



Bonding and Grounding Electrical Equipment

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Bonding and equipment grounding are ways of helping to reduce stray voltage problems caused by electrical faults in animal production centers. Bonding is the practice of joining all non-electrified metallic parts (junction boxes, appliance frames, milk lines, water lines, stanchions, floor grates, etc.) together to assure a continuous electrical path between them. Bonding is done by using copper wire to interconnect all metal components. Grounding is accomplished by connecting the bonded equipment to the earth. Methods for making each connections are discussed under “Requirements for Electrical Ground Connections.” Bonding and grounding do not correct the cause of stray voltage, but frequently reduce the harmful effects to a level where they are no longer a problem in milking and feeding areas.

How Bonding Works

Bonded equipment grounding reduces electrical shock hazards by (1) opening electrical fuses or circuit breakers when equipment faults occur, (2) maintaining equal electrical potential on all metal hardware and equipment, and (3) transferring electrical potential from metallic equipment to the earth.

A fault in electrical equipment usually consists of an insulation failure that produces a “short-circuit.” A short circuit directly to the neutral wire will produce a large current that opens the current protective device. A short to the frame of an appliance causes the frame to be energized (hot) and constitutes a shock hazard condition. A copper grounding wire, connected from the frame of the equipment to the system’s neutral in the fuse box will produce a large current flow to blow the fuse. Figure 1 shows an insulation failure that produces a short circuit through the frame of a motor and grounding wire back to the neutral wire - path abc

- and ground. With this low resistance path, a large fault current will open the circuit protective device. The circuit containing the defective equipment is thus removed from the electrical system until the problem can be found and corrected.

If a short circuit is minor in nature and has high resistance the protective device may not open and a sustained voltage will be present on the frame of the equipment. Any person or animal completing a circuit from this equipment to ground is subject to electrical shock. With bonded equipment, all the metallic surfaces in an area are connected together and to ground (Figure 2). All bonded equipment will be at a common voltage level.

A copper wire connected from this equipment to ground provides a low resistance path to the earth. The resistance of copper is much lower than that of a person or animal. Any stray current flow should be through the copper wire instead of a body touching the equipment. This provides greatest safety from electrical shock.

Requirements of Electrical Ground Connections

The neutral and bonding ground wires of electrical circuits should come together only in the service entrance equipment (fuse box) in a building. From this junction they are connected to earth. To meet National Electrical Code specifications for grounding, the earth connection (electrode) may be one of the following:

- A. Rods or pipes driven below permanent moisture level in the soil (8 feet). Minimum diameter for driven ground of various materials are: non-ferrous (copper, copper clad iron) rods-1/2 in; iron and steel rods -5/8 in; galvanized iron or steel pipe - 3/4 in trade size.

