

3M™ Cold Shrink QT-III Silicone Rubber Skirted Termination Kit 7673-S-8 & 7673-S-10 Series

Data Sheet

January 2016

Description

3M Cold Shrink QT-III Silicone Rubber Skirted Termination Kit 7673-S-8 & 7673-S-10 Series contains one silicone rubber, non-self supporting termination qualified to IEEE 48 Class 1 for 69 kV and IEC 60840 for 72.5 kV for outdoor termination applications.

The complete termination is constructed of four sub-assemblies: 1) The Silicone Rubber Skirted Stress Control Assembly 2) The Hi-K Stress Control Adapter Assembly 3) The Silicone Rubber Lug Seal Assembly 4) The Silicone Rubber Ground Seal Assembly. The skirted assembly consists of an inner Hi-K stress control layer and 8-10 silicone rubber skirts. Each assembly is pre-stretched and loaded on a support core. Following installation, the support cores can be recycled.

The termination kit shall include a high ampacity ground strap assembly as a means for grounding the terminated cable's metallic insulation shield. The ground strap assembly consists of a three-loop pre-formed ground braid with a 2-hole copper lug crimped onto the ground braid tails. Three constant force springs are used to attach the ground strap assembly to the cable's metallic shield.

The 3M cold shrink QT-III termination kit 7673-S-8 & 7673-S-10 Series are designed to terminate 69 kV, 650 mil solid dielectric, Tape (TS), Longitudinally Corrugated (LC), Jacketed Concentric Neutral (JCN), Tape Over Wire (TOW), or Wire Over Tape (WOT) shielded power cable. Covering a conductor size range of 1/0AWG to 3000 kcmil (50 -1500 mm²). The 3M cold shrink QT-III termination kit 7673-S-10 series provide a longer creepage path for higher contamination environments. See the selection table for detailed sizing information.

Kit Contents

Each kit contains sufficient quantities of the following materials as appropriate to make one single-phase termination (lug not included unless requested in advance):

- Silicone Rubber Skirted Stress Control Assembly
- Hi-K Stress Control Adapter Assembly
- Lug Seal Tube
- Ground Seal Tube
- Ground Strap Assembly
- Constant Force Springs
- Tubes 3M Red Compound P55/R (Non-Silicone Grease)
- Scotch® Electrical Shielding Tape 24
- 3M Scotch-Seal™ Mastic Tape Compound 2229
- 3M EMI Copper Foil Shielding Tape 1181
- Scotch® Vinyl Electrical Tape Super 88
- Scotch® Linerless Rubber Splicing Tape 130C (WB kits only)
- 3M Cable Cleaning Pads CC-3
- Scotch® Self-fusing Silicone Rubber Electrical Tape 70
- Instruction Sheets

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Features

- Conforms to IEEE 48 Class 1 requirements for 69 kV, 350 kV BIL outdoor applications and to IEC 60840 for 72.5 kV, 325 kV BIL outdoor applications.
- Can be used on cables with a maximum temperature rating of 105°C and an emergency overload rating of 140°C.
- Hi-K stress control, specifically formulated high dielectric constant material minimizes surface stress by more uniformly distributing the electrical stress over the entire surface of the insulator.
- Cold shrink delivery system for easy installation. Simply slide each termination sub-assembly over the prepared cable to its proper position and unwind the core to shrink in place.
- Installation temperature range of -4F to 122F (-20°C to +50°C)
- An improved compact design allows for easier Porcelain/Heat Shrink termination replacement and new installations in restricted spaces.
- Silicone rubber materials are compatible with all common solid dielectric cables, such as cross-linked polyethylene (XLPE), ethylene propylene rubber (EPR), or polyethylene (PE).
- Designed to accommodate all available cable lugs designs including hexagonal or deep indent crimping technologies or a variety of mechanical sheer-off connecting technologies.

Applications

The 3M Cold Shrink QT-III Silicone Rubber Skirted Termination Kit 7673-S-8 & 7673-S-10 Series are designed for :

- Outdoor installations required to meet:
- IEEE 48 Class 1 for 69 kV and/or IEC 60840 for 72.5 kV.
- Applications requiring 350 kV BIL performance levels.
- Solid dielectric insulation, such as (XLPE), (EPR), and (PE).
- Tape (TS), Longitudinally Corrugated (LC), Jacketed Concentric Neutral (JCN), Tape Over Wire (TOW), or Wire Over Tape (WOT) shield configurations.

