Scotch™ 23
All-Voltage Splicing Tape
Data Sheet

Product Description
Scotch™ 23 Electrical Tape is a highly conformable self-fusing EPR (Ethylene Propylene Rubber) based, high voltage splicing tape. It is a non-vulcanising, shelf-stable tape with excellent electrical properties. 23 Tape can be used as an insulation for low-voltage applications as well as an insulation for splices up to 69kV.

Tape Features
- Can be used to splice and terminate cables whose emergency overload temperatures can reach 130°C.
- Based on Ethylene Propylene Rubber (EPR).
- Physical and electrical properties are unaffected by the degree of stretch.
- Self-fusing tape.
- Excellent electrical properties.
- A special polyester liner which will not stick to the tape upon unwind.
- Compatible with all solid dielectric cable insulation:-
  Polyethylene (high and low density).
  Cross-linked polyethylene (XLPE).
  Polyvinyl chloride (PVC).
  Butyl rubber.
  Ethylene Propylene Rubber (EPR).
  Oil-based rubber.

Applications
- Primary electrical insulation for splicing cable from 600V to 69kV on all solid dielectric cables.
- Primary insulation for building stress cones on cables up to 35kV on all solid dielectric cables.
- Jacketing on high-voltage splices and terminations.
- Moisture sealing electrical connections.
- Bus bar insulations.
- End sealing high-voltage cables.

Data – Typical Properties
Physical Properties

Test Method	Typical Value*
Colour	Black
Thickness ASTM-D4325	0.76mm
Tensile Strength ASTM-D4325	1.4KN/m
Ultimate Elongation ASTM-D4325	1000%
Operating Temperature	90°C (194°F)
Emergency Operating Temperature	130°C (266°F)
Fusion, ASTM-D4388	Passes
Thermal Conductivity ASTM-D1518	0.1208 Btu (hr)(sq ft) (°F per ft)
Modulus @ 130°C	See Section 5
Ozone Resistance ASTM-D4388	Passes

Electrical Properties

Test Method	Typical Value*
Dielectric Strength ASTM-D4325 After Standard Conditioning	31.5 MV/m
After 96 hours @ 96% RH	>90% of Std Condition Value
Insulation Resistance ASTM-1000 (Indirect method of electrolytic corrosion)	>1 x 10^6 megohms
Dissipation Factor	See Section 5
Dielectric Constant	See Section 5
Dielectric Strength at elevated temperature	See Section 5

*This data is not to be used for specification. Values listed are for typical properties and should not be considered minimum or maximum.

Specifications
Product
The high-voltage corona-resistant tape must be based on ethylene propylene rubber and be capable of operation at the emergency cable temperature of 130°C (266°F). The tape must be capable of being applied in either the stretched or unstretched condition without any resulting loss in either physical or electrical properties.
The tape must not split, crack, slip or flag when exposed to various environments (indoor and outdoor). The tape must be compatible with all synthetic cable insulations. The tape must have a dissipation factor of less than 5% at 130°C (266°F) and must have a shelf life of 5 years.

Engineering/Architectural Specification
Splicing and terminating solid dielectric cables shall be done in accordance with drawings engineered by the splice material manufacturer such as the 2047 series available from 3M Company. All splices and terminations shall be insulated using Scotch™ Brand 23 Electrical Tape.

Characteristics and Test Data
Modulus at 130°C (266°F)
A high-voltage splicing tape must constantly maintain a rubber-like consistency throughout the life of a splice. One method of determining a rubber material consistency is by measuring the modulus of the material. The modulus of a material is the stress required to elongate the material to a given elongation.

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Figure 1 shows the 100% modulus (stress required to elongate 23 Tape to 100% elongation) after heat ageing the samples at 130°C (266°F) for a varying number of days. The results indicate a very stable product with excellent "body" or elasticity after oven ageing at 130°C (266°F).

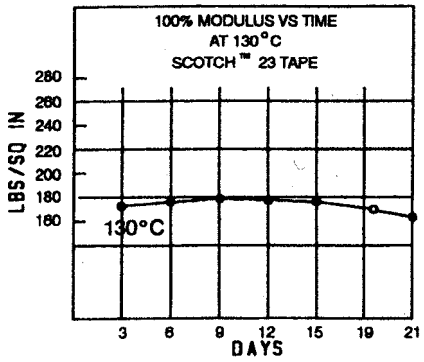

Figure 1

Dissipation Factor
Figure 2 shows the dissipation of 23 Tape. This test was run according to ASTM-D150 at a stress of 50 V/mil (2.0 MV/m) and a frequency of 60 cycles per second.

