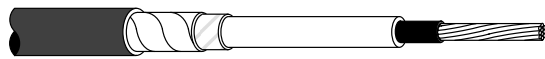


3M QS-III

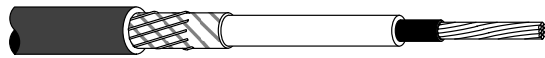
5513A, 5514A, 5515A and 5516A 15 kV Cold Shrink Inline Splice Kits



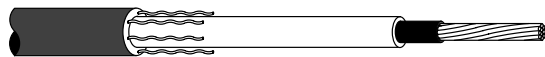
Data Sheet



Tape Shield



Wire Shield



UniShield®



Longitudinally Corrugated Shield

1. Product Description

The 3M™ 5513A, 5514A, 5515A and 5516A QS-III Cold Shrink Splice Kits are 15 kV-class inline splices for joining tape, longitudinally corrugated (LC), wire and UniShield® shielded power cables. It is a cold shrink design sized to fit Type MV-90 or Type MV-105 cables with copper or aluminum conductor sizes ranging from 2 AWG to 1000 kcmil (35 to 500mm²). The cold shrink splice body is a one-piece molded design made of special 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, 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 150 kV (equal to a 25 kV voltage class). The 5513A, 5514A, 5515A and 5516A QS-III splices meet or exceed the 15 kV Voltage Class rating requirements of ANSI/IEEE Std. 404.

⚠ 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.

Kit Contents:

- 1 Cold Shrink Silicone Rubber Splice Body
- 1 Cold Shrink Adapter Tube (2 adapters in 5513A kit)
- 1 Cold Shrink Jacketing Tube
- 1 Shielding Sleeve
- 1 Ground Strap
- 5 Constant Force Spring Ground Connectors
- 2 Tubes P55/R Red Compound
- 6 Scotch™ 2230 Mastic Sealing Strips
- 2 Scotch™ 2228 Rubber Mastic Tape Rolls
- 2 Copper Tape Strips
- 1 3M™ CC-3 Cable Cleaning Pad
- 1 Cable Preparation Template
- 1 Instruction Booklet

Splice Features:

- **Cold Shrink Design** — for quick and easy installation; excellent for cable size transitions
- **Complete Kit** — includes everything required to make one splice
- **Silicone Rubber Construction** — for good high and low temperature performance
- **High Ampacity Shield** — faults current rated for 15,000 Amps for 15 cycles, neutral current rated for 350 Amps.
- **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

2. Applications

For splicing 15 kV shielded power cables:

- For inline splicing
- For feeder and distribution circuits
- For tape, wire, UniShield® & Longitudinally corrugated (LC) shielded cables.
- For transitions from shielded to neutral power cables
- For copper or aluminum conductors
- For size transition splicing
- For direct burial installations
- For submerged locations

3. Data: Physical and Electrical Properties

The 3M™ 5513A, 5514A, 5515A and 5516A QS-III Kits 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 15 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 150 kV, which exceeds the normal 110 kV BIL rating for a 15 kV voltage class.

A. Splice Selection Table

Kit Number	Cable Insulation O.D. Range Inches (mm)	Conductor Size Range AWG or kcmil (mm ²)
5513A	0.64 - 1.01 (16,3 - 25,7)	2 - 4/0 (35 - 95)
5514A	0.84 - 1.38 (21,3 - 35,1)	4/0 - 500 (95 - 240)
5515A	1.04 - 1.70 (26,4 - 43,2)	350 - 750 (185 - 325)
5516A	1.08 - 1.70 (27,4 - 43,2)	500 - 1000 (240 - 500)

