

INDUSTRIAL MOTOR CONTROL (VIRTUAL)



PURPOSE

To evaluate each contestant's preparation for employment and to recognize outstanding students for excellence and professionalism in the field of industrial motor controls.

First, download and review the General Regulations at: <http://updates.skillsusa.org>.

ELIGIBILITY

Open to active SkillsUSA members enrolled in programs with industrial motor control as the occupational objective.

CLOTHING REQUIREMENT

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).

Contest Clothing Notes (Apply ONLY to Virtual Competitions):

- Official SkillsUSA Competition Clothing recommended but NOT required.
- Contestant clothing options include the following:
 - Official Competition Clothing.
 - Trade Appropriate Clothing.
 - Professional Dress.
 - Business Casual.
- Clothing must meet industry safety standards.
- No identification of the contestant, school or state is allowed on clothing.
- No offensive, vulgar or inappropriate images or text are allowed on contestants clothing.

- No shorts or sleeveless shirts are allowed.
- Skirts must be at least knee-length.
- Proper Personal Protective Equipment (PPE) must be worn by contestant to meet all state, local and school requirements due to COVID-19.
- Scoring deductions may only be given and/or disqualification of contestant if clothing safety standards are not met.

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.

EQUIPMENT AND MATERIALS

Supplied by the contestant:

1. Computer with high-speed internet capability and camera to use applications such as Zoom, Teams, etc. The minimum recommended internet bandwidth speeds for joining Zoom meetings, accessing on-demand curriculum and other online operations is 2.0 Mbps up and down. You can test your current internet speeds by following this link: www.speedtest.net. Allow the page to load and click on GO.
2. A secondary camera(s) may be required to provide judges with the ability to view contestants from different angles. Additional camera requirements will be located on the SkillsUSA website at: <http://updates.skillsusa.org>.
3. A contest Proctor will be required to be on site to assist judges. A local industry expert is preferred to serve as the Proctor and shall not be an individual that has been involved with the training of the contestant(s). The Proctor will serve as the onsite "hands and eyes" for the judges. Proctor will follow instructions from the judges for safety and operations related to the competition. Proctor may be asked by judges to perform several tasks such as operating a portable camera to show specific components or steps, measure parts, or any task that will provide judges with information needed to assist in accurate scoring of the contestant's work or presentation. However, the Proctor shall not serve as a judge nor have any influence on contestant scores.

4. The contestant's instructor or advisor shall be on site to observe all competition activities to ensure a safe and healthy competition experience for all participants. That instructor or advisor will not be allowed to interact or interfere with the competitor unless a safety issue arises that requires interaction. Any other support or interaction between the contestant and the instructor/advisor will result in disqualification.
5. All competitors must create a one-page résumé and submit an electronic copy to the technical committee chair at least seven (7) days in advance of the competition. Failure to do so will result in a 10-point penalty. Instructions for submission of the electronic résumé copy will be provided on the SkillsUSA website at <http://updates.skillsusa.org>.
6. All wiring panels, electrical supplies and materials as required by the problem assigned
7. Diagonal pliers
8. Sidecutters
9. Long-nose pliers
10. Pump pliers
11. Wire strippers
12. Knife
13. Assorted flat blade and Phillips screwdrivers
14. 8' folding rule
15. 12' (or longer) measuring tape
16. Electrician's hammer
17. Hacksaw
18. Torpedo level
19. Electrical tape and connectors
20. Crimping tools
21. ½" EMT conduit bender
22. Multimeter
23. Latest edition of the National Electrical Code as of the January prior to the SkillsUSA Championships
24. Supplies for drawing ladder diagram (pencil, straightedge, etc.)
25. Calculator

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 is defined by manufacturer and customer specifications, industry practice, federal regulations and industry standards such as the National Electrical Code. The contest is divided into three parts: a written portion; an oral interview; and a series of testing stations designed to demonstrate knowledge of manufacturer and customer specifications, industry practice, federal regulations and industry standards as well as the ability to apply both that knowledge and manual proficiency in applying and installing electrical wiring methods and equipment.

Knowledge Performance

The contest will include a written knowledge exam that will be administered during the contestants' meeting.

The contest will also include written descriptions of required electrical installations and/or job sheets with schematic diagrams and accompanying requirements for wiring an industrial motor control installation. The purpose will be to select and install the wiring methods, devices and equipment to complete the specified 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.

Skill Performance

The contest will include a series of testing stations designed to test the ability to perform jobs or skills selected from the following list of competencies as determined by the SkillsUSA Championships technical committee.

