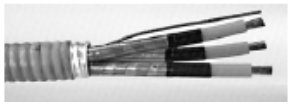
3M™ Cold Shrink 3-Conductor In-line Splice Kits QS-III 5775A-MT, 5776A-MT and 5777A-MT



15 kV for Use with Armored and Non-Armored 3/C Cable

Data Sheet **April 2011**

Description

3M™ Cold Shrink 3-Conductor In-line Splice Kits QS-III 5775A-MT, 5776A-MT and 5777A-MT are designed for splicing 3-conductor, armored and non-armored, shielded power cables. The kits are rated for use on 15 kV cables with conductor sizes from 2 AWG to 750 kcmil (35 to 325 mm^2). The kits are designed to be used with 3M™ Scotchlok™ Copper Connectors 10000 Series and 3M™ Scotchlok™ Copper/Aluminum Connectors 20000 Series, or other UL listed in-line compression connectors that fit within the dimension limits listed in the Connector Dimensional Requirements Table.

The splice utilizes several technologies to accommodate the various functions of a 3-conductor shielded power cable: 3M™ Cold Shrink Splice Bodies QS-III, Scotch® tapes for moisture sealing, constant force springs for connecting ground braid jumpers and Armorcast for replacing the cable armor and/or jacket. The completed splice is designed for use in cable trays; weather exposed or direct burial locations.

Kit Contents

Each kit contains the following materials:

- 3 Cold Shrink Splice Bodies QS-III
- 3 Cold Shrink Adapter Tubes (6 in 5775A-MT)
- 6 Tubes, P55/R Red Compound
- 3 Metallic Shield Sleeves
- 6 Constant Force Springs (small)
- 1 Amor to Armor Continuity Braid (6 AWG)
- 2 Constant Force Springs (large)
- 2 Cold Shrink Jacket Tubes
- 1 3M™ Cable Cleaning Preparation Kit CC-2
- 1 Roll, Scotch® Super 33+™ Vinyl Electrical Tape
- 2 Rolls, Scotch® Vinyl Electrical Tape Super 88
- 1 Roll 3M™ Scotch-Seal™ Mastic Tape 2229 (2 in 5776A-MT and 5777A-MT)
- 1 Roll, Scotch® Electrical Shielding Tape 24
- 1 Roll, Scotch® Rubber Mastic Tape 2228
- Rolls, 3M™ Armorcast Structural Material (3 in 5775A-MT, 4 in 5776A-MT, 5 in 5777A-MT)
- 1 Instruction Sheet
- 6 3M™ Copper Foil Tape Strips 1181
- Gloves

Features

- **Cold Shrink Splice Body Design** – for quick and easy installation; excellent for cable size transitions
- **Production Tested Splice Bodies** – partial discharge and A.C. withstand tests to provide reliability
- **Silicone Rubber Splice Bodies** – provide excellent high and low temperature performance; flexibility that allows the splice to bend with cable (prior to applying jacket materials)
- **Complete Kit** – everything included to make one 3-conductor splice (except connectors)
- **Solderless Ground Braid** – constant force spring connection (no soldering required)
- **Armorcast Jacketing** – easy to apply mechanical protection for the splice

Applications

To splice 3-conductor shielded power cables:

- For in-line splicing
- For armored and non-armored cables
- For 15 kV rated cables
- For cable conductor size range 2 AWG to 750 kcmil
- For use with solid dielectric cables: XLP, XLPE, EPR, etc.
- For indoor and outdoor applications:
  - Cable Tray
  - Cable Rack
  - Cable Hangers
  - Junction Box
  - Aerial
  - Wet or dry locations

Installation

⚠ Caution

Working around energized electrical 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.

Detailed instructions for installing the 3M™ Cold Shrink 3-Conductor In-line Splice Kits QS-III 5775A-MT, 5776A-MT and 5777A-MT are included with the kit.

