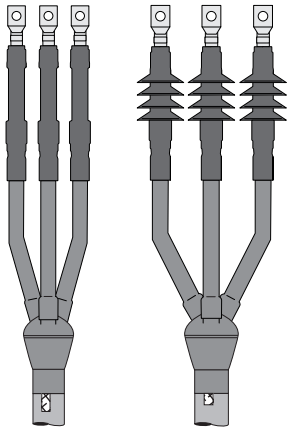
QT-III Silicone Rubber

Three Conductor Cable Termination

7600-3W Series and 7600-RJS Series

Data Sheet



1.0 Product Description

3M 7600 Series 3/C (Three Conductor) Cable Termination Kits are designed to accommodate medium voltage 3/C shielded power cables: 7600-3W Series Kits for cables without ground wires and 7600-RJS Series Cabinet-mount Kits for cables with or without ground wires.

With exception to terminal lugs and connectors, which can be selected from the 3M Electrical Products Ordering Guide, each termination kit is supplied with all the materials required for terminating one three conductor cable.

All main termination components are produced from color-matched dark gray silicone rubber. These components are:

Breakout Boot—an open ended molded rubber sealing assembly that is factory expanded and mounted on removable inner supporting plastic cores. Breakout boots are supplied for field installation in a pre-stretched condition. The supporting cores are removed after the boot has been positioned for installation around the breakout area of a 3/C cable. Core removal allows the silicone rubber boot to shrink down to a pre-determined diameter creating an environmental enclosure for individual cable phase legs and the overall cable jacket.

Re-jacketing Sleeve Assembly—a tubular silicone rubber insulating sleeve that incorporates an inner expandable polyester braid designed to reduce sliding friction and deliver the silicone tubing onto the cable phase metallic shielding. Re-jacketing sleeves are designed to protect the shielded cable phase legs from exposure to moisture, corrosion, ozone, ultra-violet radiation, physical contact and other hazards associated with termination operating environments.

QT-III Termination—a one-piece cold shrink assembly that consists of skirted or tubular insulator, high dielectric constant (Hi-K) stress control tube, conformable Hi-K stress control mastic and a built-in silicone lug-sealing compound. The complete assembly is pre-stretched and loaded onto a removable plastic core. Core removal allows the termination assembly to shrink down and seal onto prepared cable phase insulation and lug barrel surfaces.

Features and Benefits

- Versatile; installs quickly and accommodates a wide range of cable sizes.
- Simple hand application; no need for special installation tools.
- No torches or heat required.
- No specific user skills or craftsmanship required.
- Excellent resistance to ozone and ultra-violet radiation.
- Good solvent resistance; compatible with industry-approved cable cleaners.
- Excellent thermal stability.
- High dry and wet insulation resistance.
- Highly flexible; accommodates all power cable supplier bend radius recommendations.
- Seals tight; retains resiliency and pressure even after prolonged years of aging and exposure.

2.0 Product Applications

7600 Series QT-III 3/C Cable Terminations are designed to accommodate three conductor power cables ranging from No. 8 AWG (8 mm^2) @ 3 kV to 500 KCMil (240 mm^2) @ 35 kV. They are compatible with the following solid dielectric insulation types: Polyethylene (high and low density) cross-linked Polyethylene (XLPE) and ethylene propylene rubber (EPR). Their light weight makes them suitable for both free-hanging and bracket-mount, stand-off insulator type arrangements.

7600 Series Terminations are available for both protected and weather-exposed areas. The amount of airborne contaminant determines the severity of the termination operating environment and may influence its long term performance. Operating environments are defined as light, medium, heavy and extremely heavy according to pollution severity. Selecting the appropriate termination depends on system voltage and operating environment (see the following tables).

