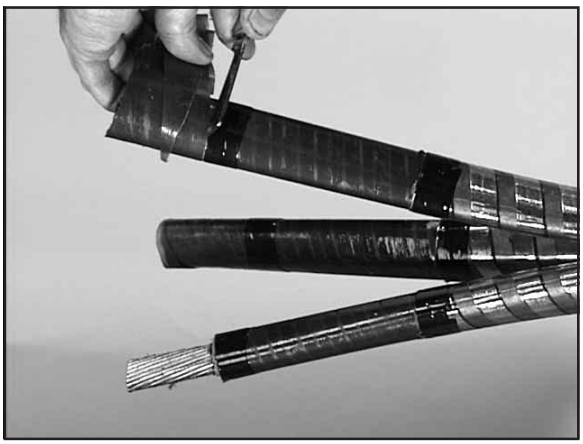
1.13 The insulation removal dimension for the 3M™ Scotchlok™ Connectors 2000T series sized 400-800 kcmil (either copper or aluminum) is 3 1/4” (82 mm).

Note: ***Determine insulation removal dimension for connectors other than the Scotchlok connectors 2000T series by adding together the depth of connector barrel, plus any growth resulting from crimping, plus 1/ 2” (13 mm).***



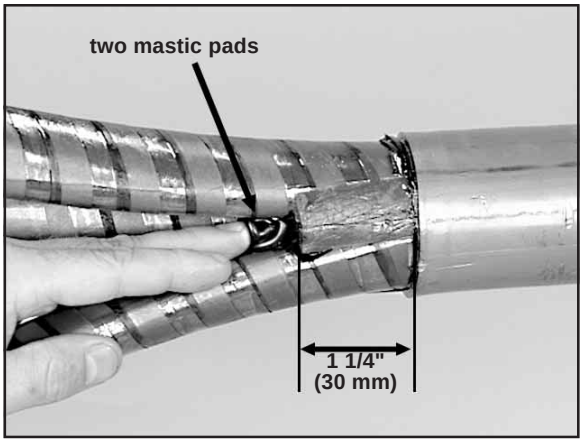
1.14 Bind the paper insulation at the determined cutback dimension with two wraps of vinyl tape.

1.15 Remove insulation from conductor ends to the vinyl tape binding. Leave all bindings in place throughout installation. **DO NOT REMOVE vinyl tape bindings.**



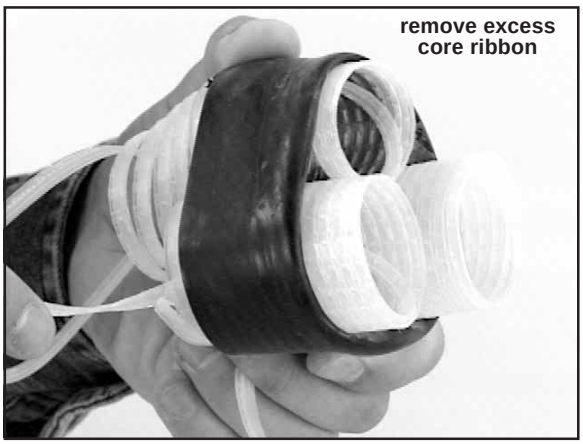
Checkpoint: Check all PILC cable cutback dimensions before proceeding.

1.16 Two 1 1/2" (38 mm) wide by 1 3/4" (44 mm) long mastic pads are provided to impede the flow of oil from between conductors during cable preparation. Force one or both pads of mastic between conductors to within 1 1/4" (30 mm) from lead. If conductors are tight together, the application of mastic may be omitted.



1.17 Prepare inner sheath seal for installation.

Before sliding part onto cable, **remove the excess core ribbon that extends beyond the folded rubber** by pulling on each loose core ribbon end.

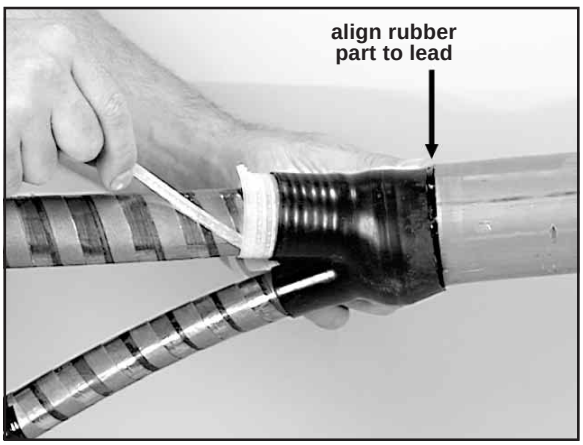


1.18 **Slide the folded inner sheath seal onto cable, with the fold of the rubber going on first.**

Ribbon ends of inner support cores should extend toward cable ends.

1.19 Push the inner sheath seal onto the cable until the core ends contact the cable fillers or cable belt insulation. Remove inner support cores from the rubber fingers by pulling while unwinding each loose core ribbon end in a counter-clockwise direction.

Unfold the folded rubber portion and pull the part if necessary **to align the rubber end with the end of the cable lead.**



2.0 Install Oil Stop

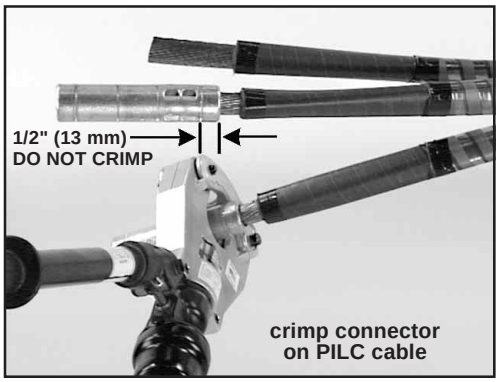
Note: ***Use Components From Bag # 2.***

3 - 3M Cold Shrink oil barrier tubes
3 - rolls of white restricting tape
1 - outer Cold Shrink sheath seal boot
1 - roll Scotch™ Rubber Splicing Tape 130C
1 - shield to lead continuity assembly

2.1 Install appropriately sized oil stop connectors onto the PILC cable conductors. Crimp the connectors per connector manufacturerôs directions.

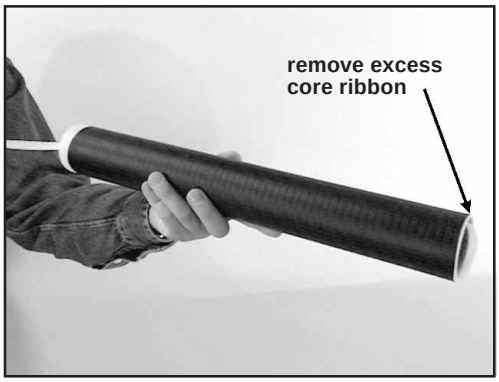
For crimp information on 3MÊ Scotchlok Connectors 2000T Series, consult the back page of these instructions.

DO NOT CRIMP CONNECTOR CLOSER THAN 1/2” (13 MM) FROM END.



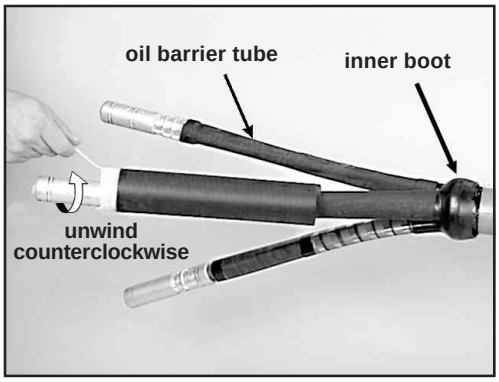
2.2 Special Cold Shrink oil barrier tubes may have several windings of core ribbon extending beyond end of rubber.

Before sliding tubes onto cable conductors, remove the excess core ribbon by pulling the loose core ribbon end.