Table 1

B. Connector Dimensional Requirements Table

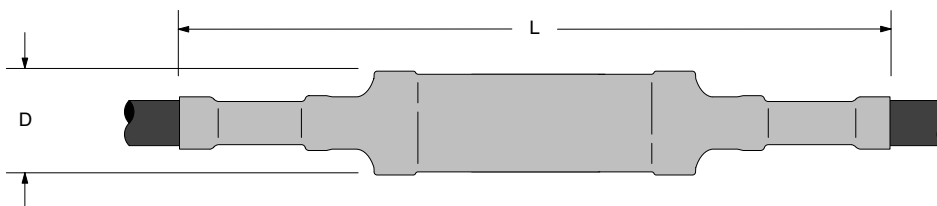
Kit Number	Minimum O.D. Inches (mm)	Maximum O.D. Inches (mm)	Maximum Length Inches (mm)		Connector O.D. Ranges that Require Adapters Inches (mm)
			Aluminum (Al/Cu)	Copper (Cu)	
5513A	0.40 (10,6)	1.06 (26,9)	4.50 (114)	5.00 (127)	0.40 - 0.64 (10,6 - 16,3)
5514A	0.69 (17,5)	1.38 (35,1)	5.00 (127)	5.75 (146)	0.69 - 0.84 (17,5 - 21,3)
5515A	0.80 (20,3)	1.84 (46,7)	6.75 (171)	7.50 (191)	0.80 - 1.04 (20,3 - 26,4)
5516A	0.80 (20,3)	1.84 (46,7)	6.75 (171)	7.50 (191)	0.80 - 1.08 (20,3 - 27,4)

Table 2

C. Typical Dimensions (Installed Splice)

Kit Number	Typical Length (L) inches (mm)	Typical Diameter (D) inches (mm)
5513A	28 (711)	2.25 (57)
5514A	29 (736)	2.50 (64)
5515A	32 (813)	3.00 (76)
5516A	32 (813)	3.00 (76)

Table 3



D. 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 ²)
Modulus @ 100% (psi) (ASTM D 412)	340 (2,3 N/mm ²)
Permanent Set (%) (100%, 100°C, 22 hrs) (3M TM 86)	5
Thermal Conductivity (W/m K) (ASTM D 518)	0.24

Electrical Properties

Test Method	Typical Value*
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 ¹⁴

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 ²)
Modulus @ 100% (psi) (ASTM D 412)	200 (1,4 N/mm ²)
Permanent Set (%) (100%, 100°C, 22 hrs) (3M TM 86)	4

Electrical Properties

Test Method	Typical Value*
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 ²)
Modulus @ 100% (psi) (ASTM D 412)	230 (1,6 N/mm ²)
Permanent Set (%) (100%, 100°C, 22 hrs) (3M TM 86)	5

Electrical Properties

Test Method	Typical Value*
Volume Resistivity (Ohm-cm) (3M TM 80)	150

Ethylene Propylene Rubber (Jacketing Tubes)

Physical Properties

Test Method	Typical Value*
Color	Black
Hardness - Shore A (ASTM D 2240)	48
Ultimate Elongation, orig. (%) (ASTM D 412)	635
Ultimate Tensile, orig. (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) (5 min. recovery, @ 40°F, 4.4°C)	8.8 14.6

Electrical Properties

Test Method	Typical Value*
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 purposes.

4. Specification

Product

(Open Specification)

The tape, longitudinally corrugated (LC), wire and UniShield® shielded power cable splice shall meet requirements of ANSI/IEEE Std. 404 for a 15 kV rating, and must be rated by the manufacturer for use on 15 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 2 to 4/0 AWG (35 to 95 mm²), 4/0 AWG to 500 kcmil (95 to 240 mm²), 350 to 750 kcmil (185 to 325 mm²), 500 to 1000 kcmil (240 to 500 mm²) 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 15 kV rated cables, tape, longitudinally corrugated (LC), wire and UniShield® shielded power cables, sized from 2 AWG to 1000 kcmil (35 to 500mm²) copper or aluminum, shall be performed in accordance with the instructions provided with the 3M™ 5513A, 5514A, 5515A and 5516A QS-III Cold Shrink Inline Splice Kits.