Standards and Competencies

Note for Virtual Competitions: Contestants may not be required to perform all the standards and competencies listed in this section. However, contestants should be prepared to perform components in all areas. Prior to the competition, the technical committee may determine which standards and competencies contestants will be perform for the virtual contests. The technical committee will determine if additional information is needed for contestants prior to the competition.

These changes will be posted on the SkillsUSA Championships contest update website at: <http://updates.skillsusa.org>.

MOTR 1.0 — Demonstrate knowledge/application of basic academic, physical and employability skills

- 1.1 Demonstrate ability to read and comprehend
 - 1.1.1 Explain the meaning of safety rules and signs
 - 1.1.2 Summarize instruction sheets for tools and equipment
 - 1.1.3 Explain technical documents, codes and standards, customer and manufacturer instructions and specifications
 - 1.1.4 Use graphs, charts and diagrams
- 1.2 Demonstrate ability to perform basic mathematical operations necessary to the occupation
 - 1.2.1 Perform addition, subtraction, multiplication and division of whole numbers, fractions, decimals, mixed numbers, ratios and percentages
 - 1.2.2 Convert square units and English and metric units
 - 1.2.3 Perform direct measurements of objects and distances
 - 1.2.4 Use basic algebra, calculate degrees and angles, and compute area and volume
 - 1.2.5 Read, interpret and perform math operations based on word problems
- 1.3 Use verbal, written and nonverbal communication skills
 - 1.3.1 Explain and use verbal instructions and warnings
 - 1.3.2 Communicate orally with others
 - 1.3.3 Communicate in writing with others
- 1.4 Demonstrate physical ability through the installation and operation of equipment
 - 1.4.1 Ensure ability to hear warning signals
 - 1.4.2 Verify ability to distinguish colors
 - 1.4.3 Maintain, balance and perform construction activities while on a ladder
 - 1.4.4 Use both hands to manipulate small objects and wires

- 1.4.5 Operate two-handed power equipment
- 1.4.6 Lift and carry objects up to 50 pounds
- 1.4.7 Reach and stretch to position equipment while maintaining balance
- 1.5 Implement employability skills and workplace attributes to work independently and with a team
 - 1.5.1 Apply ability to be self-motivated, responsible and dependable without close supervision
 - 1.5.2 Demonstrate the ability to work smoothly with others as a team
 - 1.5.3 Demonstrate ability to remain calm in emergency situations
 - 1.5.4 Maintain good working relationships with others in a work setting
 - 1.5.5 Develop alternate solutions and choose the best alternative
 - 1.5.6 Plan and organize tasks to meet deadlines
 - 1.5.7 Implement the ability to supervise and monitor others

MOTR 2.0 — Follow OSHA rules and safety regulations to ensure job site and equipment safety

- 2.1 Apply job site and shop rules and regulations (OSHA)
- 2.2 Select and use electrical and hand tools correctly
- 2.3 Perform proper techniques and practices for working on and around live equipment
- 2.4 Apply knowledge of proper grounding methods

MOTR 3.0 — Apply knowledge of the National Electric Code

- 3.1 Read and interpret the National Electrical Code
- 3.2 Demonstrate ability to apply National Electrical Code requirements

MOTR 4.0 — Interpret and draw wiring and ladder diagrams

- 4.1 Draw wiring diagrams and ladder diagrams
- 4.2 Interpret wiring diagrams and ladder diagrams
- 4.3 Read and understand customer job specifications

MOTR 5.0 — Read and interpret written and oral customer and manufacturer specifications/instructions

MOTR 6.0 — Perform electrical calculations including sizing of circuits and conductors, and calculate conduit fill

- 6.1 Size branch circuit conductors
- 6.2 Size feeder conductors
- 6.3 Size control conductors
- 6.4 Size overcurrent protection for branch circuit
- 6.5 Size overcurrent protection for feeder circuit
- 6.6 Size overloads protection
- 6.7 Calculate conduit fill

MOTR 7.0 — Select materials and equipment to meet customer needs

- 7.1 Select materials and equipment based on manufacturer and customer specifications/instructions, wiring and ladder diagrams, calculations, and applicable codes and standards

MOTR 8.0 — Select and use hand, electrical and cutting tools properly

- 8.1 Demonstrate dexterity and proper use of hand tools
- 8.2 Demonstrate the ability to properly select and use electrical ohmmeters and volt-ohmmeters
- 8.3 Select and properly use special equipment (conduit benders, KO punches, etc.)
- 8.4 Properly select and operate electrical power tools
- 8.5 Properly select and use conduit cutting and reaming equipment

