**Small Engine Technology I**

**8725/36 weeks**

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Acknowledgments

The components of this instructional framework were developed by the following curriculum development panelists:

- Adam Daghita, Instructor, Petersburg High School, Petersburg City Public Schools
- William Michael Howington, Instructor, Tazewell County Career and Technical Center, Tazewell County Public Schools
- Timothy Kennedy, Instructor, Kellam High School, Virginia Beach City Public Schools
- Zach Perkins, Motorcycle Repair Instructor, Pocahontas State Correctional Center, Pocahontas
- Clint Porter, Owner, Beach Lawn and Garden, Virginia Beach
- Erik Sides, Executive Director, Equipment and Engine Training Council, Kings Mountain, North Carolina

Correlations to the Virginia Standards of Learning were reviewed and updated by the following:

- Leslie R. Bowers, English Teacher (ret.), Newport News Public Schools
- Vickie L. Inge, Mathematics Committee Member, Virginia Mathematics and Science Coalition
- Anne F. Markwith, New Teacher Mentor (Science), Gloucester County Public Schools
- Michael L. Nagy, Social Studies Department Chair, Rustburg High School, Campbell County Public Schools

The framework was edited and produced by the CTE Resource Center:

- Debi F. Coleman, Writer/Editor
- Kevin P. Reilly, Administrative Coordinator

Virginia Department of Education Staff

Lauren-Anne Sledzinski, Specialist, Trade and Industrial Education and Related Clusters
Dr. J. Anthony Williams, Curriculum and Instruction Coordinator
Dr. David S. Eshelman, Director, Workforce Development and Initiatives
George R. Willcox, Director, Operations and Accountability
Office of Career, Technical, and Adult Education

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Course Description

Suggested Grade Level: 10 or 11
Students learn to safely maintain and repair small internal-combustion engines used in industries such as lawn and garden, marine, and high-performance power sports (e.g., motorcycles, all-terrain vehicles). Students diagnose and service manual starting systems, ignition systems, cooling systems, and exhaust systems. This program of study qualifies students for entry level positions in service sales, parts departments, merchandising, shipping/receiving, detailing, and service writing in small engine repair labs, parts and inventory departments, service writing departments, and in sales positions. The program also prepares students for enrollment in two-year technical schools.

As noted in Superintendent's Memo #058-17 (2-28-2017), this Career and Technical Education (CTE) course must maintain a maximum pupil-to-teacher ratio of 20 students to one teacher, due to safety regulations. The 2016-2018 biennial budget waiver of the teacher-to-pupil ratio staffing requirement does not apply.

**Task Essentials Table**

- Tasks/competencies designated by plus icons (+) in the left-hand column(s) are essential
- Tasks/competencies designated by empty-circle icons (○) are optional
- Tasks/competencies designated by minus icons (⃝) are omitted
- Tasks marked with an asterisk (*) are sensitive.

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Legend: ✗Essential ○Non-essential ❖Omitted
Curriculum Framework

Applying Safety Practices on the Job

Task Number 39

Identify marked safety areas.

Definition
Identification should include describing and translating signage and special markings (e.g., floor paint) that identify work and caution areas.

Process/Skill Questions
- What are the different types of work zones?
- How does one know if additional safety equipment or clothing is needed to enter a safety area?
- How are walkways identified in the lab area?
- What color-coded labels indicate Danger, Warning, Caution, or Notice?
- What symbol represents a pinch point hazard?

Equipment and Engine Training Council
105 Regulations–1, 2

Task Number 40

Identify the location and use of industry-accepted safety devices.

Definition
Identification should include describing the signage and operating procedures for:
Process/Skill Questions

- When should one use an eye-wash station?
- What safety equipment provides additional eye protection?
- How often should eye-wash stations be checked?
- When should a lockout/tagout be used?
- When should a spill kit be used?

Equipment and Engine Training Council
103 Personal Safety–4

Task Number 41

Identify the location of the posted evacuation routes.

Definition

Identification should include

- events that could trigger an evacuation
- the location and interpretation of the posted evacuation route
- the destination and procedures for evacuation.

Process/Skill Questions

- What route should be followed in the event of an evacuation?
- Where is the evacuation route posted?
- Why is it important to establish a meeting place in the case of an evacuation?
- What is safety awareness?
Task Number 42

Demonstrate knowledge of safety data sheets (SDS).

