Data Sheet

Quick Term II Silicone Rubber Termination Kit 4604 and 4605 • 46 kV

1. Product Description

3M 4604 and 4605 Quick Term II Silicone Rubber Termination Kits are three-piece Cold Shrink terminations for Tape Shield, Wire Shield, and LC Shield power cables. **They meet the requirements of IEEE standard 48 – 1990, for class 1 terminations.** In addition they meet German standard VDE 0278 parts 5 & 100, British standard BS C-89, Spanish standard UNE 21-115-75 and Brazilian standard A·B·N·T·9314. Similar terminations using Quick Term II technology meet French EdF standards HN 33-E-01 and HN 41-E-01. Data on foreign standards are available upon request. The 3M Quick Term II consists of a high dielectric constant (High-K) stress control tube insulated with a molded silicone skirted insulator. The 4600-series termination is a twelve-skirt design incorporating a one-piece base termination assembly, a four-skirt extension insulator, and a Silicone Rubber Jacket-Sealing Cold Shrink PST Assembly.

Quick Term II terminations are provided in an expanded state; mounted on a removable inner supporting plastic core. As supplied in this pre-stretched condition the termination is ready for field installation. During installation the core is unwound, allowing the termination to shrink and form a tight seal. Collectively, these termination kits cover cables with primary insulation O.D. from 1.31″ to 2.60″ (33 to 66 mm). These kits can be used to terminate 46 kV Shielded Power Cables from: 4/0 AWG to 1500 kcm.

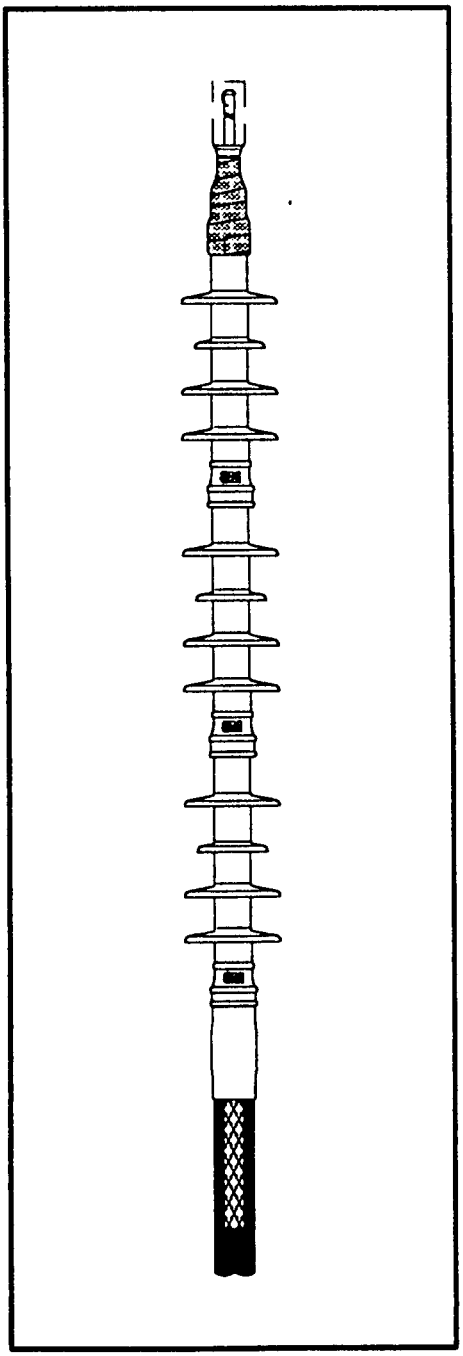
Stress Control

The 3M Quick Term II controls the electric field surrounding the terminated cable insulation shield end, by use of a special high dielectric constant (High-K) material which is an integral part of the termination. The High-K material has a dielectric constant of about 25. By controlling the electrical field, the stress concentration in the applied termination materials and at the air interface is less than 15 volts/mil at rated voltage. In the shielded portion of 46 kV cable, the stress concentrations typically vary from 45 volts/mil at the shield to about 85 volts/mil at the conductor. When terminated with the Quick Term II, the stress in the cable underneath this unit is less than it is in the shielded portion of the cable. *Figure 1* shows an actual computerized stress plot of the Quick Term II.