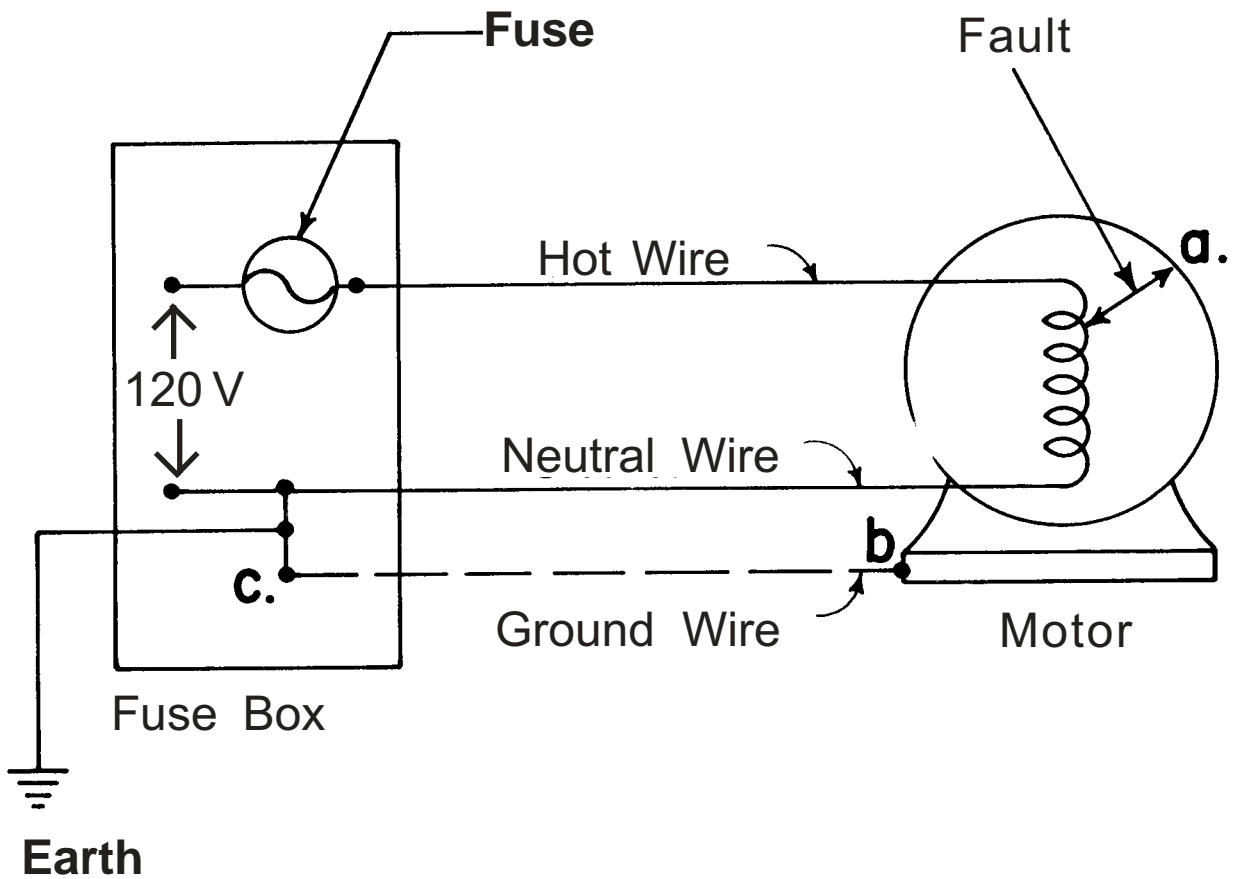


Figure 1. A grounding wire "bc" from the motor to the neutral wire in the fuse box causes the fuse to blow if a "short" occurs to the frame of the motor.

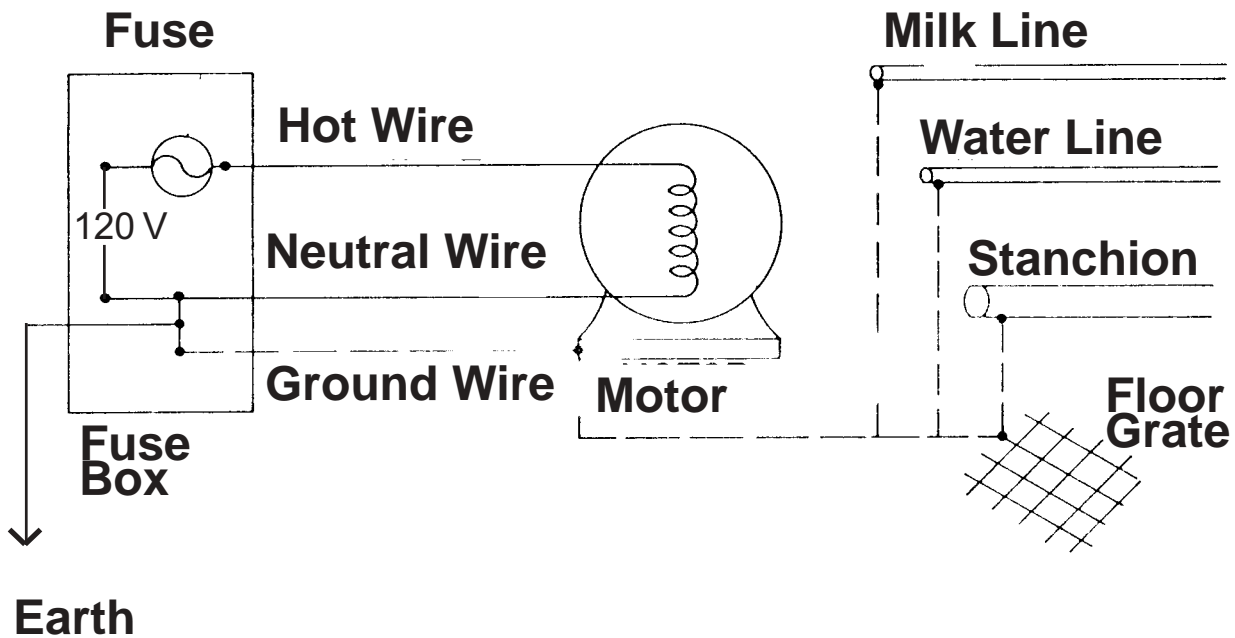


Figure 2. All metallic surfaces in an area should be bonded together and to earth by copper wire.

- B. a metal underground water pipe in direct contact with the earth for 10 feet or more. The pipe must be electrically continuous. Continuity can be assured by bonding around joints and meters.
- C. Local metal underground systems such as piping systems and underground tanks.
- D. The metal frame of a building that is effectively grounded.

Grounding wires are to be connected using approved clamps or pressure connectors. Connections that depend on solder are not approved. Failure to use the correct connectors will result in electrolytic action causing high resistance and a poor ground.

Methods of Bonding

Bonding of iron and steel components such as stanchions and grates can be done rather simply. Bonding a stainless steel milking line requires some care. Procedures for both types of bonding are described below.

Bonding Stanchions and Grates

Stanchions, grates and similar metal surfaces can be bonded as seen in Figure 3. All points of the stanchions and grates must be connected together. The simplest way to do this is to clamp or weld metal connectors across all unthreaded joints and between all

separate pieces of equipment. Clamp the copper grounding wire to this bonded network and to the ground rod. The copper grounding wire should be at least number 10-gauge wire. The ground rod should be the same one used for grounding the electrical system.