5. Performance Tests

A. IEEE Std. 404 15 kV Voltage Rating

Design Test and Sequence	Test Requirement
Minimum partial discharge (corona) level	13 kV-rms @ < 3 pC
Alternating-current 1 minute withstand	35 kV-rms
Direct-current 15 minute withstand	70 kV-dc
Impulse withstand (BIL) at 25°C (77°F)*	±110 kV-crest (150 kV)*
Impulse withstand (BIL) at 140°C (284°F)*	±110 kV-crest (150 kV)*
Minimum partial discharge (corona) level	13 kV-rms @ < 3 pC
Cyclic Aging (in air and water)	26 kV-rms
Minimum partial discharge (corona) level	13 kV-rms @ < 3 pC
High voltage time: 5 hr. alternating-current withstand	31 kV-rms
5 min. alternating-current withstand	39 kV-rms
Short-time current (ICEA P-32-382 and ANSI/IEEE C37.09)	250°C conductor temp with no damage
Alternating-current 1 minute withstand	35 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	13 kV-rms @ < 3 pC
Alternating-current 1 minute withstand	35 kV-rms

*Notes: (1) BIL rating for 5513A (5415A splice body), 5514A (5416A splice body), 5515A (5417A splice body) and 5516A (5418A splice body) QS-III is upgraded to ±150 kV-crest.

(2) Impulse test wave is 1.2 x 50 µsec. (ANSI/IEEE Std. 4).

B. Operating Temperature

Reference: AEIC CS5 and AEIC CS6:

Normal Operation

105°C

Emergency Operation

140°C

C. Shielding Short Circuit Testing

The 5513A, 5514A, 5515A and 5516A 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 5513A, 5514A, 5515A and 5516A 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.

6. Installation Techniques

Detailed instructions for installing the 5513A, 5514A, 5515A and 5516A QS-III are included with each kit. A Cable Preparation Template is provided:

1. Prepare cable according to standard procedure.
2. Slide cold shrink jacketing tubes and cold shrink splice body onto prepared cables.
3. Position expanded shield sleeve onto one cable.
4. Install inline compression (crimp) connector. Connector dimensional requirements table provided.
5. Apply a tape marker on one cable.
6. Apply red compound 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 wire 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.

7. Maintenance

Components of the 3M™ 5513A, 5514A, 5515A and 5516A QS-III Cold Shrink Splice Kits 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”).

8. Availability

3M™ 5513A, 5514A, 5515A and 5516A QS-III Cold Shrink Inline Splice Kits are available to splice 15 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. These kits are available from your local authorized 3M electrical distributor.

9. Connectors for QS-III Splices

The QS-III Cold Shrink splice kits are designed to be used with Scotchlok™ 10000, 11000, and 20000 Series Connectors, 3M™ CI-Series, or other UL listed inline compression connectors that fit within the dimension limits listed in the 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	3M Connectors
5513A	2 to 1 2 to 1/0 2 to 2/0 1/0 to 3/0 2/0 to 3/0 2 to 4/0 1/0 to 4/0 2/0 to 4/0 3/0 to 4/0	SAC1/0R2 SAC2/0R2 SAC3/0R1/0 SAC4/0R2 SAC4/0R1/0 SAC4/0R2/0	YRB25U2 YRB25U2 YRB27U25 YRB27U26 YRB28U26	MLCR 1/0-2 MLCR 3/0-1/0 MLCR 4/0-2/0	CI-T2 CI-T4 CI-T7
5514A	4/0 to 250 4/0 to 300 4/0 to 350 250 to 350 300 to 350 350 to 500	SAC250R4/0 SAC300R4/0 SAC350R4/0 SAC350R250	YRB29U28 YRB31U28 YRB31U29	MLC 250 + AAR 250-4/0 Adapter MLCR 350-4/0 MLC 350 + AAR 350-250 Adapter MLC 500 + AAR 500-350 Adapter	2000T 4/0-350 CU/AL 2000T 250-350 CU/AL 2000T 300-350 CU/AL 2000T 350-500 CU/AL
5515A	350 to 500 350 to 600 500 to 600 350 to 750 500 to 750	SAC500R350 SAC750R350 SAC750R500	YRB34U31 YRB36U31 YRB36U34 YRB39U34	MLC 500 + AAR 500-350 Adapter MLC 750 + AAR 750-350 Adapter MLCR 750-500	2000T 350-500 CU/AL
5516A	500 to 750 500 to 1000 750 to 1000	SAC750R500	YRB39U34	MLCR 750-500 MLCR 1000-750 + AAR 750-500 Adapter MLCR 1000-750	

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