Outdoor (Skirted) Termination Kit—Recommended Application Guide

Voltage Class	Termination Operating Environment			
	Light	Medium	Heavy	Extremely Heavy
3.3, 6.6 & 10 kV (U) (JIS & IEC) 5.0 & 8.7 kV (AEIC)	7620-S2-2W	7620-2S-3W	7620-2S-3W	7690-S4-3W
15 kV (U) (IEC) 15 kV (AEIC)	7620-S2-3W 7690-S4-3W	7620-2S-3W 7690-S4-3W	7690-S4-3W 7680-S8-3W	7690-S4-3W 7680-S8-3W
20 kV (U) (IEC) 25 & 28 kV (AEIC)	7690-S4-3W	7690-S4-3W	7690-S4-3W 7680-S8-3W	7680-S8-3W
30 kV (U) (IEC) 35 kV (AEIC)	7680-S8-3W	7680-S8-3W	7680-S8-3W	*

*Consult 3M Sales Representative
IEC=International Electro-Technical Commission **JIS**=Japanese Industrial Standard **AEIC**=Association of Edison Illuminating Companies

Pollution Severity Guide

Light

- Areas without industry and with low density housing.
- Areas subjected to frequent winds and/or rainfall with low density industry and housing.
- Agricultural areas.*
- Mountainous areas.

  All of these areas should be situated at least seven miles from the coast and should not be exposed to coastal winds.**

Medium

- Non-polluting industrial areas subjected to infrequent rainfall and with average density housing.
- Areas subjected to frequent winds and/or rainfall with high density industry and housing.
- Areas exposed to wind from the coast but generally over two miles from the coast.

Heavy

- High density industrial areas and some urban areas with high density housing, especially those with infrequent rainfall.
- Areas subjected to a moderate concentration of conductive dust, particularly deposits from industrial smoke.
- Areas generally close to the coast and exposed to coastal spray or to strong winds carrying sand and salt, and subjected to regular condensation.

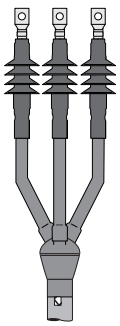
Extremely Heavy

- Usually very limited areas having extremely heavy pollutants from industrial sites, especially those located near oceans and subjected to prevailing winds from the sea.
- Very small isolated areas where terminations are located immediately adjacent to a pollutant source; especially downwind (cement plants, paper mills, etc.).

*Use of spray type fertilizers and the burning of crop residues can lead to a higher pollution level due to dispersal by wind.
**Coastline separation distances depend on the topography of the coastal area and on wind speed conditions.

Termination Type Selection Guide

Product Number (Kit Series)	Insulator Configuration	Installation Environment	Orientation	For Cable Type(s) (With or Without Ground Wires)
7600-S-3W	Skirted	Outdoor	Normal	W (Without)
7600-T-3W	Tubular	Indoor	Normal	W (Without)
7690-S-INV-3W	Skirted	Outdoor	Inverted	W (Without)
7600-S-3RJS	Skirted	Indoor—Cabinet Mount (No Breakout Boot)	Normal	G or W (With or Without)
7600-T-3RJS	Tubular	Indoor—Cabinet Mount (No Breakout Boot)	Normal	G or W (With or Without)
7690-S-INV-3RJS	Skirted	Indoor—Cabinet Mount (No Breakout Boot)	Inverted	G or W (With or Without)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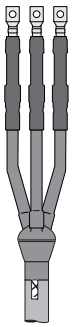
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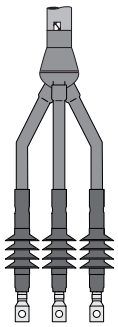
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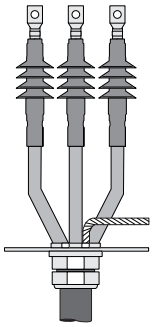
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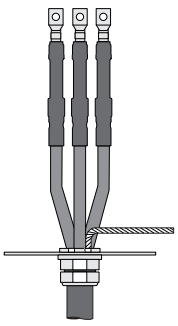
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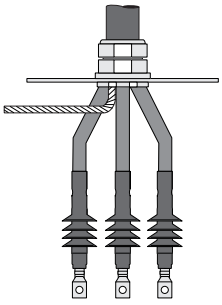

7690S-INV-3RJS

7600-S-3W Series—Kit Selection Guide

(Final determining factor is cable insulation diameter. Listed insulation ranges allow +2.54 mm (0.10") for shielding.)