1. Prepare the cable according to standard practices.
2. Slide the cold shrink jacketing tubes onto the cables.
3. Slide a cold shrink splice body and shield sleeve on each conductor phase.
4. Install connector.
5. Apply red compound on the cable insulation and to fill the edge of the cable semi-con. **DO NOT USE SILICONE GREASE.**
6. Install the splice bodies.
7. Connect shields using shield sleeves and constant force springs.
8. Cover splice end with cold shrink jacket tubes.
9. Seal between the jacket tubes with mastic tape.
10. Cover entire splice area with armorcast structural material.

Typical Properties

3M™ Cold Shrink 3-Conductor In-line Splice Kits QS-III 5775A-MT, 5776A-MT and 5798A-MT can be used on cables with a rated operating temperature up to 105ºC (221ºF), and an emergency overload rating of 140ºC (284ºF). A splice constructed from either of these kits is rated for 15 kV and meets or exceeds the requirements of IEEE Std. 404. The current rating of the splices meets or exceeds the current rating for the cables on which they are installed. BIL rating is 150 kV, which exceeds the normal 110 kV BIL rating for 15 kV voltage class splice.

A. Splice Selection Table

Kit Number	Cable Insulation O.D. Range Inches (mm)	Conductor Size Range AWG or kcmil (mm^2)
5775A-MT	0.64-1.01 (16,3-25,7)	2-4/0 (35-95)
5776A-MT	0.84-1.38 (21,3-35,1)	4/0-500 (95-240)
5777A-MT	1.04-1.70 (26,4-43,2)	350-750 (185-325)

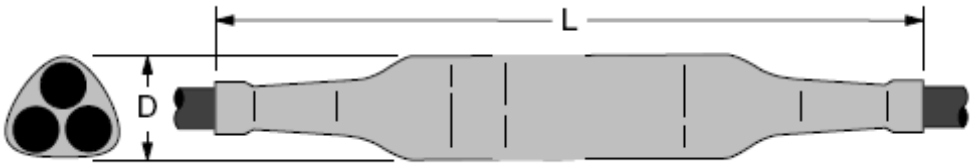
Table 1

B. Connector Dimensional Requirements Table

Kit Number	Minimum O.D. Inches (mm)	Maximum O.D. Inches (mm)	Maximum Length Inches (mm)	
			Aluminum (Al/Cu)	Copper (Cu)
5775A-MT	0.40 (10,2)	1.06 (26,9)	4.50 (114)	5.00 (127)
5776A-MT	0.69 (17,5)	1.38 (35,1)	5.00 (127)	5.75 (146)
5777A-MT	0.80 (20,3)	1.84 (46,7)	6.75 (171)	7.50 (191)

Table 2

C. Typical Dimensions (Installed Splice)



Kit Number	Typical Length (L) Inches (cm)	Typical Diameter (D) Inches (mm)
5777A-MT	52 (132	5.4 (137)
5776A-MT	54 (137)	5.9 (150)
5777A-MT	58 (147)	7.0 (178)

Table 3

Typical Properties, ***Continued***

Not for specifications. Values are typical, not to be considered minimum or maximum. Properties measured at room temperature 73°F (23°C) unless otherwise stated.

Silicone Rubber (Splice Body – Insulation)

Physical Property (Test Method)	**Typical Value** US units (metric)
Hardness – Shore A (ASTM D2240)	50
Tensile Strength (ASTM D412)	1090 psi (7,5 N/mm^2)
Elongation (ASTM D412)	610%
Modulus @ 100% (ASTM D412)	340 psi (2,3 N/mm^2)
Permanent Set (3M TM 86) 100%, 212ºF (100ºC), 22 hrs	5%
Thermal Conductivity (ASTM D518)	0.24 W/m K

Electrical Property (Test Method)	**Typical Value** US units (metric)
Dielectric Strength (ASTM D149)	370 V/mil (14,6 kV/mm)
Dielectric Strength, Wet (ASTM D149)	340 V/mil (13,4 kV/mm)
Dielectric Constant (ASTM D150)	3.3
Dielectric Loss (ASTM D150)	0.005
Volume Resistivity (3M TM 80)	6 x10^{14} Ohm-cm

Silicone Rubber (Splice Body – Inner Electrode)

