

EC&MRO

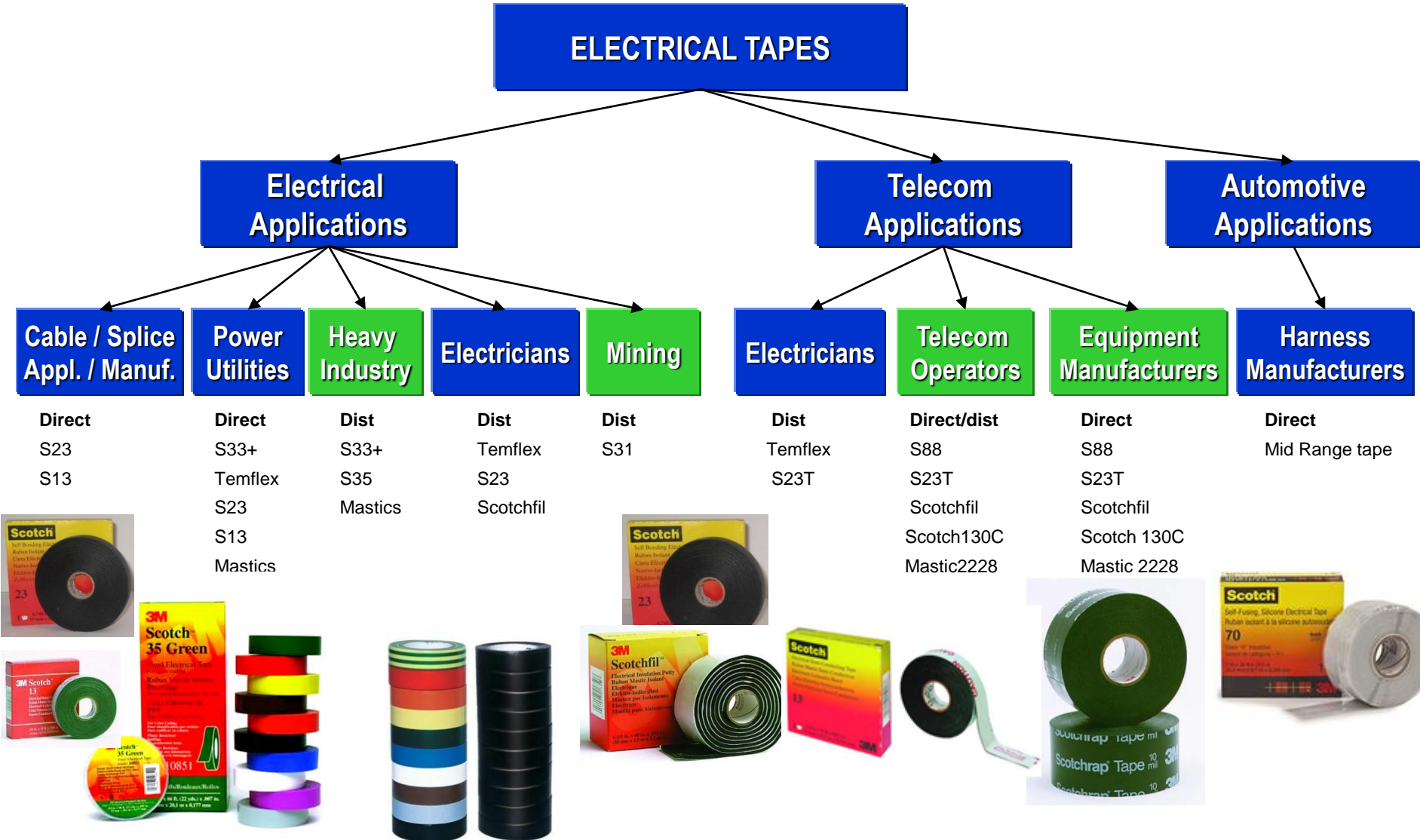
Electrical Tapes

EMD Basic Information



AGENDA

Marketing Mix – 3M EC&MRO Tapes x Markets



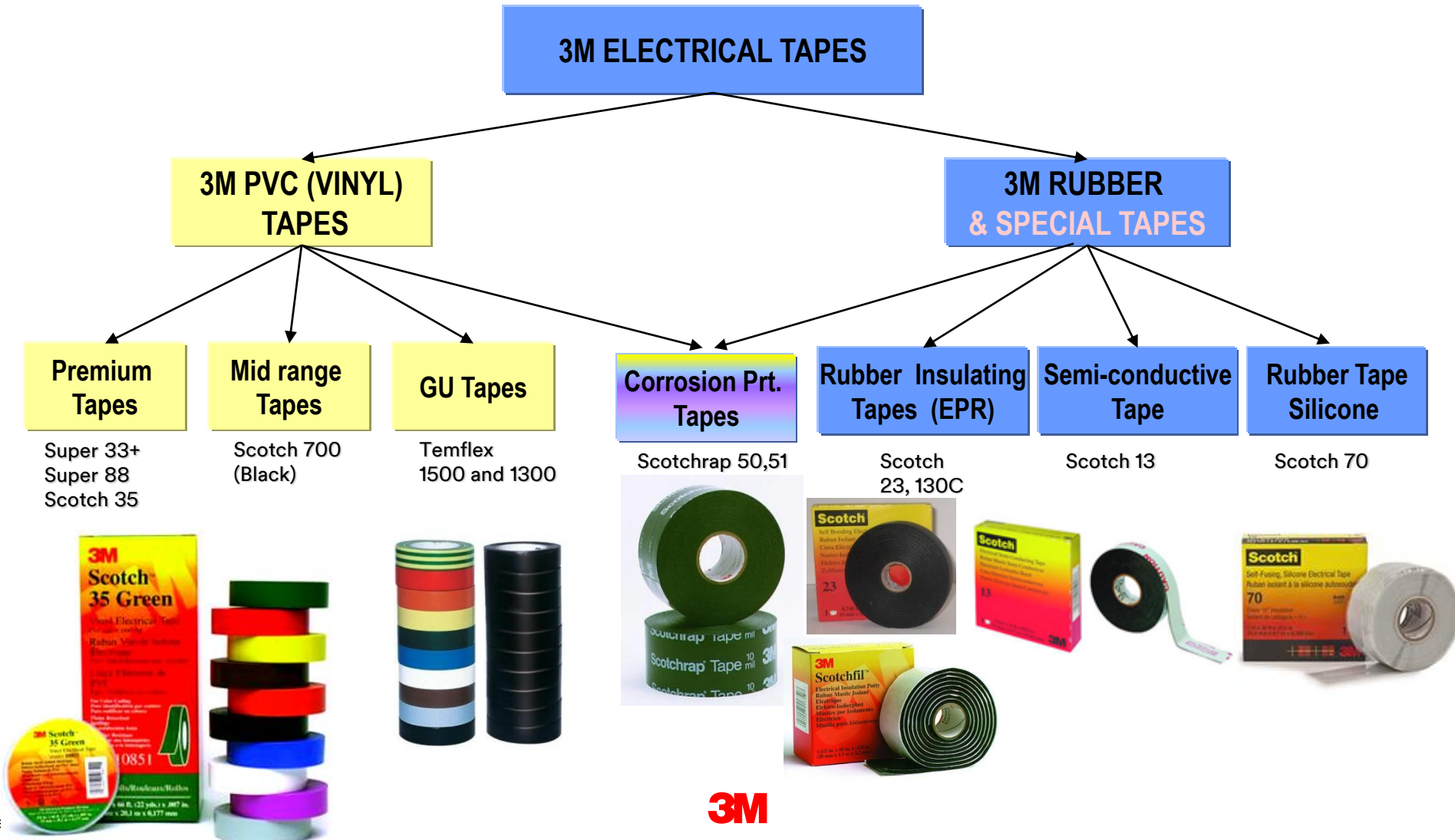
3M™ EC&MRO Electrical Tape Overview



Insulate & Protect
with Quality Tapes

3M PVC (Vinyl) and Rubber Tapes

Electrical Tape Overview/Product Range





EC&MRO Electrical Tapes

- PVC (Vinyl) Tapes

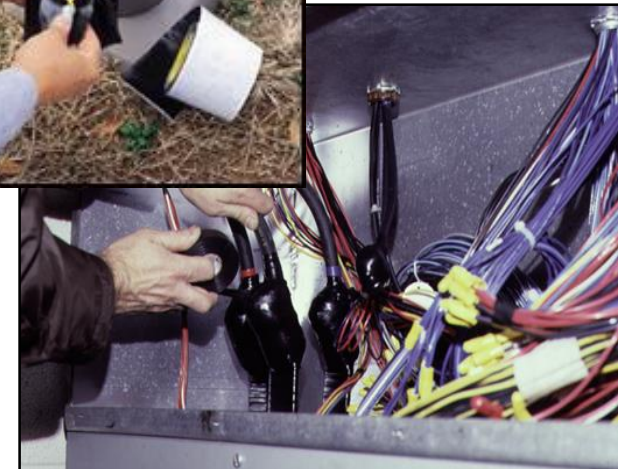
Electrical Insulation, Protection & Identification

Insulating cables and connections

- Three tiers of PVC (Vinyl)
 - Scotch Super 33+, (Super 88)
 - Scotch 700 (Black),
 - Temflex 1500 and Temflex 1300

Main application and properties

- **Electrical Insulation (mainly Low Voltage)**
 - Primary Insulation, Secondary Insulation, and Outdoor Use
- **Mechanical Protection**
 - Abrasion, Impact, Cut Through, Harnessing Bundling, Jacketing
- **Environmental Protection**
 - Moisture, Corrosion and Chemical
- **Color Coding & Identification**

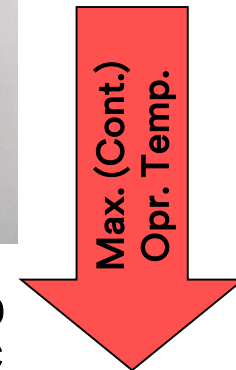
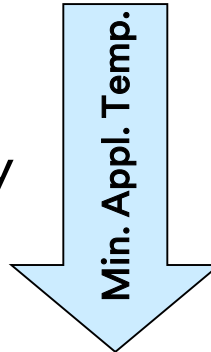


PVC Tapes, Premium vs. General Use Tapes

- Temperature range
 - Minimum application temperature
 - Max. (Continuous) operating temperature
- Adhesive / adhesion
- Type / amount of plasticizer
- Handling characteristics
- Conformability & stretchability

• Cost

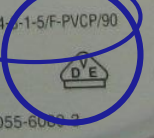
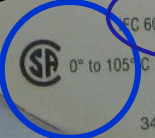
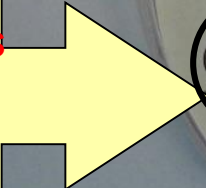
Temflex 1300	(0°C to 90°C)	0°C	GU Tape	90°C
Temflex 1500	IEC Type 5 classification (0°C to 90°C)	0°C	GU Tape	90°C
Scotch 700	(-10°C to 90°C)	-10°C	Mid Range	90°C
☺ Scotch 35	IEC Type 6 classification (-10°C to 90°C)	-10°C	Premium	105°C
Scotch Super 33+	IEC Type 7 classification (-18°C to 90°C)	-18°C	Premium	105°C





