# 3M<sup>™</sup> Cold Shrink QS-III Silicone Rubber Splice Kit 5488A-TOW/WOT

For Tape Over Wire (TOW) and Wire-Over-Tape (WOT) Shielded Cable

For 250–2000 kcmil cable with 650-mil primary insulation thickness

## Instructions

### IEEE Std. No. 404

69kV Class 350 kV BIL IEC 60840 72kV Class 325kV BIL

### A 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	Primary Insulation 0.D. Range Conductor Size	
5488A	1.94–3.08" (49,3–75,4 mm)	250–2000 kcmil (125–1000 mm²)

Table 1

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## **Kit Contents**

- 1 Silicone Rubber Splice Body
- 2 Jacketing Tubes
- 1 Shielding Sleeve, 7'
- 1 Pre-formed Ground Braid Assembly
- 7 Constant Force Springs
- 6 3M<sup>™</sup> Red Compound P55/R Tubes (non-silicone grease)
- 2 Rolls 3M<sup>™</sup> Scotch-Seal<sup>™</sup> Mastic Tape 2229, 1" x 3.5'
- 4 Rolls Scotch<sup>®</sup> Rubber Mastic Tape 2228, 2" x 36"
- 1 Roll Scotch<sup>®</sup> Electrical Shielding Tape 24, 1" x 15'
- 1 Pad Scotch<sup>®</sup> Electrical Semi-conducting Tape 13, 18" x 35"

- 2 Rolls Scotch<sup>®</sup> Vinyl Electrical Tape Super 88, 1<sup>1</sup>/<sub>2</sub>" x 44'
- 4 3M<sup>™</sup> Cable Cleaning Pads CC-3
- 3M<sup>™</sup> EMI Copper Foil Shielding Tape Strips 1811,
  15" long
- 4 Rolls Sheath Wrap Structural Material, 3" x 15'
- 1 Connector
- 1 Connector, Foil Pad
- 1 Connector, Instruction Sheet
- 3 Splice Instruction Booklets

Note: Utility Colth (Aluminum Oxide) abrasive materials are required for cable preparation, but are NOT INCLUDED IN KIT. Required grits are P180, P240 and P320. Available 3M<sup>™</sup> Utility Colth (Aluminum Oxide) Rolls UPC Codes are: P180: 51115-19788

P180: 51115-19786 P240: 51115-19786 P320: 51115-19784

Note: Do not use knives to open plastic bags.

## **1.0 Prepare Cable**

- 1.1 Check to be sure the cable fits within the kit ranges as shown in Table 1.
- 1.2 Prepare cables according to standard procedures. Refer to Figure 1 for proper dimensions. Copper foil tape strips are included to secure and cover the ends of the tape/LC shield. Approximately 30" (760 mm) additional distance is required on one cable to provide extra neutral wire length for connecting the neutrals.
- 1.3 Remove cable insulation for [B]. Insulation removal length shall not exceed 4 <sup>1</sup>/<sub>2</sub>" (114 mm) from conductor end. **Do not install connector now.**



Figure 1
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Conductor Size Kcmil (mm²)	Primary Insulation 0.D.* Inches (mm)	Semi-con Cutback [A] Inches (cm)	Insulation Cutback [B] Inches (mm)
250 - 600 (125 - 325)	1.94 - 2.24 (49.3 - 56.9)	13 ½ (34.3)	4 (102)
700 – 1000 (400 – 500)	2.25 - 2.60 (57.0 - 66.0)	13 ¼ (33.7)	
1100 - 1500 (600 - 800)	2.61 - 2.85 (66.1 - 72.4)	13 (33.0)	4 ½ (114)
1600 – 2000 (850 – 1000)	2.86 - 3.08 (72.5 - 75.4)	12 ¾ (32.4)	

