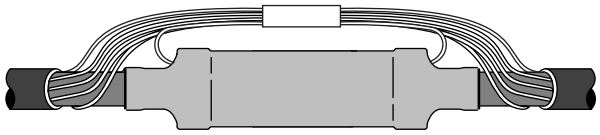
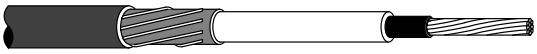
QS–III
5467A, 5467A-WG, 5468A and 5468A-WG
35 kV Cold Shrink Inline Splice Kits

5467A, 5468A

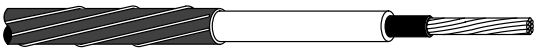


5467A-WG, 5468A-WG

Data Sheet



Jacketed Concentric Neutral (JCN)



Concentric Neutral (CN)

1. Product Description

3M™ 5467A, 5467A-WG, 5468A and 5468A-WG QS-III Cold Shrink Splice Kits are 35 kV–class inline splices for joining jacketed concentric neutral (JCN) and concentric neutral (CN) 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 1/0 AWG–1000 kcmil (60–500 mm^2). 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, 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 250 kV (equal to a 46 kV voltage class). The 5467A, 5467A-WG, 5468A and 5468A-WG QS-III splices meet or exceed the 35 kV Voltage Class rating requirements of ANSI/IEEE Std. 404.

Kit Contents for 5467A and 5468A:

- 1 Cold Shrink Silicone Rubber Splice Body
- 1 Cold Shrink Adapter Tube (2 adapters in the 5467A Kit)
- 1 Cold Shrink Jacketing Tube
- 2 Tubes P55/R Red Compound
- 6 Scotch™ 2230 Mastic Sealing Strips
- 2 Scotch™ 2228 Rubber Mastic Tape Rolls
- 1 Neutral Pad
- 1 3M™ CC-3 Cable Cleaning Pad
- 1 Cable Preparation Template (2 templates in 5468A kit)
- 1 Instruction Booklet

⚠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 for 5467A-WG and 5468A-WG:

- 1 Cold Shrink Silicone Rubber Splice Body with Wires
- 1 Cold Shrink Adapter Tube (2 adapters in 5467A-WG kit)
- 2 Tubes of P55/R Red Compound
- 4 Scotch™ 2230 Mastic Sealing Strips
- 1 Cable Preparation Template (2 templates in 5468A-WG kit)
- 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
- **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 35 kV shielded power cables:

- For inline splicing
- For feeder and distribution circuits
- For jacketed concentric neutral cables (JCN)
- For concentric neutral cables (CN)
- For Copper or aluminum conductors
- For use with standard inline crimp connectors
- For size transition splicing
- For direct burial installations
- For submerged locations

3. Data: Physical and Electrical Properties

The 3M™ 5467A, 5467A-WG, 5468A and 5468A-WG 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 35 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 250 kV, which exceeds the normal 200 kV BIL rating for a 35 kV voltage class.

A. Splice Selection Table

Kit Number	Cable Insulation O.D. Range Inches (mm)	Conductor Size Range AWG or kcmil (mm^2)
5467A, 5467A-WG	1.07–1.70 (27,2–43,2)	1/0–350 (60–185)
5468A, 5468A-WG	1.24–2.07 (31,5–52,6)	350–1000 (185–500)

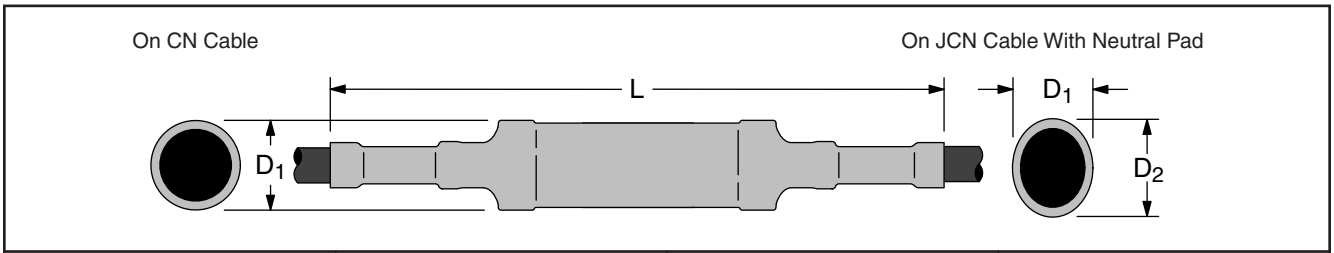
Table 1

B. Connector Dimensional Requirements Table

Kit Number	Minimum O.D. Inches (mm)	Maximum O.D. Inches (mm)	Maximum Length Inches (mm)		Connector O.D. Range Requiring Adapters Inches (mm)
			Aluminum (Al/Cu)	Copper (Cu)	
5467A, 5467A-WG	0.51 (13,0)	1.70 (43,2)	6.00 (152)	6.50 (165)	0.51–1.07 (13,0–27,2)
5468A, 5468A-WG	0.87 (22,1)	2.07 (52,6)	7.50 (191)	8.25 (210)	0.87–1.24 (22,1–31,5)