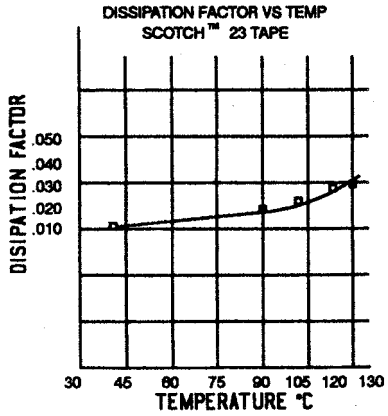

Figure 2

Dielectric Constant
Figure 3 shows the dielectric constant versus temperature of 23 Tape. This test was run according to ASTM-D150 at a stress of 50 V/mil (2.0 MV/m) and a frequency of 60 cycles per second.

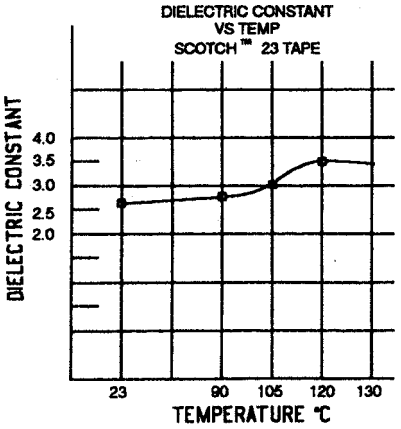

Figure 3

Dielectric Strength at Elevated Temperatures
A high-voltage splice must not only have a high dielectric strength at room temperature, but it must also have good values at the temperature at which it is expected to operate. Figure 4 shows a plot of dielectric strength versus temperature. This test was run according to ASTM-1000.

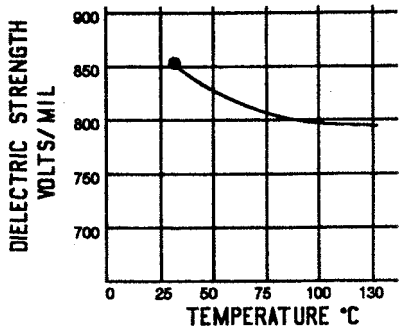

Figure 4

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Dielectric Strength Versus Thickness
Figure 5 shows a plot of dielectric strength in volts per mil versus thickness. As can be seen by the curve, the dielectric strength in the original thickness of 0.76mm is 800 V/mil (31.5 MV/m). However, the dielectric strength of a 0.51mm thickness of 23 Tape is 1200 V/mil
(47.2 MV/m). This test was run according to ASTM-1000.

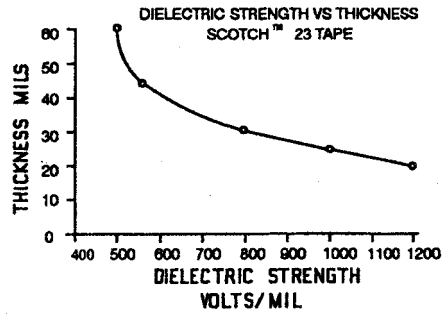

Figure 5

Installation Techniques
Scotch™ Brand 23 Electrical Tape should be applied in successive half-lapped, level-wound layers until desired build-up is reached. To eliminate voids in critical areas, highly elongate 23 Tape.
Stretch Tape in these critical areas just short of its breaking point. Doing so will not alter its physical or electrical properties. In less critical areas, less elongation may be used.
Normally, 23 Tape is stretched to ¾ of its original width in these less critical areas. Always attempt to half-lap to produce a uniform build-up. When using 23 Tape for splicing cables from 35kV to 69kV, always elongate the tape throughout the entire splice.

Maintenance
Under normal storage conditions, 23 Tape has a 5-year shelf life. The tape is not impaired by freezing nor by overheated storage up to the point of flow which prevents removal from the package.

Availability
Scotch™ Brand 23 Electrical Tape is available in the following roll sizes from your local authorised 3M electrical distributor:

19mm x 9M
25mm x 9M
51mm x 9M

Other lengths and widths are available by special request.

Complete Product and Use Specifications are available through the Electrical Products Division, 3M Company.

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