Different Agency Approvals

- UL
- CSA
- VDE /IEC



PVC TAPES



Premium Tapes

**BEST
UV
Resistance**

PRODUCT	THICKNESS	AVAILABLE COLORS
Scotch Super 88 IEC Type 7 (VDE approved)	0,220 mm	[Black color swatch]
Scotch Super 33+ IEC Type 7 (VDE approved)	0,177 mm	
Scotch 35 IEC Type 6 (VDE approved)	0,177 mm	[Blue] [Red] [Green] [Grey] [White] [Yellow] [Magenta] [Brown] [Orange]

Super 33+ and Super 88

-18 °C to 90 °C acc. to IEC (Type 7)
105 °C acc. to CSA
80 °C acc. to UL

Scotch 35 ☺

☺ -10 °C to 90 °C acc. to IEC (Type 6)
105 °C acc. to CSA
80 °C acc. to UL

All have UL, CSA, VDE approvals and IEC classified

Scotch 700 Tape



Commercial Grade Vinyl Electrical Tape 700

Data Sheet

July 2011

Description Scotch® Commercial Grade Vinyl Electrical Tape 700 is a high quality, vinyl insulating tape. It has excellent resistance to abrasion, moisture, alkalis, acids, copper corrosion and varying weather conditions. Scotch® Tape 700 provides excellent mechanical protection with minimum bulk. It is an Underwriters' Laboratories Listed and Canadian Standards Association Certified "Insulating Tape."

Agency Approvals & Self Certifications UL Listed; UL 510 Standard "Insulating Tape" (product category OANZ), File E129200
CSA Certification; Standard C22.2 No. 197-M1983 "PVC Insulating Tape," File LR48769

RoHS 2002/95/EC



RoHS Compliant 2002/95/EC means that the product or part ("Product") does not contain any of the substances in excess of the maximum concentration values in EU Directive 2002/95/EC, as amended by Commission Decision 2005/618/EC, unless the substance is in an application that is exempt under RoHS. This information represents 3M's knowledge and belief, which may be based in whole or in part on information provided by third party suppliers to 3M.

