Background & Scope

- In recent years, the effectiveness of the equipotential bonding mat has become an industry wide concern (e.g. Kinetics report and CEATI project).
- Some APIC companies such as Epcor have specific concerns on the use of the bonding mat under certain working conditions (such as Hydro-Vac job).
- This project is conducted to provide scientific information so that APIC companies can make an informed decision if they want to continue or to revise work practices which involve the use of the bonding mat.

Scope of this investigation:

- The portable bonding mats that are similar to those marketed by Kri-Tech and Hubbell;
- The mat that is laid on the ground surface when being used;
- The worksites that could be energized by distribution facilities;
- The worksites that are outside substations.

Investigation strategy:

- Establish an ideal mat to clarify the issues and requirements;
- Compare the actual mat with the ideal mat to identify differences and deficiencies;
- Determine if the differences/deficiencies are acceptable from a practical perspective;
- Conservative assumptions are used in this study since the mats are expected to work under various, unpredictable worksite conditions.

Ideal bonding mat (1)

- An ideal equipotential bonding mat is a (solid) conductive plate that meets the following requirements:

  \[ V_{\text{mat}} < V_{\text{mat-quality-reach}} \times \text{reach} \quad \text{(Duration)} \]

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**Requirement 1: Current Carrying Capacity**

The mat is required to carry the maximum fault current expected for the worksite it is intended for. Since the mat has a resistance to ground \((R_{\text{mat}})\), it will limit the fault current. This situation is depicted as follows:

**Requirement 2: Resistance of the Bonding Mat**

The resistance of the mat must be small enough to meet \(V_{\text{mat}}\) and \(V_{\text{grad}}\) limits. According to IEEE std80, the withstand current for a 70kg human body for a fault duration of 20ms is:

\[ I_{\text{grad}} = 0.021 \times \text{mass} \text{ (Amps)} \]

Facts of equipotential bonding mats

- The worst scenario of touch voltage on ideal mat:

  \[ V_{\text{touch}} = R_{\text{mat}} \times I_{\text{grad}} \]

  \[ V_{\text{touch}} = R_{\text{mat}} \times I_{\text{grad}} \]

- The portable bonding mat's modifications with respect to ideal mat:

  No | Modification | Potential issues
  --- | --- | ---
  1 | Conductive plate is modified into conductive mesh | Equipeotential does not exist at every point of the mat anymore
  2 | Polyethylene (PE) textile layer is used on top of the mesh | This layer may or may not provide added protection depending on its insulation rating and worksite condition
  3 | Braided copper conductors are used to form mesh | Fault current carrying capability may be affected, depending on mat condition
  4 | The size of the mat is limited | If the edge of the mat could be accessed accidentally depending on the mat size and work scenario

The authors are grateful to Alberta Power Industry Consortium for financial support.