

POWER EQUIPMENT TECHNOLOGY



PURPOSE

To evaluate each contestant's preparation for employment and recognize outstanding students for excellence and professionalism in engine and equipment diagnostics, overhaul and repair of both liquid and air-cooled engines. It will also evaluate the ability to troubleshoot and possibly overhaul the power train components of a piece of powered equipment and/or machinery.

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

ELIGIBILITY

Open to active SkillsUSA members enrolled in programs with small air-cooled engine repair or power equipment-related repair programs with that as its occupational objective.

CLOTHING REQUIREMENTS

Class D: Contest Specific — Blue Attire

- Official SkillsUSA light blue work shirt.
- Navy pants.
- Black, brown or tan leather work safety shoes (with protective toe cap).

Note: Safety glasses with 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.

EQUIPMENT AND MATERIALS

1. Supplied by the technical committee:
 - a. All necessary engines, engine parts, workstations, test stands, power equipment, gasoline, oil and all basic hand tools as well as necessary specialty tools
 - b. Industry manuals, including service and repair instruction manuals
2. Supplied by the contestant:
 - a. 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 at <http://updates.skillsusa.org>.

SCOPE OF CONTEST

The contest assesses understanding of two-cycle and four-cycle engines, 2 through 42 horsepower, and of both L-head and overhead valve design, as well as both single and twin cylinder design, drive train and hydraulic drive trains.

KNOWLEDGE PERFORMANCE

The contest will include a written knowledge exam based on an industry standard test. Additionally, the test could cover manufacturer's engines, parts identification, ordering and/or related equipment. There will also be the possibility of additional written portions during the day of the skill event.

SKILL PERFORMANCE

The contest will include a series of testing stations to assess skill performance.

CONTEST GUIDELINES

1. Contestants should have an understanding of engine theory, engine operation, diagnostic, failure analysis and repair and testing of engines and related power equipment as identified in the Standards and Competencies section following.

2. Contestants will demonstrate their ability to perform skills taken from the following areas:
 - a. Ignition, Charging, Fuel and Governor Systems
 - b. Starter, Cooling and Lubrication Systems
 - c. Valves, Exhaust and Engine Block Systems
 - d. Diagnostic and Failure Analysis
 - e. Shop Procedures
 - f. Business Operations
 - g. Transmission/Power Train
 - h. General Competencies

Standards and Competencies

PET 1.0 — Ignition, Charging, Fuel and Governor Systems

- 1.1 Ignition and Charging Systems
 - 1.1.1 Understand and be able to disassemble ignition system, inspect and test ignition components
 - 1.1.2 Show proficiency in testing coil/ignition modules
 - 1.1.3 Repair/replace electronic ignition components
 - 1.1.4 Test and troubleshoot equipment-related switches and harnesses along with stators, regulators and any related wiring harnesses
- 1.2 Fuel Systems
 - 1.2.1 Explain and be able to inspect, service, repair and adjust carburetors, gaseous fuel regulators and mixers
 - 1.2.2 Inspect, clean and replace filters
 - 1.2.3 Check fuel tanks and service and repair fuel pumps and solenoids
 - 1.2.4 Test equipment-related fuel tanks, lines and related systems and understand the procedures for testing for compliance systems as they are related to emission requirements and standards
- 1.3 Governor Systems
 - 1.3.1 Understand and be able to explain the various governor systems
 - 1.3.2 Inspect, service and reassemble governors

- 1.3.3 Understand and be able to explain which components cause engines to increase or decrease in the number of revolutions per minute

PET 2.0 — Starter, Cooling and Lubrication Systems

- 2.1 Starter Systems
 - 2.1.1 Recognize and be able to demonstrate the ability to inspect, service and adjust the various starting systems; use wiring schematics of related equipment systems
- 2.2 Cooling Systems
 - 2.2.1 Recognize, test and troubleshoot both liquid and air-cooled cooling systems of both engines and equipment
 - 2.2.2 Understand and recognize signs of heat-related failures or problems
- 2.3 Lubricating Systems
 - 2.3.1 Define and understand the various styles and types of lubrication systems
 - 2.3.2 Demonstrate the ability to check oil levels and fuel/oil mixtures
 - 2.3.3 Demonstrate the method of checking oil pressurized systems with the use of required tools
 - 2.3.4 Understand and explain the various grades of oils and uses in the proper engines/equipment

PET 3.0 — Valves, Exhaust and Engine Block Systems

- 3.1 Valves
 - 3.1.1 Identify and be able to service various types and styles of valve train components; explain why sealing these components is important
- 3.2 Exhaust Systems
 - 3.2.1 Identify the various types of exhaust systems and explain how they relate to the engine and or equipment
 - 3.2.2 Inspect and service exhaust and understand the procedures for testing for compliance systems as they are related to emission requirements and standards