Applications

- Primary electrical insulation for all wire and cable splices rated up to 600 volts and 80°C (176°F)
- Protective jacketing for high voltage cable splices and repairs
- Harnessing of wires and cables
- For indoor or outdoor applications
- For above or below ground applications

Product Specification Scotch® Tape 700 is based on polyvinyl chloride (PVC) and/or its copolymers, and has a rubber-based, pressure-sensitive adhesive. The tape shall be 7 mils thick, and be UL Listed and marked per UL Standard 510 as "Flame-Retardant."

Scotch® Commercial Grade Vinyl Electrical Tape 700

Typical Properties 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.

Physical Properties (Test Method ASTM D1000*)	Typical Value US units (metric)
Color	Black
Thickness*	7 mils (0,177 mm)
Temperature Rating UL 510 CSA C22.2 No 197-M1983 Continuous Operation Handling	80°C (176°F) 90°C (194°F) -10°C (14°F)
Adhesion to Steel*	25 oz/in (2.7 N/cm)
Adhesion to Backing*	19 oz/in (2.1 N/cm)
Breaking Strength*	15 lbs/in (26 N/10 mm)
Elongation*	225%
Flammability UL 510	Pass

Electrical Properties (Test Method ASTM D-1000*)	Typical Value US units (metric)
Dielectric Breakdown* Standard condition After Humidity Condition	>1,000 V/mil 90% of Standard
Insulation Resistance*	> 10 ⁶ Megohms

Installation Scotch® Commercial Grade Vinyl Electrical Tape 700 shall be applied in half-lapped layers with sufficient tension to produce a uniform covering. In most applications, this tension will reduce the tape's width to approximately 5/8 of its original width. On pigtail splices, the tape shall be wrapped beyond the end of the wires and then folded back, leaving a protective cushion to resist cut-through. **Wrap tape up-hill, taping from a smaller diameter surface to a larger diameter surface.** Apply the tape with no tension on the last wrap to prevent flagging.

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

Shelf Life & Storage This product has a 5-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).

PVC TAPES

General Use Tapes



Product	Thickness	Available Colors
Temflex 1500 IEC Type 5 (VDE approved)	0.150 mm	Black, Blue, Orange, Red, Green, Grey, White, Yellow, Magenta, Brown, Light Green, Yellow
Temflex 1300	0.130 mm	Black, Blue, Orange, Red, Green, Grey, White, Yellow, Magenta, Brown, Light Green, Yellow

Temflex 1500 0 °C to 90 °C
VDE approved, IEC classified (Type 5)

Temflex 1300 0 °C to 90 °C
No agency approval



FLEXIBILITY

Flexibility => Conformability

- Conformability =>
- * Tape wrapping takes the shape of object
 - * Critical if the object shape is not uniform, but irregular
 - => * End of the tape flags (lifts-up)
 - * End of the tape flags more in extreme outdoor conditions, because
 - * Water and dust come under the tape-end
 - * In winter, water under the tape end freezes
 - * It flags more and more
 - * Tape **does NOT** do its intended function of
 - insulation
 - sealing
 - protection
 - identification

PVC TAPES

CORROSION PROTECTION TAPES

Premium Tapes



Product	Thickness	Available colors
Scotchrap 50	0,25 mm	
Scotchrap 51	0,500 mm	



from Google

USE:

Anywhere chemicals can attack metal surfaces on piping, conduit, fittings & closures

- Chemical Plants
- Water Treatment Facilities
- Power Plants
- Refineries
- Pipelines
- Mines



PVC TAPES

CORROSION PROTECTION TAPES

Premium Tapes

- Scotchrap 50 and 51 are PVC based with special high tack adhesive
- Adhesive is formulated to resist corrosion of
 - metal piping systems
 - above and below ground
 - fittings and joints
 - on all pipe and electrical conduit systems
- Resistant to
 - corrosive salt water
 - soil acids, alkalies and salts
 - common chemicals
 - chemical vapors
 - exposure to outdoor weathering and sunlight
- Resistant to
 - impact, abrasion, punctures

PVC TAPES

CORROSION PROTECTION TAPES

Premium Tapes

Scotchrap 50 and 51 Tapes

- Application Temperature Range : -12 °C to 66 ° C
- Service Temperature Range : - 48 °C to 80 ° C

* See the Data Sheet for other properties



EC&MRO Electrical Tapes
- Rubber and Mastic Tapes

Rubber and Mastic Tape Applications

Primary electrical insulation for splicing cables

on all solid dielectric cables (i.e. XLPE, EPR) up to 69 kV

Building up hand applied stress cones

on MV splices and terminations

Replacing semi-conductive layers of MV cables

Jacketing on medium voltage

splices and terminations

Moisture sealing

terminations, electrical connections

Bus bar insulation

End-sealing power cables



Rubber Tape

- Primary insulation
- Moisture Sealing
- Bus Bar Insulation
- Cable end-sealing



Mastic Tape

- Insulating
- Sealing
- Padding

Rubber and Mastic Tapes for LV and MV

Scotch 13 Self Fusing Semi-conductive EPR Tape

Scotch 23 Self Fusing EPR Tape

Scotch 130C Self Bonding EPR Tape

Scotch 70 Self Fusing Silicone Rubber Tape

Scotchfil Putty Tape (EPR)