Pollution Class Rating

| Part Number | Specific Creepage Distance* mm/kV | USCD Required for 72.5kV per IEC 60815 |
|----------------------------------|--------------------------------------|---|
| 7673-S-8(S) 7673-S-8 | 49.7 | Class (d) 43,3 mm/kV Heavy |
| 7673-S-10(R) 7673-S-INV-10(R) | 54.0 | Class (d) 53,7 mm/kV Very Heavy |
| 7673-S-10(S) 7673-S-10 | 63.5 | Class (e) 53,7 mm/kV Very Heavy |

*Calculation based on U_0 (phase to ground) voltage for 72.5kV system, for 69kV systems mm/kV will be higher.

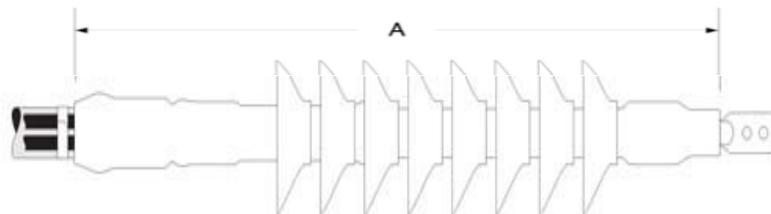
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| Selection Table | Kit Number | Primary Insulation OD Range | Jacket OD Range | Typical Conductor* Size Range | Maximum Lug Width |
|-----------------|-----------------------------------|-----------------------------|----------------------------|-------------------------------|-------------------|
| | | Inches (mm) | Inches (mm) | AWG/Kcmil (mm ²) | Inches (mm) |
| | 7673-S-8(S) | 2.01-2.87 (51,1-72,9) | 2.25-3.45 (57,2-87,6) | 350-1500 (175-725) | 3 (76) |
| | 7673-S-8 | 2.79-3.45 (70,9-87,6) | 3.00-4.25 (76,2-108,0) | 1500-3000 (800-1500) | 4 (102) |
| | 7673-S-10(R) 7673-S-INV-10(R) | 1.30-2.36 (33,0-60,0) | 1.60-2.85 (40,6-72,4) | 1/0-350 (50-175) | 2 (51) |
| | 7673-S-10(S) 7673-S- INV-10(S) | 2.01-2.87 (51,1-72,9) | 2.25-3.45 (57,2-87,6) | 350-1500 (175-725) | 3 (76) |
| | 7673-S-10 7673-S- INV-10 | 2.79-3.45 (70,9-87,6) | 3.00-4.25 (76,2-108,0) | 1500-3000 (800-1500) | 4 (102) |

*Sizing based on 650 mil insulation thickness. For reduced wall cables, use the cables Primary Insulation OD and the ranges shown above to determine the correct kit for the application. Kits with an added suffix may contain materials such as: a lug, mounting bracket, cable clamps, special instructions, "WB" for additional water blocking of 10 skirt kits or other application specific.

Typical Dimensions

| Kit Number | Dimension A Typical | Creepage Distance Typical |
|----------------------------------|---------------------|---------------------------|
| 7673-S-8(S) 7673-S-8 | 46" (117 cm) | 82" (208 cm) |
| 7673-S-10(R) 7673-S-INV-10(R) | 49" (124 cm) | 89" (226 cm) |
| 7673-S-10(S) 7673-S-10 | 52" (132 cm) | 105" (266 cm) |