- 3.3 Engine Block Components
- 3.3.1 Understand, identify and provide the necessary service/repair techniques to the various manufacturers within the industry; this could include disassembly, inspection and measuring of crankshafts, connecting rod bearings, journals, cylinders, piston and rings
- 3.3.2 Complete repairs to correct torque of critical fasteners and replace any gaskets and/or sealants

PET 4.0 – Diagnostic and Failure Analysis

- 4.1 Demonstrate the proper use of the various specialized tools of the industry. Be able to test crankcase vacuum, compression gauge, leak down testers, voltmeters/multimeters and any other required tools
- 4.2 Analyze failed engine components to determine the correct type of failure; determine best method to repair and estimate cost of repair

PET 5.0 – Shop Procedures

- 5.1 Demonstrate the proper techniques in the care and use of tools and equipment
- 5.2 Demonstrate the ability to work accurately with precision instruments
- 5.3 Use proper safety procedures; demonstrate ability to use service manuals and/or bulletins
- 5.4 Perform tasks within assigned time limits
- 5.5 Give a verbal response to a customer and answer customer-related problematic questions
- 5.6 Prepare equipment for delivery

PET 6.0 – Business Operation

- 6.1 Demonstrate the ability to look up proper part numbers by using paper, microfiche and/or electronic means available
- 6.2 Prepare both shop repair tickets and warranty claims
- 6.3 Demonstrate the ability to calculate costs accurately

- 6.4 Understand and operate equipment within equipment manufacturer's guidelines
- 6.5 Understand effective customer interaction and professional customer communications and relations

PET 7.0 – Transmission/Power Train

- 7.1 Understand the theory of transmission and transaxle components
- 7.2 Disassemble power train components, assemble power train components and diagnose and correct a potential problem
- 7.3 Understand the different types of transmissions and what types of lubrication systems are necessary for each

PET 8.0 – General Competencies

- 8.1 Basic reading and comprehension
- 8.2 Understand basic two- and four-stroke theory
- 8.3 Understand electrical theory
- 8.4 Understand carburetion theory and other related fuel systems
- 8.5 Read and follow schematics for hydraulics, electrical, etc.
- 8.6 Communicate effectively to others
- 8.7 Demonstrate basic computer skills

Additional Resources and Notes

Additional source material can be found on the manufacturers' websites, through the local central distributors, dealers or manufacturers within each state. Those manufacturers are:

- Briggs & Stratton Corp.
www.briggsandstratton.com
- Kohler Engines
www.kohlerengines.com
www.kohlerplus.com
- Equipment and Training Council
www.eetc.org
- MTD
www.mtdproducts.com
- Simplicity
www.simplicity.com

- Miller Welders
www.millerwelds.com
- John Deere
www.johndeere.com

Committee Identified Academic Skills

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

Math Skills

- Use proportions and ratios to solve practical problems.
- Use scientific notation.
- Solve practical problems involving percentages.
- Measure angles.
- Find surface area and perimeter of two-dimensional objects.
- Find volume and surface area of three-dimensional objects.
- Make predictions using knowledge of probability.
- Make comparisons, predictions and inferences using graphs and charts.
- Organize and describe data using matrixes.
- Find slope of a line.

Science Skills

- Plan and conduct a scientific investigation.
- Use knowledge of patterns of cellular organization (cells, tissues, organs, systems).
- Describe basic needs of organisms.
- Describe and recognize elements, compounds, mixtures, acids, bases and salts.
- Describe and recognize solids, liquids and gases.
- Describe characteristics of types of matter based on physical and chemical properties.
- Use knowledge of classification of elements as metals, metalloids and nonmetals.
- Describe and demonstrate simple compounds (formulas and the nature of bonding).
- Understand Law of Conservation of Matter and Energy.

- Predict chemical changes to matter (types of reactions, reactants and products; and balanced equations).
- Use knowledge of potential and kinetic energy.
- Use knowledge of mechanical, chemical and electrical energy.
- Use knowledge of heat, light and sound energy.
- Use knowledge of temperature scales, heat and heat transfer.
- Use knowledge of sound and technological applications of sound waves.
- Use knowledge of the nature and technological applications of light.
- Use knowledge of speed, velocity and acceleration.
- Use knowledge of Newton's laws of motion.
- 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.
- Provide information in oral presentations.
- 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.
- Analyze mass media messages.
- 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.

- Understand source, viewpoint and purpose of texts.
- Organize and synthesize information for use in written and oral presentations.
- Demonstrate knowledge of appropriate reference materials.
- Use print, electronic databases and online resources to access information in books and articles.
- Demonstrate narrative writing.
- Demonstrate persuasive writing.
- Demonstrate informational writing.
- Edit writing for correct grammar, capitalization, punctuation, spelling, sentence structure and paragraphing.

Connections to National Standards

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

Math Standards

- Numbers and Operations.
- Measurement.
- Problem Solving.
- Reasoning and Proof.
- 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 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 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.