**Definition**
Demonstration should include identifying

- the location of the sheets within the lab and the purpose they serve
- the administration’s (ownership’s) responsibility for workers’ health and safety
- laws, regulations, and practices affecting workers’ health and safety
- health and safety hazards
- health and safety programs
- the responsibility for environmental stewardship
- environmental laws, regulations, and practices
- sustainability initiatives.

**Process/Skill Questions**

- What environmental concerns should an industry address?
- What environmentally friendly practices and resources are available to an industry?
- What methods can be used to motivate employees to become involved in effective health, safety, and environmental practices?
- Where is the SDS stored, and who has access to it?
Demonstrate the safe use of chemicals.

Definition
Demonstration should include the different types of solvents, soaps, cleaning solutions, fuel, oils, greases, specialty additives, and gasses. Demonstration should also emphasize the correct use, the hazards, and the precautions associated with each, in accordance with manufacturers’ instructions and government regulations.

Process/Skill Questions
- Why is it important to read the manufacturer's directions when using chemicals?
- What may be the effects of using chemicals incorrectly?
- Where should chemicals be stored within the lab?

Equipment and Engine Training Council
105 Regulations–4

Task Number 44

Demonstrate the safe use of standard and metric hand tools.

Definition
Demonstration should include the various types of hand tools (including specialty tools, fasteners, and measuring tools) used in the small engine field. Demonstration should emphasize the correct use, the hazards, the precautions, and the maintenance procedures associated with each, in accordance with manufacturers’ instructions and government regulations. Hand tools should include

- various socket set components
- various wrenches
- various screwdrivers
- various styles of pliers
- various hammers
- various punches and chisels
- specialty cutting tools (e.g., hack saw, tubing cutter, hand reamer, file)
- battery specialty tools (e.g., cable puller, terminal and post cleaner, battery lifting or carrying strap)
- lubrication specialty tools (e.g., transmission funnel, oil filter-removing tool, grease gun)
- other miscellaneous specialty tools (e.g., air nozzles, C-clamp, puller set, pressure gauge, screw extractor, piston ring expander, piston ring compressor, the flywheel puller, and flywheel holder)

**Process/Skill Questions**
- Why is it important to use the proper hand tool for each job?
- Why is it necessary to keep hand tools clean and free of grease?
- What is the proper use of a hacksaw?
- Why is it important to check for frayed wires?
- Why is it important for guards and deflectors to be installed correctly and properly operating?
- How do impact sockets differ from conventional sockets?
- What should one use to clean tools?

**Equipment and Engine Training Council**

401 Service Tools and Equipment–1, 2

402 Hand Tools–1, 2, 3

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**Task Number 45**

**Demonstrate the safe use of power tools.**

**Definition**

Demonstration should include the various types of power tools (including pneumatic and electric tools) encountered in the small engine technology field. Demonstration should emphasize the correct use, the hazards, the precautions, and the maintenance procedures associated with each, in accordance with manufacturers instructions and government regulations. Power tools should include

- air impact gun
- air hammer
- air ratchet
- air drill
- drop light
- electric drill
- electric impact
- electric grinder
- diagnostic and testing tools.

**Process/Skill Questions**

- What is the purpose of a *dead man switch* on power tools?
- When should adjustments be made to power tools?
- Why is training on the use of a power tool necessary before using it?

**Equipment and Engine Training Council**

400 Tools and Equipment

401 Service Tools and Equipment–1, 2

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**Task Number 46**

**Demonstrate the safe use of lab equipment, lifting equipment, and blocking equipment.**

**Definition**

Demonstration should include the different types of equipment used in the small engine repair technology field, along with the correct use, the hazards, cleaning, storage, and the precautions associated with each, in accordance with manufacturer's specifications and instructor’s guidelines. Equipment could include

- pneumatic equipment (e.g., tire machine, pneumatic jack)
- hydraulic equipment (e.g., floor jack, lift rack, hydraulic press, engine hoist)
- electrical equipment (e.g., bench grinder, drill press, battery testers and chargers)
• blocking equipment (e.g., wheel ramps, jack stands, wheel chocks)
• ventilation equipment (e.g., exhaust fans, hose, attachments)
• mechanical equipment (e.g., work vise, arbor press, hose reels, creepers, carts, dollies)
• cleaning equipment (e.g., solvent tank, pressure washer, steam cleaner).

Process/Skill Questions
• What are unsafe uses of air compressors in the small engine lab?
• What is the safest way to hold a part in a vise?
• When is the cleaning tank used?
• When should jack stands be used?
• What are the dangers of running an engine in a confined space without appropriate ventilation?

