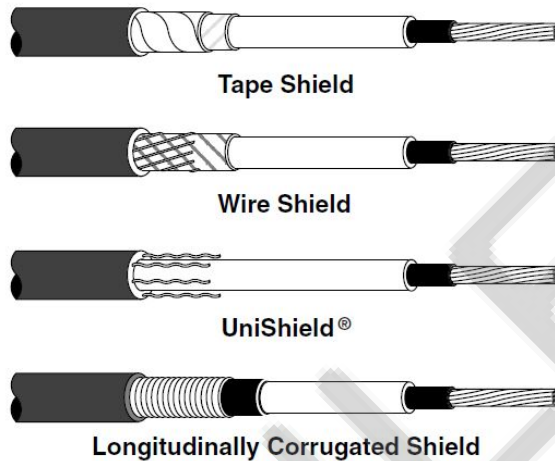


# 3M™ Cold Shrink QS-III Inline Splice Kits 25/28 kV 5524A, 5525A and 5526A

Data Sheet

July 2014



## ⚠ CAUTION

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

### Product Description

The 3M™ Cold Shrink QS-III Splice Kits 5524A, 5525A and 5526A are 25/28 kV-class inline splices for tape, longitudinally corrugated (LC), wire and UniShield® shielded power cables. They are a cold shrink design sized to fit Type MV-90 or Type MV-105 cables with copper or aluminum conductor sizes ranging from 1 AWG to 1000 kcmil (50 to 500 mm<sup>2</sup>). The cold shrink splice body is a one-piece molded design made of specially formulated silicone rubbers, while the cold shrink jacketing is made of EPDM rubber for physical protection. Each splice manufactured is factory tested to provide reliability.

The splices can be used with standard copper (Cu) or aluminum (Al/Cu) inline compression (crimp type) connectors or specified shearbolt connectors, and can be used for size transitions within the listed kit size range. They are designed to exceed minimum industry test standards, and have a BIL rating of 200 kV (equal to a 35 kV voltage class). The Cold Shrink QS-III Splice Kits 5524A, 5525A and 5526A meet or exceed the 25/28 kV Voltage Class rating requirements of ANSI/IEEE Std. 404.

# 3M™ Cold Shrink QS-III Inline Splice Kits 25/28 kV 5524A, 5525A and 5526A

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## Kit Contents for 5524A, 5525A and 5526A

- 1 3M™ Cold Shrink Silicone Rubber Splice Body
  - 1 3M™ Cold Shrink Adapter Tube (2 adapters in the 5524A Kit)
  - 1 3M™ Cold Shrink Jacketing Tube
  - 2 3M™ Red Compound Tubes P55/R
  - 6 Scotch® Mastic Sealing Strips 2230
  - 2 Scotch® Rubber Mastic Tape 2228 Rolls
  - 1 3M™ Cable Cleaning Pad CC-3
  - 1 Cable Preparation Template (2 templates in 5526A Kit)
  - 1 Shielding Sleeve
  - 1 Ground Strap
  - 5 Constant Force Spring Ground Connectors
  - 2 Copper Tape Strips
  - 1 Instruction Booklet
- 

## Splice Features

- **Cold Shrink Design** — for quick and easy installation; excellent for cable size transitions
  - **Complete Kit** — includes the required products to make one splice
  - **Silicone Rubber Construction** — for good high and low temperature performance
  - **Production Tested** — partial discharge and A.C. withstand tests to provide reliability
  - **Computer Aided Design** — for compact size and optimal distribution of electrical field
  - **Special Electrode Design** — minimizes electrical stress at critical cable/splice interface
  - **High Ampacity Shield** — faults current rated for 15,000 Amps for 15 cycles, neutral current rated for 350 Amps.
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## Applications

- For splicing 25/28 kV shielded power cables:
- For inline splicing
  - For feeder and distribution circuits
  - For tape, longitudinally corrugated (LC), wire and UniShield® shielded cables
  - For transitions from shielded to neutral power cables
  - For copper or aluminum conductors
  - For use with standard inline crimp connectors
  - For use with specified 3M™ Shearbolt Connectors QCI Series
  - For size transition splicing
  - For direct burial installations
  - For submerged locations
- 