Physical Property (Test Method)	**Typical Value** US units (metric)
Hardness – Shore A (ASTM D2240)	43
Tensile Strength (ASTM D412)	880 psi (6,1 N/mm^2)
Elongation (ASTM D412)	510%
Modulus @ 100% (ASTM D412)	200 psi (1,4 N/mm^2)
Permanent Set (3M TM 86) 100%, 212ºF (100ºC), 22 hrs	4%

Electrical Property (Test Method)	**Typical Value** US units (metric)
Volume Resistivity (3M TM 80)	50 Ohm-cm

Typical Properties, ***Continued***

Not for specifications. Values are typical, not to be considered minimum or maximum. Properties measured at room temperature 73°F (23°C) unless otherwise stated.

Silicone Rubber (Splice Body – Semi-Con Shell)

Physical Property (Test Method)	**Typical Value US units (metric)**
Hardness – Shore A (ASTM D2240)	43
Tensile Strength (ASTM D412)	890 psi (6,1 N/mm^2)
Elongation (ASTM D412)	520%
Modulus @ 100% (ASTM D412)	230 psi (1,6 N/mm^2)
Permanent Set (3M TM 86) 100%, 212ºF (100ºC), 22 hrs	5%

Electrical Property (Test Method)	**Typical Value** US units (metric)
Volume Resistivity (3M TM 80)	150 Ohm-cm

Ethylene Propylene Rubber (Jacketing Tubes)

Physical Property (Test Method)	**Typical Value US units (metric)**
Color	Black
Hardness – Shore A (ASTM D2240)	48
Ultimate Tensile Strength, orig., (ASTM D412)	1680 psi (11,6 MPa)
Ultimate Elongation, orig. (ASTM D412)	635%
Modulus @ 100% (ASTM D412)	170 psi (1,17 MPa)
Fungus Resistance (ASTM G21) 28 days	No Growth
Permanent Set 250% Strain 5 min. recovery, @ 40ºF (4.4ºC)	 8.8% 14.6%

Electrical Property (Test Method)	**Typical Value** US units (metric)
Dielectric Strength, orig. (ASTM D149)	490 V/mil (19,1 kV/mm)
Dielectric Strength, wet ASTM D149)	465 V/mil (18,1 kV/mm)
Dielectric Constant, orig. (ASTM D150)	5.0
Dielectric Constant, wet (ASTM D150)	5.6

Typical Properties, *Continued*

Not for specifications. Values are typical, not to be considered minimum or maximum. Properties measured at room temperature 73°F (23°C) unless otherwise stated.

Armorcast Structural Material

Physical Property (Test Method)	**Typical Value** US units (metric)
Color	Black
Thickness	0.035 in (1 layer) (0,89 mm)
Tensile Strength (ASTM D412)	3400 psi (23,4 N/mm^2)
Elongation, (ASTM D412)	8.7%
Puncture Resistance (ASTM D1000)	114 lb. (4 layers) (52 Kg)

Ambient Temperature	**Typical Cure Time (Hours)**	**Full Cure (Hours)**
70ºF (21ºC)	0.75	3.5
50ºF (10ºC)	1.0	5.0
32ºF (0ºC)	4 – 8	24
Not Recommended for below 32ºF (0ºC)		

Typical cure time has occurred when the surface is no longer tacky and the armorcast material becomes rigid. These numbers are based on water immersion to activate the resin. Spraying the Armorcast with water, after application, could increase the full cure time up to 2 ½ times.

NOTE: Data for Scotch® Electrical Shielding Tape 24, Scotch® Rubber Mastic Tape 2228, 3M™ Scotch-Seal™ Mastic Compound 2229, Scotch® Super 33+™ Vinyl Electrical Tape and Scotch® Vinyl Electrical Tape Super 88 that are included in the kits are available in separate "Product Data Sheets" from 3M Company.