Cold Shrink Insulators

3M Quick Term II Skirted Insulators are constructed of non-tracking silicone rubber which minimizes leakage currents in wetted conditions for three reasons:

1. The smooth surface of the silicone rubber insures that a minimum amount of contamination will adhere to the termination.
2. Silicone rubber has a hydrophobic surface: When water comes in contact with the silicone it **beads** up and runs off the skirts rather than completely wetting these surfaces. Thus a less conductive path is formed on the silicone and leakage currents are lowered.



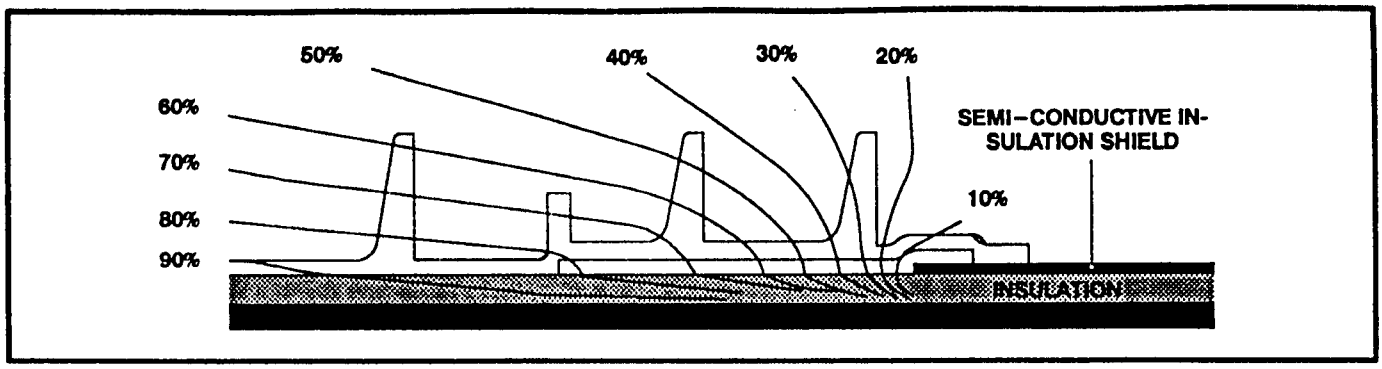


FIGURE 1

3. When leakage currents do increase and arcing occurs on the surface, the ash formed by erosion of the silicone insulator is non-organic or nonconductive. Continued degradation is thereby deterred.

Under heavy rain conditions, conventional skirted terminations with even-skirt diameter insulators tend to form drip paths or continuous water paths from insulator skirt tip to skirt tip. By comparison, 3M Quick Term II insulators are designed with unique, uneven skirt diameters. This feature allows water dripping from the upper skirt to fall free, avoiding the skirt to skirt conductive path that can develop with even-skirt diameter insulators. This design of the 3M Quick Term II termination optimizes performance under heavy rain conditions.

Kit Contents

Each kit contains sufficient quantities of the following materials to make one termination:

- 1 High-K, 8-Skirt Silicone Rubber Termination Assembly.
- 1 Four-Skirt Silicone Rubber Insulator.
- 1 Silicone Rubber Jacket-Seal PST Assembly.
- 1 Pack Silicone Grease.
- 2 Pre-Formed Ground Braids.
- 1 Constant-Force Spring.
- 2 Mastic Seal Strips.
- 1 Roll Scotch™ No. 13 Semi-Conducting Tape.
- 1 Roll Scotch™ No. 70 Silicone Rubber Tape.
- Instruction Sheet.

2. Applications

The 4604 and 4605 Quick Term II Silicone Cold Shrink Terminations are used to terminate shielded power cable rated 46 kV, having extruded solid dielectric insulation as follows: Polyethylene (high and low density), cross-linked polyethylene (XLP) and ethylene propylene rubber (EPR). The terminations are light weight for either free-hanging or bracket-mounting arrangements. They can be used in both protected and weather exposed contaminated areas.