## Physical and Electrical Properties

The 3M™ Cold Shrink QS-III Splice Kits 5524A, 5525A and 5526A can be used on cables with a rated operating temperature up to 105°C, and an emergency overload rating of 140°C. A splice constructed from this kit is rated for 25/28 kV and meets or exceeds the requirements of IEEE Std. 404. The current rating of the splice meets or exceeds the current rating for the cables on which it is installed. BIL rating is 200 kV, which exceeds the normal 150 kV BIL rating for a 25/28 kV voltage class.

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# 3M™ Cold Shrink QS-III Inline Splice Kits 25/28 kV 5524A, 5525A and 5526A

## Splice Selection Table

| Kit Number | Cable Insulation O.D. Range<br>Inches (mm) | Conductor Size Range<br>AWG or kcmil (mm <sup>2</sup> ) |
|------------|--|---|
| 5524A      | 0.84 - 1.36 (21,3 - 34,5)                  | 1 - 250 (50 - 120)                                      |
| 5525A      | 1.07 - 1.70 (27,2 - 43,2)                  | 250 - 750 (120 - 325)                                   |
| 5526A      | 1.24 - 2.07 (31,5 - 52,6)                  | 500 - 1000 (240 - 500)                                  |

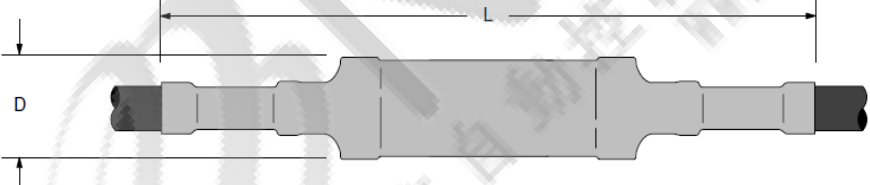
Table 1

## Connector Dimensional Requirements Table

| Kit Number | Minimum<br>O.D.<br>Inches (mm) | Maximum<br>O.D.<br>Inches (mm) | Maximum Length<br>Inches (mm)      |                            |  | Connector O.D.<br>Range Requiring<br>adapters<br>Inches (mm) |
|------------|--------------------------------|--------------------------------|------------------------------------|----------------------------|--|--|
|            |                                |                                | Aluminum<br>(Al/Cu)<br>Compression | Copper (Cu)<br>Compression | 3M™ Shearbolt<br>Connector QCI<br>Series |  |
| 5524A      | 0.46 (11,7)                    | 1.36 (34,5)                    | 4.00 (102)                         | 4.50 (114)                 | 4.41 (112)                               | 0.46 - 0.84<br>(11,7 - 21,3)                                 |
| 5525A      | 0.75 (19,1)                    | 1.70 (43,2)                    | 5.75 (146)                         | 6.50 (165)                 | 6.93 (176)                               | 0.75 - 1.07<br>(19,1 - 27,2)                                 |
| 5526A      | 1.05 (26,7)                    | 2.07 (52,6)                    | 7.50 (191)                         | 8.25 (210)                 | 7.83 (199)                               | 1.05 - 1.24<br>(26,7 - 31,5)                                 |

Table 2

## Typical Dimensions (Installed Splice)



| Kit Number | Typical Length (L)<br>Inches (mm) | Typical Diameter (D <sub>1</sub> )<br>Inches (mm) |
|------------|-----------------------------------|---|
| 5524A      | 30 (762)                          | 3.25 (83)   |
| 5525A      | 33 (838)                          | 3.60 (91)   |
| 5526A      | 35 (889)                          | 3.90 (99)   |

