PRODUCT DATA

1.

3M Quick Splice II 5411R 15 kV Molded Rubber Inline Splicing Kit

1. Product Description

3M Brand Quick Splice II 5411R is a 15 kV one-piece inline splice, molded from specially formulated EPDM rubbers and peroxide cured. The 5411R is specially designed for service on (CN) Concentric Neutral or (JCN) Jacketed Concentric Neutral cable at locations where installed cable is in need of repair. The 5411R elongated design allows for removal of a damaged cable section, not to exceed 6 inches in length (152mm). The 5411R meets all the performance requirements of IEEE 404-1986 Standard. Each splice is tested on cable at the factory to insure reliability.

Kit Contents:

- 1 EPDM molded rubber splice body
- 1 packet of silicone grease
- 1 instruction sheet

The Splice Features Are:

- An elongated splice design to allow 6 inch (152mm) removal of damaged cable section
- Accommodates 15 kV class, #2 - 1/0 cable
- Simple, one-piece installation
- Peroxide-cured EPDM rubbers
- Low thermal impedance
- Positive electrical connection of the splice semi-conductive shield to the cable insulation shield
- Superior electrical stress distribution
- Single interface reliability
- 100% electrically tested on cable at time of manufacture
- Special 3M Brand CIR series connectors are used to bridge gap where damaged cable section is removed
- Sure visual centering over the connector area

2. Applications

Quick Splice II 5411R is used to splice 15 kV class, (CN) Concentric Neutral or (JCN) Jacketed Concentric Neutral cable at locations where installed cable has been damaged. When installations involve JCN cable, a 3M Brand HSJ-1 Heat Shrinkable Splice Jacketing Kit can be used to seal the cable jacket opening. 5411R accommodates cable conductor size range from #2 AWG to 1/0 (#4 only with 220 mil insulation) whose primary insulation diameter is between .637" and .900" (16.2mm - 22.9mm).
5411R is suitable for direct burial, aerial or submersible applications.

3. Data: Physical & Electrical Properties

Quick Splice II 5411R is used on cables with a 90° C rated operating temperature and an emergency overload rating of 130° C. It meets the requirements of a 15 kV splice in IEEE 404-1986 Standard for power cable joints. Current rating of the splice meets or exceeds the current rating of the cable on which it is to be installed. Special CIR series connectors are available to join and bridge the gap between the two conductors. Such connectors meet all the requirements for Class A, partial tension connectors of ANSI C119.4 Standard for connectors for use between aluminum or aluminum-copper overhead conductors, NEMA Pub No. CC 3.

A. Splice and Connector Selection Table

Product No.	Voltage Class	Primary Insulation O.D. Range* inches(mm)	Conductor Size (AWG)		3M connector No.** (connector can be included in kit or ordered separately)
			Stranded	Solid	
5411R	15 kV	.637-.900 (16.2-22.9)	#4 (220 mil insul. only)	#2	CIR-22
			#2-#1	#1-1/0	CIR-21
			1/0	-	CIR-1/0

* The primary insulation O.D. range is the final ordering criteria.
** Splice can be ordered with or without a connector. If you wish to have a connector packed with the kit, add the connector number after the kit number. (example: 5411R/CIR-21 kit will contain a 5411R splice and a CIR-21 connector)

Table A

4. Specifications

Product

Power cable splice must be a 15 kV class device and meet the requirements of IEEE 404-1986 Standard for Power Cable Joints. The splice must be a one-piece, molded rubber device having an elongated design. Rubber must be EPDM using peroxide cure. As designed, the unit must allow for the removal of a damaged cable section to 6.0" (152mm) in length. Splice shield resistance center to end must be less than 5000 ohms. Conducting portion of splice shield must make positive electrical contact with the cable shield.

Engineering/Architectural

Splice all #2 - 1/0, 15 kV class (CN) concentric neutral cable where installed cable has been damaged and the damaged cable section is less than 6" (152mm). Splice according to instructions contained in 3M Brand Quick Splice II, 5411R Inline Splicing Kit.

6. Installation Techniques

Detailed instructions for installing the 5411R Quick Splice II are packed in each kit. A brief summary of installation steps for 5411R splice kit are outlined as follows:

a. Cut out damaged cable area, 6 inches (152mm) maximum.

b. Prepare cable according to standard procedure and install special CIR connector. Crimp one end of connector.

c. Lubricate connector and insula tion and semi-con of connected cable with silicone grease provided.

d. Slide 5411R over connector and connected cable.

e. Crimp second connector end.

f. Lubricate exposed cable insulation with silicone grease and slide splice into final position. Use bumps formed on splice end as guides for centering.