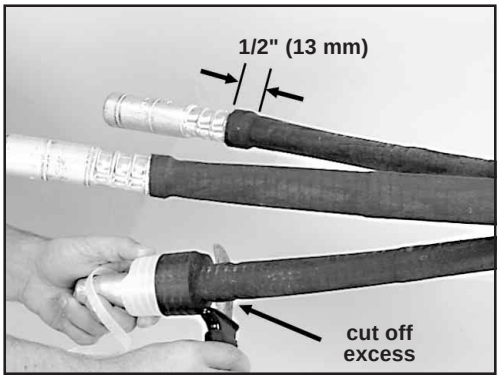


2.3 Slide special Cold Shrink oil barrier tubes onto cable conductors with the loose ribbon end extending toward cable end. Install each assembly as far as possible onto the fingers of the inner boot.

Remove core ribbon slowly by pulling, while unwinding the ribbon in a counter clockwise direction.

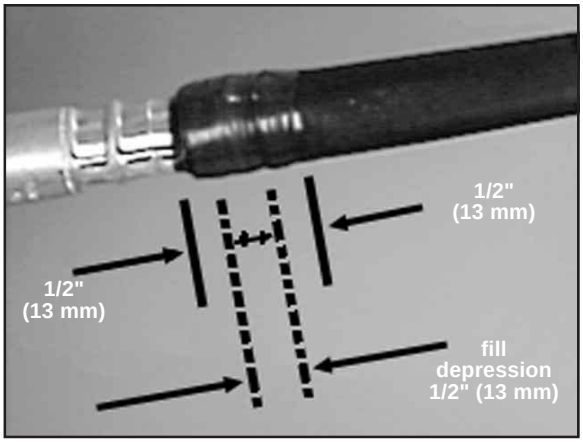


2.4 Oil barrier tubes should overlap 1/2”(13 mm) onto connectors. Any excess overlap should be cut off and discarded.



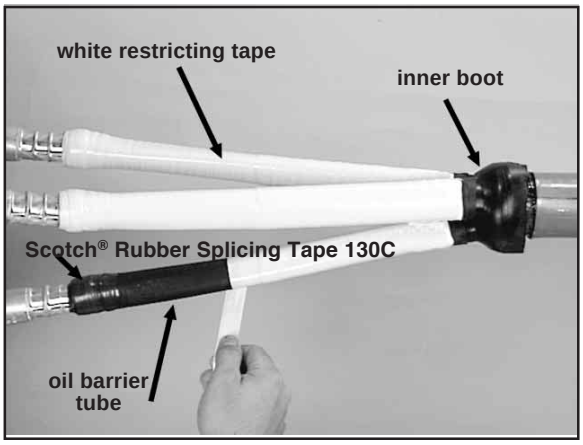
2.5 Fill in depression formed between oil/paper cable insulation and connectors with **highly stretched Scotch® Rubber Splicing Tape 130C.**

Apply final two half-lapped layers 1/2" (13 mm) onto cable insulation and 1/2" (13 mm) onto oil barrier tube over connector. If O.D. of connector is smaller than cable insulation, apply multiple wraps of Scotch® Rubber Splicing Tape 130C at connector end to increase diameter to approximate cable O.D.



2.6 Apply three half-lapped layers of white restricting tape (white tape with smooth surface) over oil barrier tubes and applied Scotch® Rubber Splicing Tape 130C. Start the tape at either end of the oil barrier tubes. **Apply the tape as smooth as possible.** To aid application, the white restricting tape may be applied in strips.

Note: ***Apply white restricting tape with constant tension to avoid wrinkling.***



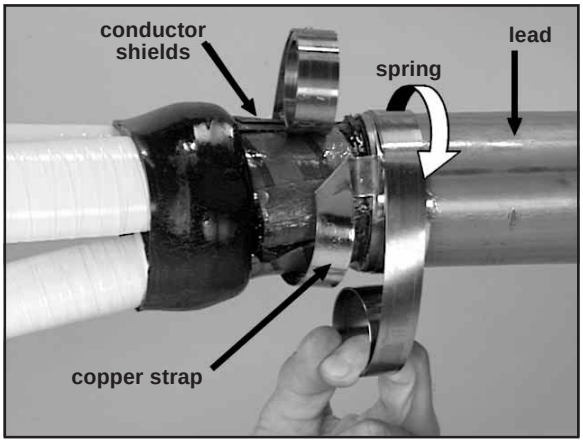
2.7 Fold the large section of the inner boot back over itself, exposing the shields of the phase conductors or belt insulation.

For Cable with Shielded Phase Conductors:

Install the shield to lead continuity assembly consisting of a bent tinned copper strap and two constant force springs. Wrap one end of strap around lead and pull the constant force spring over the top of it, allowing spring to unwrap and rewrap around itself. Install second spring in the same manner over the shields of the phase conductors.

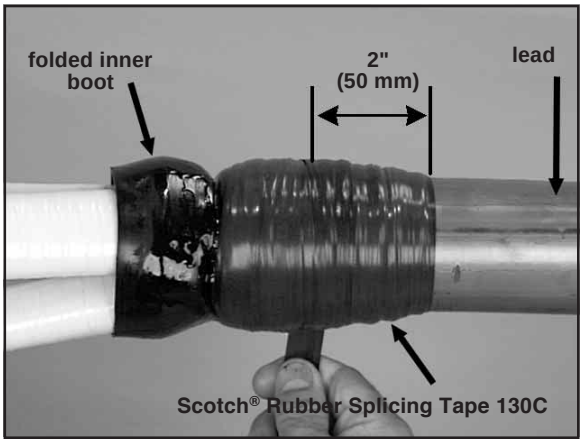
Note: ***If cable has a metallic binder around phase conductors the continuity assembly may be omitted.***

For Belted Cable: Do not install the shield continuity assembly when the cable is a belted type.



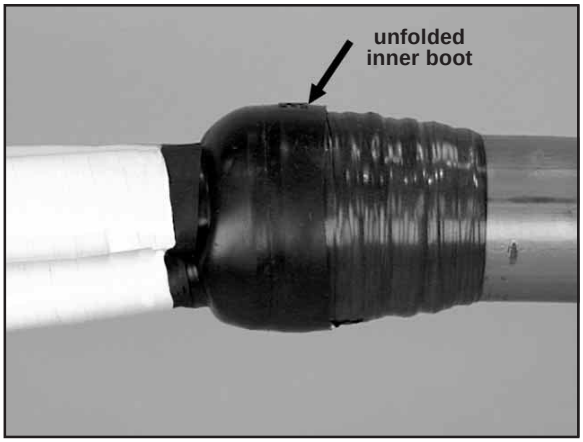
2.8 Apply multiple wraps of Scotch® Rubber Splicing Tape 130C between the folded inner boot and the end of the cable lead, over the shield continuity strap assembly or belt insulation. Extend the tape 2" (50 mm) onto the end of the cable lead, and apply over the shield continuity assembly if installed.

Highly elongate (stretch) the tape during application and only apply as much tape as is needed to provide a tight fit when the inner boot is unfolded over the tape.



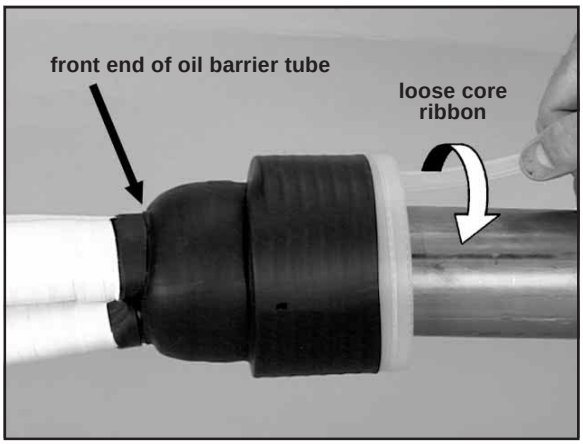
2.9 Unfold inner boot over the applied tape. If the boot is loose on the tape, refold the boot and apply additional tape where the boot overlaps the tape.