Table 3

# 3M™ Cold Shrink QS-III Inline Splice Kits 25/28 kV 5524A, 5525A and 5526A

## Typical Physical and Electrical Properties Silicone Rubber (Splice Body – Insulation)

### Physical Properties

| Test Method                                      | Typical Value*                |
|--|-------------------------------|
| Hardness – Shore A (ASTM D 2240)                 | 50                            |
| Elongation (%) (ASTM D 412)                      | 610                           |
| Tensile Strength (psi) (ASTM D 412)              | 1090 (7,5 N/mm <sup>2</sup> ) |
| Modulus @ 100% (psi) (ASTM D 412)                | 340 (2,3 N/mm <sup>2</sup> )  |
| Permanent Set % (100%, 100°C, 22 hrs) (3M TM 86) | 5                             |
| Thermal Conductivity (W/m K) (ASTM D 518)        | 0.24                          |

### Electrical Properties

|   |                    |
|---|--------------------|
| Dielectric Strength (V/mil) (ASTM D 149)      | 370 (14,6 kV/mm)   |
| Dielectric Strength, Wet (V/mil) (ASTM D 149) | 340 (13,4 kV/mm)   |
| Dielectric Constant (ASTM D 150)              | 3.3                |
| Dielectric Loss (ASTM D 150)                  | 0.005              |
| Volume Resistivity (Ohm-cm) (3M TM 80)        | 6x10 <sup>14</sup> |

## Silicone Rubber (Splice Body – Inner Electrode)

### Physical Properties

| Test Method                                      | Typical Value*               |
|--|------------------------------|
| Hardness – Shore A (ASTM D 2240)                 | 43                           |
| Elongation (%) (ASTM D 412)                      | 510                          |
| Tensile Strength (psi) (ASTM D 412)              | 880 (6,1 N/mm <sup>2</sup> ) |
| Modulus @ 100% (psi) (ASTM D 412)                | 200 (1,4 N/mm <sup>2</sup> ) |
| Permanent Set % (100%, 100°C, 22 hrs) (3M TM 86) | 4                            |

### Electrical Properties

|  |    |
|--|----|
| Volume Resistivity (Ohm-cm) (3M TM 80) | 50 |
|--|----|

## Silicone Rubber (Splice Body – Semi-Con Shell)

### Physical Properties

| Test Method                                      | Typical Value*               |
|--|------------------------------|
| Hardness – Shore A (ASTM D 2240)                 | 43                           |
| Elongation (%) (ASTM D 412)                      | 520                          |
| Tensile Strength (psi) (ASTM D 412)              | 890 (6,1 N/mm <sup>2</sup> ) |
| Modulus @ 100% (psi) (ASTM D 412)                | 230 (1,6 N/mm <sup>2</sup> ) |
| Permanent Set % (100%, 100°C, 22 hrs) (3M TM 86) | 5                            |

### Electrical Properties

|  |     |
|--|-----|
| Volume Resistivity (Ohm-cm) (3M TM 80) | 150 |
|--|-----|

\*All values are averages, based on several determinations and are not intended for specification purpose.

### Operating Temperature

Reference: AEIC CS5 and AEIC CS6:  
Normal Operation: 105°C  
Emergency Operation: 140°C

# 3M™ Cold Shrink QS-III Inline Splice Kits 25/28 kV 5524A, 5525A and 5526A

## Ethylene Propylene Rubber (Jacketing Tubes)

### Physical Properties

| Test Method  | Typical Value*  |
|--|-----------------|
| Color  | Black           |
| Hardness – Shore A (ASTM D 2240)                                   | 48              |
| Elongation (%) (ASTM D 412)  | 635             |
| Tensile Strength (psi) (ASTM D 412)                                | 1680 (11,6 MPa) |
| Modulus @ 100% (psi) (ASTM D 412)                                  | 170 (1,17 MPa)  |
| Fungus Resistance, 28 days (ASTM G 21)                             | No Growth       |
| Permanent Set % (250%, Strain)<br>(5 min. recovery, @ 40°F, 4.4°C) | 8.8<br>14.6     |

### Electrical Properties

|   |                  |
|---|------------------|
| Dielectric Strength, Orig. (V/mil) (ASTM D 149) | 490 (19,1 kV/mm) |
| Dielectric Strength, Wet (V/mil) (ASTM D 149)   | 465 (18,1 kV/mm) |
| Dielectric Constant, Orig. (ASTM D 150)         | 5.0              |
| Dielectric Constant, Wet (ASTM D 150)           | 5.6              |

\*All values are averages, based on several determinations and are not intended for specification purpose.

