Overlap and Bolting of Bus Connections

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From time to time questions arise about bus overlap dimensions and the number of bolts required in a bus joint. As pointed out in PTB 24, the factor which determines the adequacy of bus work is the temperature rise. If the temperature rise is less than the limits given by the relevant product standard, the bus work and its joints are satisfactory. If the temperature goes too high, no amount of overlap or number of bolts makes the joint okay.

When two bus bars are bolted together, the current transfer from one bar to the other takes place at a number of locations where microscopic projections on the surface of the two bars are deformed by the pressure of the bolted joint. The great majority of these points of deformation take place under the hardware. If you project a line outward a 45° from the edge of the flat washer through the thickness of the bus bar, as shown by the dotted line in figure 1, you define a surface area where effective bar-to-bar conduction takes place. This is shown by the heavy line in Figure 1. As long as the overlap of the two bus bars is sufficient to cover this area, the bolted joint will be effective, and additional overlap area is of little importance.

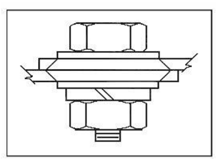

Figure 1. Bolted Bus Connection

In order to create the pressure necessary to deform the micro projections on the bus bars, the bolt torque must be rather high. Proper torques are given in PTB 53. To achieve high torques and large contact areas, it is preferable to use a few large bolts rather than many small ones. For most main buses in switchgear and motor control, we prefer to us 1/2" bolts. It is our experience, based on numerous temperature rise tests, that 1/2" bolts make a very satisfactory joint for bus rated up to 4000 A. Since most joints are made by bolting a bus bar to a splice plate or a riser bus, and then bolting the next section of bus to this same splice plate or riser bus, the complete bus-to-bus splice will normally have four bolts.

Copper bus bars are normally plated with silver, tin, or nickel at all joints in order to prevent the formation of copper oxide in the joint. Copper oxide is a semiconductor, and its presence leads to increased resistance and high temperature in the joint.

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