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	75 kV-dc
Impulse withstand (BIL) at 25ºC (77ºF)*	±110 kV-crest (150 kV)*
Impulse withstand (BIL) at 140ºC (28 ºF)*	±110 kV-crest (150 kV)*
Cyclic aging (in air and water)	26 kV-rms
High voltage time: 5 hr. alternating-current withstand 5 min. alternating-current withstand	31 kV-rms 39 kV-rms
Short-time current: ICEA P-32-382 and ANSI/IEEE C37.09	250ºC (482ºF) conductor temp with no damage
Alternating-current 1 minute withstand	35 kV-rms
Shielding	IEEE Std. 592
Connector thermal and mechanical	ANSI C119.4

***See *Notes* next page**

Performance Tests, *continued*

A. IEEE Std. 404 35 kV Voltage Rating, *continued*

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 QS-III splices 5775A-MT (5415A splice body), 5776A-MT (5416A splice body) and 5777A-MT (5417A splice body) are 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: 105ºC (221ºF) **Emergency Operation:** 140ºC (284ºF)

Product Specification (Open Specification)	3M™ Cold Shrink 3-Conductor In-line Splice Kits QS-III 5775A-MT, 5776A-MT and 5777A-MT, armored or non-armored, shielded power cable splice shall meet the requirements of ANSI/IEEE Std. 404, for a 15 kV rating, and must be rated by the manufacturer for use on 3-conductor 15 kV class shielded power cable systems. It must be rated for continuous operation at 105ºC (221ºF), with an emergency overload temperature rating of 140ºC (284ºF). The splice shall be capable of splicing cables with copper or aluminum conductors sized from 2 to 4/0 AWG (35-95 mm^2), 4/0 AWG to 500 kcmil (95-240mm^2) and 350 to 750 kcmil (185-325 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 system shall be comprised of at least two of the following items: cold shrink tubing made of EPDM rubber, mastic sealing tape, and a resin-impregnated fiberglass cloth. The color of the splice body and outer jacket shall be black.
Engineering/ Architectural (Closed Specification)	Splicing of all 15 kV rated, 3-conductor, armored or non-armored shielded power cables, sized from 2 AWG to 750 kcmil (35 to 325 mm^2) with copper or aluminum conductors shall be performed in accordance with the QS-III 5775A-MT, 5776A-MT and 5777A-MT kits.
Maintenance	The installed splices can be field tested using standard cable testing procedures (reference ANSI-IEEE Std. 400, “Guide for Making High-Direct-Voltage Tests on Power Cable Systems in the Field”).
Shelf Life & Storage	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).
Availability	Please contact your local distributor; available from 3M.com/electrical [Where to Buy] or call 1.800.245.3573.

Connectors for QS-III Splices

The 3M™ Cold Shrink 3-Conductor In-line Splice Kits QS-III 5775A-MT, 5776A-MT and 5777A-MT are designed to be used with 3M™ Scotchlok™ Connectors 10000, 11000, 20000 and CI Series, or other UL listed in-line 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
5775A-MT	2 to 1		YRB25U2		CI-T2
	2 to 1/0	SAC1/0R2	YRB25U2	MLCR 1/0-2	CI-T4
	2 to 2/0	SAC2/0R2			
	1/0 to 3/0	SAC3/0R1/0	YRB27U25	MLCR 3/0-1/0	
	2/0 to 3/0		YRB27U26		
	2 to 4/0	SAC4/0R2			
	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				C9-T7
5776A-MT	4/0 to 250	SAC25OR4/0	YRB29U28	MLC 250 + AAR 250-4/0 Adapter	
	4/0 to 300	SAC300R4/0			
	4/0 50 350	SAC350R4/0	YRB31U28	MLCR 350-4/0	2000T 4/0-350 CU/AL
	250 to 350	SAC350R250	YRB31U29	MLC 350 + AAR 350-250 Adapter	2000T 250-350 CU/AU
	300 to 350				2000T 300-350 CU/AL
	350 to 500			MLC 500 + AAR 500-350 Adapter	2000T 350-500 CU/AL
5777A-MT	350 to 500	SAC500R350	YRB34U31	MLC 500 + AAR 500-350 Adapter	2000T 350-500 CU/AL
	350 to 600		YRB36U31		
	500 to 600		YRB36U34		
	350 to 750	SAC750R350		MLC 750 + AAR 750-350 Adapter	
	500 to 750	SAC750R500	YRB39U34	MLCR 750-500	

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