### Product (Open Specification)

The tape, longitudinally corrugated (LC), wire and UniShield® shielded power cable splice shall meet the requirements of ANSI/IEEE Std. 404 for a 25/28 kV rating, and must be rated by the manufacturer for use on 25/28 kV class cable systems. It must be rated for continuous operation at 105°C, with an emergency overload temperature rating of 140°C. The splice shall be capable of splicing cables with copper or aluminum conductors sized from 1 AWG to 250 kcmil (50 to 120 mm<sup>2</sup>), 250 to 750 kcmil (120 to 325mm<sup>2</sup>) and 500 to 1000 kcmil (240 to 500 mm<sup>2</sup>) or accommodate a conductor size transition within those size ranges. The splice shall be of a cold shrink design which does not require any additional heat source for installation. The cold shrink splice body must be of a molded design made of silicone rubber. The splice jacketing shall be of a cold shrink tubing made of EPDM rubber. The color of the splice body and outer jacket shall be black.

### Engineering/ Architectural (Closed Specification)

Splicing of all 25/28 kV rated cables, tape, longitudinally corrugated (LC), wire and UniShield® shielded power cables, sized from 1 AWG to 1000 kcmil (50 to 500 mm<sup>2</sup>) copper or aluminum, shall be performed in accordance with the instructions provided with the 3M™ Cold Shrink QS-III Splice Kits 5524A, 5525A and 5526A.

### Shielding Short Circuit Testing

The 5524A, 5525A and 5526A QS-III shielding system is rated for 15 kA for 15 cycles. The shielding system was submitted to an independent test laboratory for short circuit testing. High ampacity performance was verified by applying the following series: 10 kA-RMS for 10 cycles, 12 kA-RMS for 12 cycles and 15 kA-RMS for 15 cycles. The 5524A, 5525A and 5526A QS-III Shielding System is rated for 350 Amps of neutral current. The shielding system was tested in a loop similar to that which is used in the ANSI C119.4 Connector Test Method, by measuring temperature and resistance. Ampacity performance was verified by applying current in 3-hour on/3-hour off cycles at levels up to and exceeding the 350 Amp rated current. The shielding system consists of a tin-plated braided copper sleeve which serves as the splice metallic shield and ground jumper, connected to the cable metallic shields with solderless constant force springs.

# 3M™ Cold Shrink QS-III Inline Splice Kits 25/28 kV 5524A, 5525A and 5526A

## Performance Test

### IEEE Std. 404 25/28 kV Voltage Rating

| Design Test and Sequence                                   | Test Requirement                    |
|--|-------------------------------------|
| Minimum partial discharge (corona) level                   | 26 kV-rms @ < 3pC                   |
| Alternating-current 1 minute withstand                     | 58 kV-rms                           |
| Direct-current 15 minute withstand                         | 112 kV-dc                           |
| Impulse withstand (BIL) at 25°C (77°F)*                    | ±150 kV-crest (200 kV)*             |
| Impulse withstand (BIL) at 140°C (284°F)*                  | ±150 kV-crest (200 kV)*             |
| Minimum partial discharge (corona) level                   | 26 kV-rms @ < 3 pC                  |
| Cyclic aging (in air and water)                            | 48 kV-rms                           |
| Minimum partial discharge (corona) level                   | 26 kV-rms @ < 3 pC                  |
| High voltage time: 5 hr. alternating-current withstand     | 58 kV-rms                           |
| 5 min. alternating-current withstand                       | 75 kV-rms                           |
| Short-time current<br>(ICEA P-32-382 and ANSI/IEEE C37.09) | 250°C conductor temp with no damage |
| Alternating-current 1 minute withstand                     | 58 kV-rms                           |
| Shielding  | IEEE Std. 592                       |
| Connector thermal and mechanical                           | ANSI C119.4                         |

| Production Test                          | Test Requirement   |
|--|--------------------|
| Production splices tested                | 100%               |
| Minimum partial discharge (corona) level | 26 kV-rms @ < 3 pC |
| Alternating-current 1 minute withstand   | 58 kV-rms          |

