

3M™ Cold Shrink 3-Conductor Inline Splice Kits QS-III 5786A- MT, 5787A-MT and 5788A-MT

25/28 kV for use with Armored and Non-
Armored 3/C Cable



Data Sheet

September 2010

Description

3M™ Cold Shrink 3-Conductor Inline Splice Kits QS-III 5786A-MT, 5787A-MT and 5788A-MT are designed for splicing 3-conductor, armored and non-armored, shielded power cables. The kits are rated for use on 25/28 kV cables with conductor sizes from 1 AWG to 1000 kcmil (50 to 500 mm²). The kits are designed to be used with 3M™ Scotchlok™ Connectors 10000 and 20000 Series or other UL listed inline 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® Electrical 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 5786A-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) (not include in 5788A-MT Kit)
- 2 Cold Shrink Jacket Tubes (not included in 5788A-MT kit)
- 1 3M™ Cable Cleaning Preparation Kit CC-2
- 1 Roll, Scotch® Super 33+™ Vinyl Electrical Tape
- Rolls of Scotch® Vinyl Electrical Tape Super 88 (4 in 5786A-MT, 5 in 5787A-MT, 10 in 5788A-MT)
- Rolls of 3M™ Scotch-Seal™ Mastic Tape Compound 2229 (3 in 5786A-MT, 4 in 5787a-MT, 10 in 5788A-MT)
- 1 Roll, Scotch® Electrical Shielding Tape 24
- 1 Roll, Scotch® Rubber Mastic Tape 2228 (not included in 5788A-MT)
- Rolls of Armorcast Structural Material (5 in 5786A-MT, 6 in 5787A-MT, 8 in 5788A-MT)
- 1 Instruction Sheet
- 6 Copper Foil Tape Strips
- 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 inline splicing
- For armored and non-armored cables
- For 25/28 kV rated cables
- For cable conductor size range 1 AWG to 1000 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 Inline Splice Kits QS-III 5786A-MT, 5787A-MT and 5788A-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 Inline Splice Kits QS-III 5786A-MT, 5787A-MT and 5788A-MT can be used on cables with a rated operating temperature up to 105°C (221°F), and in emergency overload rating of 140°C (284°F). A splice constructed from either of these kits is rated for 25/28 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 200kV, which exceeds the normal 150 kV BIL rating for 25/28 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)
5786A-MT	0.84-1.36 (21,3-34,5)	1-250 (50-120)
5787A-MT	1.07-1.70 (27,2-43,2)	250-750 (120-325)
5788A-MT	1.24-2.07 (31,5-52,6)	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)	
			Aluminum (Al/Cu)	Copper (Cu)
5786A-MT	0.46 (11,7)	1.36 (34,5)	4.00 (102)	4.50 (114)
5787A-MT	0.75 (19,1)	1.70 (43,2)	5.75 (146)	6.50 (165)
5788A-MT	1.05 (26,7)	2.07 (52,6)	7.50 (191)	8.25 (210)

Table 2

C. Typical Dimensions (Installed Splice)



Kit Number	Typical Length (L) Inches (cm)	Typical Diameter (D) Inches (mm)
5786A-MT	57 (145)	7.50 (191)
5787A-MT	62 (158)	8.00 (203)
5788A-MT	66 (168)	8.50 (216)

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 D-2240)	50
Tensile Strength (ASTM D-412)	1090 psi (7,5 N/mm ²)
Elongation (ASTM D-412)	610%
Modulus @ 100% (ASTM D-412)	340 psi (2,3 N/mm ²)
Permanent Set (3M TM 86) 100%, 100°C, 22 hrs	5%
Thermal Conductivity (ASTM D-518)	4 W/m K

Electrical Property (Test Method)	Typical Value US units (metric)
Dielectric Strength (ASTM D-149)	370 V/mil (14,6 kV/mm)
Dielectric Strength, Wet (ASTM D-149)	340 V/mil (13,4 kV/mm)
Dielectric Constant (ASTM D-150)	3.3
Dielectric Loss (ASTM D-150)	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 D-2240)	43
Tensile Strength (ASTM D-412)	880 psi (6,1 N/mm ²)
Elongation (ASTM D-412)	510%
Modulus @ 100% (ASTM D-412)	200 psi (1,4 N/mm ²)
Permanent Set (3M TM 86) 100%, 100°C, 22 hrs	4%

Electrical Property (Test Method)	Typical Value US units (metric)
Volume Resistivity (3M TM 80)	50 Ohms

**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 D-2240)	43
Tensile Strength (ASTM D-412)	890 psi (6,1 N/mm ²)
Elongation (ASTM D-412)	520%
Modulus @ 100% (ASTM D-412)	230 psi (1,6 N/mm ²)
Permanent Set (3M TM 86) 100%, 100°C, 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 D-2240)	48
Ultimate Tensile Strength (ASTM D-412)	1680 psi (11,6 MPa)
Ultimate Elongation, orig. (ASTM D-412)	635%
Modulus @ 100% (ASTM D-412)	170 psi (1,17 MPa)
Fungus Resistance (ASTM G-21) 28 days	No Growth
Permanent Set 250% Strain 5 min. recovery, @ 40°F (4.4°C)	8.8% 14.6%