Only apply as much tape as is needed. An excess amount of tape will prevent the installation of the plastic sheath mold.



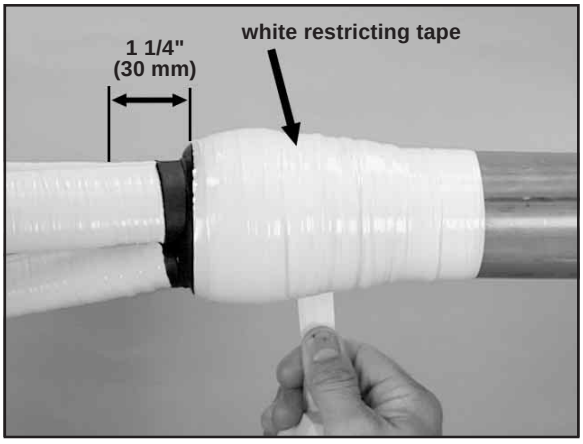
2.10 Position the oil barrier tube for lead (previously applied onto PILC cable) over the large portion of inner boot and applied Scotch® Rubber Splicing Tape 130C.

Install by pulling while unwinding the loose ribbon end in a counter clockwise direction.



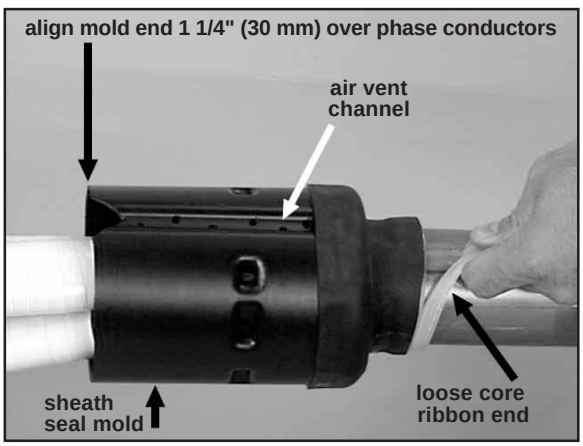
2.11 **Apply three half-lapped layers of white restricting tape over the oil barrier tube on lead.**

Start the tape on the lead at end of oil barrier tube. At this location, apply several wraps of the tape until the tape build-up approximates the O.D. of the oil barrier tube, then half lap the tape while applying over tube.



2.12 Slide the plastic sheath seal mold over the inner boot. Align leading edge of mold 1 1/4” (30 mm) over the phase conductors where they extend from the inner boot (shown in 2.11).

Rotate the mold to **locate the notch in the leading edge and air vent channel at the top.** Lock mold into position by removing the inner support core by pulling while unwinding the loose core ribbon end counter clockwise.

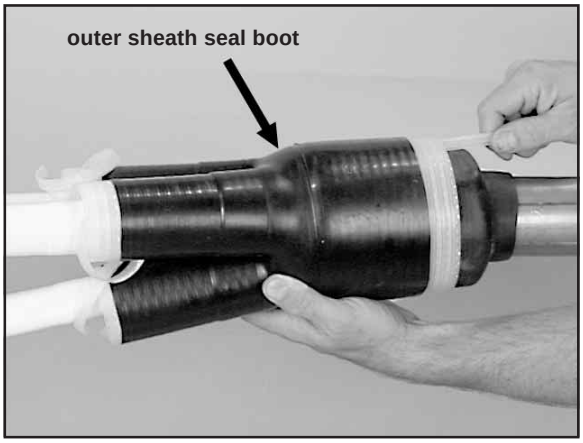


2.13 Remove excess core ribbon from fingers of outer sheath seal part in preparation for installation.

Remove the excess by pulling slowly on core's loose ribbon end until the core end on the inside is at the point where it is supporting rubber.

2.14 Slide the outer sheath seal boot onto the PILC cable with the large end going on first.

Pull the boot on until it is tight to the plastic sheath seal mold. Remove the large diameter core and then remove finger cores.

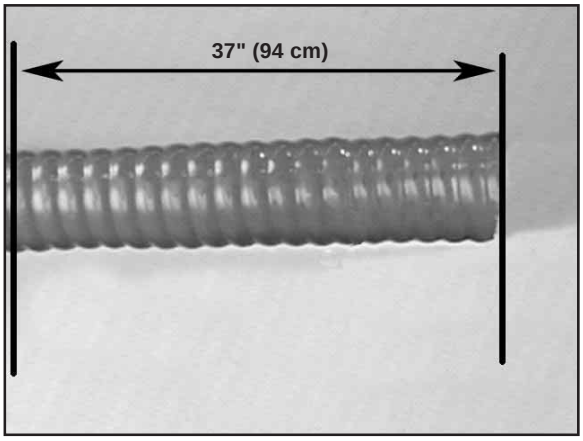


3.0 Install Splice Bodies

Note: ***Use Components From Bag # 3.***

1 - Large Cold Shrink splice jacket tube
1 - Small Cold Shrink splice jacket tube
3 - Cold Shrink splice bodies
1 - copper shield sleeve
4 - tubes of 3M™ Red Compound P55/R

3.1 Cut end off the three conductor Poly/EPR cable squarely and remove 37" (94 cm) of cable jacket from cable end. Save the cable jacket for use later in these instructions.

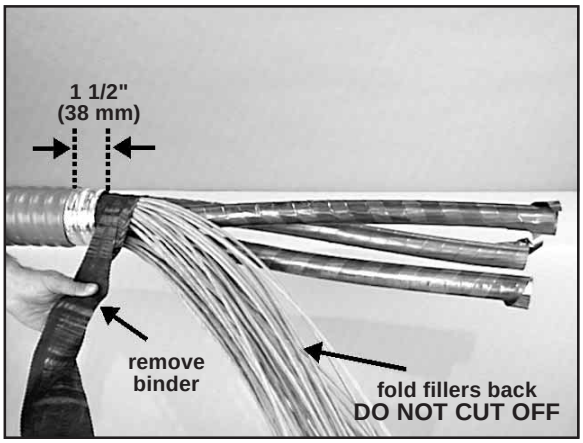


3.2 If cable is armored, remove cable armor leaving 1 1/2" (38 mm) armor exposed beyond jacket end.

Remove cable binder , if present, at the end of the jacket or armor and discard.

Fold cable fillers and ground wire(s) back over cable jacket end. Do not cut off.

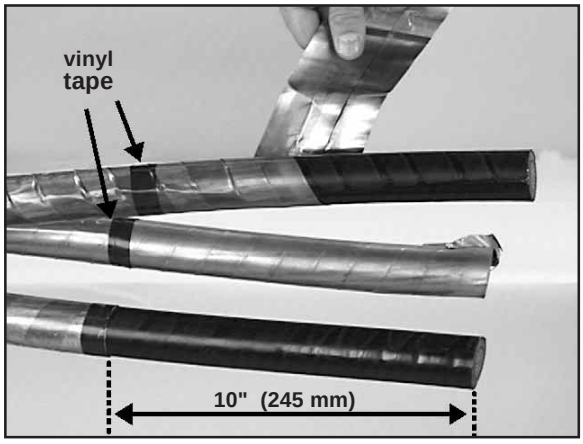
Temporarily hold the fillers and ground wire(s) back by banding them to the cable jacket using Scotch® Super 33+™ Vinyl Tape included in kit.



