
Insulation of Bus Joints

February 20, 1997

One of the defining features of metal-clad switchgear built according to ANSI/IEEE Standard C37.20.2 is that all power circuit bus work, including both factory-made and field-made joints, is covered with insulating material. The insulated bus, including the joints, must pass a power-frequency voltage test for one minute at rated voltage. This voltage is applied between the insulated conductor and an electrode, usually a foil wrapping, on the surface of the insulation. The insulation decreases the likelihood of accidentally starting a fault with a misplaced tool (or body part). If a fault does occur, due to a break in the insulating system, the fault is usually kept from traveling the length of the bus because the insulation keeps the arc rooted in one place. And finally, the insulation allows reduced spacing between the bus bars for a given B.I.L. rating, allowing more compact switchgear.

However, taking advantage of this smaller size equipment requires insulation of all joints, both in the main bus and at cable or bus duct terminations in the switchgear. Over the years a number of methods of insulating joints have been used, including the following:

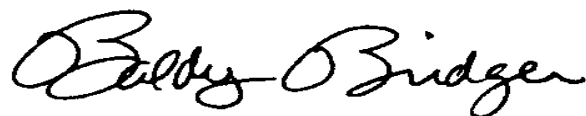
1. **Taping.** This is probably the oldest method of insulating a joint, and it is still used in some cases. It is slow, often taking several hours per joint, and a good joint is highly dependant on the skill and care of the person doing the taping. However, some joints are so complex that taping is about the only way to insulate them.
2. **Asphalt-filled plastic boxes.** 45 to 50 years ago, many main bus joints were insulated by enclosing them in hard plastic boxes and pouring the box full of an asphaltic compound. This was a messy process, and the materials used were neither flame retardant nor track resistant. It was especially messy when a joint had to be opened and cleaned for some reason. The method was abandoned before 1960 for new equipment, but there are probably many of these joints still in service in older switchgear.
3. **Flexible boots.** Boots, molded to fit the shape of the joint, are the most common method of joint insulation in switchgear up to 15 kV. The great majority of these boots are molded of PVC, but other materials have been used. The boots can be installed quickly and easily, removed readily, and reused. At voltages above 15 kV, however, it is very difficult to get these boots to pass the test for bus bar insulation required by the standard.
4. **Heat and cold shrink materials.** There are a number of heat shrink and cold shrink products available. These generally do a good job on straight in-line joints, but can be difficult to use on joints with a more complex shape.

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5. **Poured joints.** For our PV System 38[®] switchgear, Powell has developed a system of poured joints, using removable molds and a clear urethane insulating material. This joint insulation method does meet the bus bar insulation test at 38 kV, and provides for visual inspection of the bus joint.

Please be sure to insulate the bus joints when you install your metal-clad switchgear.



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