Kit Number	BIL (kV)	Cable Insulation Range [mm (inches)]	3.3 kV (mm^2) IEC	3.3 kV (mm^2) JIS	5.0 kV (AWG) AEIC	6.6 kV (mm^2) JIS	6.6 kV (mm^2) IEC	8.7 kV (AWG) AEIC	10 kV (mm^2) IEC
7620-S2-3W	95	8.40–12.7 (0.33–0.50)	16–35	8–22	8–2	—	16–25	6–4	—
7621-S2-3W	95	12.7–17.8 (0.50–0.70)	50–95	38–60	1–3/0	—	35–70	2-2/0	10-50
7622-S2-3W	110	17.8–23.4 (0.70–0.92)	120–185	100–150	4/0–400	60–100	95–150	3/0–350	70–150
7691-S4-3W	150	12.7–17.8 (0.50–0.70)	50–95	38–60	1–3/0	—	35–70	2–2/0	10–50
7692-S4-3W	150	17.8–23.4 (0.70–0.92)	120–185	100–150	4/0–400	60–100	95–150	3/0–350	70–150
7693-S4-3W	150	23.4–30.0 (0.92–1.18)	240–300	200–250	500–750	150–250	185–300	400–600	185–300
7695-S4-3W	150	30.0–38.6 (1.18–1.52)	—	300–325	800–1000	300–325	—	750–1000	—
7684-S8-3W	200	23.4–30.0 (0.92–1.18)	240–300	200–250	500–750	150–250	185–300	400–600	185–300
7685-S8-3W	200	30.0–38.6 (1.18–1.52)	—	300–325	800–1000	300–325	—	750–1000	—

Kit Number	BIL (kV)	Cable Insulation Range [mm (inches)]	15 kV (mm^2) IEC	15 kV (AWG) AEIC	20 kV (mm^2) IEC	25/28 kV (AWG) AEIC	30 kV (mm^2) IEC	35 kV (AWG) AEIC
7620-S2-3W	95	8.40–12.7 (0.33–0.50)	—	—	—	—	—	—
7621-S2-3W	95	12.7–17.8 (0.50–0.70)	16–25	—	—	—	—	—
7622-S2-3W	110	17.8–23.4 (0.70–0.92)	35–95	1/0–4/0	—	—	—	—
7691-S4-3W	150	12.7–17.8 (0.50–0.70)	16–25	—	—	—	—	—
7692-S4-3W	150	17.8–23.4 (0.70–0.92)	35–95	1/0–4/0	25–70	2–1/0	—	—
7693-S4-3W	150	23.4–30.0 (0.92–1.18)	120–185	250–450	95–185	2/0–250	—	—
7695-S4-3W	150	30.0–38.6 (1.18–1.52)	200–325	500–750	240–300	300–500	—	—
7684-S8-3W	200	23.4–30.0 (0.92–1.18)	120–185	250–450	95–185	2/0–250	35–70	1/0–3/0
7685-S8-3W	200	30.0–38.6 (1.18–1.52)	200–325	500–750	240–300	300–500	95–240	4/0–500

7600-T-3W Series—Kit Selection Guide

(Final determining factor is cable insulation diameter. Listed insulation ranges allow +2.54 mm (0.10") for shielding.)

Kit Number	BIL (kV)	Cable Insulation Range [mm (inches)]	3.3 kV (mm2) IEC	3.3 kV (mm2) JIS	5.0 kV (AWG) AEIC	6.6 kV (mm2) JIS	6.6 kV (mm2) IEC	8.7 kV (AWG) AEIC	10 kV (mm2) IEC	15 kV (mm2) IEC	15 kV (AWG) AEIC	20 kV (mm2) IEC	25/28 kV (AWG) AEIC
7620-T95-3W	95	8.40–12.7 (0.33–0.50)	16–35	8–22	8–2	—	16–25	6–4	—	—	—	—	—
7621-T95-3W	95	12.7–17.8 (0.50–0.70)	50–95	38–60	1–3/0	—	35–70	2–2/0	10–50	16–25	—	—	—
7623-T95-3W	95	17.8–23.4 (0.70–0.92)	120–185	100–150	4/0–400	—	95–150	3/0–350	70–150	35–95	—	—	—
7624-T95-3W	95	23.4–30.0 (0.92–1.18)	240–300	200–250	500–750	—	185–300	400–600	185–300	120–185	—	—	—
7625-T95-3W	95	30.0–38.6 (1.18–1.52)	—	300–325	800–1000	—	—	750–1000	—	200–325	—	—	—
7621-T110-3W	110	12.7–17.8 (0.50–0.70)	50–95	38–60	1–3/0	14–38	35–70	2–2/0	10–50	16–25	2–1	—	—
7622-T110-3W	110	17.8–23.4 (0.70–0.92)	120–185	100–150	4/0–400	60–100	95–150	3/0–350	70–150	35–95	1/0–4/0	—	—
7624-T110-3W	110	23.4–30.0 (0.92–1.18)	240–300	200–250	500–750	150–250	185–300	400–600	185–300	120–185	250–450	—	—
7625-T110-3W	110	30.0–38.6 (1.18–1.52)	—	300–325	800–1000	300–325	—	750–1000	—	200–325	500–750	—	—
7622-T125-3W	125	17.8–23.4 (0.70–0.92)	120–185	100–150	4/0–400	60–100	95–150	3/0–350	70–150	35–95	1/0–4/0	25–70	—
7624-T125-3W	125	23.4–30.0 (0.92–1.18)	240–300	200–250	500–750	150–250	185–300	400–600	185–300	120–185	250–450	95–185	—
7625-T125-3W	125	30.0–38.6 (1.18–1.52)	—	300–325	800–1000	300–325	—	750–1000	—	200–325	500–750	240–300	—
7693-T150-3W	150	17.8–23.4 (0.70–0.92)	120–185	100–150	4/0–400	60–100	95–150	3/0–350	70–150	35–95	1/0–4/0	25–70	2–1/0
7694-T150-3W	150	23.4–30.0 (0.92–1.18)	240–300	200–250	500–750	150–250	185–300	400–600	185–300	120–185	250–450	95–185	2/0–250
7695-T150-3W	150	30.0–38.6 (1.18–1.52)	—	300–325	800–1000	300–325	—	750–1000	—	200–325	500–750	240–300	300–500