Equipment and Engine Training Council
101 Work Habits–1, 2
404 Hand Tools–1, 2, 3, 4

Task Number 47

Demonstrate the safe use of diagnostic and testing equipment.

Definition
Demonstration could include the various types of equipment used in small engine diagnostics per manufacturers' instructions, and government regulations, such as

• leak down tester
• compression tester
• hydrometer
• specialty electrical system tools (e.g., volt/ohmmeter, dwell/tachometer, continuity light, timing light, remote starter switch)
• battery load tester
• borescope
• pressure washer psi gauge
• pressure/vacuum
• fuel pressure gauge.

Process/Skill Questions
• When should one use a leak down tester?
• How does one identify the appropriate tool for the task?
• How does one set up a diagnostic tool?
• What should one use to clean a diagnostic tool?

Equipment and Engine Training Council
401 Service Tools and Equipment–1, 2

Task Number 48

Demonstrate the safe use of standard and metric precision measuring tools.

Definition
Demonstration should include the proper use, maintenance, and calibration requirements per manufacturers’ instructions, and government regulations.

Precision measuring tools should include
• outside and inside micrometers
• depth micrometer
• dial indicators
• torque wrenches
• feeler gauges
• spark plug gap gauge
• calipers
• bore gauge
• pressure gauge
• vacuum gauge
• Plastigauge.

Process/Skill Questions
• How does heat affect the micrometer?
• Why are standard and quality tools necessary when repairing small engines?
• What is torque, and why is proper torque important?
• What is the difference between incremental torque and break-away torque?
• What are the various styles of torque wrenches?
• When are precision measuring tools required?
• What factors can influence precision measurement devices? In what ways?

Equipment and Engine Training Council
403 Precision Measuring Tools–1, 2, 3, 4, 5, 6, 7

Task Number 49

Demonstrate the safe use of protective clothing and equipment.

Definition
Demonstration should include the correct use, the hazards, and the precautions associated with each, in accordance with manufacturers’ instructions and government regulations concerning hazardous material and lab safety. Topics should include

• the types of protective clothing and equipment (e.g., protection of the body, eyes, ears, hands, respiratory system, auditory functions)
• grooming/hygiene (e.g., precautions related to hair length; loose clothing/jewelry; greasy hands, shoes, or clothing; dirty or scratched eye protection).
Process/Skill Questions

- What hazards exist due to loose-fitting clothing or long hair?
- When is it advisable to use goggles in a small engine lab?
- Would it ever be necessary to wear ear protection in the small engine repair lab?
- Why are steel-toed boots and shoes worn in small engine repair labs?

Equipment and Engine Training Council
103 Personal Safety—1, 2, 3

Task Number 50

Demonstrate the safe use of fire protection equipment.

Definition

Demonstration should include

- different types of fires encountered in the automotive technology field (Class A, B, C, and D)
- appropriate types of extinguishers to use with each fire
- hazards and the precautions associated with each
- fire emergency procedures that follow government regulations and instructor’s guidelines
- fire safety awareness and safety precautions to prevent fires.

Process/Skill Questions

- What are the different types of fire extinguishers?
- What types of fire extinguishers are appropriate for what types of fires?
- What procedure should students follow in case of an emergency or accident?

Equipment and Engine Training Council
104 Emergency Awareness—1
Task Number 51

Demonstrate the safe use of outdoor power equipment.

Definition
Demonstration should include the safe use of equipment and attachments used in

- lawn and garden
- marine
- high-performance power sports.

Process/Skill Questions
- What PPE is required when operating a string trimmer?
- How many riders are allowed on a zero-turn mower?

Task Number 52

Follow safety standards and regulations of the U.S. Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), the Equipment and Engine Training Council (EETC), and Safety Data Sheets (SDS).

Definition
Identification should include the regulations and requirements of EPA, OSHA, EETC, and SDS for the use, storage, and disposal of hazardous materials. Discussion should include the correct applications, the training, and the penalties associated with each regulation/requirement, according to government ordinances and instructor’s guidelines.

Process/Skill Questions
- What information should be sent to the hospital with a student and emergency responders if a chemical is splashed in an eye or wound?
- What agency requires labs and businesses to use the services of companies such as Safety Clean?
• What are the dangers of running an engine in a confined space without proper ventilation?

Equipment and Engine Training Council
105 Regulations–5

Using Tools and Equipment

Task Number 53

Identify standard and metric designation.

Definition
Identification should include

• the function and application of each system
• the relationship among measurements, tools, and systems used.