Scotch 2228 Rubber Mastic Tape

Scotch 2229 Sealing Compound



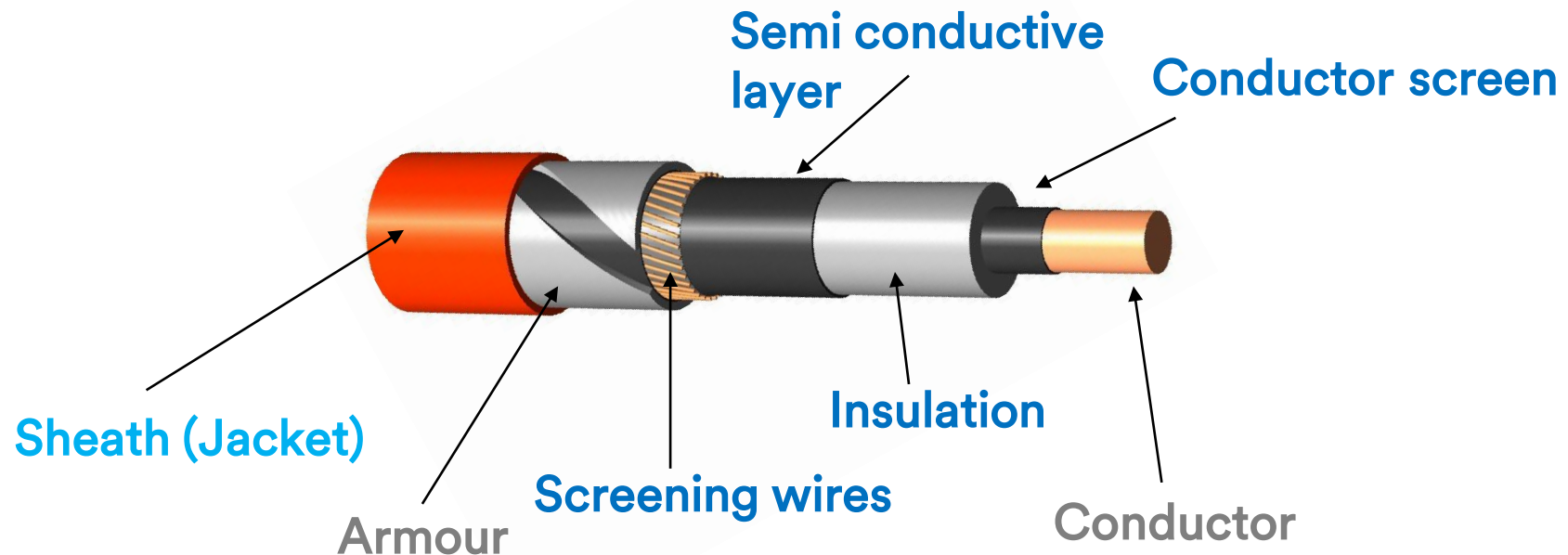
3M



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Rubber Tape Applications

- Splicing means that you **repeat the cable construction** by means of using different tapes and components (or by means using pre-molded or extruded parts or other products / technologies)



Rubber Tape Applications

- Splicing means that you **repeat the cable construction** by means of using different tapes and components (*or by means using pre-molded or extruded parts or other products / technologies*)

- If you make a MV tape splice,
- This means you replace the conductor by using a connector (*also for other splice technologies*).
- then, you replace the inner semi-conductive layer of the cable with semi-conductive Scotch 13 tape.
- then, you replace cable insulation by applying several layers of Scotch 23 tape
- then, you replace the outer semi-conductive layer of the cable with semi-conductive Scotch 13 tape.
- then, (*other steps to complete the splice*)

RUBBER TAPE (Semi-conductive)

Scotch 13

30 MIL (0.76 mm)
SEMI-CONDUCTING TAPE

- Self-fusing
- On liner
- Printed on itself and on liner
(CAUTION, Semi-Conducting /
Self-Fusing Tape)

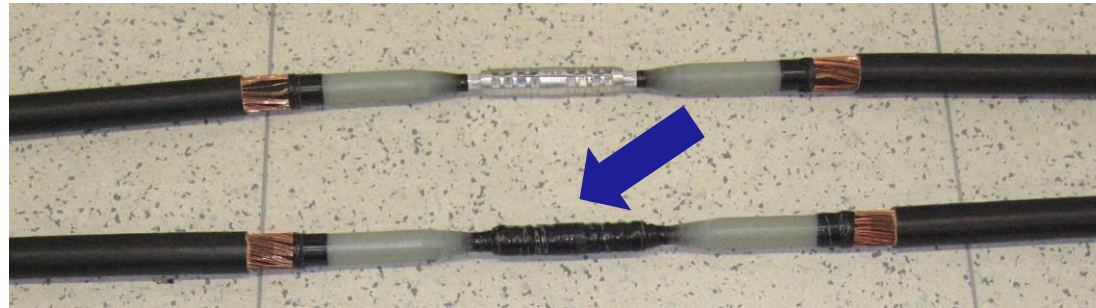


RUBBER TAPES

Scotch 13 Applications



- ❑ REPLACING SEMI-CONDUCTIVE LAYERS OF MV CABLE
- ❑ SMOOTH THE CONNECTOR



1

2

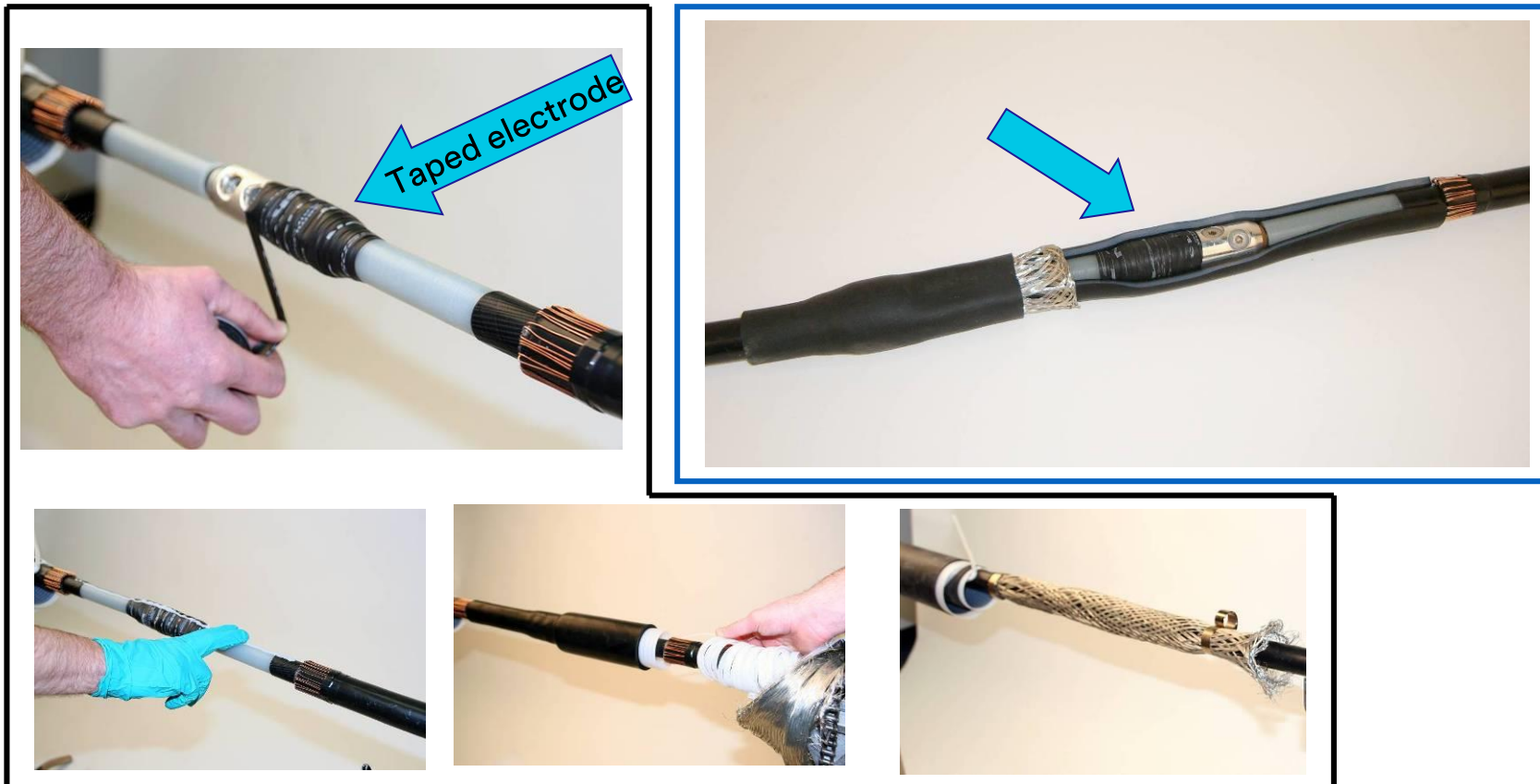
- ❑ Scotch 13 self-fusing tape is wrapped on the connector as half-overlapped and with printed side coming out. 2
- ❑ If you apply printed side in, functionally no issue, BUT then you can not differentiate it from Scotch 23 tape, because in this case both look simply black and you may make mistakes at installations.