\* Insulation OD is the final determining factor

1.4 Clean or cover the cable jackets if necessary, 36" (915 mm) from the cable jacket cutback.

## 2.0 Install Ground Braid Assembly (Optional)

### Note: If not grounding at this splice location, continue at step 3.0.

2.1 (Corrugated shielded cable only.) Fill the valleys on the corrugated shield with several wraps of Scotch<sup>®</sup> Electrical Shielding Tape 24. Half-hitch to tie off. Repeat for both cables. (*Figure 2*)



Figure 2

2.2 Select the pre-formed ground braid assembly from the kit. Pass the end of the cable through the ground braid assembly loop, and position the ground braid assembly around the tape shield or corrugated shield and Scotch<sup>®</sup> Electrical Shielding Tape 24 tape as shown. (*Figure 3*)



Figure 3

2.3 Select the 3 constant force springs from the kit. Starting at the loop of the ground braid assembly nearest the cable jacket edge, install the 3 constant force springs, one around each ground braid loop. Cinch (tighten) the springs after wrapping the final turn. Extend the ground braid tails down the cable jacket. (*Figure 4*)



Figure 4

- 2.4 Select the roll of 1" (25 mm) wide 3M<sup>™</sup> Scotch-Seal<sup>™</sup> Mastic Tape 2229 from the kit. Cut a length of the tape long enough to wrap around the cable jacket. Remove the release liner from the mastic and, using light tension, apply a single wrap of mastic around the cable jacket, positioned under the ground braid solder blocks. (*Figure 5*)
- 2.5 Secure the two tails of the ground braid assembly to the cable jacket approximately 6 inches (150 mm) from the cable jacket edge with several wraps of vinyl tape. (*Figure 5*)



Figure 5

2.6 Cut four 1" (25 mm) lengths of 1" (25 mm) wide 3M<sup>™</sup> Scotch-Seal<sup>™</sup> Mastic Tape 2229. Remove the release liner and roll each mastic strip into a small roll. (*Figure 6*) Press the mastic rolls into place on either side of the ground braid solder blocks. (*Figure 7*)







Figure 7

2.7 Select the roll of 1" (25 mm) 3M<sup>™</sup> Scotch-Seal<sup>™</sup> Mastic Tape 2229 from the kit and cut a length of the mastic. Using light tension, apply a single wrap of mastic around the cable jacket over the ground braid solder blocks and the previously applied mastic. (*Figure 8*)



Figure 8

2.8 Cover springs and mastic seal with two half-lapped layers of stretched vinyl tape. Do not cover exposed cable shield. (*Figure 9*)





## 3.0 Park Splice Components

3.1 Carefully bend the neutral wires back over the edge of the corrugated shield and cable jacket. Keep wire profile low; do not fold wires square back but follow concentric turn of the cable and turn the wires in that direction. Press the wires against the cable jacket and secure the ends with vinyl tape. Repeat for both cables (*Figure 10*).



Figure 10

3.2 Slide the jacketing tubes onto one cable end (small tube inside larger tube with loose core ends opposite each other) (*Figure 11*). Slide splice body onto the opposite cable, loose core end first (*Figure 12*).



Figure 11



Figure 12

3.3 Slide expanded shield sleeve over the splice body onto the cable (*Figure 13*).



Figure 13

## 4.0 Install Connector

4.1 Install connector according to connector instructions included with the connector.



## 5.0 Install Splice

5.1 Apply tape marker to semi-con insulation shield  $1\frac{3}{4}$ " (45 mm) from the cut back edge of the cable semi-con on the cable which does not contain splice (*Figure 15*).





- 5.2 Clean cables using standard practice:
  - a. Do not allow solvent or abrasive to contact the cable semi-conductive insulation shield.
  - b. Do not reduce cable insulation diameter below 1.94" (49,3 mm) specified for the splice.
  - c. The insulation surface must be round, smooth and free of cuts/voids. Finish sanding must be done with a 300 grit or higher electrical grade abrasive.
  - d. Make certain that the cable insulation is smooth, clean and dry before continuing.
- 5.3 Apply 3M<sup>™</sup> Red Compound P55/R on cable insulations, making certain to fill in edge of cable semi-con. Do not use silicone grease (*Figure 16*).





