Electrical Construction Wiring

Purpose
The Electrical Construction Wiring event will allow each contestant the opportunity to perform in a practical work environment. Each contestant will have the opportunity to use his or her acquired electrical wiring skills to construct an electrical wiring installation, using electrical blueprints, 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: http://updates.skillsusa.org.

Clothing Requirements
Class C: Contest Specific — Manufacturing/Construction Khaki Attire
- Official SkillsUSA khaki short-sleeve work shirt and pants.
- Black, brown or tan leather work shoes.

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

These regulations refer to clothing items that are pictured and described at: www.skillsusastore.org. If you have questions about clothing or other logo items, call 1-888-501-2183.

Note: Contestants must wear their official contest clothing to the contest orientation meeting.

Restrictions
Contestant electronic devices are not allowed in the testing area or the contest area anytime during the competition.

Eligibility
Open to active SkillsUSA members enrolled in career and technical education programs with electrical wiring or electrical trades as the occupational objective.

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.
   c. Calculator (nonprogrammable).
2. Supplied by the contestant:
   a. Latest edition of the National Electrical Code as of the January prior to the SkillsUSA Championships. ***Note:*** The NEC handbook is not approved for use in the written test.
   b. All competitors must create a one-page résumé and submit a hard copy to the technical committee chair at orientation. Failure to do so will result in a 10-point penalty.

   Note: Your contest may also require a hard copy of your résumé as part of the actual contest. Check the Contest Guidelines and/or the updates page on the SkillsUSA website: http://updates.skillsusa.org.

Scope of the Contest
The contest will assess the ability to perform jobs or skills selected from the following list of competencies as determined by the SkillsUSA Championships technical committee.

Knowledge Performance
The contest will include a written knowledge exam assessing general knowledge of electrical construction wiring. There will be additional questions related to professional development. Written portions may also exist during the skills portion of the contest. Knowledge of terms and principles used in residential wiring will be required for the skill demonstration portion of the contest.

Skill Performance
The skills portion of the contest will include a series of workstations equipped with

information and instruction sheets for wiring a residence or completing a commercial installation.

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.

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 hangable 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

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 PVC and 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

Committee Identified Academic Skills

The technical committee has identified that the following academic skills are embedded in this contest.

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.

Source: McREL compendium of national science standards. To view and search the compendium, visit: www2.mcrel.org/compendium/browse.asp.

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.