Small Engine Repair

Exam Information

Exam number
501

Items
48

Points
68

Prerequisites
None

Recommended course length
One semester

National Career Cluster
Transportation, Distribution, & Logistics

Performance standards
Included (Optional)

Certificate available
Yes

Description

The Small Engine Repair industry certification exam prepares individuals to apply technical knowledge and skill to maintain and repair small internal-combustion engines used on portable power equipment, such as lawn and garden equipment. Work ethics, productivity, and safety are an integral part of the classroom and laboratory activities of these classes.

Exam Blueprint

Standard	Percentage of exam
1. Leadership development	0%
2. Workplace readiness	7%
3. General shop safety	7%
4. Hand tools, fasteners, & shop equipment	15%
5. Small engine basic services	21%
6. Diagnosing small engines	18%
7. Disassembling/reassembling small engines	26%
8. Automotive technology mathematics	7%

Standard 1

Students will understand and demonstrate general shop safety.

Objective 1 Learn safe working habits and procedures. Pass relevant safety tests with 100 percent.

1. Personal safety
2. Tool and equipment safety
3. Workplace safety
4. Personal protective equipment (PPE).

Objective 2 Comply with safety rules for working with automotive chemicals.

1. Chemical manufacturers provide a Safety Data Sheets (SDS) for each chemical they produce.
2. Identify the location of and navigate through the SDS for critical information.
3. Store and dispose of chemicals in properly labeled containers.

Objective 3 Identify the gasses encountered in the automotive field and the hazards they present.

1. Water, oxygen, nitrogen, carbon dioxide (CO2), hydrocarbons (HC), oxides of nitrogen (NOx), and carbon monoxide (CO).
2. HC, NOX, and CO can pose health and environmental problems if they are not controlled.

Objective 4 Identify potential electrical safety hazards.

1. Standard Electrical Battery
2. Electrical Equipment
3. Loss of Isolation

Objective 5 Identify potential hazards in workplace practices.

1. Chain, bar, and sprockets
2. Blades and cables
3. Pinch/nip points
4. Pulleys and belts
5. Power takeoff (PTO)

Objective 6 Assess lifting equipment for safe and proper operation.

1. Inspect & verify for safe operation
2. Safety devices (swing arms, locks, latches, etc.)
3. Lift points (unibody and full frame)
4. Jacks and jack stands, auxiliary lift supports

Performance Skills

1. Pass relevant safety tests with 100 percent.
2. Comply with safety rules and procedures for working with automotive chemicals.
3. Use concepts and practices to solve, mitigate, and manage potential shop hazards & substances.
4. Assess lifting and shop equipment for safe and proper operation.
5. Demonstrate safe and proper operation of lifting and shop equipment.
6. Comply with safety procedures when working with electrical components and systems (lock out, tag out).

7. Demonstrate proper use of appropriate PPE.

Standard 2

Students will be able to understand basic hand tools, fasteners, shop equipment, and procedures.

Objective 1 Identify, size, and measure metric and standard fasteners.

1. Bolts, nuts, lock washers, keys, cotter pins, and snap rings.
2. Right-hand and left-hand threads, and course and fine threads.

Objective 2 Correctly identify and use basic hand tools.

1. Screwdrivers, Wrench, Sockets, Drive handles, Extensions, Pilers, Hammer, Chisels, Punches, Files, Hacksaw, Pullers, Vises, Drill bits, Grinding tools.
2. Describe the use of each of the above tools

Objective 3 Use the reference manuals or information systems to find service procedures and specifications

1. Computer oriented
2. Printed manuals
3. Owner's manuals

Performance Skills

1. Measure metric and standard fasteners.
2. Correctly identify, use and maintain basic hand tools, including torque wrench.
3. Complete a repair order including cause, concern, and correction, use reference manuals or information systems to find service procedures and specifications.

Standard 3

Students will be able to identify and perform basic services on a small engine.

Objective 1 Locate and identify basic service components.

1. Fuel systems: fuel filter, lines, tank
2. Ignition systems: spark plug, magneto, coil
3. Air filter, Breather filter
4. Lubrication system: dip stick, drain plug, oil types, oil levels, filters
5. Cooling system

Objective 2 Compare routine maintenance manufacturer specifications.

1. Oil

2. Air filter
3. Spark plug
4. Power Takeoff Attachments (blades, chains, cables, etc.)
5. Component & equipment cleaning

Objective 3 Identify and demonstrate use of basic measuring tools.