RUBBER TAPES

Scotch 13 Applications

Cold Shrink Splice QS 2000E

Inline Splice Installation 92/93/94-AS 6x0-1



RUBBER TAPES (Insulating)

Scotch 23

30 MIL (0.76 mm)

ALL-VOLTAGE SPLICING TAPE

- Self-fusing
- On liner
- Insulating up to 69 kV



Scotch 130C

30 MIL (0.76 mm)

LINERLESS SPLICING TAPE

- Self-bonding
- Linerless
- Insulating up to 69 kV
- High thermal conductivity



Scotch 70

12 MIL (0.30 mm)

SILICONE RUBBER TAPE

- Self-fusing
- On liner
- Class "H", arc and track resistant insulation

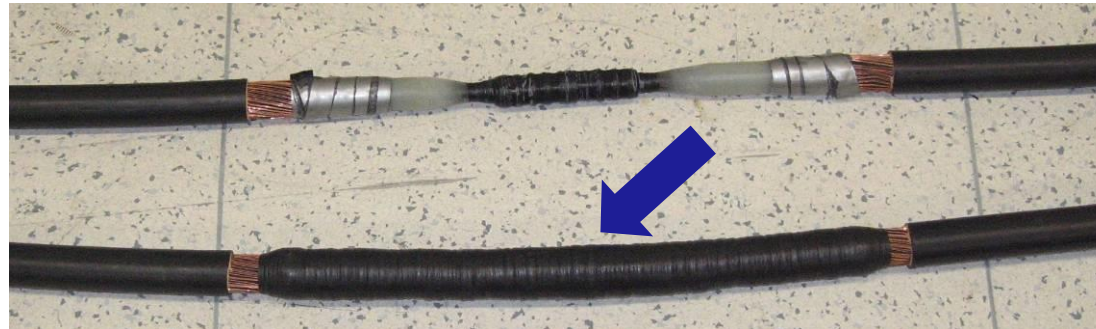


RUBBER TAPES

Scotch 23 Applications



- PRIMARY ELECTRICAL INSULATION for splicing and terminating up to 69 kV on all solid dielectric cables (i.e. XLPE, EPR)



3

Scotch 2220
Stress Control
Tape

4

- This means you can replace an XLPE or EPR insulation of a MV cable by wrapping several layers of # 23 tape stretched about 50-70% and half-overlapped until you reach the required insulation thickness. **IMPORTANT** is to obtain an air void free insulation layer due to self-fusing feature of #23 tape.

4

Self Fusing Rubber Tape Scotch 23 application



Can I use a PVC tape to replace cable insulation in a MV splice, instead of using Scotch 23 tape?

YES

WHY?

If we use 10 layers of Scotch 23 how many layers of Temflex 1500 would be enough?

3M

Data Sheet

Temflex™ 1500
PVC Electrical Tape

Thickness¹

0.15 mm

Electric Strength¹

40 kV/mm

0,15 mm => 6 kV/layer => 20 kV with 3.3 (4.0) layers



NO

WHY?

A tape with adhesive can not be applied without any air gap between its layers.

This means you will have Partial Discharges inside the insulation of the splice and it will fail.

RUBBER TAPES



Scotch 130C Applications

- **PRIMARY ELECTRICAL INSULATION**
for splicing and terminating up to 69 kV on all
solid dielectric cables (i.e. XLPE, EPR)

- You can use #130C tape the same as #23 tape. Difference is such that #23 tape is more practical when used on 3 core cables splices than using #130C tape. For 3 core splices you have to use short strips of the tape rather than applying directly from a roll because a roll can not be easily passed between the cable cores. # 23 tape will not have any problems here, but #130C tape will, Because #130C has a sticky side and it sticks to itself and makes it difficult when you try to pass its strips between the cores.
- Therefore, #130C is used more with 1 core cables/splices.

RUBBER TAPES



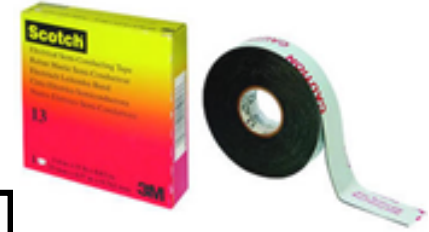
Scotch 130C Applications

- **PRIMARY ELECTRICAL INSULATION**
for splicing and terminating up to 69 kV on all
solid dielectric cables (i.e. XLPE, EPR)

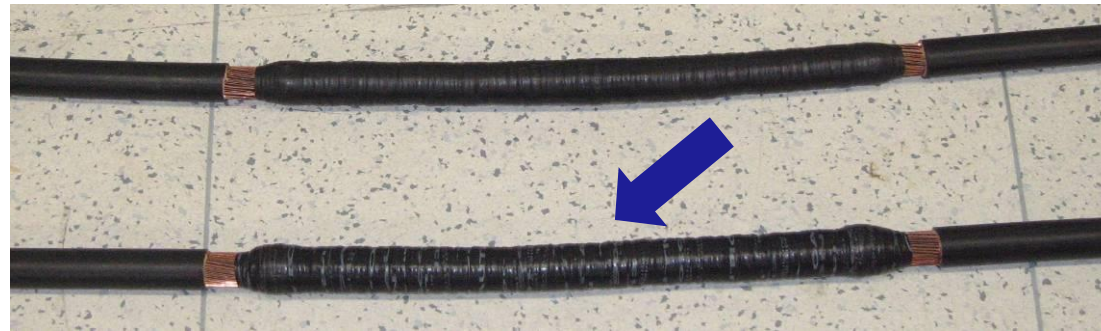
- **#130C tape has higher thermal conductivity than #23 tape. Therefore it is preferable to use it for splicing at higher voltages. Higher voltage means more layers of insulation tape and thicker insulation and in this case #130C tape offers the advantage of dissipating the heat of the splice to outside better at its operation and increasing the life time of splice. There are examples of customer made splice designs with #130C tape even higher than 69 kV due to this property (high therm. cond.).**