5.4 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 <sup>1</sup>/<sub>4</sub>" (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 17*).



Figure 17

## 6.0 Connect the Wires and Corrugated/Tape Shields

6.1 Wrap the Scotch<sup>®</sup> Electrical Semi-conducting Tape 13, 18" x 36" Pad over the shield sleeve (36" length following the cable), centered over the splice body. The pad can be trimmed to fit between the metallic shields. Secure with four bands of vinyl tape (Figure 18). Do not cover the entire pad with vinyl tape.



Figure 18

- 6.2 Take the temporary tape off neutral wires. Do not twist wires in to a single bundle.
- Route the longer neutral wires straight across the previously installed pad. Secure to pad, over the splice body, 6.3 with a band of vinyl tape (Figure 19).



Figure 19

6.4 Connect the longer neutral wires to the shorter wires using multiple connectors (3 or more). This is done to avoid damage to the splice body shoulders and end seals caused by large diameter wire/connectors being pressed in to them (Figure 20).



Figure 20

6.5 Cover the connectors with two half-lapped layers of vinyl tape (*Figure 21*).



Figure 21

6.6 Center the expanded shield sleeve over the semi-con pad (Figure 22).



Figure 22

6.7 Hand tighten the sleeve outward while keeping it centered over the semi-con pad. Secure the centered shield sleeve to the cable metallic shield on both sides using two constant force springs on each end. Trim excess shield sleeve. (*Figure 23*).





6.8 Wrap two half-lapped layers of highly-tensioned Scotch<sup>®</sup> Vinyl Electrical Tape Super 88 over the constant force springs (*Figure 24*).





### 7.0 Install Jacket

### Note: Jacketing is not optional.

7.1 Wrap a roll of slightly stretched Scotch<sup>®</sup> Rubber Mastic Tape 2228, 2" x 36" around cable jacket ends (tacky side toward cable) (*Figure 25*). Stretch and tear off last 1–2" (25–50 mm) of mastic (*Figure 26*). If grounding was applied, apply tape centered over 3M<sup>™</sup> Scotch-Seal<sup>™</sup> Mastic Tape 2229.



Figure 25





7.2 Install the smaller cold shrink tube by covering the rubber mastic, overlapping the cable jacket approximately 1/4–1/2" (6–12 mm), and unwinding toward the splice body, slowly pulling and unwinding the core counterclockwise (*Figure 27*).



Figure 27

7.3 Wrap a single wrap of 3M<sup>™</sup> Scotch-Seal<sup>™</sup> Mastic Tape 2229, 1" x 10' around the smaller cold shrink tube ¼" from the end (over the splice body). Completely cover the sealing mastic with a wrap of vinyl tape (*Figure 28*).



Figure 28

7.4 Install the larger cold shrink tube over the rubber mastic on the other cable in the same manner (Figure 29).



Figure 29

7.5 Using the four rolls of Sheath Wrap Structural Material provided, wrap half-lapped layers over the entire splice extending 3" (76 mm) onto the cable jacket. Bind the final wrap in place with vinyl tape (*Figure 300*).

Tear open the top end of the foil Sheath Wrap material 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.

## Note: Wear rubber gloves provided when handling Sheath Wrap material. The resin contains a black dye that will stain human skin.

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.



Figure 30

7.6 Connect optional grounding.

## 8.0 Prepare Cable

- 8.1 Check to be sure the cable fits within the kit ranges as shown in Table 1.
- 8.2 Prepare cables according to standard procedures. Refer to Figure 31 for proper dimensions. Copper foil tape strips are included to secure and cover the ends of the tape shield. Approximately 30" (760 mm) additional distance is required on one cable to provide extra neutral wire length for connecting the neutrals.
- 8.3 Remove cable insulation for [B]. Insulation removal length shall not exceed 4 <sup>1</sup>/<sub>2</sub>" (114 mm) from conductor end. **Do not install connector now.**