1. Spark Plug Gap
2. Gauge
3. Feeler Gauge
4. Measuring Tape

Performance Skills

1. Successfully service a spark plug, air filter, breather filter, and oil.
2. Correctly mix 2-cycle oil and gasoline mixture based on manufacturer specifications.
3. Safely sharpen blades and/or chains for small engine equipment.
4. Demonstrate use of basic measuring tools to manufacturers' specifications.
5. Demonstrate proper fuel preventative maintenance (seasonal storage).
6. Inspect and clean components of debris.

Standard 3 Performance Evaluation included below (Optional)

Standard 4

Students will be able to perform a diagnosis on a small engine.

Objective 1 Inspect engine mechanical components and operations.

1. Internal (piston, connecting rod, crank shaft, cam shaft, oil sling, governor)
2. External (block, cooling fins, bearings)
3. Head (intake/exhaust manifold, valve train)
4. Top Dead Center (TDC)
5. Bottom Dead Center (BDC)

Objective 2 Compare four strokes and two strokes.

1. Intake, compression, power, exhaust
2. Ports vs valves

Objective 3 Inspect air and fuel system components and operations.

1. Carburetor systems and types
2. Air filter types
3. Air fuel ratios and adjustments

Objective 4 Inspect ignition system components and operations.

1. Spark plug specifications
2. Primary and secondary ignition
3. Spark timing

Objective 5 Show effective diagnostic strategies.

1. Diagnostic steps: verify failure, visual inspection, diagnose, repair, verify repair Smoke color and condition (white coolant, blue = oil, black = fuel)
2. Interpret compression and/or cylinder leak test results.
3. Engine oil consumption failures
4. Verify engine mechanical timing

Performance Skills

1. Diagnose air and fuel system problems to manufacturer specifications.
2. Diagnose ignition system problems to manufacturer specifications.
3. Diagnose compression problems to manufacturer specifications.
4. Diagnose mechanical engine timing problems to manufacturer specifications.

Standard 4 Performance Evaluation included below (Optional)

Standard 5

Students will be able to disassemble and reassemble a small gas engine.

Objective 1 Inspect, remove, label, store, and reinstall components for engine reassembly.

1. Cylinder head torque pattern
2. Inspect the cylinder
3. Ring end gap
4. Inspect the piston
5. Connecting rod, bearing clearance (plastigage)
6. Check crankshaft endplay
7. Check valve clearance
8. Inspect valve and valve seat

Objective 2 Research and follow all manufacturer specifications for engine reassembly.

a. Torque
b. Valve timing
c. Mechanical timing Gasket materials
d. Tools & specialty tools
e. Fluids

Performance Skills

1. Disassemble a small gas engine.

2. Inspect major small gas engine components and parts
3. Successfully service components and parts.
4. Successfully reassemble a small gas engine.

Standard 5 Performance Evaluation included below (Optional)

Standard 6

Students will solve basic mathematical equations related to small engine repair tasks and concepts.

Objective 1 Solve whole and fractional/decimal problems (two- and three-digits).

1. Addition
2. Subtraction
3. Multiplication
4. Division

Objective 2 Solve conversion problems

1. Fraction-to-decimal
2. Decimal-to-fraction
3. Decimal-to-percent
4. Percent-to-decimal

Objective 3 Identify basic ratio, proportions, and volumes.

1. Fluids: gallon, liter, quart
2. Units of measure: psi, kpa, foot, lbs, newton meters, inch

Objective 4 Solve basic linear-measurement problems.

1. Measure using the Imperial system
2. Measure using the Metric system

Performance Skills

1. Solve whole number problems with two- and three-digits.
2. Solve fraction problems.
3. Solve decimal problems with two- and three-digits.
4. Solve conversion problems.
5. Solve basic ratio-to-proportion problems.
6. Solve basic linear-measurement problems.
7. Use basic ratios, proportions, and volumes when servicing a small engine.

Standard 6 Performance Evaluation included below (Optional)

Standard 7

Students will be encouraged to participate in a relevant CTSO through the demonstration of automotive repair workplace

and career readiness skills. These standards will not appear on state skill certification exams, but should be taught throughout the duration of the course.

Objective 1 Students will display personal skills related to the essential values, personality traits, and personal characteristics for success in automotive repair and life.

