



## AUTOMOTIVE MAINTENANCE AND LIGHT REPAIR



SkillsUSA Championships Technical Standards

### PURPOSE

To evaluate each competitor's preparation for employment and to recognize outstanding students for excellence and professionalism in the field of automotive service technology.

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

### CLOTHING REQUIREMENT

#### **Class D: Competition 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](http://www.skillsusastore.org). If you have questions about clothing or other logo items, call 1-888-501-2183.

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

### ELIGIBILITY

Open to active SkillsUSA high school members enrolled in career and technical programs with automotive technician or automotive service technology as the occupational objective.

## EQUIPMENT AND MATERIALS

1. Supplied by the technical committee:
  - a. All necessary tools and equipment for the competition
  - b. All necessary service publications for the competitors
2. Supplied by the competitor:
  - a. All competitors must create a one-page resume. See “Resume Requirement” below for guidelines.

## RESUME REQUIREMENT

Competitors must create a one-page resume to submit online. SkillsUSA national competitors should submit their resume by June 1. The link for resume submission will be published on <http://updates.skillsusa.org> on May 1. Failure to submit a resume will result in a 10-point penalty.

**Your resume must be saved as a PDF file type using file name format of “Last Name\_First Name.”** For example, “Amanda Smith” would save her resume as **Smith\_Amanda**. If you need assistance with saving your file as a PDF, visit [the Adobe website](#) for more information.

**Note:** Check the Competition Guidelines and/or the updates page on the SkillsUSA website at <http://updates.skillsusa.org>.

## PROHIBITED DEVICES

Cell phones 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 SkillsUSA Championships director. If confirmed that the competitor used the device in a manner which compromised the integrity of the competition, the competitor’s scores may be canceled.

## SCOPE OF THE COMPETITION

The competition will be consistent with the automobile technician task list outlined in guidelines published by the National Institute for Automotive Service Excellence (ASE) and the ASE Education Foundation at: [www.aseeducationfoundation.org](http://www.aseeducationfoundation.org).

Competitors will demonstrate their ability to perform jobs or skills selected from the standards mentioned above as determined by the SkillsUSA Championships technical committee. Committee membership includes American Honda Motor Co. Inc., ATech, ConsuLab, Gates Corp., General Motors, Hunter Engineering Co., Megatech Corp., National Institute for Automotive Service Excellence, Pittsburg State University, Snap-on Inc., S/P2, Toyota Motor

North America, Inc., CCAR, ATech, Stellantis North America, Nissan North America, Lucas-Nuelle and Subaru of America, and Mercedes-Benz, USA.

## **KNOWLEDGE PERFORMANCE**

The competition will include a written knowledge test given by ASE covering all skill areas found in the ASE Education Foundation Maintenance and Light Repair Program Standards and the Official ASE Study Guide — Auto Maintenance and Light Repair (G1) test. The test for this competition will consist of maintenance and repair content from these skill areas: engine repair, automatic transmission/transaxle, manual drivetrain and axles, suspension and steering, brakes, electrical/electronic steering, heating and air conditioning and engine performance.

## **SKILL PERFORMANCE**

The competition will include a series of workstations. Workstations consist of a vehicle and/or simulators, components, service publications, and interpersonal skills stations (such as Customer Service and Job Interview).

## **COMPETITION GUIDELINES**

1. A variety of vehicles sold in the United States will be used in the competition. This will include both domestic and imported vehicles.
2. Safety, quality, ability to follow instructions and procedures, accuracy (in comparison with factory specifications), workmanship, and other skills representative of the trades identified by industry leaders will be judged.
3. A total of eight to 15 stations will be assigned. Each station must be broken down into specific task criteria and separate steps based on the task. For example:

### **Station No. 1 Wire test and repair segments**

Identify faulty circuit = x points

Repair condition = x points

Assemble/retest = x points

Resistor board tests = x points

Compare values to specs = x points

Workmanship = x points

Safety practices = x points

4. The points allowed for each station will be assigned by the national technical committee and will be based on the difficulty of each assigned task.
5. Time limits will be assigned for each task, but no bonus points will be awarded for early completion.
6. Stations and equipment to be used in the national competition will be published annually by April 15 the updates page on the SkillsUSA website at <http://updates.skillsusa.org>.