Process/Skill Questions
• Why is it important not to mix the systems?
• What determines the measurement system to be used?
• How does one convert fractions to decimals? Why would one want or need to make these conversions?

Task Number 54

Demonstrate proper cleaning, storage, and maintenance of tools and equipment.

Definition
Demonstration should include safety and maintenance procedures for pneumatic, electric, and hydraulic tools and equipment.
Process/Skill Questions

- Why is it important to lubricate air tools?
- What should one use to clean tools?

Equipment and Engine Training Council
401 Tools and Equipment–1, 2

Performing Lab Operations

Task Number 55

Use technical publications.

Definition
Use should include

- identification of the types of technical publications (e.g., safety/operation, parts/maintenance, service/technical manual, instruction sheets, equipment setup manual, predelivery inspection sheets, service/repair bulletins),
- the formats of manuals (e.g., printed and electronic media)
- the methods of locating information in them (e.g., table of contents, index, unique numbering systems).

Process/Skill Questions

- Will one manual answer questions for all small engines?
- Why use a service manual?
- How can troubleshooting charts be helpful, and what kinds of information do they contain?
- Where would torque specifications be found?

Equipment and Engine Training Council
300 Technical Publications–1, 2
Task Number 56

Maintain a clean and orderly work area.

Definition

Maintenance should include

- a neat and well-maintained office, storage, lab, and grounds areas
- clean and regularly maintained tools and equipment
- precautions for keeping customer’s unit and unit contents clean.

Process/Skill Questions

- Why should a work area be orderly if the specific repair technician knows where everything is?
- What are the benefits of maintaining a clean and orderly workspace?
- Who will do the cleanup in a typical small engine repair lab with multiple workers?
- Why should tools and equipment be kept clean?

Equipment and Engine Training Council

102 Work Environment–1, 2

Task Number 57

Prepare equipment for delivery.

Definition

Preparation should include

- retesting and verifying correct operation after making repairs
- inspecting the work completed
- completing paperwork
• making arrangements for delivery.

Process/Skill Questions
• How should equipment be prepared for delivery or pickup after completing a service job?
• Who handles the final paperwork, such as billing and packing?
• Who is responsible for performing the final inspection on the repair?

Identifying Fasteners and Their Uses

Task Number 58

Identify type and grade of standard, metric, and specialty fasteners.

Definition
Identification should include threaded fasteners, screws, nuts, retaining rings, pins, and keys. Discussion should include measuring tensile strength and identifying markings for each, according to industry standards and instructor’s guidelines.

Process/Skill Questions
• What, if any, is the difference between standard and metric fastener threads?
• When an engine vibrates, does it require a special bolt or thread? Explain.
• How is the metric series different from other threads?

Task Number 59

Choose appropriate fastener for the corresponding job.

Definition
Choice should be based on industry standards and instructor’s guidelines.
Process/Skill Questions

- When is a bolt used? A screw?
- What fastener is used for pulleys, gears, and shafts?
- When is a self-tapping screw used?

Understanding Four-Stroke Engine Operation Theory and Components

Task Number 60

Explain four-stroke engine theory order of operation.

Definition

Explanation should include

- intake
- compression
- power
- preignition and its effects
- normal combustion process, detonation and its effects
- exhaust, as well as the events taking place during each of these strokes (cycles).

Process/Skill Questions

- How does understanding four-stroke theory benefit the small engine technician?
- When the intake valve is open and the piston is traveling down, what stroke is occurring?
- When the exhaust valve is open and the piston is traveling up, what stroke is occurring?
- What is detonation?
- What is preignition?
- What does TDC stand for?
What does BDC stand for?

**Equipment and Engine Training Council**

100 Small Engine Fundamentals

103 Four Stroke Engine–1, 2

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**Task Number 61**

**Describe the types, purpose, function, and common terminology of four-stroke air-cooled engine components.**

**Definition**

Description should include an explanation of

- engine block, crankcase, and cylinder
- piston, piston pin, and piston rings
- connecting rod and cap
- crankshaft
- engine bearing types
- oil seal types
- cylinder head
- valve train
- camshaft
- automatic compression release (ACR) mechanism
- lifters/tappets
- mechanical governor components
- flywheel.

**Process/Skill Questions**

- What types of piston rings are commonly found on four-stroke, air-cooled small engines?
- What are the different types of valve retainers?
● What does the ACR mechanism make easier?
● What is the purpose of the flywheel?
● What component is referred to as the oil dipper?
● What purpose do the fins have on the engine block and cylinder head?
● What component has a lobe?