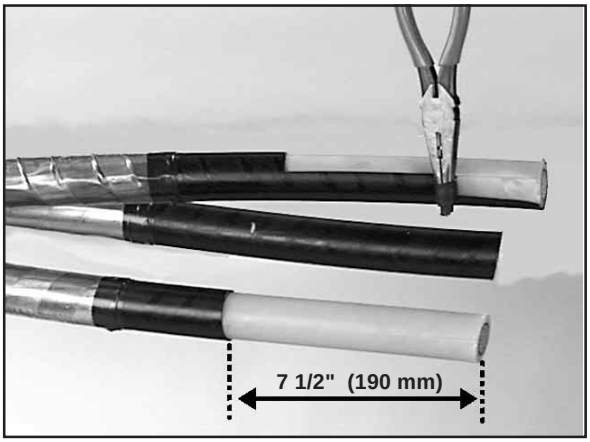
3.3 If the conductors are individually jacketed, remove the individual jackets a distance of 13” (319 mm) from the end of each conductor.

Bind the metallic shields of the Poly/EPR cable conductors with a wrap of 33+ vinyl tape at a point 10” (245 mm) from the end of each conductor.

Remove the metallic shields to the vinyl tape binding .



3.4 Remove cable semi-conductive insulation shields from conductors to a distance of 7 1/2” (190 mm) from the end of each conductor.

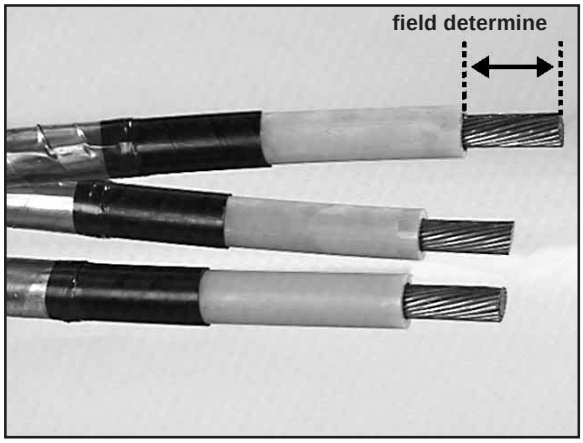


3.5 Remove cable insulation from conductors ends.

Remove insulation the depth of the connector barrel plus an allowance * for increase in connector length due to crimping.

If using 3M™ Scotchlok™ Connectors 2000T series sized 500 -1000 kcmil (240-500mm), remove 2 1/2" (65mm) of cable insulation from cable end.

Do not install connectors now.



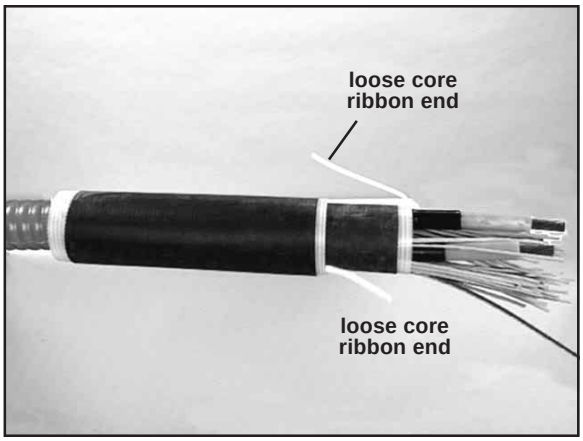
Note:** **This assumes that the installer has determined the increased length of an aluminum connector crimped with a specific tool and die. Copper connectors do not require a length change allowance. Clean exposed cable insulation using a solvent approved for use on Power Cables.

Checkpoint: Check all 3/C Poly/EPR cable cutback dimensions before proceeding.

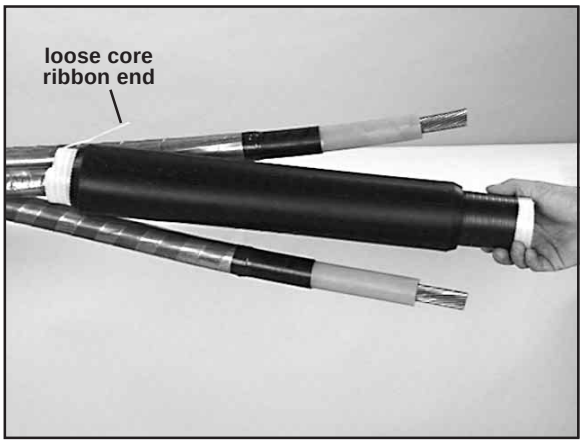
3.6 Slide the large splice jacket tube onto the Poly/EPR cable with the loose core ribbon end going on the cable last, toward cable end.

Slide the smaller splice jacket tube onto the Poly/EPR cable with the loose core ribbon end going on the cable last, toward cable end.

The smaller jacket tube should slide into the larger jacket tube to minimize parking distance.

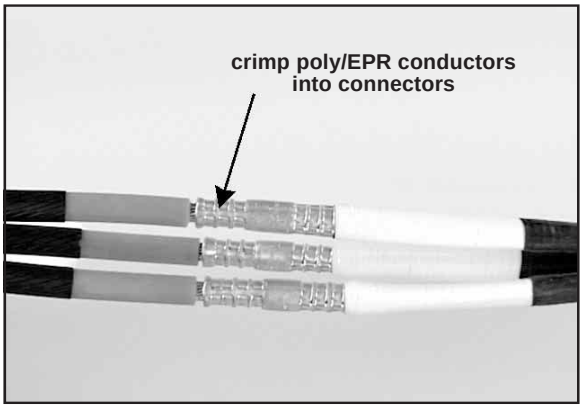


3.7 Slide a Cold Shrink splice body onto each conductor of the Poly/EPR cable with the loose core ribbon end going on the cable first, away from cable end.



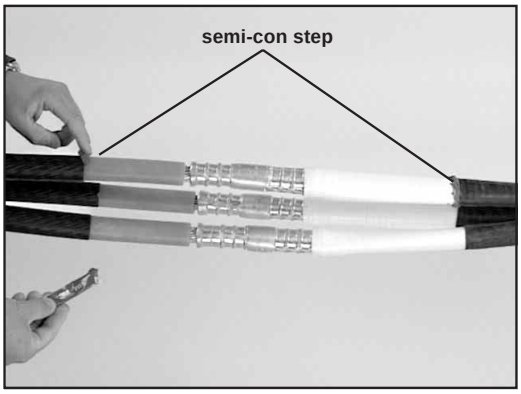
3.8 **Expand the diameter of the shield sleeve** by compressing the sleeve ends together and slide the sleeve into park position on the PILC cable.

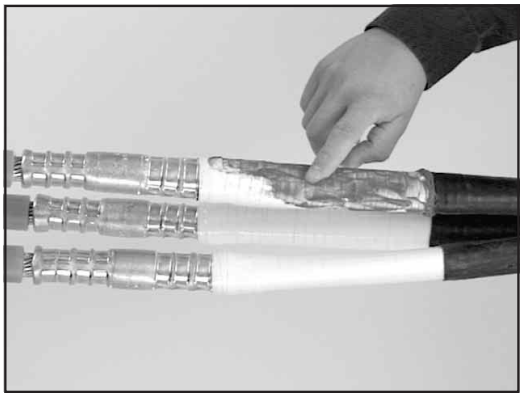
3.9 **Crimp poly/EPR cable conductors** into connectors. Follow connector manufacturers directions when crimping.



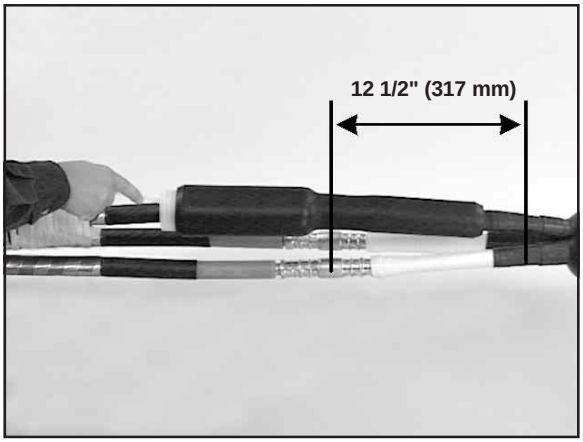
3.10 **Apply a liberal amount of 3M™ Red Compound P55/R at the semi-con step of both cables and over the white restricting tape on PILC cable.** Any extra compound may by applied along Poly/EPR insulation surface.

