

Personnel protective grounding in substations made easy

Crews welcome fewer parts, faster installation at half the weight and cost

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We have been searching for better ways to implement our policy for substation grounding almost since we adopted it. While the grounding equipment we've been using is the widely-accepted standard for this application, it has always had room for improvement in practice.

Our typical grounding set for a

three-phase application included:

- One shepherd-hook mounted on a two-section 16-foot insulated pole with a rope-block assembly,
- Three jumpers, each consisting of a two-section 16-foot insulated pole fitted with a large grounding clamp connected by 4/0 copper grounding cable to a smaller grounding clamp,
- One cluster bar with chain binder (to accomplish equipotential principle as the common connection point for the three phase jumpers, above, and the ground-grid lead, below)

and

- One ground "tail," consisting of two smaller grounding clamps connected by 4/0 grounding cable.

'Heavy metal' background

Our chief concern with this set is its considerable weight. That factor is inherent in its need for the shepherd-hook tool. With its hook placed in turn over each phase bus, its rope-block helps guide into position each of the three clamps large enough to fit on 2½" IPS busbar. So heavy due to their size, these clamps also must be stick-mounted.

This all resulted in a rather cumbersome procedure from a set weighing over 100 pounds. Yet, at the same time, it did meet our technical requirements for substation grounding equipment:

- Available fault currents and apparatus clearing times,
- Equipotential protection scheme,
- Single down-lead to ground plane.

So our search for better equipment bore a twofold challenge. It needed to weigh less, but also would have to perform all these criteria of our Personnel Protective Grounding Policy.

'State-of-the-art' solution

Our search culminated soon after the Chance ball-socket ground clamp became available. We purchased a few samples and tried them with various lengths of 4/0 copper phase-to-phase jumpers and ground tails to find the workable combinations that best suit our system needs. This resulted in a substation three-phase set weighing



New system makes grounding easier. Ball studs mounted back-to-back on copper plate add convenience for placing socket clamps of phase-to-phase ground leads. Torque-controlled clampstick head ensures proper tightening.

under 50 pounds, even with the two clampsticks and a torque-controlled adapter required to install it.

Our substation maintenance crew's preference for the eyescrew-socket clamp configuration was based on its reduced weight and ease of installation compared to the stick-mounted clamp set. This made the new sets much faster to install, too. And since shorter cables are easier to control, the new sets can add to the margin of crew safety during emergency repairs.

Storage space also was reduced due to the need for only standard clampsticks as opposed to long hotsticks "dedicated" to the individual busbar clamps and shepherd-hook. By using "common" hot-line tools, we have fewer parts to track and maintain for grounding.

Cost improvement was significant. Prices for the new-style set list for one-half of the total for the old set. As in our comparison of weight totals, this includes the two clampsticks and torque tool (which actually are not in the new set).

The ball-stud/socket-clamp system keeps our Personnel Protective Grounding Policy in full effect. It continues our commitment to the equipotential grounding principle, while its lower weight factor is readily apparent to substation and power electricians.

In the first three months, we have installed 500 ball studs. Since we are making the changeover throughout our system as we take substation equipment out of service to perform other work, it could take up to six years to accomplish.

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Length of grounding leads is a compromise to enable their use on other equipment with wider phase-to-phase spacing. 4/0 ground cable matches gauge of copper conductors from bus and line disconnects to OCB bushings.



Cataloged as two separate items for various multiples, ball stud and clamp body (with eyescrew) are copper alloy for efficient current transfer.



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