7690-S-INV-3W Series—Kit Selection Guide

(Final determining factor is cable insulation diameter. Listed insulation ranges allow +2.54 mm (0.10") for shielding.)

Kit Number	Cable Insulation Range [mm (inch)]	3.3 kV (mm2) IECJIS	3.3 kV (mm2) AEIC	5.0 kV (AWG) JISIEC	6.6 kV (mm2) AEIC	6.6 kV (mm2) IEC	8.7 kV (AWG) IEC	10 kV (mm2) AEIC	15 kV (mm2) IEC	15 kV (AWG) AEIC	20 kV (mm2)	25/28 kV (AWG)
7693-S4-INV-3W	23.4–30.0 (0.92–1.18)	240–300	200–250	500–750	150–250	185–300	400–600	185–300	120–185	250–450	95–185	2/0–250
7695-S4-INV-3W	30.0–38.6 (1.18–1.52)	—	300–325	800–1000	300–325	—	750–1000	—	200–325	500–750	240–300	300–500

7600-S-3RJS Series—Kit Selection Guide

(Final determining factor is cable insulation diameter. Listed insulation ranges allow +2.54 mm (0.10") for shielding.)

KitNumber	BIL (kV)	Cable Insulation Range [inch (mm)]	3.3 kV (mm^2) IEC	3.3 kV (mm^2) JIS	5.0 kV (AWG) AEIC	6.6 kV (mm^2) JIS	6.6 kV (mm^2) IEC	8.7 kV (AWG) AEIC	10 kV (mm^2) IEC
7620-S2-3RJS	95	0.33–0.50 (8.40–12.7)	16–35	8–22	8–2	—	16–25	6–4	—
7621-S2-3RJS	95	0.50–0.70 (12.7–17.8)	50–95	38–60	1–3/0	—	35–70	2–2/0	10–50
7622-S2-3RJS	110	0.70–0.92 (17.8–23.4)	120–185	100–150	4/0–400	60–100	95–150	3/0–350	70–150
7691-S4-3RJS	150	0.50–0.70 (12.7–17.8)	50–95	38–60	1–3/0	—	35–70	2–2/0	10–50
7692-S4-3RJS	150	0.70–0.92 (17.8–23.4)	120–185	100–150	4/0–400	60–100	95–150	3/0–350	70–150
7693-S4-3RJS	150	0.92–1.18 (23.4–30.0)	240–300	200–250	500–750	150–250	185–300	400–600	185–300
7695-S4-3RJS	150	1.18–1.52 (30.0–38.6)	—	300–325	800–1000	300–325	—	750–1000	—
7684-S8-3RJS	200	0.92–1.18 (23.4–30.0)	240–300	200–250	500–750	150–250	185–300	400–600	185–300
7685-S8-3RJS	200	1.18–1.52 (30.0–38.6)	—	300–325	800–1000	300–325	—	750–1000	—