**Equipment and Engine Training Council**

100 Small Engine Fundamentals

104 Four Stroke Engine–1, 2, 3, 4, 5, 6, 7

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**Task Number 62**

**Disassemble a four-stroke engine.**

**Definition**

Disassembly should include

- removal and storage of components and fasteners
- disposing of fluids per governmental regulations
- cleaning of engine components
- inspection according to manufacturer’s specifications and instructor’s guidelines.

**Process/Skill Questions**

- What safety related issues would apply to removal and disassembly of a four-stroke engine?
- Where can the proper procedures for disassembling a four-stroke engine be found?
- What special tools might be necessary when removing a four-stroke engine?

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**Task Number 63**

**Install oil seals and gaskets.**
Definition
Installation should include

- following manufacturer’s specifications and instructor’s guidelines
- determining appropriate gasket sealers, if needed
- using appropriate tools to install seals to prevent damage to sealing surface
- aligning gaskets before installing related parts.

Process/Skill Questions
- What important part do oil seals and gaskets play in engine rebuilding?
- Why are gaskets manufactured in different thicknesses?
- Why is a head gasket made of different material than other gaskets?

Equipment and Engine Training Council
600 Four Stroke Engine Service–11

Task Number 64
Install a crankshaft.

Definition
Installation should include

- following manufacturer’s specifications and instructor’s guidelines
- lubricating wear surfaces with appropriate lubricant
- rotating engine crankshaft to check for binding and accurate operation during and after assembly
- checking the endplay for crankshaft.

Process/Skill Questions
- When should a crankshaft be replaced?
- What precision tools are required in the replacement of a crankshaft?
- Why is cleanliness an important part of crankshaft replacement?
Task Number 65

Install piston rings.

Definition
Installation should include checking the condition of related parts, cleaning ring grooves, and reinstallation, according to manufacturer’s specifications and instructor’s guidelines.

Process/Skill Questions
- What special tools are needed to install piston rings?
- What safety-related issues are involved when installing piston rings?
- What tool is used to clean ring grooves?
- When should a piston ring be replaced?

Task Number 66

Install a piston.

Definition
Installation should include checking the condition of related parts and reinstallation, according to manufacturer’s specifications and instructor’s guidelines.

Process/Skill Questions
- What special tools are needed to install a piston?
- What safety-related issues are involved when installing a piston?
- Why is cleanliness a very important aspect of piston installation?
Task Number 67

Replace connecting rods.

Replacement should include installing the crankshaft and piston pin, according to manufacturer’s specifications and instructor’s guidelines.

Process/Skill Questions

- When should a connecting rod be replaced?
- What precision tools are needed to determine wear on a connecting rod?
- What special tools are required to install a connecting rod?

Task Number 68

Install valve train components.

Definition

Installation should follow manufacturer’s specifications and instructor’s guidelines and include

- inspecting and testing valve springs for squareness, pressure, and free height comparison; replacing as needed
- inspecting valve spring retainers, locks, and valve grooves
- replacing valve stem seals
- inspecting valve guides for wear; checking valve guide height and stem-to-guide clearance; reconditioning or replacing as needed
- inspecting valves; resurfacing or replacing
- inspecting valve seats; resurfacing or replacing
● checking valve face-to-seat contact and valve seat concentricity (runout), checking lapping seat-to-face; servicing seats and valves as needed

● checking valve spring assembled height and valve stem height; servicing valve and spring assemblies as needed

● inspecting and measuring camshaft bearings for wear, damage, out-of-round, and alignment; determining needed repairs.

**Process/Skill Questions**

● What measuring tools are required in the installation of the valve train?

● When should valve seats/faces need reworking?

● How are overhead valve systems different from L-head valve systems?

**Equipment and Engine Training Council**

600 Four Stroke Engine Service–2, 3, 6, 7, 11

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**Task Number 69**

**Install a camshaft.**

**Definition**

Installation should follow manufacturer’s specifications and instructor’s guidelines and include

- lubricating wear surfaces with appropriate lubricant
- determining sequence for installing related parts
- installing camshaft in block following proper timing procedures
- rotating engine crankshaft and camshaft to check for binding and proper operation.

**Process/Skill Questions**

- When should a crankshaft be replaced?
- What precision tools are required in the replacement of a crankshaft?
- Why is cleanliness an important part of crankshaft replacement?