Figure	31
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Conductor Size Kcmil (mm²)	Primary Insulation 0.D.* Inches (mm)	Semi-con Cutback [A] Inches (cm)	Insulation Cutback [B] Inches (mm)
250 - 600 (125 - 325)	1.94 – 2.24 (49.3 - 56.9)	13 ½ (34.3)	4 (102)
700 – 1000 (400 – 500)	2.25 - 2.60 (57.0 - 66.0)	13 ¼ (33.7)	
1100 – 1500 (600 – 800)	2.61 – 2.85 (66.1 – 72.4)	13 (33.0)	4 ½ (114)
1600 – 2000 (850 – 1000)	2.86 - 3.08 (72.5 - 75.4)	12 ¾ (32.4)	

\* Insulation OD is the final determining factor

8.4 Clean or cover the cable jackets if necessary, 36" (915 mm) from the cable jacket cutback.

## 9.0 Install Ground Braid Assembly (Optional)

### Note: If not grounding at this splice location, continue at step 10.0 Park Splice Componets.

9.1 Fold the shield wires back along the cable jacket. Select the pre-formed ground braid assembly from the kit. Pass the end of the cable through the ground braid assembly loop, and position the ground braid assembly around the tape shield as shown. (*Figure 32*)



Figure 32

9.2 Select the 3 constant force springs from the kit. Starting at the loop of the ground braid assembly nearest the cable jacket edge, install the 3 constant force springs, one around each ground braid loop. Cinch (tighten) the springs after wrapping the final turn. Extend the ground braid tails down the cable jacket. (*Figure 33*)



Figure 33

9.3 Bend shield wires up, away from cable jacket, spacing them evenly around the ground braid tails. (Figure 34)



Figure 34

- 9.4 Select the roll of 1" (25 mm) wide 3M<sup>™</sup> Scotch-Seal<sup>™</sup> Mastic Tape 2229 from the kit. Cut a length of the tape long enough to wrap around the cable jacket. Remove the release liner from the mastic and, using light tension, apply a single wrap of mastic around the cable jacket, positioned under the ground braid solder blocks. (*Figure 35*)
- 9.5 Secure the two tails of the ground braid assembly to the cable jacket approximately 6 inches (150 mm) from the cable jacket edge with several wraps of vinyl tape. (*Figure 35*)





9.6 Cut four 1" (25 mm) lengths of 1" (25 mm) wide 3M<sup>™</sup> Scotch-Seal<sup>™</sup> Mastic Tape 2229. Remove the release liner and roll each mastic strip into a small roll. (*Figure 36*) Press the mastic rolls into place on either side of the ground braid solder blocks. (*Figure 37*)







Figure 37

9.7 Select the roll of 1" (25 mm) wide 3M<sup>™</sup> Scotch-Seal<sup>™</sup> Mastic Tape 2229 from the kit. Using light tension, apply a single wrap of mastic around the cable jacket over the ground braid solder blocks and the previously applied mastic. (*Figure 38*)





9.8 Cover springs and mastic seal with two half-lapped layers of stretched vinyl tape. Do not cover shield wires or exposed cable shield. (*Figure 39*)





## 10.0 Park Splice Components

10.1 Carefully bend the neutral wires back over the edge of the cable jacket. Keep wire profile low; do not fold wires square back but follow concentric turn of the cable and turn the wires in that direction. Press the wires against the cable jacket and secure the ends with vinyl tape. Repeat for both cables (*Figure 40*).



Figure 40

10.2 Slide the jacketing tubes onto one cable end (small tube inside larger tube with loose core ends opposite each other) (*Figure 41*). Slide splice body onto the opposite cable, loose core end first (*Figure 42*).



Figure 41



Figure 42

10.3 Slide expanded shield sleeve over the splice body onto the cable (Figure 43).



Figure 43

## 11.0 Install Connector

11.1 Install connector according to instructions included with the connector.





### 12.0 Install Splice

12.1 Apply tape marker to semi-con insulation shield  $1\frac{3}{4}$ " (45 mm) from the cut back edge of the cable semi-con on the cable which does not contain splice (*Figure 45*).





