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Equipotential Plane in Livestock Containment Areas



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Equipotential Plane in Livestock Containment Areas

Developed by the Equipotential Plane Engineering Practice Subcommittee of the ASAE Agricultural Wiring and Energy Application Committee; approved by the Information and Electrical Technologies Division Standards Committee; adopted by ASAE February 1994; revised editorially August 1994; revised November 1997, January 2001; reaffirmed February 2006; reaffirmed January 2011; reaffirmed October 2015.

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1 Purpose and Scope

1.1 This Engineering Practice is intended as a guide to engineers, technicians, and contractors for the design, layout, and construction of equipotential planes and voltage gradient ramps (transition areas) in livestock (excluding poultry) containment areas along with other specifications necessary to accomplish the following objectives:

- provide a surface and surroundings such that all possible livestock or personnel contact points within the equipotential plane area are nearly the same electrical potential;
- provide minimum step and touch potential gradients for livestock frequently (daily or more often) entering or exiting from the perimeters of an equipotential plane.

1.2 This Engineering Practice is intended to present methods of constructing and installing equipotential planes and voltage gradient ramps and retrofitting structures with equipotential planes. The judgment of personnel familiar with the site conditions and specific installations may enhance the specifications of this Engineering Practice or indicate use of alternative approaches that yield equivalent results.

2 Normative References

The following standard contains provisions which, through reference in this text, constitute provisions of this Standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this Standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Standard organizations maintain registers of currently valid standards.

ANSI/NFPA 70-1999, *National Electrical Code*

ASAE EP342.2 MAR95, *Safety for Electrically Heated Livestock Waterers*

3 Definitions and Glossary of Terms

3.1 electrical bonding: Electrically connecting non-current-carrying metal parts to an electrical grounding system. It assures that no open circuits or high resistance circuits occur in grounding paths. Bonding screws, bonding jumpers, welds, brazing, clamps, exothermic welding, and other means are used as bonding methods.

3.2 equipment grounding: Consists of circuits or conducting paths connecting non-current-carrying metal parts of equipment, raceways, and other metallic enclosures to the electrical grounding system.

3.3 equipotential plane: A surface where wire mesh, reinforcing bars, or other conductive elements are embedded in concrete, bonded to all extensive metal structures and fixed nonelectrical metal equipment in livestock areas that may become energized, and bonded to the electrical grounding system of the facility. This prevents a difference in potential from developing across the plane.

3.4 step potential: The potential difference between two points on the earth's surface separated by a distance of one pace (assumed to be 1 m [approximately 3 ft]). This potential difference can be dangerous should it reach levels high enough to cause sufficient current through a person or animal.

3.5 touch potential: The potential difference between a grounded metallic structure and a point on the earth's surface separated by a distance equal to the normal maximum reach (assumed to be 1 m [approximately 3 ft]). This potential difference can be dangerous should it reach levels high enough to cause sufficient current through a person or animal.

3.6 voltage gradient ramp: An area where a gradual change in potential from the equipotential plane to the surrounding area is provided by installation of conductive elements.

4 Equipment Grounding

4.1 All electrical equipment in livestock buildings shall have equipment grounding. This equipment grounding shall be accomplished by a conducting path from metallic equipment to the electrical grounding system. Article 547-4-(f), ANSI/NFPA 70, requires all equipment grounding conductors to be copper, and if underground, to be insulated or covered (see Article 547, ANSI/NFPA 70).

4.2 Equipment shall not be grounded solely by connecting to a grounding electrode (ground rod or similar means). This is prohibited by Articles 250-2 and 250-54, ANSI/NFPA 70. However, the earth (ground rod or similar means) may be used as a supplemental grounding system.

5 Metalwork Bonding

5.1 All extensive metal structures and non-electrical metallic equipment in the livestock area likely to become energized shall be bonded to the electrical grounding system of the facility (see Articles 250-116 [FPN] and 250-104[c], ANSI/NFPA 70). This includes items such as exposed floor grid work, waterers, feeders, stanchions, pipes, stall work systems, pipelines, floor grates, crates and all metal siding, metal roofing or metal structures within 2.4 m (8 ft) of the floor. A recommended method of grounding stainless steel, such as a milk line, is shown in Figure 1.

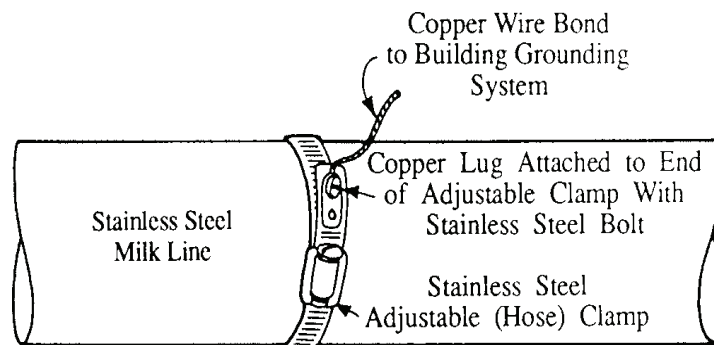


Figure 1 – Grounding of milk line

5.2 Extensive metal equipment embedded in the concrete should be bonded to any adjacent metal grid in the floor. To maintain continuity of bonding between bolted joints of stanchions or tie-stalls, No. 3 steel reinforcing rods laid in the front curb to bond posts to the grid, or the back of the dividers bonded to the grid, have been found to be effective.