



ELECTRICAL SYSTEMS

2024 GUIDANCE

Revised: 7 March 2025

ASSOCIATE SUPERINTENDENT CONTACT INFORMATION

Nathan Clark Senior Instructor-Agricultural Education
Colorado State University, Fort Collins, CO
Telephone (970) 491-3930
Email: Nathan.Clark@colostate.edu

PURPOSE

The purpose of the Electrical Skill Activity is to provide students with the opportunity to demonstrate critical thinking, problem solving, analytical and hands-on skills related to agricultural technology and mechanical systems and the practical application of those skills to meet the need of a dynamic agricultural workplace.

Possible activities for the 2024 event

- Connect a dual-voltage electric motor to a power source for a given agricultural application.
- Install electrical circuits, switching devices, current protection, contact relays, sensors, etc. for proper electric motor installation.
- Connect electric motor controls for given motor use in a given agricultural application.

UPDATE as of 9/23/2024

- **Use of the National Electric Code**
 - We will use the 2020 version of the National Electric Code for this year's event. If you would like free access to a free version online version of the code, you can go to:
 - <https://link.nfpa.org/free-access/publications/70/2020> (you may have to create a free account to access the code)
- **Use of Agricultural Wiring Handbook**
 - We will be using the 18th edition (2024) version of the Ag Wiring Handbook. You can download a free PDF copy of this book at this link:
 - <https://link.nfpa.org/free-access/publications/70/2020>
 - https://mrec.org/wp-content/uploads/sites/302/2024/08/Ag-Wiring-Handbook_Updated-2024.pdf

Note: Each of the possible activities could involve determining the correct size of conductors, devices and overcurrent protection for specific circuit applications based on ampacity, Ohm's law, wire length and size, specific applications such as in the air, in conduit, or underground and preparing conductors and connecting devices.

Event Related Competencies

- Use appropriate standards for agricultural applications, including the National Electrical Code (NEC), Electrical Testing Laboratory (ETL), Factory Mutual, Underwriters Laboratory (UL), Canadian Standard Association (CSA) and/or OSHA standards.
- Determine volt, amp and ohm relationships (Ohm's and other application laws).
- Interpret electric motor nameplate data.
- Identify electric motors and motor parts.
- Identify methods of providing electric motor protection.
- Identify and describe basic principles of controls including thermostats; humidistats; photoelectric; magnetic relays; programmable controllers; proximity switches and sensors; ultrasonics; timers and other time-delay equipment and pressure, motion, limit, float and sail switches.
- Select appropriate wire sizes and protection devices for specific loads and lengths of circuits.
- Read schematics and sketch wiring circuits.
- Install service entrance for single phase 120/240V service or three-phase power.
- Connect and operate electrical motors to power source.
- Change the direction of electric motor rotation

Agriculture, Food and Natural Resources Content Standards

- AS.05.01.02.c. Select, use and evaluate equipment, technology and handling procedures to enhance sustainability and production efficiency.
- CS.03.04.01.b. Analyze and summarize protective equipment requirements on various AFNR tools and equipment.
- CS.03.04.01.c. Design plans to ensure the use of appropriate protective equipment when using various AFNR tools and equipment.
- CS.06.04.02.c. Evaluate and select appropriate tools and equipment to complete AFNR tasks.
- CRP.02.01.01.b. Assess workplace problems and identify the most appropriate academic knowledge and skills to apply.
- PS.03.05.04.b. Analyze the proper conditions required to maintain the quality of plants and plant products held in storage and during shipping.
- PST.01.02.03.b. Select, maintain and demonstrate the proper use of tools, machines and equipment used in different AFNR-related mechanical systems.
- PST.03.02.01.c. Analyze and design electrical circuits for AFNR power, structural and technical systems using knowledge of the basic units of electricity.
- PST.03.02.02.b. Analyze and interpret electrical system symbols and diagrams.
- PST.03.02.03.b. Distinguish and select materials and tools used in electrical control circuit installation.
- PST.04.04.01.c. Install and/or repair fixtures following appropriate codes and standards.
- PST.04.04.02.c. Plan and wire electrical circuits (i.e., single pole switch, three-way switch, duplex outlet, etc.).

Suggested Resources

- NFPA 70, 2023 National Electric Code, National Fire Protection Association
- Agricultural Wiring Handbook (17th ed. or later).
- Electrical Wiring (7th ed. or later) by Ralph Duncan & James E. Wren. Available from AAVIM
- Electrical Controls (2nd ed.) by James M. Allison. Available from AAVIM