ELECTRICAL SYSTEMS

2025 GUIDANCE

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ASSOCIATE SUPERINTENDENT CONTACT INFORMATION

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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.

UPDATE as of 10/1/2025

- **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

Possible activities for the 2025 event
Given a circuit breaker panel (SEP and/or Branch) and various electrical system components, students will determine how to correctly wire the panel, and an electrical circuit based on a given scenario.

- Students should know how to properly install a breaker panel including:
  - Source installation
  - Grounding
  - Bonding
  - Etc.
- Students will wire a circuit from the panel which may include:
  - Switch loops including:
    - Single switch loop
    - 3-way switch loop
    - 4-way switch loop
    - Motion detection switches
    - Smart Switches
    - Etc.
  - Outlet loops
    - 120 or 240 outlet loops

        - GFCI outlets
        - Smart outlets
        - Etc.
- Students may utilize at multi-meter to diagnose issues in circuit.
    - Meter use may include
        - Determine Resistance
        - Circuit Continuity
        - Voltage
        - Etc.

NOTE: Each of the possible activities could involve: Determining the correct size conductors, devices and overcurrent protection for specific circuit applications based on: ampacity, Ohm's law, wire length and size, specific applications such as in air, in conduit, 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.
- Plan and evaluate proper grounding systems and ground-fault protection.
- Determine volt, amp and ohm relationships (Ohm's and other application laws).
- Select adequate and appropriate lighting fixtures.
- 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 circuit loads and lengths.
- Use low-voltage electrical control equipment.
- Use electrical test instruments such as a VOA (volt-ohm-amp) meter, DMM (digital multimeter) and tachometer.
- Read schematics and sketch wiring circuits.
- Install service entrance for single-phase 120/240V service or three-phase power.

Agriculture, Food and Natural Resources Content Standards

- FPS.03.04.01.b. Demonstrate adherence to protective equipment requirements when using various AFNR tools and equipment.
- FPS.03.04.02.c. Choose appropriate tools and equipment to safely complete AFNR tasks.
- AS.05.01.02.c. Select, use and evaluate equipment, technology and handling procedures to enhance sustainability and production efficiency.
- 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. Demonstrate the proper selection, maintenance, and use of tools (including measuring tape), machines, and equipment.
- PST.03.02.01.b. Perform the measurements of the basic units of electrical circuits (e.g., motors, controls, lighting, etc.) with the appropriate tools.
- PST.03.02.01.c. Design electrical circuits using knowledge of the basic units of electricity and code.
- PST.03.02.02.b. Utilize electrical systems, symbols, and diagrams.

- PST.03.02.02.c. Evaluate malfunctioning electrical components and systems using testing procedures and equipment service/technical manuals.
- PST.03.02.03.b. Select materials and tools used in electrical control circuit installation.
- PST.04.05.01.c. Install and/or repair loads and control devices following appropriate codes and standards.
- PST.04.05.02.c. Install and/or repair electrical circuits (e.g., single pole switch, three-way switch, duplex outlet, etc.).
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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