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Electrical Hazards on the Farm[1]

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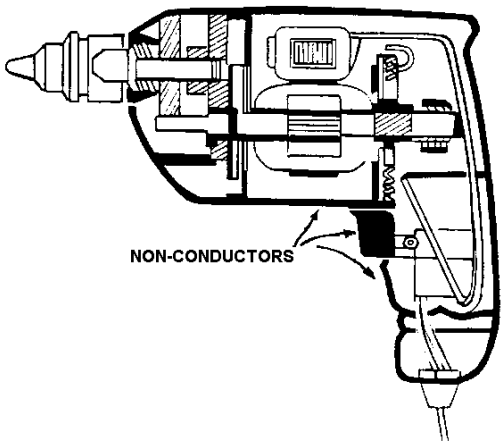
Since the 1930's, electrical service has been brought to virtually ever rural area of the state and has increased the productivity of the Michigan farmer. Electricity has proven invaluable to the Michigan farm industry; but some rural farmers have found that if improperly used it can be the source of fires, injuries, and even death.

Electrical hazards on the farm can: result in electrical shock to humans or to livestock and possibly result in a fire within structures or in operating equipment.

Risks associated with electrical hazards on the farm are increased by the presence of moisture, especially by the dampness that is common in confined livestock areas.

Animals are naturally grounded, making them more sensitive to low intensity electrical currents than humans. Humans have dryer skin than animals and normally wear shoes or boots which provide greater resistance to electrical shock. Humans usually will not feel an electrical shock from stray current that a well-grounded animal does when standing on a damp concrete slab or damp ground.

Animals experiencing even a minor electrical shock may be reluctant to drink from a waterer. On a dairy farm, for example, this reduced water intake may result in less milk production that a financial loss to the farmer.



Double-insulated power tools can reduce the risk of electrical shock because the tool does not conduct electrical leals to the operator.

Figure 1.

REDUCING ELECTRICAL HAZARDS

There are several ways to reduce the electrical hazards in farm buildings and around work areas. You can protect yourself and your livestock from electrical shock by following these recommendations:

1. Select a shock protection system. If you have two-conductor circuits and a variety of tools, some with two-wire cords and plugs and some with

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three-wire cords and plugs, you have four alternatives:

a. Have an electrician install ground-fault circuit interrupters (GFCI) permanently in each electrical circuit in the shop and other farm buildings.

b. Plug in a portable GFCI when individual power tools are used.

c. Convert your two-conductor circuits to three-wire, grounding-type circuits.

d. Replace your present tools with new double insulated tools (see Figure 1).

Get the advice of a competent electrician who is familiar with agricultural wiring to help you decide the safest and most economical alternative for your farm. A combination of methods may be your best choice.

2. Purchase tools and equipment designed to prevent shock. Look for tools and equipment that carry the approval label of a recognized inspection and approval agency. The label "UL Listed" indicates that the item has been evaluated for electrical safety considerations by the Underwriters Laboratory. The PTI "Safety Seal" indicates approval by the Power Tool Institute. Approved tools are equipped with three-wire, grounding-type cords and plugs or a two-prong plug with double insulation on the tool. Buy either type if your shop has grounding-type circuits. Double insulated tools can reduce the risk of electrical shock if you have two-conductor circuits, with or without GFCI protection.

3. Avoid using grounding adapters. Grounding adapters are risky because two-conductor circuits do not have a grounding conductor to connect to the "pigtail" of the adapter.

4. If you find it necessary to use extension cords, refer to the guidelines in the Electrical Cords section of this Fact Sheet.

5. Do not abuse electrical power tools. The insulation on the conductors inside the tool may be damaged from rough handling. Dropping power tools, throwing them around, or picking them up by the power cord can destroy the insulation and connections inside the equipment. Avoid overheating. Allow tools to cool when they become hot from continuous use or from temporary overloads.

GROUND-FAULT CIRCUIT INTERRUPTERS (GFCI)

A ground-fault circuit interrupter (GFCI) is a circuit breaker designed to prevent serious shock to people or animals under certain conditions. It can reduce the risk of shock when using electrical tools or appliances in damp or wet areas.

The GFCI works on the principle that the two wires supplying a single-phase electrical load must carry the same number of amperes (current) when the circuit is operating properly. If a ground-fault occurs either to the grounding wire, or through a person or animal, some of the current will take an alternate route back to the system's grounding electrode. One of the wires will then carry less current than the other wire. When this occurs the GFCI will break the circuit, stopping the flow of electricity in a fraction of a second to reduce the electric shock hazard.

Ground-fault circuit interrupters come in several styles. They are commonly used as a receptacle outlet, part of an extension cord, or can be installed in the main electrical panel to replace an existing circuit breaker. When installed as a circuit breaker, the GFCI offers shock protection to an entire electrical branch.

Ground-fault circuit interrupters are available for 120-V circuits with one hot wire and a neutral. A GFCI will work on older two-wire electrical systems that have no ground wire. A 120-V, single-pole GFCI fits into the same size space as a standard single-pole breaker. There are also GFCIs for 240-V circuits using two hot wires.

All equipment plugged into a GFCI protected receptacle, including any two-prong (two-wire) electrical plug, will have ground-fault protection.

A portable GFCI is recommended for persons using power tools in damp or wet locations. The portable GFCI is plugged into an outlet and the power tool is plugged into the GFCI.

Certain conditions can result in "nuisance tripping" of a GFCI protected circuit or receptacle.

Nuisance tripping can be reduced by avoiding:

- Circuits longer than 100 ft.

- Older non-double insulated power tools that contain faulty electrical insulation.

- Fluorescent or other types of electric-discharge lighting fixtures.

