

# Equipotential Plane Requirement for all Livestock Confinement Concrete Floors

**Larry Jacobson, Minnesota Extension Engineer**

On July 1, the Minnesota Board of Electricity started enforcing a new 1996 National Electric Code (NEC) requirement concerning equipotential planes and voltage gradients in new livestock (excludes poultry) "confinement areas." NEC section 547-8(b) requires an equipotential plane to be created for concrete floors in animal confinement areas that have electrical equipment or other equipment or systems connected to an electrical grounding conductor. This should be done by installing wire mesh or other conductive elements (reinforcing rods) in the concrete and bonding these elements to all adjacent conductive equipment, structures, or surfaces, and then bonding this potential plane to the grounding electrode system for the building. The bonding conductor must be copper, not smaller than AWG No. 8, utilizing connectors (and associated screws and bolts) of brass, copper, or copper alloy.

A voltage gradient is also required at an animal entrance or exit to a building so animals do not experience an abrupt voltage/current sensation when moving from one potential to another. USDA research has found that 8-ft copper-clad ground rods installed at a 45 degree angle outward from the vertical, on 12-in. centers across an entrance or exit, and bonded to the building's equipotential plane will provide the necessary voltage gradient. (See University of Wisconsin publication A3433, *Guidelines for Installing an Equipotential Plane*, by David Kammel.) Voltage gradients are not required if animals are normally moved into or out of the facility on vehicles rather than by walking.

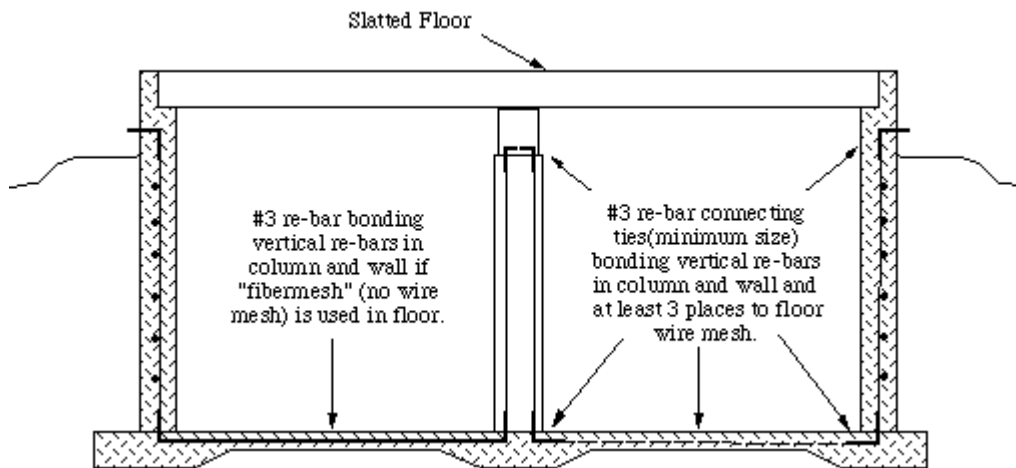
Animal "confinement areas" which are included in this ruling are those areas that contain electrical equipment or other equipment that is directly connected to the electrical grounding system. Also, animals must be exposed to more than one electrically conductive element, including things like waterers, feeders, manure collection units, milking equipment, stalls, and partitions where the potential for "stray" currents between elements exists. This could include outside feeding floors and holding areas beside confinement "barns."

Concrete floors and slabs must have embedded elements installed in all areas where animals can contact other conductive elements, as listed above (i.e., waterers, etc.). Reinforcing bars in slatted floors will NOT be required to be individually bonded if they are supported by a deep pit or shallow drain or flush gutter which is part of the equipotential plane. This means that the floors and walls of pits and gutters need to be electrically bonded together and bonded to the electrical grounding system. Thus, before concrete is poured for pits and floors in livestock buildings, an electrical inspector must verify that the proper electrical bonding is in place for the equipotential plane and the voltage gradient.

Questions concerning this new ruling should be directed to the State of Minnesota Board of Electricity in St. Paul (612) 642-0800. Electrical inspectors around the state should also be able to provide information on this new requirement.

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Figure 1. Suggested methods to convert a manure pit, covered by a slatted floor, into an equipotential plane using either the existing wire mesh in the floor or #3 re-bar to electrically connect the column to the wall. (Modified from Figure 44, MWPS-36, *Concrete Manure Storages Handbook*.)



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