**Equipment and Engine Training Council**

600 Four Stroke Engine Service–11, 14, 16
Task Number 70

Install a side cover or sump.

Definition
Installation should include

- alignment of side cover
- torquing hardware in the correct sequence if applicable
- checking the end play of the crankshaft.

Process/Skill Questions

- Why is it important to check the end play of the crankshaft?
- Why is torque sequence important?

Equipment and Engine Training Council
600 Four Stroke Engine Service–11

Understanding Lubrication Systems

Task Number 71

Demonstrate knowledge of common oil standards.

Definition
Demonstration should include the following standards:

- ISO/LEG
- JASO
- NEMA (BIA)
Process/Skill Questions
- What is JASO in engine oil?
- What are the different temperature ranges for various oil standards?

Equipment and Engine Training Council
200 Maintenance, 201 Lubrication Fundamentals–5, 6, 7,

Task Number 72

Apply lubrication systems theory.

Definition
Application should be based on knowledge of
- differences between four- and two-cycle lubrication
- effects of clearances on lubrication systems
- criteria for choosing lubricants
- types of oil filtration
- function of oil
- types of lubricating systems
  - splash
  - pressure lubrication
  - pressure filtration.

Process/Skill Questions
- How does four-stroke lubrication differ from two-stroke lubrication?
- How is lubrication connected to clearances within the engine?
- How is the proper type of lubricant determined for different types of engines?
- What is the difference between a dipper and a slinger?
- How does a pressure filtration system differ from a pressure lubrication system?
Task Number 73

Service different types of lubrication systems.

Definition
Servicing should follow the manufacturer's specifications and instructor's guidelines and include

- checking the engine oil level
- draining engine oil
- replacing the oil filter, if applicable
- refilling engine oil to the proper level.

Process/Skill Questions

- What are the different types of oil filters used on outdoor power equipment?
- What is the engine oil application chart?
- What is a dipstick?
- What are some common oil contaminants?
Task Number 74

Service the crankcase ventilation system.

Definition
Servicing should include

- identifying the components of the crankcase ventilation system operation
- servicing the crankcase breather assembly.

Process/Skill Questions
- What are the benefits of positive crankcase ventilation?
- What is the function of a breather hose?

Equipment and Engine Training Council
200 Maintenance, 202 Lubrication, Engine Maintenance –11, 12, 13

Diagnosing and Servicing the Fuel System

Task Number 75

Describe the principles of fuel delivery.

Definition
Description should include the theory (including the Venturi principle) and method of delivery (e.g., gravity, pressurized, vacuum).

Process/Skill Questions
- What principles of physics are used in fuel delivery systems?
- When must pressurized fuel systems be used?

104 Engine Components–25, 29, 34
Task Number 76

Evaluate the operation of a carburetor.

Definition
Evaluation should include the examination of accessible parts for function and damage, according to manufacturer’s specifications. Parts include

- idle circuit
- main circuit
- choke system
- purging or priming system
- high-speed nozzle
- emulsion tube
- orifice jets.

Process/Skill Questions
- What is the difference between the high- and low-idle circuits?
- What is the difference between an adjustable carburetor and a fixed-jet carburetor?
- How does fuel quality affect the performance of the carburetor?
- What alternative fuels are available for use in small engines? For which engines would they be used?

Equipment and Engine Training Council
100 Small Engine Fundamentals
104 Engine Components–26, 27, 28, 29, 30, 31

Task Number 77

Determine fuel, type, grade, and quality.
**Definition**
Determination is made by checking indicators, such as

- color of exhaust
- odor of fuel
- engine temperature
- power produced
- alcohol content.

**Process/Skill Questions**

- Why does fuel quality matter to the efficiency of an engine?
- What does *octane rating* mean?
- Why should fuel cans be kept clean?
- How does one verify the alcohol content of fuel?
- What are the different grades of gasoline?

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**Task Number 78**

**Replace the fuel tank and fuel lines.**

**Definition**
Replacement should include the removal of applicable fasteners and clamps and reinstallation, according to factory specifications and safety guidelines for handling fuel.

**Process/Skill Questions**

- When replacing a fuel tank, what is the first step?
- How does one keep gas from leaking out of the lines when replacing them?
- When does one use a fuel shutoff valve?
- What damage can be caused to fuel lines by ethanol?
Task Number 79

Inspect fuel tank cap and vent.

Definition
Inspection should include checking to ensure the free flow of air.

Process/Skill Questions
- What is the purpose of the fuel tank vent?
- What problems can arise from an obstructed fuel tank vent?
- How can fuel tank vents become obstructed?