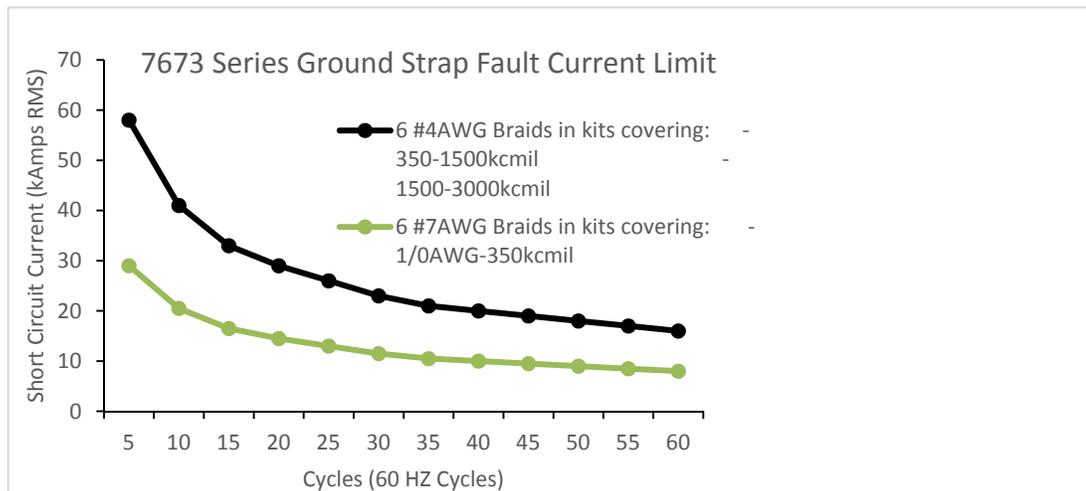


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Typical Physical and Electrical Properties

Typical Materials Data for Silicone Rubber

| Property | Units | Numerical Value | | |
|---------------------------------|---------|------------------|-----------------|-------------------|
| | | Insulation | Semi-Conductive | High-Permittivity |
| Hardness | Shore A | 30 | 40 | 40 |
| Tensile Strength | Mpa | 7.5 | 6.0 | 5.5 |
| Ultimate Elongation | % | 750 | 600 | 400 |
| Tear Resistance | N/mm | 25 | 20 | 15 |
| Compression Set | % | 20 | 20 | 15 |
| Volume Resistivity | Wcm | 10 ¹⁵ | <100 | 10 ¹¹ |
| Dielectric Strength | kV/mm | 25 | - | - |
| Relative Permittivity | | 2.8 | - | 20 |
| Dielectric Loss Factor Tan δ | | 0.003 | - | 0.1 |
| Service Temperature Range | °C | -20 to +50 | -20 to +50 | -20 to +50 |



Product Specification

The non-self supporting cable termination must have a voltage rating equal to or greater than the cable being terminated. The termination shall be rated for 69 kV, 350 kV BIL and meet the requirements of IEEE 48 for Class 1 outdoor termination. The termination shall meet the requirements of IEC 60840 for 72.5 kV outdoor terminations. It must have a maximum operating temperature of 105°C, with an emergency overload temperature of 130°C. The termination kit shall consist of four cold shrink subassemblies, 1) Silicone Rubber Lug Seal Assembly. 2) Stress Control Assembly. 3) Silicone Rubber Ground Seal Assembly. 4) Silicone Rubber 8 Skirt Insulator Assembly. All exposed insulating materials shall be manufactured of track-resistant silicone rubber. The termination kit shall include a ground strap assembly as the means of grounding the terminated cable. The ground strap assembly shall consist of a three loop pre-formed ground braid with a copper lug crimped onto the ground braid tails. Three constant force springs shall be used to attach the ground strap assembly to the cable's metallic shield. The termination stress control shall be capacitive and constructed of a Hi-K stress control assembly and a Hi-K/Skirted insulator assembly. The termination subassemblies shall be pre-stretched cold shrink design, and installed by removing the support core. The termination kit shall include all materials necessary for installation on a single-conductor shielded power cable except for the lug, unless specified in advance.

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Engineering/ Architectural Specification

Terminate shielded power cable rated for 69 kV, 350 kV BIL per IEEE 48 - Class 1 for outdoor non-self supporting terminations using a 3M Cold Shrink QT-III Silicone Rubber Skirted Termination Kit 7673-S-8 & 7673-S-10 Series.

Terminate shielded power cable rated for 72.5 kV, 325 kV BIL per IEC 60840 for outdoor termination with 3M Cold Shrink QT-III Silicone Rubber Skirted Termination Kit 7673-S-8 & 7673-S-10 Series.

Typical Performance Testing

Typical Results, IEEE Standard 48 Long-Term Test Sequence

| 3M™ Cold Shrink Silicone QT-III Rubber Skirted Termination Kit 7673-S-8 & 7673-S-10 Series | | 69 kV | |
|--|-------------------|---------------|--|
| Insulation Class Test | Requirements | Typical Value | |
| Partial Discharge Extinction Voltage @ 3 pC* | 60 kV | 80 kV | |
| Power Frequency Voltage 1 Min. Dry Withstand | 175 kV | Pass | |
| Power Frequency Voltage 6 Hour Dry Withstand | 120 kV | Pass | |
| Power Frequency Voltage 1 Min. Wet Withstand | 145 kV | Pass | |
| Direct Voltage 15 Min. Dry Withstand | 245 kV | Pass | |
| Lightning Impulse Voltage Withstand (BIL) | 350 kV | Pass | |
| Partial Discharge Extinction Voltage @ 3 pC | 60 kV | 80 kV | |
| Cycling Aging (30 Days, 130°C Cond. Temp.) | 80 kV | Pass | |
| Lightning Impulse Voltage Withstand (BIL) | 350 kV | Pass | |
| Partial Discharge Extinction Voltage @ 3 pC | 60 kV | 80 kV | |
| Pressure Leak (See Sealing Tests Below) | 7 psi for 6 hours | Pass | |

