



## ELECTRICAL CONSTRUCTION WIRING

SkillsUSA Championships Technical Standards



### PURPOSE

The Electrical Construction Wiring competition will allow each competitor the opportunity to perform tasks commonly found in a practical work environment. Each competitor will have the opportunity to use his or her acquired electrical wiring skills to construct an electrical wiring installation using electrical prints, sketches, and notes, written specifications, and verbal instructions based on the National Electrical Construction Wiring standards in accordance with the National Electrical Code.

First, download and review the General Regulations at [updates.skillsusa.org](https://updates.skillsusa.org).

### ELIGIBILITY

Open to active SkillsUSA members enrolled in programs with electrical wiring or electrical technology as an occupational objective. Each state may send one high school and one college/postsecondary entry.

### CLOTHING REQUIREMENTS

#### **Class C: Competition Specific — Manufacturing/Construction Khaki Attire**

- Official SkillsUSA khaki short-sleeve work shirt
- Khaki pants
- Black, brown, or tan work shoes

**Note:** Safety glasses must have side shields or goggles. (Prescription safety glasses may be used if they are equipped with side shields. If not, they must be covered with goggles.)

These regulations refer to SkillsUSA Championships Clothing Classifications that are pictured and described at [skillsusastore.org](https://skillsusastore.org). If you have questions about competition uniforms, call the SkillsUSA Store at 888-501-2183.

**Note:** Competitors must wear their official competition clothing to the competition orientation.

## EQUIPMENT AND MATERIALS

1. Supplied by the technical committee:
  - a. All wiring panels, electrical supplies, and materials as required by the project assigned.
  - b. All necessary hand tools will be provided.
2. Supplied by the competitor:
  - a. Latest edition of the National Electrical Code as of January prior to the SkillsUSA Championships. (all other form of notes, textbooks, Ugly's book are NOT allowed)  
**Note:** The NEC handbook is NOT approved for use in the knowledge test.
  - b. Non-programmable calculator
  - c. Cordless drill (only), with #2 Philips tip, and a wood drill bit (5/8" recommended).
  - d. All competitors must create and submit online a one-page single sided resume. See "Online Submission Requirements" below for guidelines.

**Note:** All national competitors must also check for competition-specific updates and/or competitor preparation instructions on the SkillsUSA website at [updates.skillsusa.org](https://updates.skillsusa.org).

### PROHIBITED DEVICES

Cellphones, electronic watches and/or other electronic devices not approved by a competition's national technical committee are **NOT** allowed in the competition area. Please follow the guidelines in each technical standard for approved exceptions. Technical committee members may also approve exceptions onsite during the SkillsUSA Championships if deemed appropriate.

### Penalties for Prohibited Devices

If a competitor's electronic device makes noise or if the competitor is seen using it at any time during the competition, an official report will be documented for review by the Director of the SkillsUSA Championships. If confirmed that the competitor used the device in a manner which compromised the integrity of the competition, the competitor's scores may be removed.

## ONLINE SUBMISSION REQUIREMENTS

All SkillsUSA national competitors must submit their one-page single sided resume online. The deadline and link for online submissions will be published on [updates.skillsusa.org](https://updates.skillsusa.org).

Failure to submit any of the required document(s) listed below by the established deadline will result in a 10-point penalty.

1. One-page single sided resume

Your submission must be saved as PDF file type using the file name format of "Your Last Name\_Your First Name\_Resume." For example, "Amanda Smith" would save the individual PDF submissions file as:

- Smith\_Amanda\_Resume

## SCOPE OF THE COMPETITION

### KNOWLEDGE PERFORMANCE

The competition will include a test assessing general knowledge of electrical construction wiring. There will be additional questions related to professional development. Competitors are also required to take the SkillsUSA Professional Development Test.

### SKILL PERFORMANCE

The skills portion of the competition will include a series of workstations equipped with information and instruction sheets for wiring a residence or completing a commercial installation. Written portions may exist during the skills performance of the competition. Knowledge of terms and principles used in residential wiring will be required for the skill performance portion of the competition.

All work must conform to the specifications of the latest edition of the National Electrical Code as of the January prior to the SkillsUSA Championships. Industry Standards (i.e. green for grounding), and safe work practices will be part of the scoring.

### STANDARDS AND COMPETENCIES

#### **ECW 1.0 — Define and apply safety rules and practices in electrical construction wiring according to NEC standards**

- 1.1. Apply shop rules and regulations to workstations
- 1.2. List the techniques and practices used to prevent fires
- 1.3. Use electrical and hand tools correctly
- 1.4. Discuss the appropriate methods for lifting and climbing ladders
- 1.5. Explain appropriate clothing for electrical wiring construction
- 1.6. Outline the safety requirements for installing temporary electrical services

#### **ECW 2.0 — Apply knowledge of basic wiring theory according to NEC standards**

- 2.1. Use wiring diagrams, schematic diagrams and prints successfully in a scenario
- 2.2. Apply math calculations to circuits and measurements
- 2.3. Discuss theory concepts for troubleshooting

#### **ECW 3.0 — Discuss important trade information and standards according to the NEC**

- 3.1. Explain the purpose and use of the National Electric Code
- 3.2. Sketch and diagram effectively
- 3.3. Plan the layout of an electrical installation
- 3.4. Use trade catalogs and publications to solve electrical construction wiring problems
- 3.5. Correlate specifications, prints and job sites

#### **ECW 4.0 — Use basic equipment and procedures defined by industry standards**

- 4.1. Discuss techniques of residential and commercial wiring
- 4.2. Demonstrate wire-pulling techniques