1. **Integrity** - demonstrate honesty and personal responsibility for actions in repairing and maintaining vehicles.
2. **Work ethic** - demonstrate tenacity, hard work, excellence, punctuality, meet deadlines; and be self- directed when completing tasks in the automotive repair classroom or shop
3. **Professionalism** - demonstrate maturity, self-confidence; and a positive image when working with teammates or clients on automotive repair jobs/projects.
4. **Responsibility** - demonstrate dependability, consistency, and personal well-being when safely completing automotive repair tasks
5. **Adaptability/Flexibility** - Foster creativity, new ideas, and resilience when working to solve problems in automotive repair tasks.
6. **Self-motivated** - demonstrate a willingness to learn, independence, initiative, and a positive attitude when approaching new information

Objective 2 Students will display workplace skills related to the essential attitudes and abilities for success in the automotive repair industry.

1. **Communication** - Demonstrates skills in listening and speaking; communicates professionally with teammates, supervisors, and customers in relation to automotive repair.
2. **Decision making** – Analyzes key facts, data, and situations to employ reasoning skills for completing automotive repair tasks.
3. **Teamwork** - Builds trusting relationships, works cooperatively with others and utilizes individual strengths of team members when completing automotive repair tasks.
4. **Environmental Awareness** - Builds rapport with peers and fosters appropriate workplace relationships and interaction; respects differing opinions.
5. **Planning, organizing, and management** - Designs, prepares, and implements automotive repair tasks within a desired timeframe; Sets priorities and responds to changing priorities.
6. **Leadership** - Builds positive relationships and mitigates conflict

Objective 3 Students will display technical skills that are grounded in automotive repair that deliver essential knowledge and competencies for success in the industry.

1. Computer and technology literacy
2. Job specific skills
3. Safety and health
4. Service orientation - responds to internal and external customers; demonstrates focus and presence; attends to personal matters away from the classroom.
5. Professional development - demonstrates openness to learn, grow, and change in the automotive repair industry.

Small Engine Repair

Performance assessments may be completed and evaluated at any time during the course. The following performance skills are to be used in connection with the associated standards and exam. To pass the performance standard the student must attain a performance standard average of 8 or higher on the rating scale. Students may be encouraged to repeat the objectives until they average 8 or higher.

Student's Name: _____

Class: _____

Performance standards rating scale

0	Limited skills	2	→	4	Moderate skills	6	→	8	High skills	10

Standard 3 – General Shop Safety **Score:**

- Pass a safety test with 100 percent.
- Comply with safety rules when working with chemicals.
- Identify the harmful exhaust gasses encountered in the small engine field and the hazards they present.

Standard 4 – Hand Tools, Fasteners, and Shop Equipment **Score:**

- Understand basic hand tools, fasteners, and shop equipment.
- Identify, size, and measure metric and standard fasteners.
- Correctly identify and use basic hand tools.
- Identify and demonstrate use of basic measuring tools (accurate to 1/32 or 1mm).
- Use reference manuals or information systems to find service procedures and specifications.

Standard 5 – Small Engine Basic Services **Score:**

- Identify and perform basic services on a small engine.
- Locate and identify basic engine components.
- Change engine oil and filter on a small engine. Use proper disposal methods for waste oil.
- Understand the four stroke cycle.
- Understand the two stroke cycle.

Standard 6 – Diagnosing Small Engines **Score:**

- Perform a diagnosis on a small engine.
    - Understand combustion, internal and external, as it relates to the four elements of combustion.
    - Troubleshoot fuel system problems.
    - Troubleshoot ignition system problems.
    - Troubleshoot compression problems.
    - Troubleshoot lubrication system.

Standard 7 – Disassembling/Reassembling Small Engines **Score:**

- Disassemble and reassemble a small gas engine.
- Identify major small gas engine components and parts.
- Disassemble a small gas engine.
- Inspect major small gas engine components and parts.
- Recondition,repair, or replace components and parts.
- Reassemble a small gas engine.

Standard 8 – Automotive Technology Mathematics **Score:**

- Solve basic mathematical equations related to automotive.

- Solve whole number problems with two- and three-digits.
- Solve fraction problems.
- Solve decimal problems with two- and three-digits.
- Solve basic ratio-to-proportion problems.

Performance standard average score:

Evaluator Name: _____

Evaluator Title: _____

Evaluator Signature: _____

Date: _____