*IEEE 48 Requires <5 pC @ 60 kV

Typical Results, IEC 60840 Test Sequence

| 3M™ Cold Shrink QT-III Silicone Rubber Skirted Termination Kit 7673-S-8 & 7673-S-10 Series | | 72.5 kV | |
|--|--------------|------------------------------------|--|
| Insulation Class Test | Requirements | Typical Value | |
| PD at Ambient CSV 63 kV for 10 Sec CEV 54 kV | Pass | Pass | |
| Load Cycle for 20 Cycles (8 Hour Loading to 95°C-100°C, at Least 2 Hours at Temperature, and 16 Hours Off-24 cycle) at 72 kV | Pass | Pass | |
| PD at Ambient | Pass | Pass | |
| PD at Elevated Temperature (95-100°C) | Pass | Pass | |
| Impulse (10 Impulses Each Polarity) at Elevated Temperature (95°-100°C) | Pass | Pass | |
| 15 Min AC Withstand at 90 kV | Pass | Pass | |
| Cable and Accessory Examination | Pass | No Evidence of Electrical Activity | |

Test Definitions

Partial Discharge (Corona) Tests

The purpose of partial discharge testing is to determine that all properly installed terminations operate corona free at a minimum of 150% of their operating voltage. For the test, the applied test voltage is gradually increased until discharges appear on the test set oscilloscope display. The voltage at which these discharges reach a magnitude greater than 3 Pico coulombs is recorded as the corona starting voltage (CSV). The applied voltage is then lowered until the discharge level drops below 3 Pico coulombs, and this is recorded as the corona extinction voltage (CEV).

Lightning Impulse Tests

The 3M Cold Shrink QT-III Silicone Rubber Skirted Termination Kit 7673-S-8 & 7673-S-10 Series was evaluated to IEEE Standard 48 Basic Impulse Levels. For this test a 1.2 X 50 microsecond voltage wave is applied to the termination lug. The test consists of both positive and negative polarity surges per the specified standard. The 3M cold shrink QT-III termination kit 7673-S-8 & 7673-S-10 Series meets or exceeds the requirements of IEEE Standard 48.

Power Frequency (AC) Withstand Tests

The AC Power Withstand test consists of a 1 minute dry withstand, 10 second wet withstand and 6 hour dry withstand per the voltages specified in Table 2 of IEEE Standard 48. The 3M cold shrink QT-III termination kit 7673-S-8 & 7673-S-10 Series meets the requirements of IEEE Standard 48 Class 1. Additional AC Withstand for 1 hr. after current cycling.

Sealing Tests

Termination top and bottom seals are tested by applying 7 psi (0.05 MPa) and a vacuum of ~13 Pisa to the cable conductor strands with the termination submerged in water. Both seals withstand this internal air pressure for 6 hours and vacuum for 30 minutes without leaking. Per IEEE 48, 8.4.3a Pressure Leak Tests.

EHS



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 high-voltage electrical equipment. De-energize and ground all electrical systems before installing product.

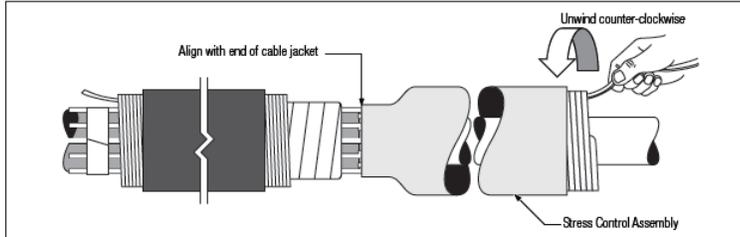
- 3M Cold Shrink Removable Core is mixed polymer and recyclable with  waste.
- Read all Health Hazard, Precautionary and First Aid statements found in the Material Safety Data Sheet (MSDS) and/or product label prior to handling or use.