IMPORTANT: <u>DO NOT SUBSTITUTE</u> SILICONE GREASE FOR 3M Red Compound P55/R.





3.11 Place a mark on PILC cable conductor 12 1/2" (317 mm) from connector center. **Slide splice body over connector and align leading edge of semi-con extension to mark.** Slowly pull while unwinding the inner support ribbon.



4.0 Install Splice Shields

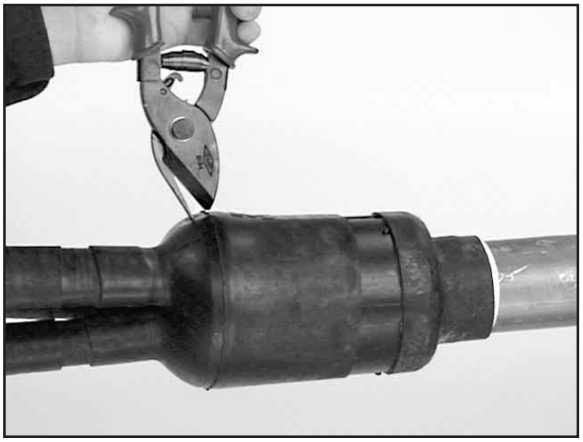
Note: ***Use Components From Bag #4:***

3 - U shaped ground braids
1 - roll Scotch® Rubber Mastic Tape 2228
3 - small constant force springs
1 - roll Scotch® Electrical Shielding Tape 24
5 - large constant force springs
3 - copper overlap connectors
6 - rolls Scotch® Vinyl Tape Super 88

Packed separate in box:

5 - rolls Sheath Wrap
2 - rolls 3M™ Scotch-Seal™ Mastic Tape 2229
1 - Scotchcast™ 4N Resin (in gallon can)

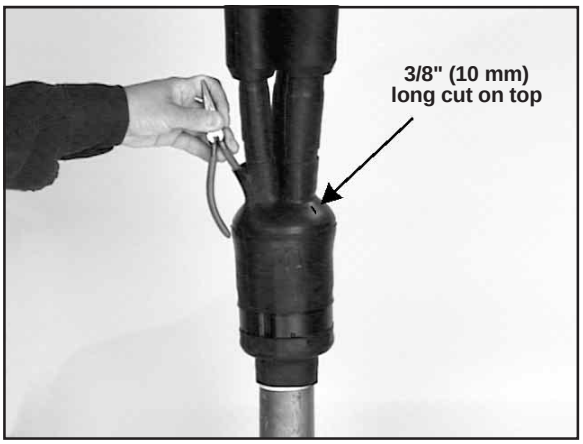
4.1 **For Horizontal Installation:** Cut a slit using a diagonal cutter or similar tool 3/8" (10 mm) long in the top of the sheath seal boot where the notch section in the plastic mold part can be felt.



4.1.1 **For Vertical Installation:** Lubricate a handle of diagonal cutter, plier or similar tool, with a light film of 3M™ Red Compound P55/R.

Insert the lubricated handle down the interface between a finger extension of the outer sheath seal and phase shield tube. The inserted tool handle provides an air vent. Air will escape from the sheath seal along the sides of the tool handle while the resin is injected.

Make a 3/8" (10mm) long cut in the top of the sheath seal on the opposite side of the inserted tool handle. Resin will be injected through the cut in the rubber.

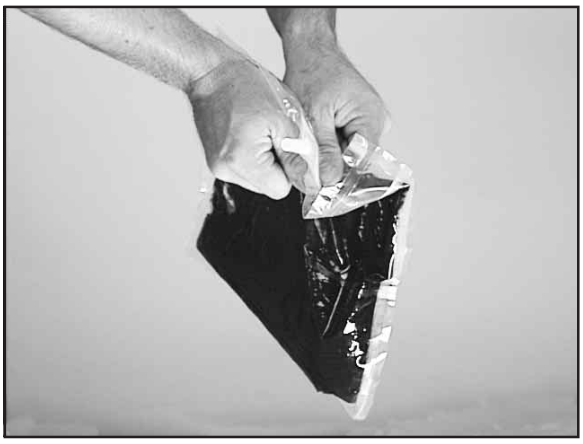


4.1.2 **For Vertical Installation:** Apply vinyl tape around the exposed plastic portion of the sheath seal to close off the vent channel.

4.2 Tear the top off the foil guard bag containing the 3M™ Scotchcast™ Resin 4N. Remove the resin bag and place a thumb on each side of the bag next to the barrier strip that keeps the resin from the hardener. Roll thumbs towards the barrier, forcing it to separate. Pull outward on the sides of the bag, allowing the resin to mix with the hardener. Squeeze the bag 30 to 40 times to force the compound to mix.

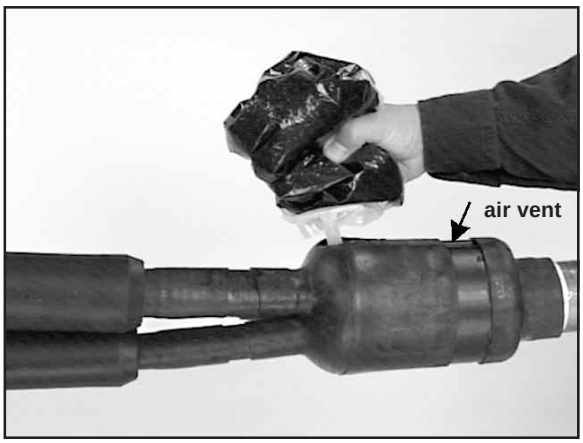
4.3 Separate the barrier next to bag nozzle by positioning thumbs the same way as before. Allow compound to flow into the injection nozzle.

4.4 Inject Scotchcast Resin 4N .

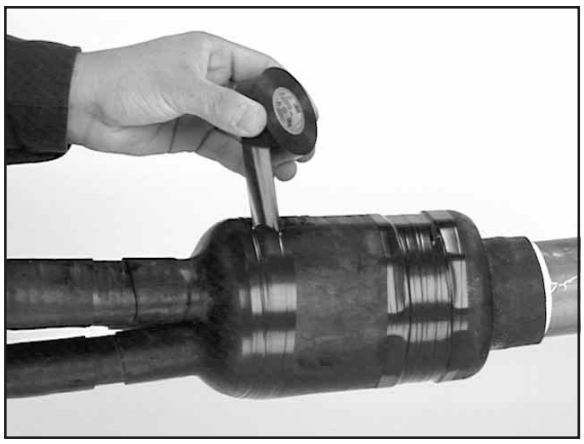


4.4.1 **For Horizontal Installation:** Insert nozzle into the cut in the rubber sheath seal boot and squeeze bag to force compound from bag to sheath seal.

When compound is visible in the air vent channel of the rigid plastic part, the sheath seal is full.

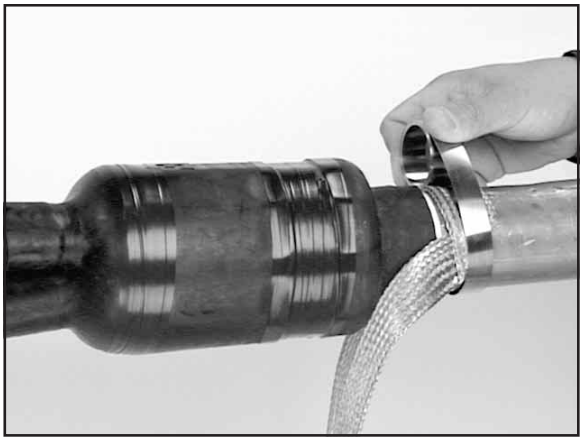


4.4.2 **For Horizontal Installation:** Apply one half-lapped layer of vinyl tape around the resin filled boot to cover the air vent channel and the resin injection hole.