5. Performance Tests IEEE 404-1986 Standard for Power Cable Joints

Design Test and Sequence	Test Requirements
Minimum Partial Discharge (Corona Extinction) Voltage Level	13 kV-rms @ < 3 pC
1 Minute Alternating-Current w/s Voltage Test	35 kV-rms
15 Minute Direct-Current w/s Voltage Test	-70 kV-dc
Impulse w/s Voltage Test (BIL) at 20°C (68°F)	±150 kV-crest*
Impulse w/s Voltage Test (BIL) at 130°C (266°F)	±150 kV-crest*
Minimum Partial Discharge (Corona Extinction) Voltage Level	13 kV-rms @ < 3 pC
Short Time Current Test (ICEA Standard P-32-382 and ANS Standard C37.05-1964, Revised 1976)	0.17 second
1 Minute Alternating-Current w/s Voltage Test	35 kV-rms
Minimum Partial Discharge (Corona Extinction) Voltage Level	13 kV-rms @ < 3 pC
Cyclic Aging Test, 30 Days in Air	26 kV-rms
Cyclic Aging Test, 30 Days in 40°C (104°F) Water	26 kv-rms
Minimum Partial Discharge (Corona Extinction) Voltage Level	13 kV-rms @ < 3 pC
High Voltage Time Tests (in Water) - 5 Hour Alternating-Current w/s Voltage - 1 Hour Alternating-Current w/s Voltage	 35 kV-rms 52.5 kV-rms
Shielding Test	IEEE Std. 592
Connector Thermal and Mechanical Tests	ANSI Std. C119.4 and EEI TD 161
NOTE: *Impulse test wave 1.2 x 50 µsec. (ANSI/IEEE Standard 4, 10 positive and 10 negative impulses.	
Production Tests	**Test Requirements**
Voltage Rating	15 kV-rms
Minimum Partial Discharge (Corona Extinction) Voltage Level 1 Minute Alternating-Current w/s Voltage Test	13 kV-rms @ < 3 pC 35 kV-rms

B. Splice Ratings

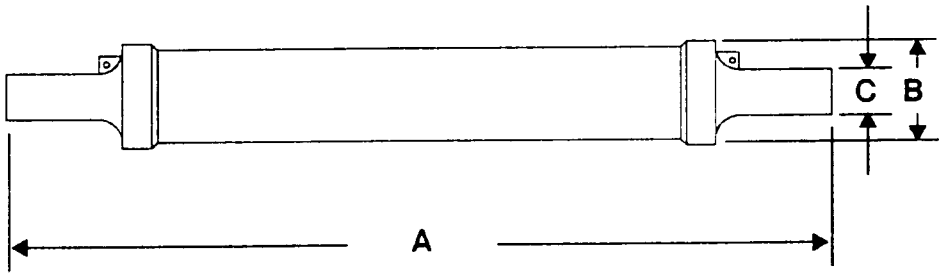
Product No.	Voltage Class	BIL	Maximum continuous operating Temp.	Emergency operating temp. (500 hrs. max.)
5411R	15 kV	150 kV	90° C	130° C

Table B

C. Typical Dimensions

Product No.	Dimensions inches (mm)		
	A	B	C
5411R	15.7 (400)	1.9 (48)	.61 (15.5)

Table C



D. Typical Physical and Electrical Properties

Insulating Rubber

Physical Properties

Test Method	Typical Value*
Color	White
Ultimate Elongation ASTM-D-412	570% min.
Ultimate Tensile Strength ASTM-D-412	900 psi min. (6.21 MPa min.)
Shore A Hardness ASTM-D-2240	55
Permanent Set - 70 hrs. @ 90° C (194° F) 100% elongation, 5 min. recovery (3M Test Method)	25%
Compression Set - 70 hrs. @ 100° C (212° F) ASTM-D-395, Method B	18.7%
- 100% Modulus ASTM-D-412	185 psi (1.28 MPa)
- 300% Modulus ASTM-D-412	650 psi (4.49 MPa)

Electrical Properties

Test Method	Typical Value*
Dielectric Constant (SIC) ASTM-D-150	
23° C (73° F)	2.71
90° C (194° F)	2.58
130° C (266° F)	2.56
Dissipation Factor ASTM-D-150	
23° C (73° F)	0.4%
90° C (194° F)	1.3%
130° C (266° F)	4.7%
Dielectric Strength ASTM-D-149	
25 mil gap	1177 volt/mil (46.3 MV/m)
100 mil gap	518 volts/mil (20.41 MV/m)
20 days @ 96% R.H. 90° C (194° F)	
25 mil gap	1066 volts/mil (42.00 MV/m)
100 mil gap	790 volts/mil (31.13 MV/m)

Semi-Conducting Rubber

Physical Properties

Test Method	Typical Value*
Color	Black
Ultimate Elongation ASTM-D-412	300% (min.)
Ultimate Tensile Strength ASTM-D-412	1700 psi min. (11.73 MPa min.)
Shore A Hardness ASTM-D-2240	70
Die C Tear ASTM-D-624	225 lbs/inch min. (39.38 KN/m min.)
Permanent Set 3M Test Method TM 86A	20% max.
- 100% Modulus ASTM-D-412	400 psi (2.76 MPa)
- 300% Modulus ASTM-D-412	1800 psi (12.42 MPa)
Ozone Resistance - 70 hrs. 150 ppm @ 20% strain	No Cracking
U.V. Resistance - 70 hrs. @ 20% strain	No Cracking

Electrical Properties

Test Method	Typical Value*
Volume Resistivity 3M Test Method TM 80	15.4 ohm-inch max. (40 ohm-cm max.)