RUBBER TAPES

Scotch 13 Applications



- REPLACING SEMI-CONDUCTIVE LAYERS OF MV CABLE



4

5

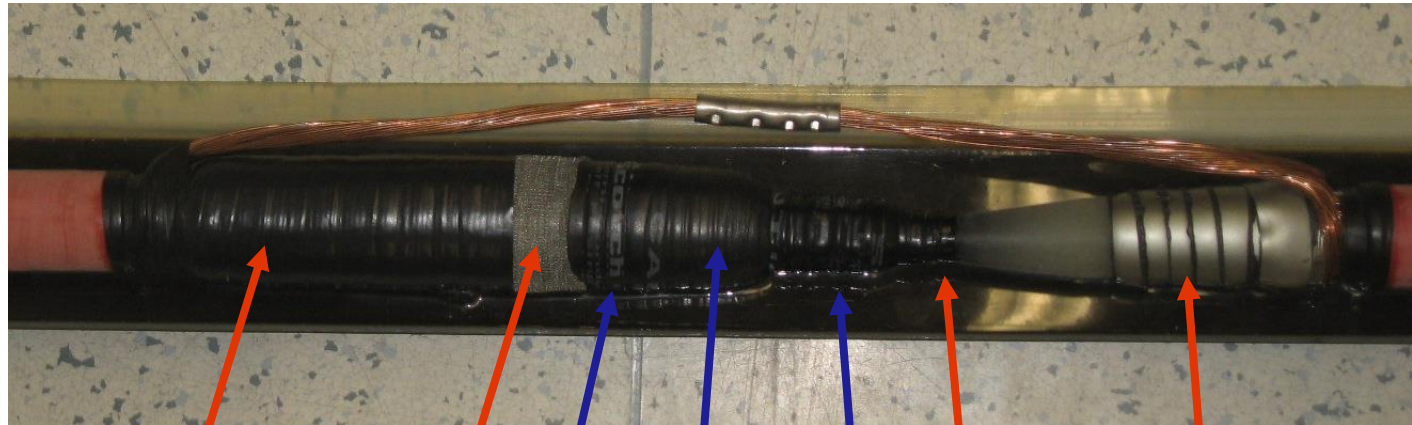
- Scotch 13 self-fusing tape is wrapped over the insulation made by using Scotch 23 tape as half-overlapped and with printed side coming out. (5)

- If you apply printed side in, functionally no issue, BUT then you can not differentiate it from Scotch 23 tape because in this case both look simply black and you may make mistakes at installations.

MV SPLICING WITH RUBBER TAPES and OTHERS

“ I . . . ALL TOGETHER ”

Example: Section of a Tape Splice for 10 kV XLPE cable,
„an old technology, but still valid“



- 7
Outer Protection
Example:
PVC tape + resin
or
Cold Shrink
or
Heat Shrink
- 6
Scotch 24
- 5
Scotch 13
- 4
Scotch 23
- 2
Scotch 13
- 1
Connector
(under S 13)
- 3
Scotch 2220
- 1

RUBBER TAPES

Scotch 70 Applications



- SEALING TOP END (on cable lug) OF QT II SILICONE TERMINATION
- HIGH TEMPERATURE RESISTANCE (180 °C) (other than termination applications)

- Scotch 70 self-fusing tape is made of silicone rubber, like the silicone material of QT II termination. Its layers fuses to itself and also almost to the silicone material of QT II and provides an excellent seal.
- It is a high track resistance material (resistance to surface currents) like QT II insulation body. This means it also resists to surface currents on the termination and adds to long life of the termination.
- Also used for other applications while Scotch 70 tape has 180 C continuous operating temperature.



RUBBER TAPES and family

FILLERS IN TAPE FORM

□ SCOTCHFIL Electrical Insulating Putty

- Rubber-based, elastic, 3.175 mm thick
- Insulate LV connections up to 1000 V
- Fill irregularities and voids in LV joints
- Create resin dam in resin-pressure joints
- Moisture seal



□ Scotch 2228 RUBBER MASTIC TAPE

- E.P.R. backing with a tacky, temperature stable mastic, 1.65 mm thick
- Superior moisture sealing
- Electrical insulation for 1 - 30 kV bus bar connections
- Environment and corrosion protection for MV bus bar connections



