

Equipotential Planes in Livestock Confinement Areas

The Construction Codes and Licensing Division 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 National Electrical Code (NEC) identifies the applicability of this article to livestock. Subpart (A) of Section 547.44 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.

Sections from the 2023 National Electrical Code (NEC)

NEC section 100 Definitions:

Equipotential Plane. Conductive elements that are connected together to minimize voltage differences.

547.44 Equipotential Planes and Bonding of Equipotential Planes.

The installation and bonding of equipotential planes shall comply with 547.44(A) and (B). For the purposes of this section, the term *livestock* shall not include poultry.

(A) Where Required.

Equipotential planes shall be required in the following areas:

(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 bonded to the grounding electrode system or an equipment grounding terminal in any panelboard of the electrical grounding system associated with the equipotential plane. 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 other 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: See ASEA/ASABE EP473.2-2001 (R2015), Equipotential Planes in Animal Containment Areas, for methods to establish equipotential planes.

Informational Note No. 2: See ASEA/ASABE EP342.3-2010 (R2015), Safety for Electrically Heated Livestock Waterers, for methods for safe installation of livestock waterers.

Informational Note No. 3: Low grounding electrode system resistances may reduce voltage 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 or an equipment grounding terminal in any panelboard of the electrical grounding system associated with the equipotential plane of the structure or area served to provide an equipotential plane per NEC 547.44 (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 547.44.
3. Inspection of bonding methods that become encased in concrete or covered by concrete must be made before the concrete is poured. Minnesota Rules 3801.3770 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 www.asabe.org