KitNumber	BIL (kV)	Cable Insulation Range [inch (mm)]	15 kV (mm^2) IEC	15 kV (AWG) AEIC	20 kV (mm^2) IEC	25/28 kV (AWG) AEIC	30 kV (mm^2) IEC	35 kV (AWG) AEIC	
7620-S2-3RJS	95	0.33–0.50 (8.40–12.7)	—	—	—	—	—	—	
7621-S2-3RJS	95	0.50–0.70 (12.7–17.8)	16–25	—	—	—	—	—	
7622-S2-3RJS	110	0.70–0.92 (17.8–23.4)	35–95	1/0–4/0	—	—	—	—	
7691-S4-3RJS	150	0.50–0.70 (12.7–17.8)	16–25	2–1	—	—	—	—	
7692-S4-3RJS	150	0.70–0.92 (17.8–23.4)	35–95	1/0–4/0	25–70	2–1/0	—	—	
7693-S4-3RJS	150	0.92–1.18 (23.4–30.0)	120–185	250–450	95–185	2/0–250	—	—	
7695-S4-3RJS	150	1.18–1.52 (30.0–38.6)	200–325	500–750	240–300	300–500	—	—	
7684-S8-3RJS	200	0.92–1.18 (23.4–30.0)	120–185	250–450	95–185	2/0–250	35–70	1/0–3/0	
7685-S8-3RJS	200	1.18–1.52 (30.0–38.6)	200–325	500–750	240–300	300–500	95–240	4/0–500	

7600-T-3RJS Series—Kit Selection Guide

(Final determining factor is cable insulation diameter. Listed insulation ranges allow +2.54 mm (0.10") for shielding.)

Kit Number	BIL (kV)	Cable Insulation Range [inch (mm)]	3.3 kV (mm^2) IEC	3.3 kV (mm^2) JIS	5.0 kV (AWG) AEIC	6.6 kV (mm^2) JIS	6.6 kV (mm^2) IEC	8.7 kV (AWG) AEIC	10 kV (mm^2) IEC	15 kV (mm^2) IEC	15 kV (AWG) AEIC	20 kV (mm^2) IEC	25/28 kV (AWG) AEIC
7620-T95-3RJS	95	0.33–0.50 (8.40–12.7)	16–35	8–22	8–2	—	16–25	6–4	—	—	—	—	—
7621-T95-3RJS	95	0.50–0.70 (12.7–17.8)	50–95	38–60	1–3/0	—	35–70	2–2/0	10–50	16–25	—	—	—
7623-T95-3RJS	95	0.70–0.92 (17.8–23.4)	120–185	100–150	4/0–400	—	95–150	3/0–350	70–150	35–95	—	—	—
7624-T95-3RJS	95	0.92–1.18 (23.4–30.0)	240–300	200–250	500–750	—	185–300	400–600	185–300	120–185	—	—	—
7625-T95-3RJS	95	1.18–1.52 (30.0–38.6)	—	300–325	800–1000	—	—	750–1000	—	200–325	—	—	—
7621-T110-3RJS	110	0.50–0.70 (12.7–17.8)	50–95	38–60	1–3/0	14–38	35–70	2–2/0	10–50	16–25	2–1	—	—
7622-T110-3RJS	110	0.70–0.92 (17.8–23.4)	120–185	100–150	4/0–400	60–100	95–150	3/0–350	70–150	35–95	1/0–4/0	—	—
7624-T110-3RJS	110	0.92–1.18 (23.4–30.0)	240–300	200–250	500–750	150–250	185–300	400–600	185–300	120–185	250–450	—	—
7625-T110-3RJS	110	1.18–1.52 (30.0–38.6)	—	300–325	800–1000	300–325	—	750–1000	—	200–325	500–750	—	—
7622-T125-3RJS	125	0.70–0.92 (17.8–23.4)	120–185	100–150	4/0–400	60–100	95–150	3/0–350	70–150	35–95	1/0–4/0	25–70	—
7624-T125-3RJS	125	0.92–1.18 (23.4–30.0)	240–300	200–250	500–750	150–250	185–300	400–600	185–300	120–185	250–450	95–185	—
7625-T125-3RJS	125	1.18–1.52 (30.0–38.6)	—	300–325	800–1000	300–325	—	750–1000	—	200–325	500–750	240–300	—
7693-T150-3RJS	150	0.70–0.92 (17.8–23.4)	120–185	100–150	4/0–400	60–100	95–150	3/0–350	70–150	35–95	1/0–4/0	25–70	2–1/0
7694-T150-3RJS	150	0.92–1.18 (23.4–30.0)	240–300	200–250	500–750	150–250	185–300	400–600	185–300	120–185	250–450	95–185	2/0–250
7695-T150-3RJS	150	1.18–1.52 (30.0–38.6)	—	300–325	800–1000	300–325	—	750–1000	—	200–325	500–750	240–300	300–500