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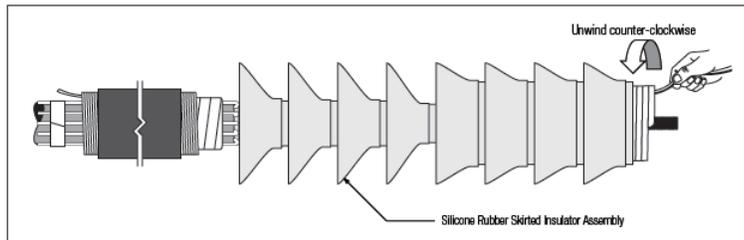
Installation

Detailed instructions are included in each kit to provide the installer with all of the information required to properly install the 3M Cold Shrink QT-III Silicone Rubber Skirted Termination Kit 7673-S-8 & 7673-S-10 Series. A brief summary of the typical installation steps are outlined as follows:

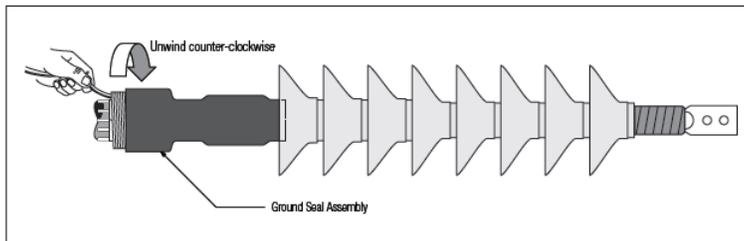
1. Prepare the cable following standard procedures.
2. Install the Cold Shrink Hi-K Stress Control Assembly.



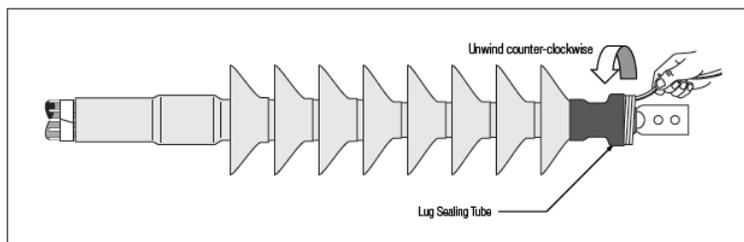
3. Install the Cold Shrink Silicone Rubber Skirted Assembly.



4. Shrink the Ground Seal Tube at the bottom of the termination.



5. Shrink the Lug Seal Tube covering the top of the skirted assembly and onto the lug barrel.



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Maintenance

It is good practice to incorporate a general inspection/cleaning of 3M Cold Shrink QT-III Silicone Rubber Skirted Termination Kits during normal scheduled or maintenance inspections. Once the area has been de-energized, the terminations can be inspected, and if need be, cleaned. Some recommendations for surface cleaning 3M Cold Shrink QT-III Silicone Rubber Skirted Terminations are as follows:

Use a can of compressed 'air' in order to blast off dust and miscellaneous airborne contaminants on the surface of the termination body. If needed, wipe the surface of the termination with a cable cleaning solvent, such as 3M Cable Cleaning Solvent (CC-2), and allow it to dry before re-energizing the installation.

Mix a mild soap and water solution (deionized water is recommended, if available) in a hand sprayer, or spray bottle, and spray down the surface of the termination. Wipe dry, or allow to air dry, before re-energizing.

If tan discoloration between skirts is observed on the surface of the termination, wipe with a cable cleaning solvent. The discoloration itself does not pose any detrimental effect to the installation, and may not disappear entirely, but it will lighten up to some degree. This discoloration is a typical result of the outgassing effect of EPR cable and does not interfere with the performance of the termination in any capacity.

Do not abrade the surface of the termination in any way. Do not use high pressure cleaning (this can tear, or split, the termination), high pressure water with corn cobs, sandpaper or other abrasive products. This will damage the termination surface and reduce tracking and arcing resistance provided, in the expanded state.

Shelf Life & Storage

As provided, in the expanded state, the 3M Cold Shrink QT-III Silicone Rubber Skirted Termination Kit 7673-S-8 & 7673-S-10 Series have a 3 year shelf life from date of manufacture when stored in a humidity controlled storage (50°F/10°C to 80°F/27°C and <75% relative humidity).

Availability

Please contact your local distributor; available from 3M.com/electrical [Where to Buy] or call 1.800.245.3573.

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