3. Data: Physical and Electrical Properties

The 4604 and 4605 Quick Term II terminations can be used on cables with a rated operating temperature of 90°C and an emergency overload rating of 130°C, (reference: AEIC CS5 and AEIC CS6). These kits meet the requirements for 46 kV Class 1 terminations in IEEE Standard Test Procedures and Requirements for High-Voltage Cable Terminations (IEEE Standard 48 – 1990). (See Section 5, **"Performance Tests"**). The current rating of Quick Term II terminations exceeds the current rating of the cable installed.

Typical Physical and Electrical Properties

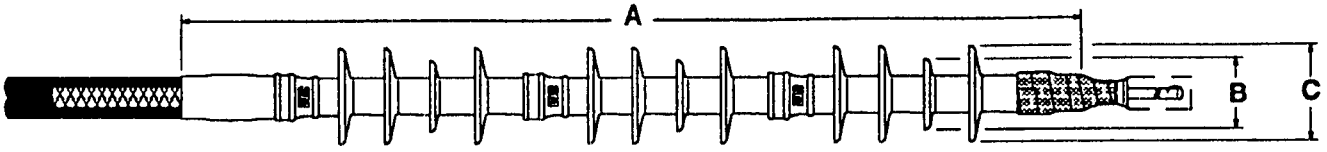
Silicone Rubber Insulator

Physical Properties

Test Method	Typical Value*
• Color	Munsel Gray
• Permanent Set 22 hours @ 100°C (212°F) 100% elongation 5 minute recovery	8%
• Ultimate Tensile Strength (ASTM D412-68)	1200 psi (8.28 MPa)

Electrical Properties

Test Method	Typical Value*
• Dielectric Constant (K) (ASTM D150-70)	
23°C (73°F)	3.4
90°C (194°F)	3.0
130°C (266°F)	2.7
• Dissipation Factor (ASTM D150-70)	
23°C (73°F)	.4%
90°C (194°F)	1.3%
130°C (266°F)	1.2%
• Dielectric Strength (ASTM D149-70) .075" (1.9 mm) gap	507 volts/mil (20 kV/mm)
• Track Resistance (ASTM 2303-68) 2.5 kV, 10 k Ohms	10 hrs.



TWELVE-SKIRT TERMINATION

Typical Dimensions

Product Number	A	B	C	Creepage Distance	Arcing Distance
4604	28″ (max.) (711 mm)	2.0″ (51 mm)	3.55″ (90 mm)	46″ (max.) (1168 mm)	30″ (max.) (762 mm)
4605	28″ (max.) (711 mm)	2.4″ (61 mm)	4.0″ (102 mm)	46″ (max.) (1168 mm)	30″ (max.) (762 mm)

Termination Selection Table

Product Number	Primary Insulation O.D. Range Inches (mm)	Conductor Range (AWG / Kcmil) 46 kV
4604	1.31″ – 2.10″ (33 – 53 mm)	4/0 – 600
4605	1.80″ – 2.66″ (46 – 66 mm)	600 – 1500

**See Recommended Application Guide, on page 2.

Typical Results per IEEE STD. 48 – 1990 Tests

IEEE STD. 48 Test	46 kV Class	
	Requirement	Results
60 sec. w/s ac	120 kV	150 kV*
10 sec. w/s wet ac	100 kV	115 kV*
6 hours w/s ac	100 kV	135 kV*
Corona @ 3 pc. CSV CEV	— 40 kV	52 kV 49 kV
15 min. w/s dc	170 kV	Pass 170 kV
Impulse w/s	250 kV	+285 kV* –275 kV*
30 day Cyclic Aging @ 130°C w/s ac Corona @ 3 pc. CEV > Impulse +10 –10	53 kV 40 kV +250 kV –250 kV	Pass Pass Pass Pass

* At higher voltage flashovers occur.