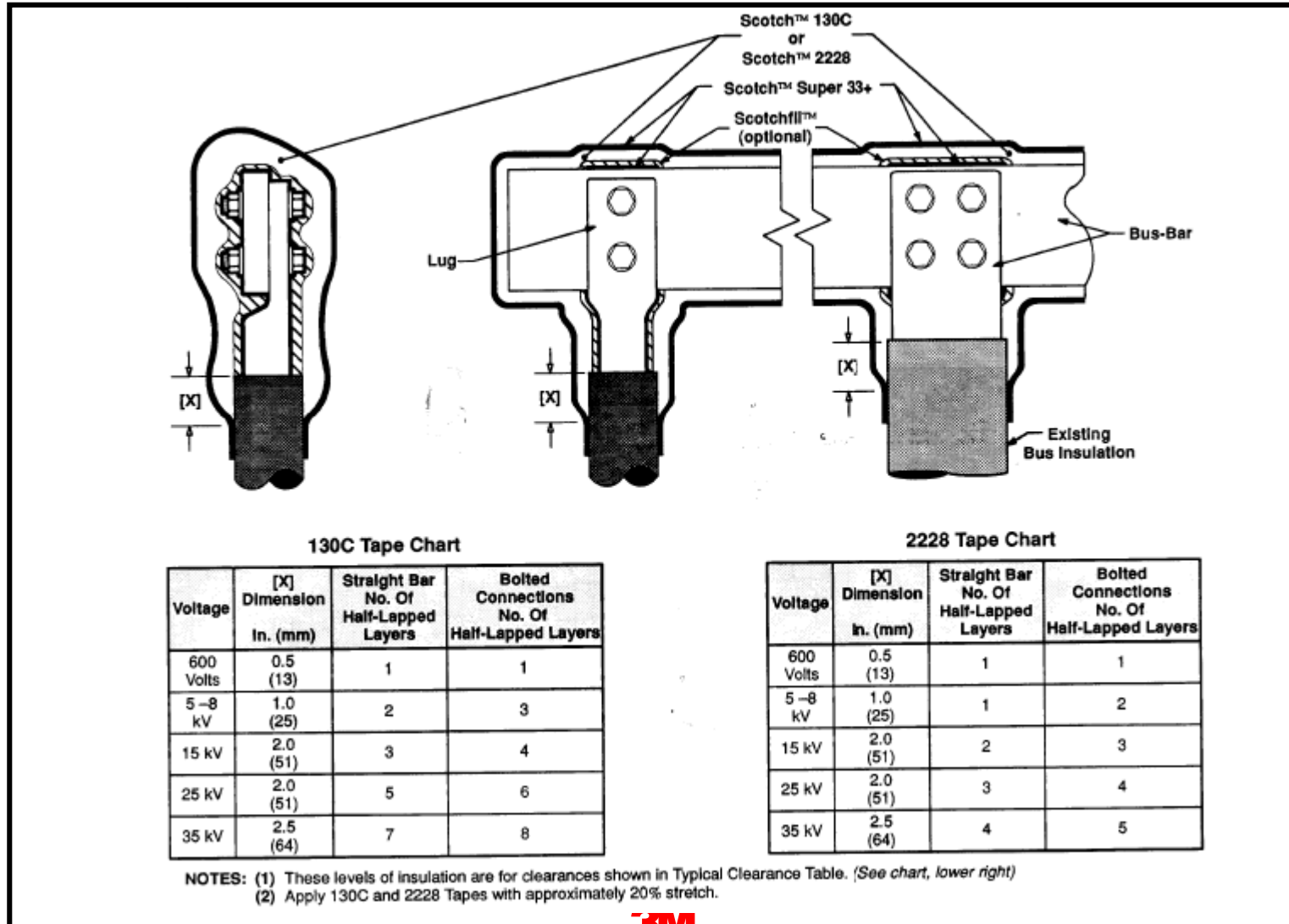
□ Scotch-Seal 2229 COMPOUND

- Un-backed tacky mastic on a liner, 3.175 mm thick
- Insulating, padding and sealing, waterproofing and protecting of electrical connections and other objects against adverse environment



RUBBER TAPES APPLICATIONS

BUS BAR INSULATION with Scotch 130C or Scotch 2228



MASTIC TAPES APPLICATIONS

Moisture Sealing Applications

Connections that need sealing from moisture/the elements

- **Mastic only (2229)**, overwrap with vinyl for abrasion resistance
- **Rubber mastic (2228)**, overwrap with vinyl for abrasion resistance
- **Vinyl mastic (2210/2200)**, vinyl incorporated





EC&MRO Electrical Tapes

- Other (Special) Tapes

Other Tapes in EC&MRO Portfolio

- Scotch 2220 Stress Control Tape (K-Tape)
- Scotch 401 Semi-Conducting Crepe Paper Tape
- Scotch 404 Insulating Crepe Paper Tape
- Scotch 24 Electrical Shielding Tape (K-Tape)
- Scotch 27 & 69 Glass Cloth
- Scotch 45 (45bk) Polyester Film
- Scotch Vinyl Mastic 2210/2215
- VM Tape Vinyl Mastic
- Scotch 9545N Colored Clear
- Scotch 2234 (31) Cable Jacket Repair Tapes
- Scotch 77 Fire & Electric Arc Proofing Tape



Other (Special) Tapes

- Stress Control
- Oil impregnated paper
- Glass Cloth
- Fire-Retardant
- Filament reinforced
- Cable jacket repair



Scotch 45 and Scotch 45 Bk



The tape for fixing/holding of cables and resist to dynamic forces of energized 3 x 1 (single) core cables

Scotch 9545N Coated Cloth Tape



Scotch™ 9545N Gewebeband mit Leuchtkraft

Scotch 9545N ist ein leistungsstarkes, imprägniertes Gewebeband mit mattglänzender PVC-Oberflächenbeschichtung. Eine leichte Handhabung, gute Sichtbarkeit und hervorragende mechanische Eigenschaften machen Scotch 9545N zu einem unverzichtbaren Helfer für eine Vielzahl von Anwendungen in Industrie und Handwerk.



Anwendungsbereiche

Scotch 9545N garantiert dauerhaft haltbare und saubere Ergebnisse. Insbesondere eignet sich das Gewebeband Scotch 9545N für:

- Kennzeichnung von Leitungen
- Markierung von Gefahrenstellen
- Bündelung von Kabeln
- Temporäre oder permanente Befestigung

Produkteigenschaften

- Exzellente Klebkraft auf unterschiedlichen Oberflächen
- Rückstandslos wieder entfernbar
- Reißfest, aber von Hand abtrennbar
- Leicht abwickelbar
- Dauerhaft beschreibbar
- Wasserabweisend
- Alterungsbeständig
- REACH- und RoHS konform

Leicht abtrennbar!



Dauerhaft beschreibbar!



→ 9545N
In 7 Colors und 3 Widths

→ Fixing
→ Wire/Cable harness
→ Identification

→ Excellent adhesion
→ High tensile strength, but you can tear by hand
→ Writable (lead, ballpoint, permanent pen)

What

For what

Why

OIL IMPREGNATED CREPE PAPER TAPES

Scotch 401 Semi-Conducting Crepe Paper Tape

Scotch 404 Insulating Crepe Paper Tape

are used for tape splices on oil impregnated cables



Scotch 24 Electrical Shielding Tape



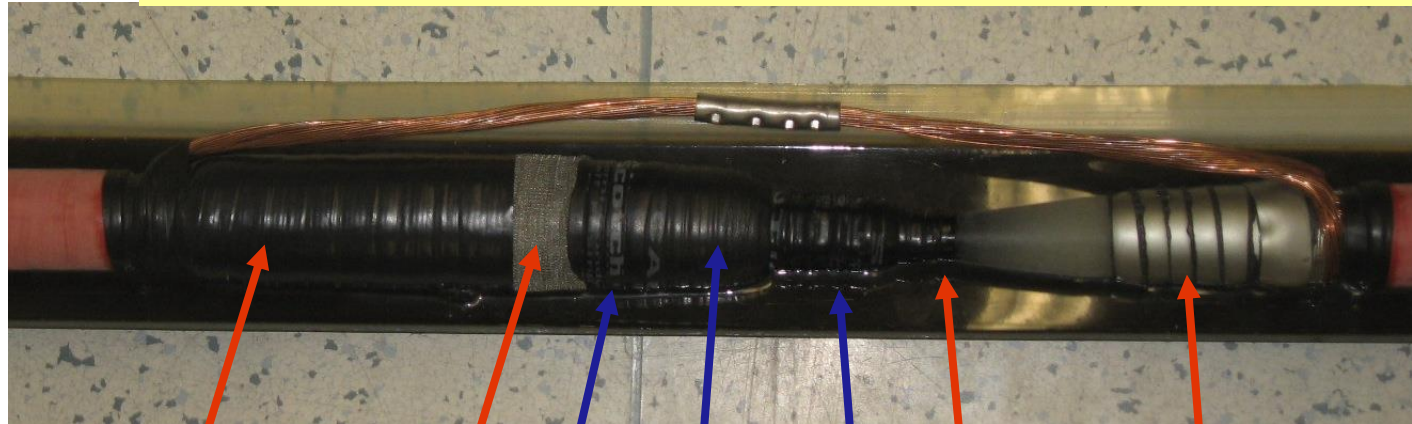
Scotch 2220 Electrical Stress Control Tape