Bonding Stainless Steel Milklines

For sanitation reasons, it is recommended that copper not be bonded directly to stainless steel milklines. A method for bonding such lines using two stainless steel hose clamps is shown in Figure 4. A large clamp secures a small clamp to the pipeline. The small clamp surrounds and holds the bonding wire. Run the copper grounding wire along the stanchions and tie from it to the pipeline at 4-6 foot intervals.

Installation of Grounds

Grounding wires should be located where they will be free from mechanical damage and will remain undisturbed. Even if they seem to be protected, they should be checked and tightened periodically. If two or more ground rods are used they should be (a) more than six feet apart or (b) bonded together if less than six feet apart. Driven rods should be at least two feet away from a foundation wall.

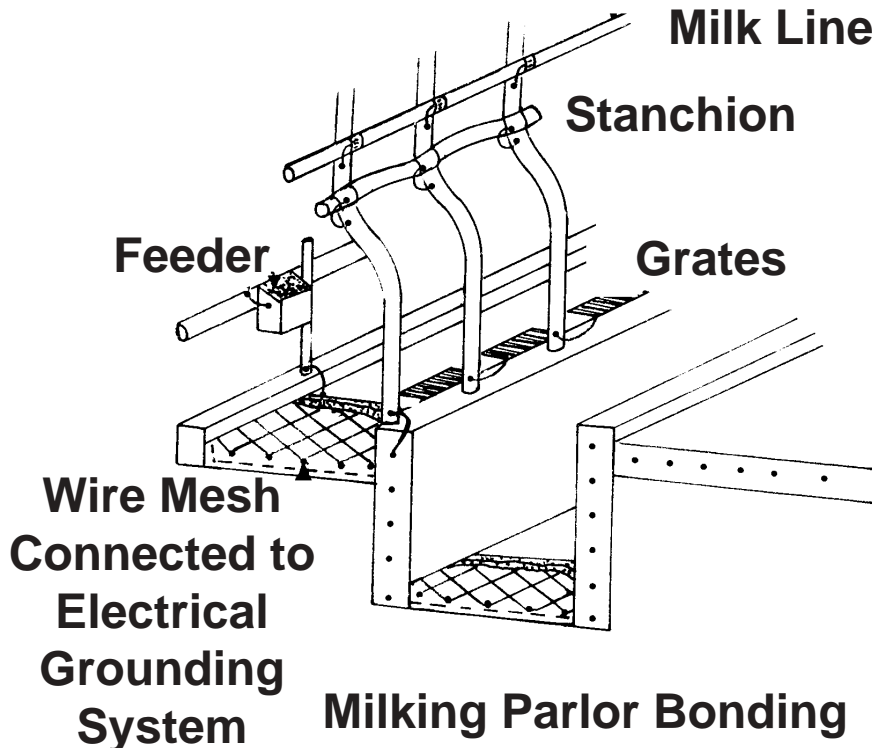
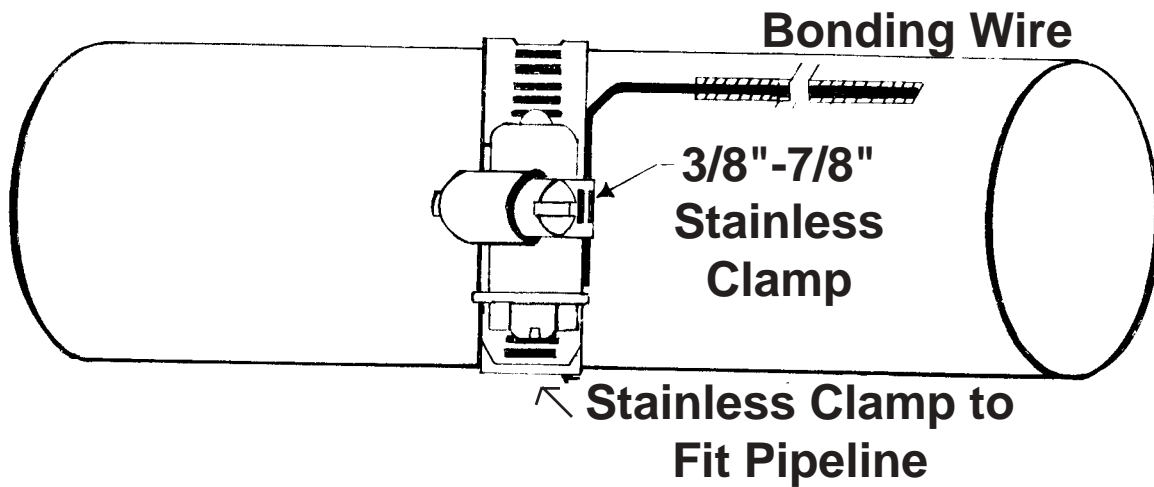


Figure 3. Stanchions, grates and wire mesh in the floor can be bonded by clamping or welding metal connectors across all unthreaded joints and between all separate pieces of equipment.



Milcline Bonding

Figure 4. Two stainless steel hose clamps can be used to bond a copper ground wire to stainless steel milclines. The clamps should be placed at 4-6 foot intervals along the pipeline.

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