7690-S-INV-3RJS Series—Kit Selection Guide

(Final determining factor is cable insulation diameter. Listed insulation ranges allow +2.54 mm (0.10") for shielding.)

Kit Number	Cable Insulation Range [inch (mm)]	3.3 kV (mm^2) IEC	3.3 kV (mm^2) JIS	5.0 kV (AWG) AEIC	6.6 kV (mm^2) JIS	6.6 kV (mm^2) IEC	8.7 kV (AWG) AEIC	10 kV (mm^2) IEC	15 kV (mm^2) IEC	15 kV (AWG) AEIC	20 kV (mm^2) IEC	25/28 kV (AWG) AEIC
7693-S4-INV-3RJS	0.92–1.18 (23.4–30.0)	240–300	200–250	500–750	150–250	185–300	400–600	185–300	120–185	250–450	95–185	2/0–250
7695-S4-INV-3RJS	1.18–1.52 (30.0–38.6)	—	300–325	800–1000	300–325	—	750–1000	—	200–325	500–750	240–300	300–500

3.0 Physical and Electrical Properties

Some termination technical information is beyond the scope of this document. If additional information is desired, the individual component data sheets listed below can be made available.

Component	Product No. Reference	Literature No.
Breakout Boot	8560 Series	78-8124-4242-0
Re-jacketing Sleeve	RJS-Series	78-8111-0894-9
QT-III Termination	7620/90/80 Series	80-6108-5326-1

3.1 Ratings

3M 7600 Series 3/C Terminations can be used on cables rated with a continuous operating temperature of 90° C and an emergency overload temperature of 130° C.

7600 Series 3/C Terminations meet or exceed the current rating of the cable on which they are applied.

7600 Series 3/C Terminations are Class I designated products according to Standard IEEE-48 definition.

3.2 Material Characteristics

Hydrophobicity

When airborne contaminants are deposited on a termination surface destructive leakage currents can initiate when the surface becomes wet. Fog and drizzle are normally considered to be worse than rain as these two forms of precipitation can combine with accumulated surface contaminants to reduce surface resistivity and promote leakage current formation. Rain tends to wash the pollutants off the termination surface.

The inherent hydrophobic nature of the silicone rubber compound used to make 7600 Series Termination components tends to reject moisture accumulation and, thereby, reduces the probability for discharge-initiated material erosion and tracking.

Severe environmental conditions that are sustained for long time periods can cause any polymeric surface to lose its hydrophobicity. Because of this, EPDM polymers and others tend to lose their hydrophobic nature over time. Porcelain surfaces become increasingly hydrophilic with time which can result in premature failure or flashover. Silicone surfaces can regenerate their hydrophobic character. This unique ability is a major factor for ensuring a long service life.

Ozone, Heat and UV Resistance

One of the most outstanding physical characteristics of silicone rubber is its retention of desirable properties over the very wide temperature range of -150° F (-100° C) to 600° F (315° C).

While there are applications that take advantage of these temperature extremes, a more attractive feature might be that of its extremely long life expectancy at moderate operating temperatures.

The silicone polymer molecular backbone, silicon-oxygen linkage, provides the same strong -Si-O-Si- type bond occurring in quartz, sand and glass which accounts for the outstanding temperature properties of silicones and their resistance to oxidation by ozone, corona and weathering. Polymer chains from organic rubber materials often have double carbon bond molecular backbones which are quickly cleaved by ozone, ultraviolet light, heat or other influences found in the operating environment.

4.0 Product Performance

Critical performance characteristics for 3/C cable terminations include resistance to damage from impulse flashover and from tracking during long-term exposure to severe environmental conditions.