- 12.2 Clean cables using standard practice:
  - a. Do not allow solvent or abrasive to contact the cable semi-conductive insulation shield.
  - b. Do not reduce cable insulation diameter below 1.94" (49,3 mm) specified for the splice.
  - c. The insulation surface must be round, smooth and free of cuts/voids. Sanding may be necessary, finish sanding should be done with a 300 grit or higher electrical grade abrasive.
  - d. Make certain that the cable insulation is smooth, clean and dry before continuing.
- 12.3 Apply 3M<sup>™</sup> Red Compound P55/R on cable insulations, making certain to fill in edge of cable semi-con. **Do not use silicone grease** (*Figure 46*).





12.4 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 <sup>1</sup>/<sub>4</sub>" (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 47*).



Figure 47

## 13.0 Connect the Tape Shields/LC Shields

13.1 Wrap the Scotch<sup>®</sup> Electrical Semi-conducting Tape 13, 18" x 36" Pad over the shield sleeve (36" length following the cable), centered over the splice body. The pad can be trimmed to fit between the metallic shields. Secure with four bands of vinyl tape (*Figure 48*). **Do not cover the entire pad with vinyl tape.** 



Figure 48

13.2 Center the expanded shield sleeve over the semi-con pad (Figure 49).



Figure 49

13.3 Hand tighten the sleeve outward while keeping it centered over the semi-con pad. Secure the centered shield sleeve to the cable metallic shield on both sides using two constant force springs on each end. Trim excess shield sleeve. (*Figure 50*).





13.4 Wrap two half-lapped layers of highly-tensioned Scotch<sup>®</sup> Vinyl Electrical Tape Super 88 over the constant force springs (*Figure 51*).



Figure 51

- 13.5 Take the temporary tape off neutral wires. Do not twist wires in to a single bundle.
- 13.6 Route the longer neutral wires straight across the previously installed pad. Secure to pad, over the splice body, with a band of vinyl tape (*Figure 52*).



Figure 52

13.7 Connect the longer neutral wires to the shorter wires using multiple connectors (3 or more). This is done to avoid damage to the splice body shoulders and end seals caused by large diameter wire/connectors being pressed in to them (*Figure 53*).



Figure 53

13.8 Cover the connectors with two half-lapped layers of vinyl tape (Figure 54).





## 14.0 Install Jacket

### Note: Jacketing is not optional.

14.1 Wrap a roll of slightly stretched Scotch<sup>®</sup> Rubber Mastic Tape 2228, 2" x 36" around cable jacket ends (tacky side toward cable) (*Figure 55*). Stretch and tear off last 1–2" (25–50 mm) of mastic (*Figure 56*). If grounding was applied, apply tape centered over 3M<sup>™</sup> Scotch-Seal<sup>™</sup> Mastic Tape 2229.







Figure 56

14.2 Install the smaller cold shrink tube by covering the rubber mastic, overlapping the cable jacket approximately 1/4–1/2" (6–12 mm), and unwinding toward the splice body, slowly pulling and unwinding the core counterclockwise (*Figure 57*).



Figure 57

14.3 Wrap a single wrap of 3M<sup>™</sup> Scotch-Seal<sup>™</sup> Mastic Tape 2229, 1" x 10' around the smaller cold shrink tube ¼" from the end (over the splice body). Completely cover the sealing mastic with a wrap of vinyl tape (*Figure 58*).



Figure 58

14.4 Install the larger cold shrink tube over the rubber mastic on the other cable in the same manner (Figure 59).



Figure 59

14.5 Using the four rolls of Sheath Wrap Structural Material provided, wrap half-lapped layers over the entire splice extending 3" (76 mm) onto the cable jacket. Bind the final wrap in place with vinyl tape (*Figure 60*).

Tear open the top end of the foil Sheath Wrap material 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.

## Note: Wear rubber gloves provided when handling Sheath Wrap material. The resin contains a black dye that will stain human skin.

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.





#### 14.6 Connect optional grounding.

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Electrical Markets Division 13011 McCallen Pass Austin, TX 78753 USA

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