Table 2

C. Typical Dimensions (Installed Splice)



Kit Number	Typical Length (L) Inches (mm)	Typical Diameter (D_1) Inches (mm)	Typical Diameter (D_2) Inches (mm)
5467A, 5467A-WG	33 (838)	3.60 (91)	3.85 (98)
5468A, 5468A-WG	35 (889)	3.90 (99)	4.15 (105)

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)	8.8
(5 min. recovery, @ 40˚F, 4.4˚C)	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 jacketed concentric neutral (JCN) and concentric neutral (CN) power cable splice shall meet the requirements of ANSI/IEEE Std. 404 for a 35 kV rating, and must be rated by the manufacturer for use on 35 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 1/0 AWG to 350 kcmil (60–185 mm^2) and 350 to 1000 kcmil (185–500 mm^2) 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 35 kV rated cables, jacketed concentric neutral (JCN) and concentric neutral (CN) power cables, sized from 1/0 AWG to 1000 kcmil (60 to 500 mm^2) copper or aluminum, shall be performed in accordance with the instructions provided with the 3M™ 5467A, 5467A-WG, 5468A and 5468A-WG QS–III Cold Shrink Inline Splice Kits.

5. Performance Tests
A. IEEE Std. 404 35 kV Voltage Rating

Design Test and Sequence	Test Requirement
Minimum partial discharge (corona) level	30 kV–rms @ < 3 pC
Alternating-current 1 minute withstand	71 kV–rms
Direct-current 15 minute withstand	125 kV–dc
Impulse with stand (BIL) at 25˚C (77˚F)*	±200 kV–crest (250 kV)*
Impulse withstand (BIL) at 140˚C (284˚F)*	±200 kV–crest (250 kV)*
Minimum partial discharge (corona) level	30 kV–rms @ < 3 pC
Cyclic aging (in air and water)	61 kV–rms
Minimum partial discharge (corona) level	30 kV–rms @ < 3 pC
High voltage time: 5 hr. alternating-current withstand	71 kV–rms
5 min. alternating-current withstand	91 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	71 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	30 kV–rms @ < 3 pC
Alternating-current 1 minute withstand	69 kV–rms

*Notes: (1) BIL rating for 5467A, 5467A-WG, 5468A and 5468A-WG QS-III is upgraded to ±250 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**	**Emergency Operation**
	105˚C	140˚C

6. Installation Techniques for 5467A and 5468A Kits

Detailed instructions for installing the 5467A and 5468A QS–III kits 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. Install inline compression (crimp) connector. Dimensional requirements table provided.
4. Apply a tape marker on one cable.
5. Apply red compound on cable insulation and fill in edge of cable semi–con. **DO NOT use silicone grease.**
6. Install splice over connector area, aligning end with tape marker, and removing core by pulling and unwinding counterclockwise.
7. Connect neutral wires.

8 Route neutral wires over the neutral pad which is centered on splice body.

9. Connect ground wire 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 wire to ground if splice is to be grounded.
13. If located in direct sunlight, overwrap splice with vinyl tape.

7. Installation Techniques for 5467A-WG and 5468A-WG Kits

Detailed instructions for installing the 5467A-WG and 5468A-WG QS–III kits are included with each kit. A Cable Preparation Template is provided:

1. Prepare cable according to standard procedure.
2. Slide cold shrink splice body onto prepared cables.
3. Install inline compression (crimp) connector. Dimensional requirements table provided.
4. Apply a tape marker on one cable.
5. Apply red compound on cable insulation and fill in edge of cable semi–con. **DO NOT use silicone grease.**
6. Install splice over connector area, aligning end with tape marker, and removing core by pulling and unwinding counterclockwise.
7. Connect neutral wires along with the neutral wires on the splice body.
8. Connect ground wire to neutral wires if circuit grounding is required at this location.
9. Connect ground wire to ground if splice is to be grounded.

8. Maintenance

Components of the 3M™ 5467A, 5467A-WG, 5468A and 5468A-WG 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”).

9. Availability

3M™ 5467A, 5467A-WG, 5468A and 5468A-WG QS-III Cold Shrink Inline Splice Kits are available to splice 35 kV jacketed concentric neutral (JCN) and concentric neutral (CN) 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.

10. 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
5467A, 5467A-WG	1/0 to 2/0				2000T 1/0-2/0 Cu/Al
	1/0 to 3/0	SAC3/0R1/0	YRB27U25	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	2000T 2/0-4/0 Cu/Al
	3/0 to 4/0				CI-T7
	2/0 to 250	SAC250R2/0			
	3/0 to 250	SAC250R3/0		MLCR 250-3/0	
	4/0 to 250	SAC250R4/0	YRB29U28		
	3/0 to 350				2000T 3/0-350 Cu/Al
	4/0 to 350	SAC350R4/0	YRB31U28	MLCR 350-4/0	2000T4/0-350 Cu/Al
	250 to 350	SAC350R250	YRB31U29		2000T 250-350 Cu/Al
5468A, 5468A-WG	350 to 500	SAC500R350	YRB34U31		2000T 350-500 Cu/Al
	350 to 750	SAC750R350		MLCR 750-500 plus AAR 500-350	
	500 to 750	SAC750R500	YRB39U34	MLCR 750-500	
	500 to 1000	SAC1000R500		MLCR 1000-750 plus AAR 750-500	
	750 to 1000	SAC1000R750		MLCR 1000-750	

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