## **ECW 5.0 — Apply knowledge of service loads and electrical safety to electrical construction wiring situations**

- 5.1. Compute service loads
- 5.2. Calculate individual service loads
- 5.3. Determine the number of outlets permitted in a circuit
- 5.4. Compute the size of service entrance conductors
- 5.5. Use any wire types listed in NEC 310.16

## **ECW 6.0 — Install a service entrance to meet NEC standards**

- 6.1. Install a main service panel and sub-panel
- 6.2. Install circuit breakers in a panel
- 6.3. Install a service entrance cable to service drop
- 6.4. Install temporary electrical service
- 6.5. Install equipment disconnect
- 6.6. Install meter bases

## **ECW 7.0 — Install switch boxes and outlet boxes to meet NEC standards**

- 7.1. Install box hangers
- 7.2. Install recess boxes for outlets
- 7.3. Install gangable metal switch boxes
- 7.4. Install octagon boxes
- 7.5. Install surface mount boxes
- 7.6. Install recessed fixture housing in a ceiling
- 7.7. Install outlet boxes in drywall, lath plaster or paneled walls
- 7.8. Install telephone boxes in drywall, lath plaster or paneled walls
- 7.9. Install old work switch boxes and Madison bars

## **ECW 8.0 — Maintain already existing wiring to meet NEC standards**

- 8.1. Diagnose and repair incandescent lights
- 8.2. Replace existing receptacles and switches
- 8.3. Troubleshoot a branch circuit
- 8.4. Test wiring for correct voltages

## **ECW 9.0 — Rough in, connect and install electrical devices to meet NEC standards**

- 9.1. Rough in, connect and install a single pole switch
- 9.2. Rough in, connect and install a three-way switch
- 9.3. Rough in, connect and install a four-way switch
- 9.4. Rough in, connect and install a duplex grounded receptacle
- 9.5. Rough in, connect and install a 120-240-volt distribution panel
- 9.6. Rough in, connect and install a door chime system
- 9.7. Rough in, connect and install a ground fault interrupting device
- 9.8. Rough in, connect and install an emergency warning system
- 9.9. Rough in, connect and install a photoelectric cell control
- 9.10. Rough in, connect and install a surface raceway
- 9.11. Rough in, connect and install an exterior lighting fixture

- 9.12. Rough in, connect and install lighting dimmers
- 9.13. Rough in, connect and install TV outlets
- 9.14. Rough in, connect and install telephone outlets
- 9.15. Rough in, connect and install emergency lighting systems
- 9.16. Rough in, connect and install appliance circuits
- 9.17. Rough in, connect and install occupancy sensor
- 9.18. Rough in, connect and install motion sensor

#### **ECW 10.0 — Install ¾" EMT conduit to meet NEC standards**

- 10.1. Make 90-degree bends from measurements
- 10.2. Make offset bends from measurements
- 10.3. Make back-to-back bends from measurements
- 10.4. Make saddle bends from measurements
- 10.5. Determine correct conduit measurements

#### **ECW 11.0 — Install telecommunications infrastructure to meet current TIA/EIA 570 standards**

- 11.1. Install a coaxial cable with "F" type connectors and terminating hardware
- 11.2. Install unshielded twisted-pair cable, connectors and terminating hardware
- 11.3. Install 110-type terminating hardware

#### **ECW 12.0 — Apply knowledge of NEC Chapter 5 Special Occupancies**

#### **ECW 13.0 — Apply knowledge of the International Energy Conservation Code**

#### **ECW 14.0 — SkillsUSA Framework**

The SkillsUSA Framework is used to pinpoint the Essential Elements found in Personal Skills, Workplace Skills and Technical Skills Grounded in Academics. Students will be expected to display or explain how they used some of these Essential Elements. For more, visit:

[www.skillsusa.org/who-we-are/skillsusa-framework/](http://www.skillsusa.org/who-we-are/skillsusa-framework/).

### **COMMITTEE IDENTIFIED ACADEMIC SKILLS**

The committee has identified the following academic skills embedded in this competition.

#### **Math Skills**

- Use fractions, decimals and percents to solve practical problems
- Calculate and measure angles
- Find perimeter area and volume of two- and three-dimensional objects
- Apply Pythagorean Theorem
- Solve problems using proportions, formulas and functions

#### **Science Skills**

- Use knowledge of mechanical, chemical and electrical energy
- Use knowledge of the atom theory including principles of electricity and magnetism
- Use knowledge of static electricity, current electricity and circuits

## **Language Arts Skills**

- Demonstrate knowledge of appropriate reference materials

## **CONNECTIONS TO NATIONAL STANDARDS**

State-level academic curriculum specialists identified the following connections to national academic standards.

### **Math Standards**

- Numbers and operations
- Algebra
- Geometry
- Measurement
- Problem solving
- Communication
- Connections
- Representation

*Source: NCTM Principles and Standards for School Mathematics. For more information, visit: <http://www.nctm.org>.*

### **Science Standards**

- Understands the structure and properties of matter
- Understands the sources and properties of energy
- Understands forces and motion
- Understands the nature of scientific inquiry

### **Language Arts Standards**

- Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes
- Students use a variety of technological and information resources (e.g., libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge
- Students use spoken, written, and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion, and the exchange of information)

*Source: IRA/NCTE Standards for the English Language Arts. To view the standards, visit: [www.ncte.org/standards](http://www.ncte.org/standards).*