## **STANDARDS AND COMPETENCIES**

### **MLR 1.0 — Perform vehicle HVAC system inspection and maintenance to related tasks in the ASE Education Foundation Maintenance and Light Repair (MLR) Program Standards — Heating and Air Conditioning section of the ASE MLR (G1) Test Task List.**

- 1.1. Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins.
- 1.2. Inspect and replace A/C compressor drive belts, pulleys, and tensioners; determine necessary action.
- 1.3. Identify hybrid vehicle A/C system electrical circuits and the service/safety precautions.
- 1.4. Inspect A/C condenser for airflow restrictions; determine necessary action.
- 1.5. Inspect engine cooling and heater systems hoses; perform necessary action.
- 1.6. Inspect A/C-heater ducts, doors, hoses, cabin filters, and outlets; perform necessary action.
- 1.7. Identify the source of A/C system odors.

### **AST 2.0 — Perform vehicle engine performance diagnosis and testing to related tasks in the ASE Education Foundation Maintenance and Light Repair (MLR) Program Standards — Engine Performance section of the ASE MLR (G1) Test Task List**

- 2.1. Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins.
- 2.2. Perform engine absolute (vacuum/boost) manifold pressure tests; determine necessary action.
- 2.3. Perform cylinder power balance test; determine necessary action.
- 2.4. Perform cylinder cranking and running compression tests; determine necessary action
- 2.5. Perform cylinder leakage test; determine necessary action.
- 2.6. Remove and replace spark plugs; inspect secondary ignition components for wear and damage.
- 2.7. Use a provided factory scan tool for the current model vehicle
  - 2.7.1. Read and record DTC
  - 2.7.2. Read and record OBD monitor status
  - 2.7.3. Read and record freeze frame data
  - 2.7.4. Clear codes when applicable
- 2.8. Describe the importance of operating all OBD monitors for repair verification.
- 2.9. Inspect, service, or replace air filters, filter housings, and intake duct work.
- 2.10. Check and refill diesel exhaust fluid (DEF).
- 2.11. Inspect, test and service positive crankcase ventilation (PCV) filter/breather cap, valve, tubes, orifices, and hoses; perform necessary action.

### **MLR 3.0 — Perform vehicle body electrical testing to related tasks identified in the ASE Education Foundation Maintenance and Light Repair (MLR) Program Standards — Electrical/Electronic Systems section of the ASE MLR (G1) Test Task List.**

- 3.1. Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins.
- 3.2. Demonstrate knowledge of electrical/electronic series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law).
- 3.3. Demonstrate proper use of a DMM when measuring source voltage, voltage drop, current flow, resistance, and parasitic draw.

- 3.3.1. Identify correct test procedures
- 3.3.2. Follow the correct test procedure
- 3.3.3. Identify connector pin-outs
- 3.3.4. Identify component locations
- 3.3.5. Use wiring schematics
- 3.4. Check operation of electrical circuits:
  - 3.4.1. With fused jumper wires
- 3.5. Inspect and test fusible links, circuit breakers, and fuses; determine necessary action.
- 3.6. Perform solder repair of electrical wiring
- 3.7. Replace electrical connectors and terminal ends.
- 3.8. Perform battery state-of-charge test.
- 3.9. Confirm proper battery capacity for vehicle application
- 3.10. Maintain or restore electronic memory functions.
- 3.11. Identify vehicle systems that require initialization or code entry after reconnecting the vehicle battery.
  - 3.11.1. Perform battery capacity test
- 3.12. Identify high voltage circuits of electric or hybrid electric vehicle and related safety precautions
  - 3.12.1. Identify hybrid 12v battery service and test procedures
- 3.13. Inspect and test starter control circuits
  - 3.13.1. Perform current draw test
  - 3.13.2. Perform voltage drop test
- 3.14. Inspect and test charging system
  - 3.14.1. Perform output test
  - 3.14.2. Perform voltage drop test
- 3.15. Inspect, adjust, or replace generator (alternator) drive belts; check pulleys and tensioners for wear; check pulley and belt alignment.
- 3.16. Inspect interior and exterior lamps and sockets
- 3.17. Identify system voltage and safety precautions associated with high-intensity discharge headlights
- 3.18. Verify windshield wiper and washer operation; replace wiper blades.
- 3.19. Verify operation of instrument panel gauges and warning/indicator lights; reset maintenance indicators.
- 3.20. Diagnose and repair a body electrical issue on a current model vehicle