MOTR 9.0 — Lay out components on mounting boards based upon customer specifications

MOTR 10.0 — Select and install proper wiring methods, boxes and enclosures

- 10.1 Select the proper wiring methods, boxes and enclosures based on manufacturer and customer specifications, wiring/ladder diagrams and applicable codes and standards
- 10.2 Install the selected wiring methods
- 10.3 Mount boxes and enclosures according to manufacturer and customer specifications and instructions, federal regulations, and applicable codes and standards
- 10.4 Bend and install raceways using the proper tools and supplies

MOTR 11.0 — Demonstrate the ability to properly install and connect devices and equipment

- 11.1 Install and connect disconnect switches
- 11.2 Install and connect push buttons
- 11.3 Install and connect selector switches
- 11.4 Install and connect indicator lights
- 11.5 Install and connect limit switches
- 11.6 Install and connect control transformers
- 11.7 Install and connect control relays
- 11.8 Install and connect timing relays (all types)
- 11.9 Install and connect contractors
- 11.10 Install and connect motor starters
- 11.11 Install and connect photoelectric switches
- 11.12 Install and connect temperature control
- 11.13 Install and connect counters
- 11.14 Install and connect overload relays
- 11.15 Install and connect solid-state motor starters
- 11.16 Install, connect, and properly wire a dual-voltage motor
- 11.17 Install and connect reversing motor starters
- 11.18 Install and connect press-to-test pilot lights

MOTR 12.0 — Troubleshoot and repair power and control circuits

- 12.1 Use a wiring diagram or ladder diagram, and an electrical multimeter
- 12.2 Demonstrate the ability to troubleshoot a fault in either a power or control circuit

MOTR 13.0 — Complete necessary job tickets, reports and as-built drawings

- 13.1 Demonstrate the ability to prepare necessary job tickets, reports and as-built drawings as directed by your supervisor

Committee Identified Academic Skills

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

Math Skills

- Use fractions to solve practical problems.
- Use proportions and ratios to solve practical problems.
- Simplify numerical expressions.
- Use scientific notation.
- Solve practical problems involving percentages.
- Solve single variable algebraic expressions
- Measure angles.
- Find surface area and perimeter of two-dimensional objects.
- Find volume and surface area of three-dimensional objects.
- Construct three-dimensional models.
- Apply Pythagorean Theorem.
- Solve problems using proportions, formulas and functions.
- Use laws of exponents to perform operations.

Science Skills

- Use knowledge of work, force, mechanical advantage, efficiency and power.
- Use knowledge of simple machines, compound machines, powered vehicles, rockets and restraining devices.
- Use knowledge of principles of electricity and magnetism.
- Use knowledge of static electricity, current electricity and circuits.
- Use knowledge of magnetic fields and electromagnets.
- Use knowledge of motors and generators.

Language Arts Skills

- Provide information in conversations and in group discussions.
- Demonstrate use of such verbal communication skills as word choice, pitch, feeling, tone and voice.

- Demonstrate use of such nonverbal communication skills as eye contact, posture and gestures using interviewing techniques to gain information.
- Demonstrate comprehension of a variety of informational texts.
- Use text structures to aid comprehension
- Identify words and phrases that signal an author's organizational pattern to aid comprehension.
- Demonstrate knowledge of appropriate reference materials.
- Use print, electronic databases and online resources to access information in books and articles.

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.
- Data analysis and probability.
- Problem solving.
- Communication.
- Connections.
- Representation.

Source: NCTM Principles and Standards for School Mathematics. For more information, visit: 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 read a wide range of print and nonprint texts to build an understanding of texts, of themselves, and of the cultures of the United States and the world; to acquire new information; to respond to the needs and demands of society and the workplace; and for personal fulfillment. Among these texts are fiction and nonfiction, classic and contemporary works.
- Students apply a wide range of strategies to comprehend, interpret, evaluate and appreciate texts. They draw on their prior experience, their interactions with other readers and writers, their knowledge of word meaning and of other texts, their word identification strategies and their understanding of textual features (e.g., sound-letter correspondence, sentence structure, context, graphics).
- 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 employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes.
- Students apply knowledge of language structure, language conventions (e.g., spelling and punctuation), media techniques, figurative language and genre to create, critique and discuss print and nonprint texts.
- Students conduct research on issues and interests by generating ideas and questions, and by posing problems. They gather, evaluate and synthesize data from a variety of sources (e.g., print and nonprint texts, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience.
- 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.