- Extension cords with cuts or splices where moisture has entered the cut or splice creating a "leak" (ground fault) or path for the current to flow outside of the wire to the ground.

- Permanently installed electric motors.

Installing a GFCI to prevent electrical shock from farm equipment seems like a good idea, but nuisance tripping may become a serious problem. The loss of a ventilation system in certain livestock facilities can be fatal to animals. Stock waterers may freeze in northern climates if the GFCI trips. Carefully consider the effects of loss of power to an agricultural circuit before installing GFCI protection. The most effective shock prevention system for agricultural equipment and circuits is a good equipment grounding conductor run with the circuit wires and connected to all metal agricultural equipment.

EXTENSION CORDS

Damaged or improperly used cords can result in electrical shocks or start fires. Avoid using extension cords in farming operations. Follow these precautions if you must use an extension cord:

- Do not use in wet areas.

- Do not try to repair a damaged extension cord or splice two wires together. Replace the cord.

- Keep cords away from sharp objects, heat, oil, and solvents that can damage insulation.

- Check an extension cord before each use for nicks and cuts. Replace or repair the cord if the insulation is damaged or worn.

- Use an extension cord with correct size wiring (gauge) for the intended use. Do not overload an extension cord or use a "household" type extension cord to operate heavy-duty machinery. Overloading may cause excessive heating that may result in a fire.

- Use a grounded wire (three-prong with a "safety grounding" wire) for tools and machines having a grounded plug or use a portable GFCI (ground-fault circuit interrupter).

- Buy extension cords carrying a listing mark or certification of a recognized independent testing laboratory.

- Be sure the package for the cord indicates the maximum current and/or wattage rating of the cord.

- Route the cord to protect it from machinery and animals. Also, people should not be able to trip over or accidentally damage the cord.

- Two extension cords plugged together for additional length will reduce the amperage rating and increase the risk of an electrical hazard.

- Extension cords deteriorate; do not use them in place of permanent electrical installations.

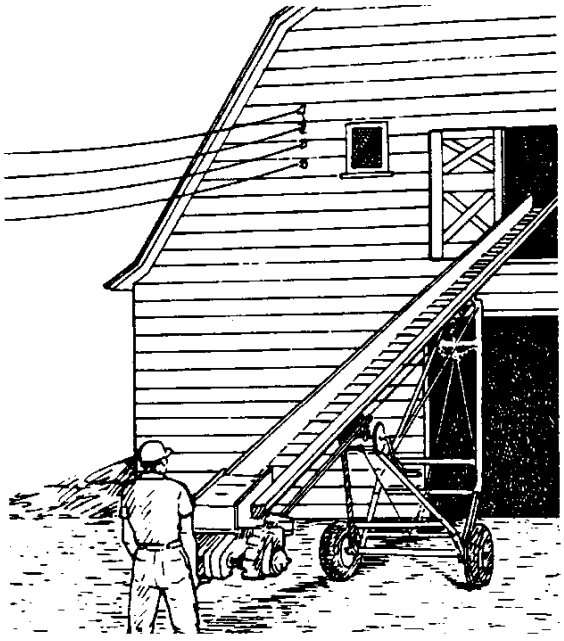
OTHER ELECTRICAL HAZARDS ON THE FARM

Portable Elevators

Moving a grain auger in the elevated position may electrocute someone if it comes into contact overhead power lines. Anyone moving an auger should lower it first. Check the height of all tall equipment to ensure that it will not touch overhead powerlines during the move. Recently manufactured augers should have a warning label attached that indicates DANGER, Electrocution Hazard. Follow safety warnings (see Figure 2).

Mechanical Damage to Electrical Wiring

Problems can occur when using or moving equipment inside buildings if wiring is not securely fastened and protected. Interior wiring should also be protected from animal damage by encasing it in metal or plastic conduit or by elevating the wiring above the animals' reach.



Check that elevators and augers don't come into contact with overhead power lines.

Figure 2.

"UF" vs. "NM" Type Electrical Wiring

Type UF cable wiring is rated for dry, damp, wet, or corrosive locations. This type cable is permitted for surface and concealed wiring in buildings, and for direct burial in the earth. It may not be embedded in poured concrete.

Exercise care if electrical conduit is used. Moist and extremely corrosive conditions may quickly destroy metal conduit. Animals may chew nonmetallic conduit or it may become damaged by impact from animals or machines. Check installations frequently and be prepared to replace damaged conduit or cable.

Type "NM" wire should not be buried because of the potential damage from moisture. Type "NM" electrical wire is not generally recommended for agricultural environments associated with animals or damp areas. Consult an electrician for specific applications or recommendations for your farm wiring concerns.

Electrical Fires in Agricultural Machinery

Electrical malfunctions in machinery can be a fire hazard. Combines can be a particular problem because of the grain fines and crop residues that are readily combustible. Check a combine's hydraulic and fuel systems for leaks, and inspect all electrical components, including battery terminal connections, for proper operation before the harvest season and at least weekly during harvesting. Shut off the machine as quickly as possible if a fire is suspected. Turn off the ignition and remove the key to prevent electrical current flow to the area of the fire and to prevent someone else from restarting the engine.

If an Accident Involving Electrical Shock or Fire Occurs Could You...?

- Turn off or disconnect electric power to farm buildings?
- Do family members and farm workers know how to contact fire and rescue personnel for assistance?

To eliminate confusion, have a complete set of directions available to instruct emergency crews to the farm site.

Keep the telephone number of the fire department and other emergency services posted near the telephone to avoid any delay in reporting an emergency.

REFERENCES

Ag Safety, John Deere.

Agricultural Electrification - Surbrook and Mullin.

Illustrations courtesy of John Deere and Company, *Agricultural Safety*, Fundamentals of Farm Safety, 1987.