**MLR 4.0 — Demonstrate application of environment, health and safety knowledge in auto service situations to related OSHA section 1910 standards and EPA standards**

- 4.1. Identify and explain the use of personal protective equipment
- 4.2. Recall information about automotive-related EPA and OSHA requirements
- 4.3. Identify and explain the use of blood- borne pathogens kits
- 4.4. Answer questions from a provided Safety Data Sheet (SDS)
- 4.5. Describe proper use of a fire extinguisher
- 4.6. Demonstrate knowledge of automotive lift safety best-practices
- 4.7. Demonstrate knowledge of automotive battery safety best-practices

**MLR 5.0 — Complete a mock job interview for maintenance and light repair related position**

- 5.1. Conduct a mock job interview with appropriate professional behavior
- 5.2. Communicate clearly and effectively
- 5.3. Clearly and completely fill out a job application
- 5.4. Submit copy of resume as directed in “Resume Requirement” above

**MLR 6.0 — Perform suspension and steering related tasks identified in the ASE Education Foundation Maintenance and Light Repair (MLR) Program Standards — Suspension and Steering section of the ASE MLR (G1) Test Task List.**

- 6.1. Perform pre alignment inspection and measure vehicle ride height
- 6.2. Inspect tire condition; identify tire wear patterns; check for correct tire size, application (load and speed ratings), and air pressure as listed on the tire information placard/label.
- 6.3. Rotate tires according to manufacturer's recommendations
- 6.4. Dismount, inspect and remount tire on wheel
- 6.5. Balance tire and wheel assembly
- 6.6. Inspect tire and wheel assembly for air loss
- 6.7. Repair tire using an internal patch
- 6.8. Identify indirect and direct tire pressure monitoring systems (TPMS); calibrate system; verify operation of instrument panel lamps.
- 6.9. Demonstrate knowledge of steps required to remove and replace sensors in a tire pressure monitoring system (TPMS) including relearn procedure.
- 6.10. Identify and inspect steering components
- 6.11. Identify and inspect suspension components
- 6.12. Use reference materials provided
- 6.13. Use tools provided to complete the above tasks.

**MLR 7.0 — Perform manual drive train service, testing and diagnosis to related tasks identified in the ASE Education Foundation Maintenance and Light Repair (MLR) Program Standards— Manual Drive Train and Axles section of the ASE MLR (G1) Test Task List.**

- 7.1. Identify components manual drive trains, axles, drivelines and transfer cases
- 7.2. Inspect, remove, and replace front wheel drive bearings, hubs and seals
- 7.3. Inspect, service, and replace shafts, yokes, boots, and universal/CV joints
- 7.4. Check and adjust clutch master cylinder fluid level
- 7.5. Check manual transmission/transaxle fluid level and condition
- 7.6. Check and adjust differential housing fluid level
- 7.7. Use tools provided to complete the above tasks

**MLT 8.0 — Perform brake inspection and service for the related tasks identified in the ASE Education Foundation Maintenance and Light Repair (MLR) Program Standards— Brake Systems section of the ASE MLR (G1) Test Task List.**

- 8.1. Identify different brake components
- 8.2. Describe procedure for performing a road test to check brake system operation, including antilock brake systems (ABS)
- 8.3. Install wheel and torque lug nuts
- 8.4. Measure brake pedal height, travel, and free play
- 8.5. Test brake fluid for contamination
- 8.6. Measure brake drum diameter