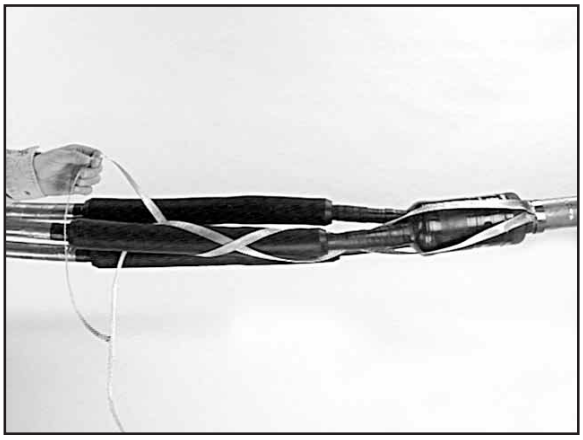


4.4.3 **For Vertical Installation:** Insert the nozzle into the cut in sheath seal and squeeze bag to force the compound from the bag to the sheath seal. When compound is visible along the sides of the inserted tool handle, the sheath seal is full. Remove the nozzle and tool handle from sheath seal finger extension when full. Wipe tool handle clean.

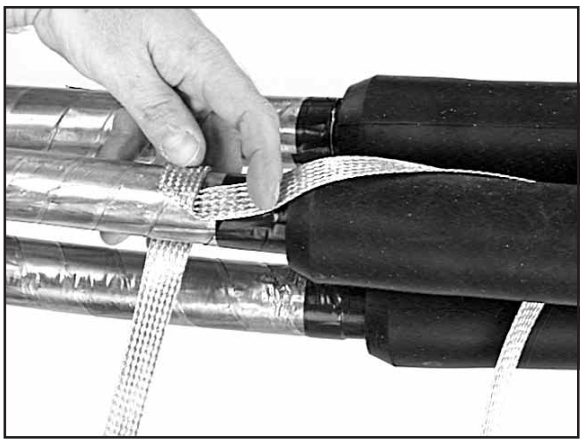
4.5 **Install the three U-shaped ground braids** by wrapping center section of each braid around the PILC cable lead. Make the first connection next to the sheath seal and make subsequent connections next to each preceeding connection.



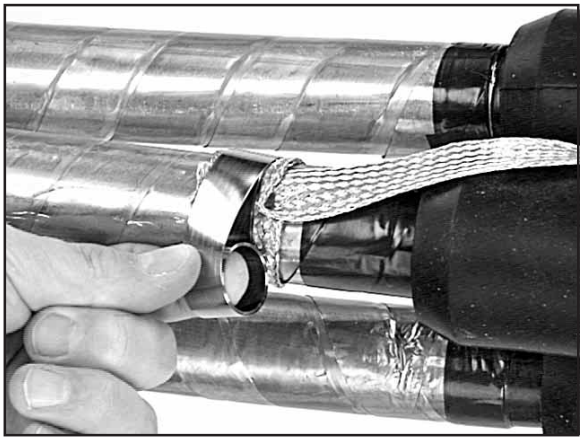
4.6 Extend braid tails toward the 3/C poly/EPR cable and spiral wrap the two tails from each braid around each splice body.



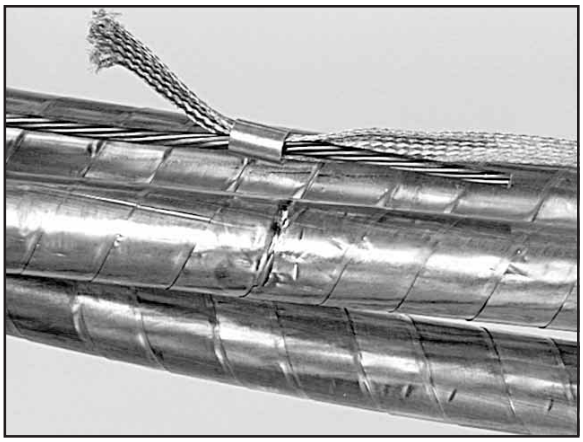
4.7 Connect one tail of each ground braid to the shield of each phase on the 3/C Poly/EPR cable. Make a 90° bend in the braid over the shield, wrap one turn around shield and cut off excess braid.



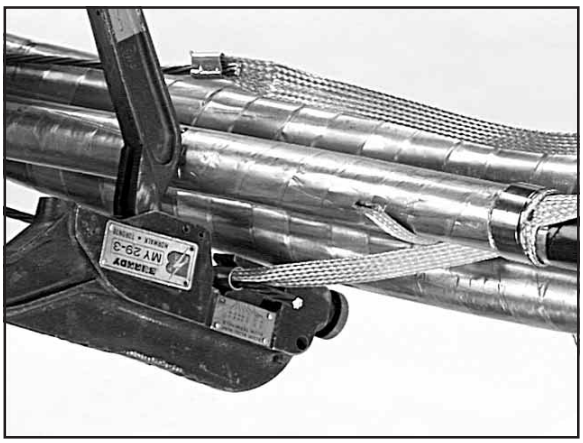
Secure tail wrap with a small constant force spring.



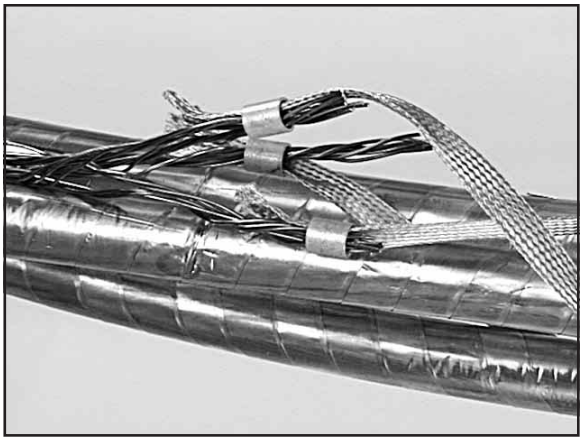
4.8 Using the three copper overlap connectors, connect the remaining ground braid tails to the 3/C Poly/EPR cable ground wires. If the cable has three ground wires, connect one wire to each tail. If the cable has a single ground wire, separate the wire strands into thirds and connect to each tail. After crimping, trim off excess ground braid and ground wire next to the connector. File off or cover any sharp edges with tape.



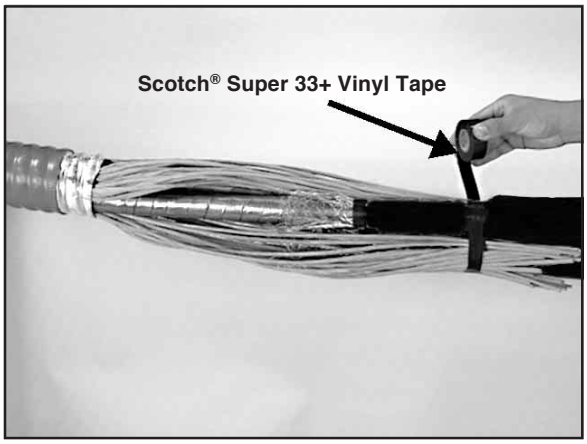
4.8 (crimping)



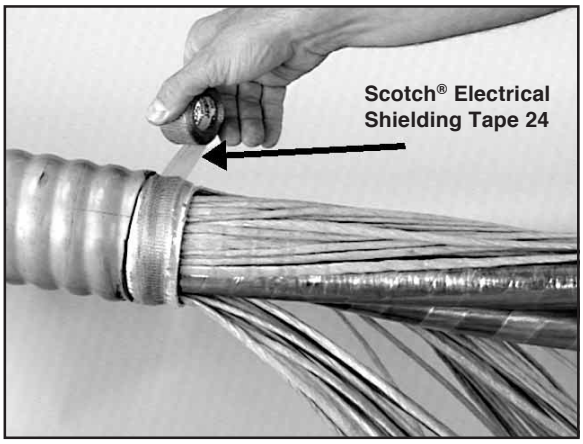
4.8 Single ground wire, divided into three separate groups. Crimp one group per braid.



