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Electrical Safety for Center Pivot Irrigation Systems

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Mount a quarter mile of metal pipe on wheels. Connect several electric motors to pump water, to inject fertilizer or to move the system. Move the system continuously around a 130-acre field. Then pump water through it at a rate of several inches per hour and thoroughly soak everything within 50 feet of the system.

You have just designed a potential situation for someone to be electrocuted.

Electrical inspections

Many irrigators have received minor tingles while working around electrical irrigation machinery. Under pressure to keep the system running, they tend to ignore warning signs until serious injury occurs. Two electrical inspection surveys (conducted in Nebraska) point out the dangers of such practices.

A rural power supplier conducted a series of electrical tests and inspections of electrically driven center pivot systems with electric pump motors. The survey showed 37 percent were potentially hazardous because of the lack of a grounding conductor. Nearly 40 percent did not have a ground rod installed. More than 50 percent failed to have a fuse or a means of disconnection. Other hazardous situations were found, including loose connections, improper circuit and motor protection and deteriorated insulation.

A second series of inspections (by a Nebraska state electrical inspector) showed similar results. Of 77 systems inspected at the owners' requests, 10 were classified as lethal; 38 were definitely hazardous; the remaining 29 were potentially hazardous. The 10 lethal systems had current flowing to ground at the time of the inspection or had almost killed someone shortly before the inspection. The National Electrical Code (NEC) had been violated in all 77 installations.

Proper grounding

Proper grounding of the system is one of the keys to preventing injury. Two of the five electrocutions were directly related to electrical equipment being improperly installed and grounded.

Note
Studies show lethal hazards can be prevented only if irrigation systems are supplied with a grounding conductor from the electrical source. Simply connecting the system to a well casing or to a grounding rod driven into the ground is not sufficient to protect persons working around the system.

To be ensured of a safe system, the farmer, dealer and installer should insist that:

- Grounding is in accord with NEC Section 675-9, which says a separate non-current-carrying equipment grounding conductor needs to be run with all circuit conductors..
- Ground rods should be driven as indicated in Figure 1. Steel or iron rods should be at least 5/8 inch in diameter. Non-ferrous rods should be at least 1/2 inch in diameter. All rods must be driven at least 8 feet deep.
- Grounding conductors must be metallically bonded to the ground at the source of electrical supply (Figure 1).
- All metal enclosures, equipment and grounds must be connected to the grounding conductor. Also bond to the well casing if it is metal.

Irrigation wiring standards

Special wiring standards for irrigation machines have been accepted by various organizations. All wiring must of course conform to the National Electrical Code, which has a special section devoted to irrigation machines (Article 675). In addition, the American Society of Agricultural Engineers Standard S362, "Wiring and Equipment for Electrically Driven or Controlled Irrigation Machines," specifies the type of wiring required for the machine itself. Center pivot manufacturers follow this code when designing their equipment. A third wiring standard has been proposed for use by farmers, well drillers, irrigation equipment dealers and power suppliers.

This standard, entitled "Standard for Electrical Service and Equipment for Irrigation," pays particular attention to grounding procedures. It has been approved by the Nebraska Inter-Industry Electrical Council, the Irrigation Association (formerly the Sprinkler Irrigation Association) and the Agricultural Research Service, U.S. Department of Agriculture.

In addition to discussing the importance of proper service grounding, this standard has sections on pumps, control panels, equipment sizing and protection, lightning arresters, irrigation machines, interlocking of various parts of the system and miscellaneous requirements.

What to do

An inspection of many Missouri irrigation systems probably would show some of the same problems found in Nebraska. The following precautions should be taken when working with irrigation systems involving the use of electricity:

- Make certain only well-trained people familiar with the National Electrical Code and the new irrigation standard are allowed to work on the wiring.
- When servicing the machine, personally shut off and lock the master control switch.
- Stay away from the machine during lightning storms. A properly installed machine is an ideal lightning receptor and will carry the current for long distances.
- Install lightning arresters to protect equipment.
- Mark the location of all buried electrical lines.
- As with any electrical system, do not over-fuse. Instead, find out why the fuses are blowing and correct the problem.
- Don't cut corners on the electrical installation to save money. Include the cost of the electrical components when estimating the cost of your system.
- Avoid contact with overhead lines when moving equipment.
- Use the disconnect switch located at each tower when working on the system. It is there to protect

a person from injury if someone accidentally energizes the system or if the system automatically restarts after a power outage. The Occupational Safety and Health Act (OSHA) requires the switch to be within 15 feet of the motor.
- If you feel a tingle when you contact any part of the system, shut it down until a competent electrician can troubleshoot the system.

Further information

- Copies of *Wiring and Equipment for Electrically Driven or Controlled Irrigation Machine*, may be obtained from Room 200, Agricultural Engineering Building, MU, Columbia, Mo. 65211.

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Related MU Extension publications

- G1409, Is Your Wiring System Safe and Energy Efficient? http://extension.missouri.edu/publications/DisplayPub.aspx?P=G1409
- G1934, How to Prevent Electrical Accidents http://extension.missouri.edu/publications/DisplayPub.aspx?P=G1934
- G1961, Agriculture and the Occupational Safety and Health Act http://extension.missouri.edu/publications/DisplayPub.aspx?P=G1961
- MWPS28, Wiring Handbook for Rural Facilities http://extension.missouri.edu/publications/DisplayPub.aspx?P=MWPS28

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