Task Number 80

Replace the fuel filter systems.

Definition
Replacement should include the removal of applicable fasteners and clamps and reinstallation, according to factory specifications, instructor’s guidelines, and safety guidelines for handling fuel. The used filter must be properly disposed of, according to EPA regulations.

Process/Skill Questions
- What are some types of fuel filters?
- What is the function of a fuel filter?
- How will an engine run once the fuel filter stops working?
**Task Number 81**

**Service various types of air cleaner.**

**Definition**  
Service should include

- the removal of the pre-cleaner or air cleaner
- cleaning and treating the foam element (if applicable)
- reinstalling to manufacturer’s specifications and instructor’s guidelines.

**Process/Skill Questions**

- What is the composition of a foam filter?  
- What are some types of foam filters?  
- How is a foam filter cleaned?  
- When should a foam filter be cleaned?  
- How often should a paper element be replaced?

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**Task Number 82**

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Service a diaphragm-type carburetor.

Definition
Servicing should follow manufacturer’s specifications and instructor’s guidelines and include

- conducting a pressure/vacuum test
- checking condition of diaphragm
- checking condition of primer system
- inspecting passageways for obstructions.

Process/Skill Questions

- What is the composition of the diaphragm?
- Where should the spring fit on the diaphragm-type carburetor?
- Why does a carburetor need a diaphragm?

Equipment and Engine Training Council
200 Maintenance
204 Fuel System– Engine Maintenance –3, 4, 5, 6, 7, 8, 9
300 Two Stroke Engine
301 Test a Two Stroke Engine–2
500 Four Stroke Engine Diagnosis–2

Task Number 83

Service a float-type carburetor.

Definition
Servicing should follow manufacturer’s specifications and instructor’s guidelines and include

- checking passageways for obstructions
- checking float for buoyancy
• inspecting needle valve and seat for proper operation.

Process/Skill Questions
• How does a float-type carburetor function?
• What is the composition of a float?
• What happens when a float has a hole in it?
• Why should the float be set level?
• How is the float set level?
• Where are the specifications for setting a float level?

Equipment and Engine Training Council
200 Maintenance

204 Fuel System– Engine Maintenance –3, 4, 5, 6, 7, 8, 9

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Diagnosing and Servicing the General Electrical System

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Task Number 84

Demonstrate the proper use of a multimeter.

Definition
Demonstration should follow manufacturer's specifications and instructor's guidelines and include

• direct current (D.C.) voltage test
• alternating current (A.C.) voltage test
• voltage drop test
• continuity test
• resistance test
• amperage test (amp clamp and multimeter)
• diode test.

Process/Skill Questions
• How can proper use of a multimeter aid in troubleshooting a problem in the electrical system?
• Why is it necessary to obtain correct readings when diagnosing an electrical problem?
• What could result from incorrectly reading the multimeter?
• Why would someone test the multimeter’s leads for resistance?
• What are milli-volts?
• What is a voltage drop test?

Equipment and Engine Training Council
100 Electrical Systems

101 Electrical Theory—12, 36, 37, 38, 40

Task Number 85

Apply electrical theory.

Definition
Application of theory should be based on knowledge of

• Ohm’s law
• electricity produced mechanically, chemically, and statically
• alternating current
• direct current
• magnetism
• units of measurement—Ohm’s, voltage, and amperage
• conductors, semiconductors, and insulators
• electrical function
- current flow
- wire size (AWG)
- series, parallel, and series-parallel circuits
- schematic symbols
- schematic reading
- electrical terms/nomenclature
- circuit types: open, closed, and short.

**Process/Skill Questions**
- How can knowledge of electrical theory aid in the repair of small engine technology?
- What are some possible consequences of applying incorrect electrical theory?
- What is the electrical symbol for a fuse?
- What is the electrical symbol for a switch?
- What is the electrical symbol for a battery? A relay? A solenoid?

**Equipment and Engine Training Council**
100 Electrical Systems

101 Electrical Theory–1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 14, 15

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**Task Number 86**

**Service the starting circuit.**

**Definition**
Servicing should include following manufacturer's specifications and instructor's guidelines and include checking

- the ignition switch
- wiring
- fuses
- safety switches
- the starter solenoid
- battery cables
- ground straps.

**Process/Skill Questions**

- Why is correct procedure important in troubleshooting electrical starting circuit problems?
- What potential issues could result from incorrectly troubleshooting a starting circuit problem?
- How could incorrect diagnosis of a starting circuit problem lead to customer dissatisfaction?
- What is dielectric grease? Where should it be used?