- 8.7. Remove, inspect and install brake shoes, springs, pins, clips, levers, adjusters and other brake hardware
- 8.8. Remove, inspect and install wheel cylinders
- 8.9. Pre-adjust brake shoes and parking brake before installing brake drums
- 8.10. Remove, inspect and install caliper, pads and related hardware; measure brake pad wear; check wear indicators; determine necessary action
- 8.11. Clean and inspect rotor, measure thickness, thickness variation, and lateral runout; determine necessary action
- 8.12. Remove, inspect and install caliper, pads and related hardware and determine necessary action
- 8.13. Check parking brake components; clean, lubricate, adjust or replace as necessary
- 8.14. Describe importance of operating vehicle to burnish/break-in replacement brake pads
- 8.15. Inspect brake booster for proper operation
- 8.16. Remove, clean, inspect, repack and install wheel bearings; install hub and adjust wheel bearings
- 8.17. Check operation of brake stop light system
- 8.18. Inspect and replace wheel studs.
- 8.19. Use tools provided to complete the above tasks

**MLR 9.0 — Perform automatic transmission maintenance to related tasks identified in the ASE Education Foundation Maintenance and Light Repair (MLR) Program Standards— MLR Automatic Transmission/Transaxle section of the ASE MLR (G1) Test Task List.**

- 9.1. Identify components on an automatic transmission/transaxle
- 9.2. Check fluid level in a transmission/ transaxle equipped with a dipstick
- 9.3. Check fluid level in a transmission/ transaxle not equipped with a dipstick
- 9.4. Check fluid condition
- 9.5. Describe the operational characteristics of a continuously variable transmission (CVT)
- 9.6. Describe the operational characteristics of a hybrid vehicle drivetrain
- 9.7. Use tools provided to complete the above tasks

**MLR 10.0 — Perform engine inspection and maintenance to related tasks identified in the ASE Education Foundation Maintenance and Light Repair (MLR) Program Standards— MLR Engine Systems section of the ASE MLR (G1) Test Task List.**

- 10.1. Remove and replace timing belt; verify correct camshaft timing
- 10.2. Perform common fastener thread repair
  - 10.2.1. Remove broken bolt
  - 10.2.2. Restore internal and external threads
  - 10.2.3. Restore internal and external threads using a thread insert
- 10.3. Adjust valves (mechanical or hydraulic lifters)
- 10.4. Check coolant condition and level
  - 10.4.1. Inspect and test radiator and pressure cap
  - 10.4.2. Test coolant concentration
- 10.5. Inspect, replace, and adjust drive belts, tensioners, and pulleys; check pulley and belt alignment
- 10.6. Use tools provided to complete the above tasks

### **MLR 11.0 — Use electrical service information resources**

- 11.1. Locate specifications and other service information using electronic service information resources

### **MLR 12.0 — Vehicle lifting and support**

- 12.1. Use provided information to identify the proper vehicle lifting location using a floor jack; lift vehicle and properly locate jack stands to support vehicle during service.

### **COMMITTEE IDENTIFIED ACADEMIC SKILLS**

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

#### **Math Skills**

- Use fractions to solve practical problems
- 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
- Apply transformations (rotate or turn, reflect or flip, translate or slide and dilate or scale) to geometric figures
- Solve problems using proportions, formulas and functions
- Use laws of exponents to perform operations

#### **Science Skills**

- Use the knowledge of potential and kinetic energy
- Use the knowledge of mechanical, chemical and electrical energy
- Use the knowledge of temperature scales, heat and heat transfer
- Use the knowledge of principles of electricity and magnetism
- Use the knowledge of static electricity, current electricity and circuits
- Use the knowledge of magnetic fields and electromagnets
- Use the knowledge of motors and generators

#### **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. 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
- Understands the scientific enterprise

*Source: McREL Compendium of National Science Standards. To view and search the compendium, visit: <http://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 and 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](http://www.ncte.org/standards)*