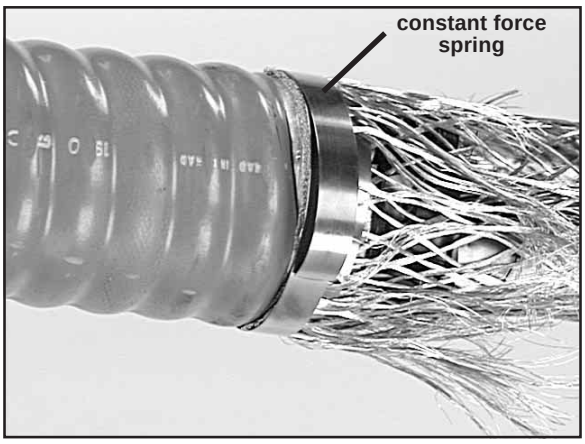
4.9 Unfold the cable fillers on the Poly/EPR cable side and nest the filler strands back to their original position between the phase conductors. Bind the fillers in place with bands of Scotch® Super 33+ Vinyl Tape.



4.10 Apply multiple wraps of Scotch® Electrical Shielding Tape 24 around the armor to fill the valleys in the corrugated armor. Half hitch the shield tape to the tie off the end.



4.11 Move the shield sleeve centering it over the splice bodies. Pull the ends of the shield sleeve toward the exposed lead and the 3/C Poly/EPR cable armor. Using large constant force springs, secure the shield sleeve to the lead (next to the last ground braid) and to the exposed armor on the 3/C Poly/EPR cable (over the 24 tape).



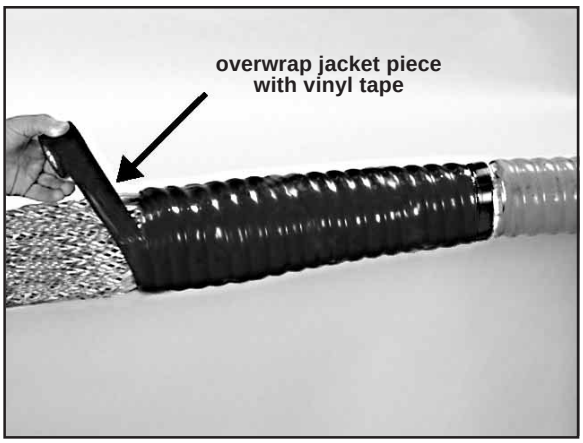
For non-armored cables:

Secure shield sleeve to individual conductor shields by wrapping constant force spring around all three conductor shields and shield sleeve next to cable jacket end.

Cover constant force spring on lead side with two half lapped layers of vinyl tape.

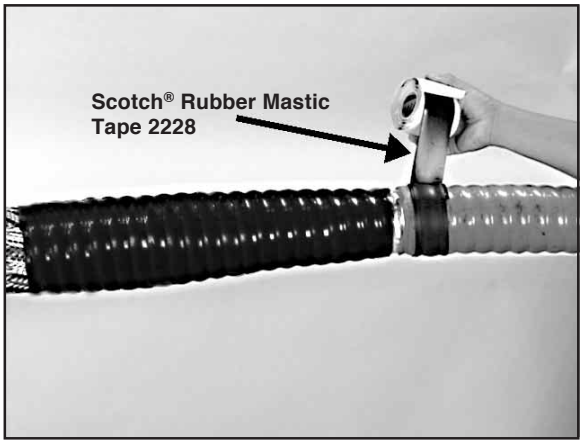
4.12 Cut a 27” (685 mm) long cable jacket piece (saved in step 3.1) and cover the cable fillers on the Poly/EPR cable side with the jacket. Overwrap the the constant force spring connection (if installed) and jacket piece with one half lapped layer of 1 1/2” (38 mm) wide Super 88 tape.

4.13 Use Super 88 tape to bind the three splice bodies together to minimize space between them.



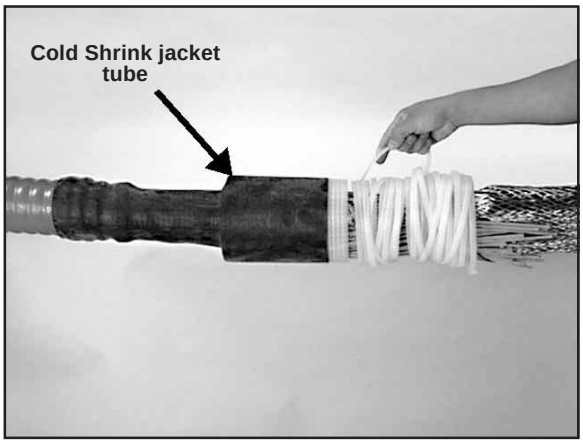
4.14 At the jacket end of the three conductor Poly/EPR cable, apply four wraps of Scotch® Rubber Mastic Tape 2228 around the cable jacket, 1/2” (13 mm) from jacket end.

Stretch the tape to 75% original width when applying.

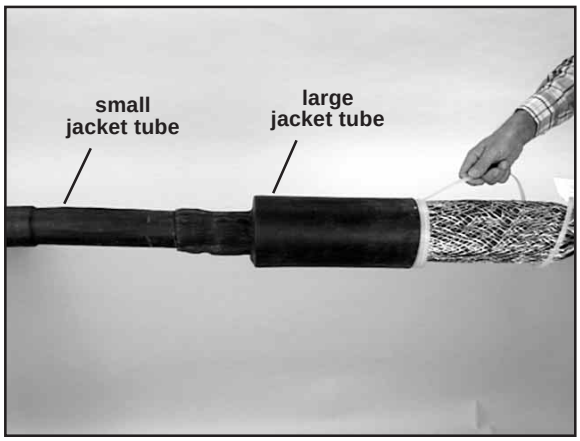


4.15 Move the small Cold Shrink jacket tube tube over the splice area with the trailing end just covering the Scotch® Rubber Mastic Tape 2228 and remove the inner support core ribbon. **To install, pull while unwinding the loose core ribbon end in a counterclockwise direction.**

4.16 Wrap four lapped layers of Scotch® Rubber Mastic Tape 2228 over the end of the small jacket tube, 1/2” (13mm) from tube end closest to the PILC cable. (Apply mastic using technique detailed in step 4.14).

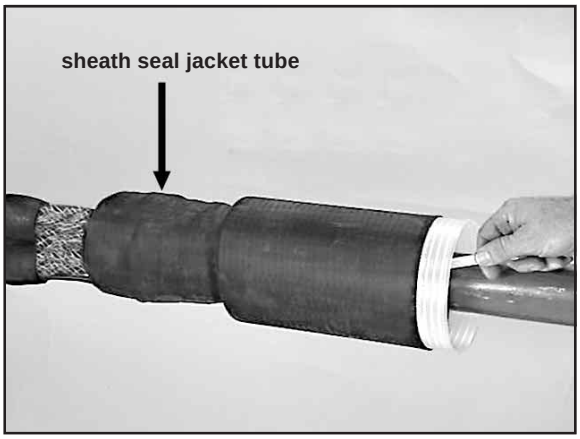


4.17 Position the large Cold Shrink jacket tube as far as possible over the splice bodies while overlapping the Scotch® Rubber Mastic Tape 2228 wrap applied to end of small jacket tube. **Remove the inner support core by pulling while unwinding the loose core ribbon end in a counterclockwise direction.**