Electrical Property (Test Method)	Typical Value US units (metric)
Dielectric Strength, orig. (ASTM D-149)	490 (19,1 kV/mm)
Dielectric Strength, Wet ASTM D-149)	465 (18,1 kV/mm)
Dielectric Constant, orig. (ASTM D-150)	5.0
Dielectric Constant, wet (ASTM D-150)	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" (1 layer) (0,89 mm)
Tensile Strength (ASTM D-412)	3400 psi (23,4 N/mm ²)
Elongation, (ASTM D-412)	8.7%
Puncture Resistance (ASTM D-1000)	114 lb. (4 layers) (52 Kg)

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

Typical cure time has occurred when the surface is no longer tacky and the 3M™ Armorcast Structural Material becomes rigid. These numbers are based on water immersion to activate the resin. Spraying the Armorcast Material with water, after application, could increase the full cure time up to 2 ½ times.

NOTE: *Data for Scotch® Electrical Tapes and Mastics 24, 2228, 2229, Super 33+™ and Super 88 that are included in the kits are available in separate "Product Data Sheets" from 3M Company.*

Performance Tests A. IEEE Std. 404 25/28 kV Voltage Rating

Design Test and Sequence	Test Requirement
Minimum partial discharge (corona) level	22 kV-rms @ < 3 pC
Alternating-current 1 minute withstand	58 kV-rms
Direct-current 15 minute withstand	112 kV-dc
Impulse with stand (BIL) at 25°C (77 °F)*	±150 kV-crest (200 kV)*
Impulse with stand (BIL) at 140°C (284 °F)*	±150 kV-crest (200 kV)*
Cyclic aging (in air and water)	48 kV - rms
Minimum partial discharge (corona) level	22 kV – rms @ < 3 pC
High voltage time: 5 hr. alternating-current withstand 5 min. alternating-current withstand	58 kV – rms 75 kV - rms
Short-time current: ICEA P-32 and ANSI/IEEE C37.09	250°C (482°F) conductor temp with no damage
Alternating-current 1 minute withstand	58 kV – rms
Shielding	IEEE Std. 592
Connector thermal and mechanical	ANSI C119.4

*See Notes next page

3M™ Cold Shrink 3-Conductor Inline Splice Kits QS-III 5786A-MT, 5787A-MT and 5788A-MT

Performance Tests, continued **A. IEEE Std. 404 25/28 kV Voltage Rating, continued**

Production Test	Test Requirement
Production splices tested	100%
Minimum partial discharge (corona) level	22 kV – rms @ < 3 pC
Alternating-current 1 minute withstand	58 kV – rms

- *Notes: 1) BIL rating for 5786A-MT (5456A splice body), 5787A-MT (5457A splice body) and 5788A-MT (5458A splice body) QS-III splices are upgraded to ±200 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 (221°F) **Emergency Operation:** 140°C (284°F)

Product Specification (Open Specification)	3M™ Cold Shrink 3-Conductor Inline Splice Kits QS-III 5786A-MT, 5787A-MT and 5788A-MT, armored or non-armored, 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 3-conductor 25/28 kV class shielded power cable systems. It must be rated for continuous operation at 105°C (221°F), with an emergency overload temperature rating of 140°C (284°F). The splice shall be capable of splicing cables with copper or aluminum conductors sized from 1 AWG to 250 kcmil (50 to 120 mm ²), 250 to 750 kcmil (120 to 325 mm ²) and 500 to 1000 kcmil (240 to 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 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.
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Engineering/ Architectural (Closed Specification)	Splicing of all 25/28 kV rated, 3-conductor, armored or non-armored shielded power cables, sized from 1 AWG to 1000 kcmil (50 to 500 mm ²) with copper or aluminum conductors shall be performed in accordance with the QS-III 5786A-MT, 5787A-MT and 5788A-MT 25/28 kits.
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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").
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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).
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Availability	Please contact your local distributor; available from 3M.com/electrical [Where to Buy] or call 1-800-245-3573.
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3M™ Cold Shrink 3-Conductor Inline Splice Kits QS-III 5786A-MT, 5787A-MT and 5788A-MT

Connectors for QS-III Splices

The 3M™ Cold Shrink 3-Conductor Inline Splice Kits QS-III 5786A-MT, 5787A-MT and 5788A-MT 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
5786A-MT	1 to 1/0				CI-T9
	1/0 to 3/0	SAC3/OR1/A	YRB27U26	MILCR E/0-1/0	
	2/0 to 1			MLCR 2/0-1	
	2/0 to 3/0		YRB27U26		
	1/0 to 4/0	SAC4/OR1/0			
	2/0 to 4/0	SAC4/OR2/0	YRB28U26	MLCR 4/0-2/0	
	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	SAC240R4/0			
5787A-MT	250 to 350	SAC50R250	YRB31U29		2000T 250-350 CU/AL
	350 to 500	SAC1000R500		MILCR 1000-750 plus AAR 750-500	2000T 350-500 CU/AL
	500 to 750		YRB39U34		
5788A-MT	500 to 750	SAC750R500	YRB39U34	MLCR 750-500	
	500 to 1000	SAC1000R500		MILCR 1000-750 plus AAR 750-500	
	750 to 1000	SAC1000R750		MLCR 1000-750	

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