\*Notes: (1) BIL rating for 5524A (5456A splice body), 5525A (5457A splice body) and 5526A (5458A splice body) QS-III is upgraded to ±200 kV-crest.  
(2) Impulse test wave is 1.2 x 50 µsec. (ANSI/IEEE Std. 4).

## Installation Techniques for 5524A, 5525A, and 5526A Kits

Detailed instructions for installing the 3M™ Cold Shrink QS-III Splice Kits 5524A, 5525A, and 5526A are included with each kit. A Cable Preparation Template is provided:

1. Prepare cable according to standard procedure.
2. Slide cold shrink jacketing tube and cold shrink splice body onto prepared cables.
3. Position expanded shield sleeve onto one cable
4. Install connector. Dimensional requirements table provided.
5. Apply a tape marker on one cable.
6. Apply 3M™ Red Compound P55/R on cable insulation and fill in edge of cable semi-con.  
**DO NOT use silicone grease.**
7. Install splice over connector area, aligning end with tape marker, and removing core by pulling and unwinding counterclockwise.
8. Install shield sleeve, centered over splice body, and attach to cable metallic shields with constant force springs.
9. Connect ground strap if circuit grounding is required at this location. Apply mastic sealing strips to seal ground strap at end of cable jacket.
10. Apply rubber mastic tape around the end of both cable jackets.
11. Install cold shrink jacketing tube over splice.
12. Connect ground strap to ground if splice is to be grounded.
13. If located in direct sunlight, overwrap splice with vinyl tape.

# 3M™ Cold Shrink QS-III Inline Splice Kits 25/28 kV 5524A, 5525A and 5526A

## Maintenance

Components of the 3M™ Cold Shrink QS-III Splice Kits 5524A, 5525A and 5526A are stable under normal storage conditions. Normal stock rotation procedures are recommended. As provided, in the expanded state, the QS-III splice kits have an on-shelf storage life of three years from the date of manufacture. The installed splices can be field tested using standard field cable testing procedures (reference ANSI/IEEE Std. 400, "Guide for Making High-Direct-Voltage Tests on Power Cable Systems in the Field").

## Connectors for QS-III Splices

The QS-III Cold Shrink Splice kits are designed to be used with 3M™ Scotchlok™ Connectors 10000, 11000, and 20000 Series, 3M™ Connectors CI-Series, or other UL listed inline compression connectors that fit within the dimension limits listed in the 3M™ Connector Dimensional Requirements Table 2. In addition, the following transition connectors may be used:

| Kit Number | Conductor Sizes (AWG or kcmil) | 3M™ Compression Connectors | 3M™ Shearbolt Connectors QCI Series |
|------------|--------------------------------|----------------------------|-------------------------------------|
| 5524A      | 1 to 1/0                       | CI-T9                      | QCI-2-250                           |
|            | 1 to 2/0                       |                            |                                     |
|            | 1/0 to 3/0                     |                            |                                     |
|            | 2/0 to 3/0                     |                            |                                     |
|            | 1 to 4/0                       |                            |                                     |
|            | 1/0 to 4/0                     |                            |                                     |
|            | 2/0 to 4/0                     |                            |                                     |
|            | 3/0 to 4/0                     | CI-T7                      |                                     |
|            | 1 to 250                       |                            |                                     |
|            | 1/0 to 250                     |                            |                                     |
|            | 2/0 to 250                     |                            |                                     |
|            | 3/0 to 250                     |                            |                                     |
| 4/0 to 250 |                                |                            |                                     |
| 5525A      | 250 to 350                     | 2000T 250-350 CU/AL        | QCI-4/0-600                         |
|            | 300 to 350                     | 2000T 300-350 CU/AL        | QCI-4/0-600                         |
|            | 350 to 500                     | 2000T 350-500 CU/AL        | QCI-4/0-600 or QCI-350-750          |
|            | 350 to 600                     |                            | QCI-350-750                         |
|            | 500 to 600                     |                            |                                     |
|            | 350 to 750                     |                            |                                     |
| 500 to 750 |                                |                            |                                     |
| 5526A      | 500 to 750                     |                            | QCI-500-1000                        |
|            | 500 to 1000                    |                            |                                     |
|            | 750 to 1000                    |                            |                                     |