MV SPLICING WITH RUBBER TAPES and OTHERS

“ALL TOGETHER”

Example: Section of a Tape Splice for 10 kV XLPE cable, an old technology, but still valid



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Outer Protection
Example:
PVC tape + resin
or
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- 6
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- 5
Scotch 13
- 4
Scotch 23
- 2
Scotch 13
- 1
Connector
(under S 13)
- 3
Scotch 2220

Scotch 2234 CABLE JACKET REPAIR

Scotch® Heavy Duty Tape 2234

- *On-site, quick, universal cable repair*
- *Tough, abrasion resistant*
- *Moisture, chemical and oil-resistant, flexible, heavy-duty backing*



Mining applications / Cable jacket repair

Scotch® Heavy Duty Mining Tape 31



- Scotch® Mining Tape 31 is approved by MSHA (Mining Safety & Health Administration) as the outer jacketing of the 3M™ Mining Cable Splice Kits 3100 Series. The tape is printed with the MSHA logo
- On-site, quick, universal cable repair
- Abrasion, water and oil-resistant, flexible, heavy-duty backing
- Moisture-resistant, self-healing, flame-retardant mastic
- MSHA-Approved



Scotch 77 Fire-Retardant Electric Arc Proofing Tape

Scotch® Fire-Retardant Electric Arc Proofing Tape 77 is designed to protect all types of electrical cables where exposed to potential failures of other high voltage cables or exposed to other high energy cables.

Scotch®

Fire-Retardant Electric Arc Proofing Tape 77 Series

Data Sheet

March 2009

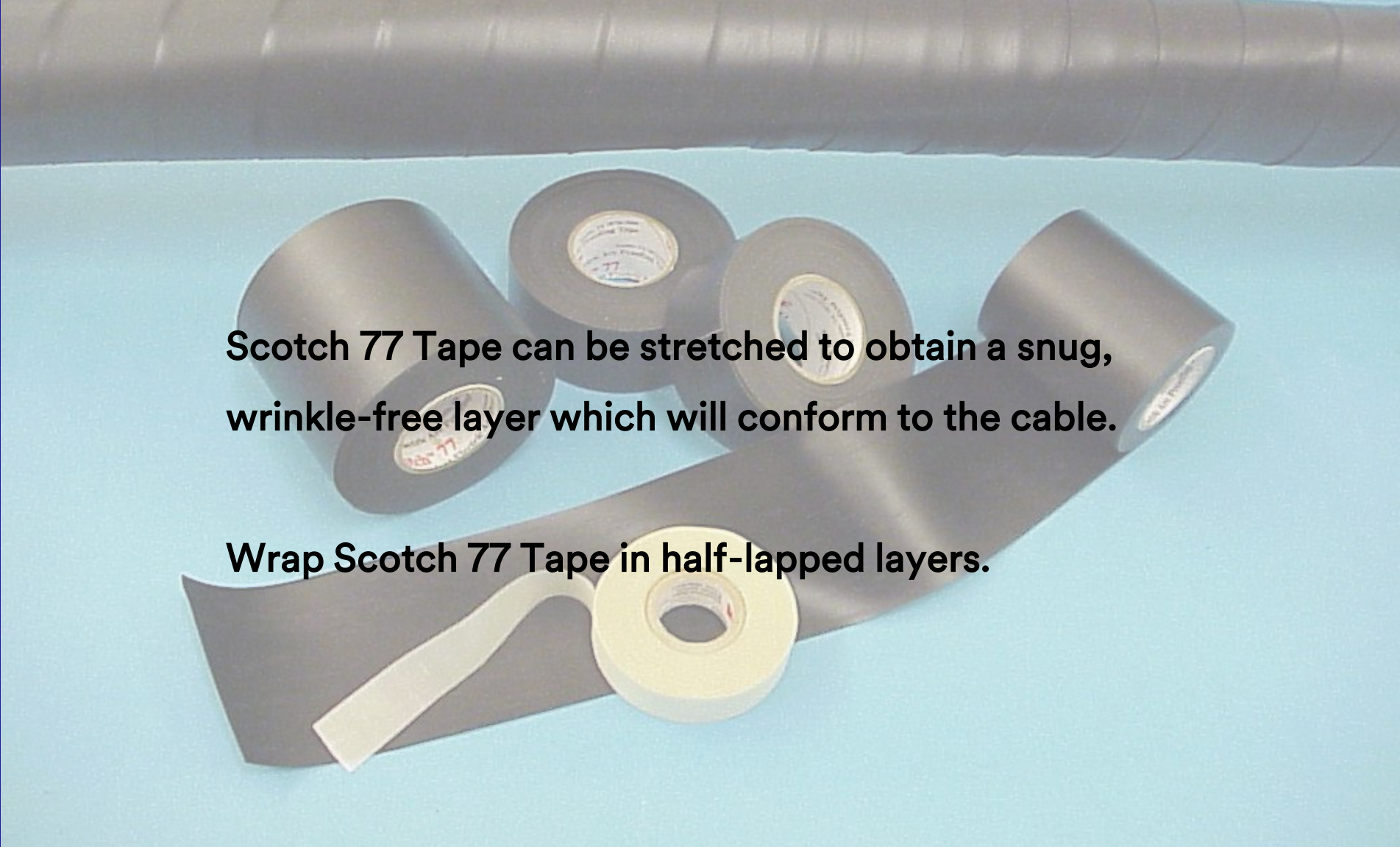
Description

Scotch® Fire-Retardant Electric Arc Proofing Tape 77 Series is a fire-retardant arc proofing tape designed to protect all types of electrical cables. Its unique formulation allows the manufacture of an unsupported elastomer that expands to provide a thick char buildup. This insulating shield is designed to protect the cables and accessories from fault arc generated heat and flames. All adjacent wrapped cables and accessories are protected when exposed to fault arcs until limiting devices can interrupt the faulted circuit.

Because Scotch® Electric Arc Proofing Tapes 77 Series are unsupported, they are extremely conformable. Installers can provide wrinkle-free coverage of cables and irregularly-shaped accessories, easily and rapidly. This exceptional conformability provides better product control while wrapping and more uniform coverage. Also, the tape's thick cross sections greatly reduce the overall weight compared to other methods while providing equal or better arc protection times. The light gray color allows for easy identification of the Scotch® Electric Arc Proofing Tape 77.

Scotch® Fire-Retardant Electric Arc Proofing Tape 77

Installation Technique



Scotch 77 Tape can be stretched to obtain a snug, wrinkle-free layer which will conform to the cable.

Wrap Scotch 77 Tape in half-lapped layers.