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

g. Ground splice by connecting concentric neutral wires. Attach one concentric strand from each cable to its splice ground ing eye.
Note: When the 5411R is installed on (JCN) Jacketed Concentric Neutral cable the 3M Brand HSJ-1 Heat Shrinkable splice jacket kit can be used to seal the cable jacket opening.

7. Maintainance

Compounds of 3M Quick Splice II kits are stable under normal storage conditions. Normal stock rotation procedures are recommended. The rubber splice is not impaired by freezing nor by over heated storage up to the point of flow. After installation,splices can be checked periodically using visual inspection or normal hypotting procedures.

8. Availability

3M Quick Splice II 5411R is packaged one kit per box. The 5411R, CIR series connectors and HSJ-1 are available from your local authorized 3M electrical distributor.

IMPORTANT NOTICE TO PURCHASER:
All statements, technical information and recommendations contained herein are based on tests we believe to be reliable, but the accuracy or completeness thereof is not guaranteed, and the following is made in lieu of all warranties, expressed or implied:
Seller's and manufacture's only obligation shall be to replace such quantity of the product proven to be defective. Neither seller nor manufacturer shall be liable for any injury, loss or damage, direct or consequential, arising out of the use of or the inability to use the product. Before using, user shall determine the suitability of the product for his intended use, and user assumes all risk and liability whatsoever in connection therewith.No statement or recommendation not contained herein shall have any force or effect unless in an agreement signed by officers of seller and manufacture.

80-6102-9632-1 (1274)R1

Litho in U.S.A.

3M Electrical Products Division

Building 225-4N-05, 3M Center
St. Paul, Minnesota 55144-1000

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Kit Contents:

- 1 EPDM molded rubber splice body
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The Splice Features Are:

- An elongated splice design to allow 6 inch (152mm) removal of damaged cable section
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Product No.	Voltage Class	Primary Insulation O.D. Range* inches(mm)	Conductor Size (AWG)		3M connector No.** (connector can be included in kit or ordered separately)
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			#2-#1	#1-1/0	CIR-21
			1/0	-	CIR-1/0

* The primary insulation O.D. range is the final ordering criteria.
** Splice can be ordered with or without a connector. If you wish to have a connector packed with the kit, add the connector number after the kit number. (example: 5411R/CIR-21 kit will contain a 5411R splice and a CIR-21 connector)

Table A

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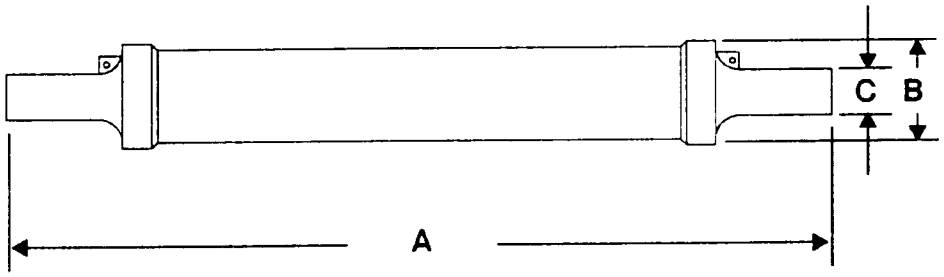

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Insulating Rubber

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Semi-Conducting Rubber

Physical Properties

Test Method	Typical Value*
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Die C Tear ASTM-D-624	225 lbs/inch min. (39.38 KN/m min.)
Permanent Set 3M Test Method TM 86A	20% max.
- 100% Modulus ASTM-D-412	400 psi (2.76 MPa)
- 300% Modulus ASTM-D-412	1800 psi (12.42 MPa)
Ozone Resistance - 70 hrs. 150 ppm @ 20% strain	No Cracking
U.V. Resistance - 70 hrs. @ 20% strain	No Cracking

Electrical Properties

Test Method	Typical Value*
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Seller's and manufacture's only obligation shall be to replace such quantity of the product proven to be defective. Neither seller nor manufacturer shall be liable for any injury, loss or damage, direct or consequential, arising out of the use of or the inability to use the product. Before using, user shall determine the suitability of the product for his intended use, and user assumes all risk and liability whatsoever in connection therewith.No statement or recommendation not contained herein shall have any force or effect unless in an agreement signed by officers of seller and manufacture.

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