Taping High Voltage Connections

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Generally speaking, switchgear users prefer their bus joints and cable connections be insulated with a removable insulating boot to make maintenance procedures like checking the torque of hardware much easier. Unfortunately some connections are too complex for a boot and require taping. Because taping has become somewhat a lost art, there are always questions. This Technical Brief is intended to remove some of the mystery about taping high voltage connections.

The primary types of tape used for electrical connection insulation are vinyl, rubber, and mastic. Older taped connections may have used varnished cambric or similar. Each of the tapes has a specific purpose in the creation of a moisture–resistant electrically sound installation.

Types of Tape

Mastic tape is used to shape the electrical field around the conductor by filling the voids and smoothing the surface. Mastic provides a good moisture barrier but does not provide any appreciable insulation.

Rubber tape is used to build up the insulation. Rubber tape may also be used in place of mastic to shape the electrical field as it can be stretched to conform to irregular shapes.

Duct Seal putty, although not a tape, is often used as the filler material when the connection shape makes applying a tape too difficult. Putties provide no dielectric strength and are covered with rubber tape to create the insulation layer.

Semi-conductive tape is sometimes required to further enhance the field shaping by applying it on top of the mastic or conformal rubber tape to create a smooth energized surface that is then insulated. The object here is to create a uniform field that reduces the electrical stress around the connection. This technique is used for high voltage connections and when partial discharge is a concern. It is not typically used on switchgear rated 38kV or less.

Vinyl tape is used as the final layer in any taping procedure to create a layer that is UV resistant and more physically robust than the soft rubber layers below.

Taping Procedure

Step 1 in the process is to shape the connection. The assembly hardware, cable lug, and even the bus bar itself rarely provide a well-shaped surface and this creates dielectric stress around the connection. Mastic, rubber tape, a combination of the two, or a filler material like Duct Seal putty is used to build up around hardware and shape the connection into a smooth surface with no voids or sharp edges.

Step 2 uses rubber tape to build the insulation layers. This tape is generally non-adhesive and comes in two forms; lined or linerless. Either type is acceptable. The rubber tape is easily stretched during the wrapping process and the stretching process helps the non-adhesive tape stick to itself. However as it stretches the width is reduced and care must be exercised to avoid stretching it past its breaking point. The tape should be layered on itself (lapped) to increase adhesion and cover the previous layer seam.

The general rule for taping HV connections calls for the thickness of the rubber tape build up to be 1.5 times the thickness of the insulation of the connecting cable. In the wrapping process the tape is...
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stretched to approximately ¾ of its original width and wrapped in a half-lapped (each successive turn covers half of the previous turn) technique to form a moisture barrier and provide the necessary level of insulation. Equipment manufacturers will provide instructions for how many layers and what type of overlap is required for their design and the equipment voltage rating.

Step 3 applies a vinyl tape to the exterior surface for UV and mechanical protection. The vinyl tape is also half-lapped and typically applied for two layers.

Powell provides detailed taping instructions for each type of connection joint in all equipment instruction bulletins.

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