

Equipotential Planes in Livestock Confinement Areas

The Construction Codes and Licensing Division of the Minnesota Department of Labor and Industry enforces the following definitions:

- "Animal" includes all poultry, livestock, fish, or similar creature.
- "Poultry" refers to birds raised or kept for food or breeding purposes.
- "Livestock" refers to cattle, hogs, sheep, goats, horses, and similar animals raised or kept for food, breeding, or pleasure purposes.



Applicability: The 2014 National Electrical Code® (NEC) identifies the applicability of this article to livestock. Subpart (A) of Section 547.10 applies to all areas accessible to livestock (except poultry) whereas Subpart (B) applies to only livestock confinement areas. This subpart applies to confinement areas and is not restricted to areas within buildings, but also applies to confinement areas located outdoors.

Selections from the 2014 National Electrical Code® (NEC)

NEC section 547.2 Definitions:

Equipotential Plane. An area where wire mesh or other conductive elements are embedded in or placed under concrete, bonded to all metal structures and fixed nonelectrical equipment that may become energized, and connected to the electrical grounding system to minimize voltage potentials within the plane and between the planes, the grounded equipment and earth

547.10 Equipotential Planes and Bonding of Equipotential Planes. The installation and bonding of equipotential planes shall comply with 547.10(A) and (B). For the purposes of this section, the term livestock shall not include poultry.

(A) Where Required. Equipotential planes shall be installed where required in (A)(1) and (A)(2).

(1) Indoors. Equipotential planes shall be installed in confinement areas with concrete floors where metallic equipment is located that may become energized and is accessible to livestock.

(2) Outdoors. Equipotential planes shall be installed in concrete slabs where metallic equipment is located that may become energized and is accessible to livestock. The equipotential plane shall encompass the area where the livestock stands while accessing metallic equipment that may become energized.

(B) Bonding. Equipotential planes shall be connected to the electrical grounding system. The bonding conductor shall be solid copper, insulated, covered or bare, and not smaller than 8 AWG. The means of bonding to wire mesh or conductive elements shall be by pressure connectors or clamps of brass, copper, copper alloy, or an equally substantial approved means. Slatted floors that are supported by structures that are a part of an equipotential plane shall not require bonding.

Informational Note No. 1: *Methods to establish equipotential planes are described in American Society of Agricultural and Biological Engineers (ASABE) EP473.2-2001 , Equipotential Planes in Animal Containment Areas.*

Informational Note No. 2: *Methods for safe installation of livestock waterers are described in American Society of Agricultural and Biological Engineers (ASABE) EP342.3- 2010, Safety for Electrically Heated Livestock Waterers.*

Informational Note No. 3: *Low grounding electrode system resistances may reduce potential differences in livestock facilities.*



This section makes it clear that wire mesh or other conductive elements are required to be installed in the concrete floors of livestock confinement areas and must be bonded to the grounding electrode system of the structure or area served to provide an equipotential plane per NEC 547.10 (A) and (B).

Providing an equipotential plane will minimize a voltage potential from developing that can cause abnormal animal behavior or reduced productivity. The means of bonding to conductive elements shall be by pressure connectors or clamps of brass, copper, copper alloy, or an equally substantial approved means.

The bonding of conductive elements in confinement areas with concrete floors where metallic equipment is located that may become energized and is accessible to livestock must be accomplished as follows:

1. Concrete floors, walls, and footings of confinement areas must contain conductive elements that are effectively bonded together and be either reinforcing steel or mesh, or solid bare copper conductors not smaller than #8. Isolated reinforcing elements located in slatted floor panels will not be required to be bonded where the slat panels are supported by concrete structure that contains bonded elements that are a part of an equipotential plane.



2. All conductive equipment, structures, or surfaces that are accessible to each other and from a concrete floor of a confinement area must be bonded together to create an equipotential plane. The term "confinement area" includes areas that are located outdoors without structure, such as feeding floors and holding areas. Confinement areas that do not contain electrically supplied equipment or systems that are connected to an electrical equipment grounding conductor system are not required to comply with the requirements of Section 547.10.

3. Inspection of bonding methods that become encased in concrete or covered by concrete must be made before the concrete is poured. Minnesota Rules 3800.3770 requires wiring concealed without inspection to be exposed to enable the required inspection to be performed. It is the responsibility of the installer of the wiring to notify the inspection authority sufficiently in advance to allow the inspection to be completed before wiring is concealed in any manner.

For more information refer to the latest edition of EP473, published by the American Society of Agricultural and Biological Engineers, 2950 Niles Road, St. Joseph, MI 49085

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