4.1 Impulse Flashover

3M Test Method—Maximum Impulse

The purpose of this test method is to establish both the maximum impulse withstand level and the 100% impulse flashover level (on both positive and negative polarity) for high voltage terminations.

A 1.2 X 50 microsecond voltage wave is applied to the termination lugs as per IEEE Standard 48-1996. Additional test standard references and procedures include those of IEEE Standard 4-1995, IEEE Standard Test Procedures and Requirements for Alternating Current Cable Terminations 2.5 kV Through 765 kV and IEEE Standard 82-1994, IEEE Standard Test Procedure for Impulse Voltage Tests on Insulated Conductors.

To establish the insulating performance suitability of 7600 Series Termination phase re-jacketing sleeve components, 15 kV Class termination samples were built in two configurations; those with an exposed grounding ring at the termination base (control) and those without. All specimens exceeded the IEEE Standard 48-1996 BIL requirement by 50% during this test. Increasing the impulse voltage to termination flashover level resulted in no damage to the termination phase insulating re-jacketing components.

4.2 Alternating Current (AC) Flashover Test

3M Test Method—AC Step Test

The purpose of this test method is to establish the highest AC voltage that a termination can withstand and is used to determine if a termination will meet the minimum performance requirements outlined in IEEE Standard 48-1996.

Terminations are exposed to a stepped AC voltage rise to failure or flashover. The voltage magnitude required to arc across the termination surface in air (from terminal lug to ground point) is determined.

Individual 3/C 15 kV Class Termination phases that were tested with and without exposed termination body grounding rings achieved test levels associated with 25 kV Class products during this evaluation. Termination phase re-jacketing sleeves were not damaged at flashover level.

4.3 Contamination Chamber

3M Test Method TM-402/ASTM 2132 Contaminant

Terminations are coated with a slurry consisting of flint, clay, paper pulp, salt and water and allowed to dry. They are then placed in the test chamber where they are energized at 1.5 times rated voltage and exposed to a continuous water mist spray from a rotating nozzle. Individual terminations are re-coated every 300 hours.

Because of the salt content and other solid particulate, this procedure is thought to be representative of industrial-seacoast location exposures.

To determine the tracking performance capability of 7600 Series Termination re-jacketing sleeves, 15 kV Class termination specimens were built with grounding rings located over the re-jacketing sleeves; eight and sixteen inches below the termination bodies respectively.

Specimens exceeded 2500 hours under these test conditions. This duration equals, or exceeds, the typical performance of 1/C conventionally grounded terminations. There were no signs of re-jacketing sleeve material degradation or tracking at the conclusion of the test.

4.4 Dielectric Test Performance

3M 3/C QT-III Termination Kits are designed to conform with applicable international standards (IEEE-48, CENELEC HD 629.1 S1 and VDE 0278). From extensive performance testing in single phase configuration, it has been established that these terminations meet, or exceed, the test requirements defined in these standards.

QT-III Terminations pass pressure leak tests as described in Standard IEEE-48-1996 in the single conductor configuration and all 7600 Series 3/C Termination components have demonstrated the ability to provide a good moisture seal.

Typical performance values for the various QT-III 7600 Series Termination Products are provided in the chart below.

5.0 Specifications

5.1 Product

The 3M 3/C 7600 Series Termination design must conform to all internationally recognized termination performance standards; specifically to VDE 0278, CENELEC HD 629.1 S1 and the Class I designation of IEEE-48-1996. 7600 Terminations shall be made from dark gray track-resistant silicone rubber. Each component (breakout boot, phase insulators and termination body) shall be supplied in the in the form of a one-piece assembly for hand application. Installation shall require no flame, heat source or specialized tools. The finished termination shall conform to all applicable cable industry bend radius standards.

Typical Results

Product Series	Recommended Voltage Class (U)	Partial Discharge Volt. @ 3 pC	1 Minute Dry AC Withstand	6 Hour Dry AC Withstand	15 Minute Dry AC Withstand	Basic Impulse Level (BIL)
-95T	15 kV (CENELEC)* 8.7 kV (IEEE)	20 kV	75 kV	70 kV	52 kV	100 kV
-110T	15 kV (CENELEC) 15 kV (IEEE)*	35 kV	95 kV	90 kV	75 kV	130 kV
-125T	20 kV (CENELEC) 15 kV (IEEE)*	35 kV	100 kV	95 kV	100 kV	140 kV
-150T	20 kV (CENELEC) 25 kV (IEEE)*	40 kV	105 kV	100 kV	105 kV	175 kV
-2S	15 kV (CENELEC) 15 kV (IEEE)*	25 kV	85 kV	75 kV	75 kV	135 kV
-4S	20 kV (CENELEC) 25 kV (IEEE)*	33 kV	100 kV	90 kV	105 kV	165 kV
-8S	30 kV (CENELEC) 35 kV (IEEE)*	45 kV	125 kV	115 kV	140 kV	240 kV