## 3M™ Cold Shrink QS-III Inline Splice Kits 25/28 kV 5524A, 5525A and 5526A

### Connectors for QS-III Splices

The QS-III Cold Shrink Splice kits are designed to be used with 3M™ Scotchlok™ Connectors 10000, 11000, and 20000 Series, 3M™ Connectors CI-Series, or other UL listed inline compression connectors that fit within the dimension limits listed in the 3M™ Connector Dimensional Requirements Table 2. In addition, the following transition connectors may be used:

| Kit Number | Conductor Sizes (AWG or kcmil) | Homac Connectors | Burndy Connectors | Mac Products                        |
|------------|--------------------------------|------------------|-------------------|-------------------------------------|
| 5524A      | 1 to 2/0                       |                  |                   | MLCR 2/0-1                          |
|            | 1/0 to 3/0                     | SAC3/0R1/0       | YRB27U26          | MLCR 3/0-1/0                        |
|            | 2/0 to 3/0                     |                  | YRB27U26          |                                     |
|            | 1/0 to 4/0                     | SAC4/0R1/0       |                   |                                     |
|            | 2/0 to 4/0                     | SAC4/0R2/0       | YRB28U26          | MLCR 4/0-2/0                        |
|            | 3/0 to 4/0                     |                  |                   |                                     |
|            | 2/0 to 250                     | SAC250R2/0       |                   |                                     |
|            | 3/0 to 250                     | SAC250R3/0       |                   | MLCR 250-3/0                        |
|            | 4/0 to 250                     | SAC250R4/0       |                   |                                     |
| 5525A      | 250 to 350                     | SAC350R250       | YRB31U29          | MLCR 350 + AAR 350-250 Adapter      |
|            | 350 to 500                     | SAC500R350       | YRB34U31          | MLCR 500 + AAR 500-350 Adapter      |
|            | 350 to 600                     |                  | YRB36U31          |                                     |
|            | 500 to 600                     |                  | YRB36U34          |                                     |
|            | 350 to 750                     | SAC750R350       |                   | MLCR 750 + AAR 750-350 Adapter      |
|            | 500 to 750                     | SAC750R500       | YRB39U34          | MLCR 750-500                        |
| 5526A      | 500 to 750                     | SAC750R500       | YRB39U34          | MLCR 750-500                        |
|            | 500 to 1000                    |                  |                   | MLCR 1000-750 + AAR 750-500 Adapter |
|            | 750 to 1000                    |                  |                   | MLCR 1000-750                       |

# 3M™ Cold Shrink QS-III Inline Splice Kits 25/28 kV 5524A, 5525A and 5526A

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## Shelf-Life

This product has a 3-year shelf life from date of manufacture when stored in a humidity controlled storage (10°C / 50°F to 27°C / 80 °F and <75% relative humidity).

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## Availability

3M™ Cold Shrink QS-III Splice Kits 5524A, 5525A and 5526A are available to splice 25/28 kV tape, longitudinally corrugated (LC), wire and UniShield® shielded power cables. The connectors can be either ordered with the kit or provided separately. Standard dimension copper (Cu) or aluminum (Al/Cu) compression (crimp type) connectors are suitable for use with these splice kits, as are 3M™ Shearbolt Connectors QCI Series. These kits are available from your local authorized 3M electrical distributor.

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