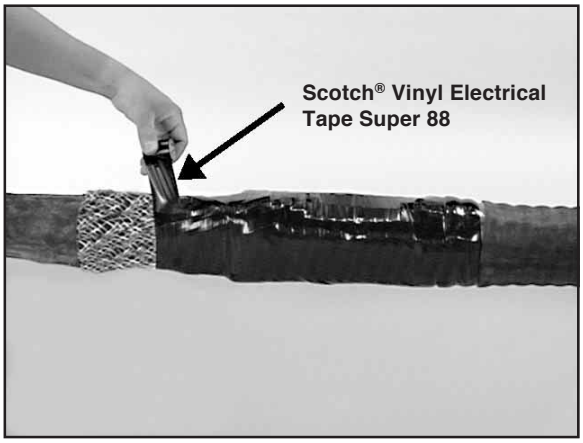


5.0 Seal and Jacket Lead End

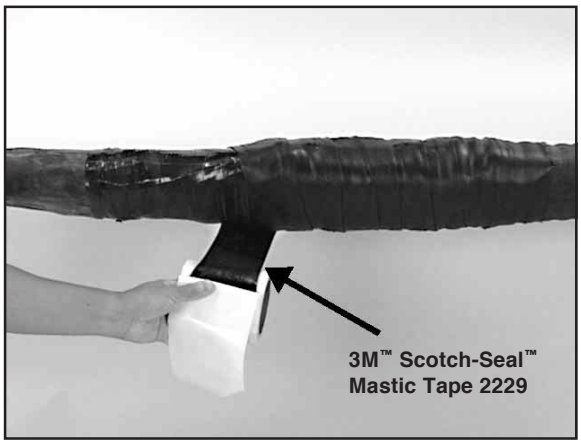
5.1 Position Cold Shrink sheath seal jacket tube over sheath seal. **For horizontal installation**, the leading tube end should extend beyond resin inject hole and previously applied vinyl tape. **For both horizontal and vertical installations**, tube should completely cover the body of the sheath seal boot, constant force springs and any exposed lead between constant force springs and PILC cable jacket. Remove core ribbon by pulling while unwinding the loose core ribbon end.



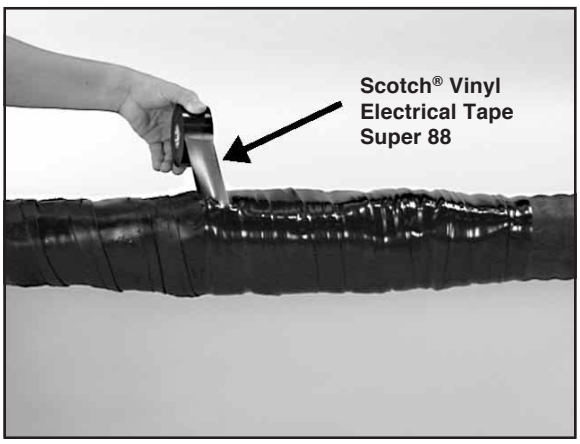
5.2 Apply one half-lapped layer of Scotch® Vinyl Electrical Tape Super 88 over the unjacketed area of the splice. Do not overlap the Cold Shrink jacket tubes at splice ends.



5.3 Apply two half-lapped layers of 3 3/4" (95 mm) wide 3M™ Scotch-Seal™ Mastic Tape 2229 over applied vinyl tape in splice center. Overlap ends of Cold Shrink jacket tubes 2" (51 mm).



5.4 Cover the applied Scotch-seal mastic tape 2229 with two half lapped layers of Scotch® Vinyl Electrical Tape Super 88.

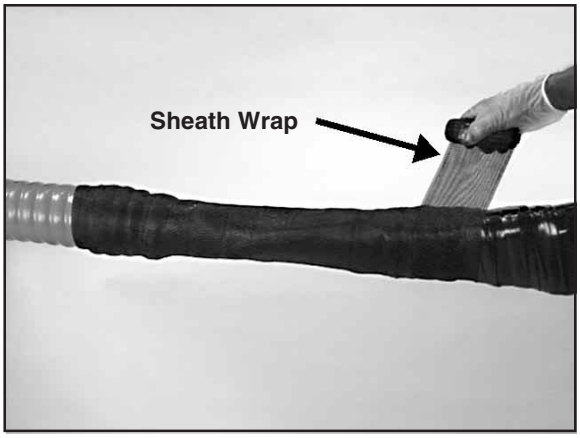


5.5 Overwrap the entire splice with a minimum of two half lapped layers of 3M™ Sheath Wrap.

Tear open the top end of the foil 3M™ Sheath Wrap container and fill foil container half full with water.

Squeeze the container four or five times allowing the water to penetrate the roll. Pour out water, remove roll from foil container and immediately apply to splice area.

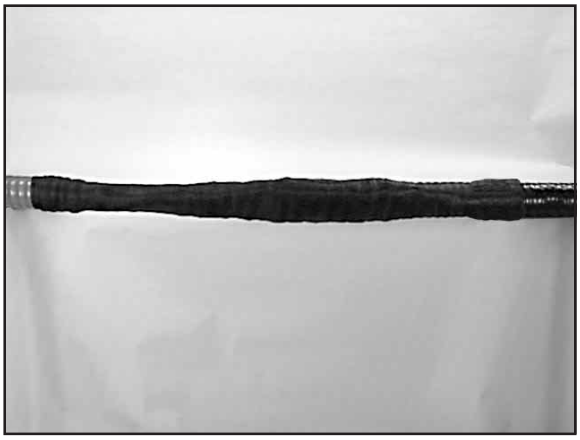
Bind the final wrap in place with vinyl tape.



Note: Wear rubber gloves provided when handling 3M™ Sheath Wrap. The resin contains a black die that will stain human skin.

3M™ Sheath Wrap can be applied first and then sprayed with water to activate the curing system It will also cure from moisture in the air in humid conditions.

5.6 Splice is complete.



Aluminum Connectors (Copper/Aluminum)

Conducto Size (kcmil)	CRIMPING TOOL–DIE SETS (NO. OF CRIMPS/END)					
	Burndy	Kearney		Thomas & Betts		Anderson
	Y35, Y39, Y45*, Y46*	WH–1, WH–2 WH–3, PH15	PH25	TBM 12	TBM14M TBM 15	VC6
400	U31ART (2)	1–1/8 to 2 (2)	1–1/8 to 1 (1)	87H (3)**	87H (3)**	Universal (3)
450 500 550	U34ART (3)	1–5/16 (3)	1–5/16 (1)	106H (3)**	106H (3)**	Universal (3)
600 650 750	S39ART (3)	1–1/2 (3)	1–1/2 (1) 1–19/32 (3)	125H (3)**	125H (3)**	—
800 1000	S40ART (3)	1–1/2 (3)	1–1/2 (1) 1–19/32 (3)	140H (3)**	140H (3)**	—

*** Y45 and Y46 accept all Y35 dies ("U" series). For Y45 use PT6515 adapter. For Y46 use PUADP adapter.**
**** Anderson VC6–3 and VC6–FT require no die.**

Copper Connectors

Conductor Size (kcmil)	CRIMPING TOOL–DIE SETS (NO. OF CRIMPS/END)					
	Burndy		Thomas & Betts			Anderson
	Y34A	Y35, Y39, Y45*, Y46*	TBM 5 TBM 8	TBM 12	TBM 14M TBM 15	VC6–3, VC6–FT**
500	A34R (2)	U34RT (2)	Brown (3)	87H (3)**	87H (3)**	Universal (2)
750	—	U39RT (3)	—	106H (3)**	106H (3)**	FT only (3)
1000	—	S44RT (4) P44RT (4)	—	125H (3)**	125H (3)**	—

*** Y45 and Y46 accept all Y35 dies ("U" series). For Y45 use PT6515 adapter. For Y46 use PUADP adapter.**
**** Anderson VC6–3 and VC6–FT require no die.**

3M

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