Note: (1) Typical results are not intended for specification purposes.
(2) *Indicates the cable insulation class used for testing. Terminations tested on cables with thinner insulation yield slightly lower values, but still exceed industry standards specified for associated voltage classes.

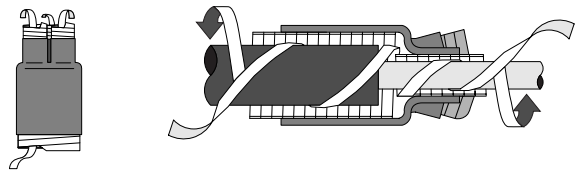
5.2 Engineering/Architectural

Terminate all three conductor 3 kV through 35 kV Class shielded power cables in accordance with the instructions provided in 3M QT-III Silicone Rubber 7600 Series 3/C Cable Termination Kits.

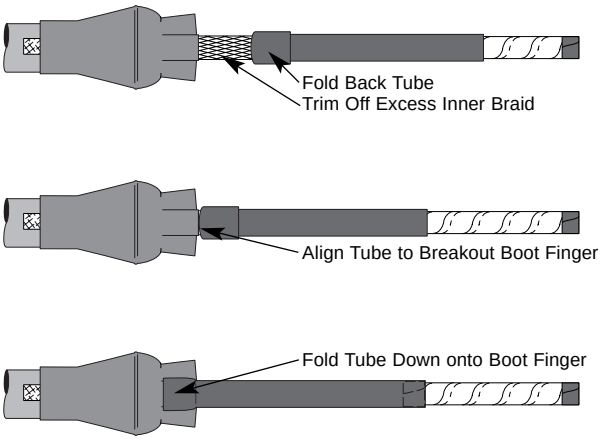
6.0 Installation Technique

Detailed instructions are included in each 7600 Series 3/C Termination Kit to provide the installer with all information required to properly install the appropriately sized termination product. A brief summary of the installation sequence is outlined below (Example: 7600-S4-3W Kit).

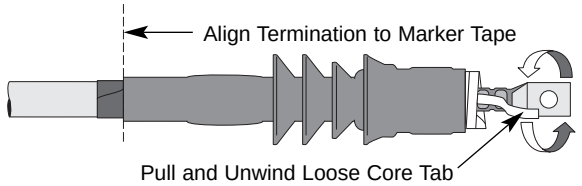
(a) Remove cable jacket and armor layers. After attaching shield grounding braids, install silicone rubber breakout boot by unwinding inner plastic supporting cores.



(b) After measuring required length, install RJS-Series silicone rubber phase re-jacketing sleeves.



(c) After preparing cable phase leg ends, install QT-III Termination Assemblies by removing inner plastic supporting cores.



7.0 Maintenance

7.1 Hi-Potting

7600 Series Terminations can be field tested by using normal cable testing procedures (reference: ANSI/IEEE Standard 400 “Guide for Making High Direct Voltage Tests on Power Cable Systems in the Field”).

7.2 Surface Cleaning

3M 7600 Series 3/C Terminations are not harmed by field surface cleaning. Established techniques for cleaning insulators and terminations, such as high pressure water or pulverized corn cobs, are acceptable. It should be noted, however, that only extreme areas of environmental contamination should require this kind of attention.

8.0 Shelf Life

Maximum recommended storage temperature is 43ºC (110ºF). The termination assemblies are not affected by freezing storage temperatures. Normal stock rotation is recommended. As provided in the expanded state, 7600 Series Terminations have an on-shelf storage life of three years from the date of manufacture.

9.0 Availability

One 7600 Series 3/C Termination is supplied per kit carton. With exception to terminal lugs and connectors, all materials required for building the termination, along with a cable preparation (cleaning) kit, are included in the termination carton. 7600 Series 3/C Termination Kits can be purchased through your local authorized 3M electrical distributor.

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