**Equipment and Engine Training Council**

100 Small Engine Fundamentals

100 Electrical Systems

101 Electrical Theory–23,35, 42

104 Engine Components –46, 50

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**Task Number 87**

**Service the battery.**

**Definition**

Servicing should include

- an inspection of the battery for leakage and physical damage
- hydrometer and load testing according to industry safety regulations, manufacturer's specifications, and instructor’s guidelines
- charging the battery with a battery charger
- jumpstarting the battery using booster cables
- cleaning the battery, battery tray, and terminal connections
• removal and replacement of the battery
• terminal corrosion prevention methods.

Process/Skill Questions

• How does a battery work in theory?
• What are the standard methods of rating batteries?
• What diagnostic tools could be used to test a battery?
• What safety precautions should be used when testing or charging a battery?
• How does a battery lose charge?
• What are the types of charging systems?
• What are the procedures for battery disposal based on EPA and local ordinances?
• Why does a holding device (clamp or bracket) secure a small engine equipment battery?
• How should a battery be stored for long-term storage?

Equipment and Engine Training Council
100 Small Engine Fundamentals

100 Electrical Systems

101 Electrical Theory–13

104 Engine Components–65, 67

Servicing Starting System

Task Number 88

Service the starter drive gear.

Definition
Service should include
following manufacturer's specifications and instructor's guidelines

- removing the starter
- replacing the starter drive gear
- verifying the starter is working and engaging as designed after reassembly.

**Process/Skill Questions**

- Why would a starter drive gear need to be replaced?
- What safety related issues apply to starter servicing?
- How is proper spring tension determined?
- What safety related issues apply to starter servicing?
- Why are torque specifications important in starter cup replacement?

**Equipment and Engine Training Council**

100 Electrical Systems

101 Electrical Theory–33

200 Maintenance

205 Start System–1, 2

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**Task Number 89**

**Describe the operation of a kickstart system.**

**Definition**

Description should include components and theory of operation.

**Process/Skill Questions**

- What are the most common kickstart systems?
- How does the kick-starter work with the other components to provide ignition?
- Why are the benefits of kick-starters over other starting systems?
Task Number 90

Service the rewind starter system.

Definition
Service should include

- identifying the rewind starter system components
- inspecting for damage or wear
- replacing the starter rope.

Process/Skill Questions
- What are the three types of rewind starter systems?
- Why is correct rope length important when replacing starter rope?

Equipment and Engine Training Council
100 Small Engine Fundamentals
104 Engine Components–45
200 Maintenance,
205 Start System–1
400 Two Stroke Engine Overhaul
401 Disassembly, Inspection, and Repair–9

Servicing Ignition System

Task Number 91

Describe ignition systems.
Definition
Description should include the purpose, function, nomenclature, and components of the following ignition systems:

- Battery
- Electronic
- Magneto

Process/Skill Questions
- What are the major components of an ignition system?
- What does the acronym CDI mean?
- What is the function of the primary coil?
- What coil winding amplifies the voltage going to the spark plug?

Equipment and Engine Training Council
100 Small Engine Fundamentals
104 Engine Components–11, 12, 13, 14

Task Number 92

Service the spark plugs.

Definition
Service should include using proper tools and following manufacturer's specifications and instructor's guidelines to

- select appropriate spark plug
- remove and replace spark plug
- inspect for fouling, wear, and damaged insulator
- verify/adjust air gap
- perform a spark test with a spark tester.
Process/Skill Questions
- What measuring tool is used when installing a spark plug?
- How would one determine proper torque specification when installing a spark plug?
- What conditions would require replacement of a spark plug?

Task Number 93
Service the flywheel.

Definition
Service should include following manufacturer's specifications and instructor's guidelines to inspect for
- cracks in flywheel
- damage to fins, taper, keyway scot, magnets
- loose magnets
- quality of flywheel key
- foreign objects, grease/oil on taper surface
- torque of flywheel retainer.

Process/Skill Questions
- What safety related issues would be involved in removal and replacement of the flywheel?
- Why are torque specifications important when replacing a flywheel?
- Why are proper tools needed in removal of a flywheel?

Equipment and Engine Training Council
500 Four Stroke Engine Diagnosis–10

Task Number 94
Service the armature.
**Definition**
Service should include

- setting the air gap according to manufacturer’s specifications and instructor’s guidelines
- checking components for damage.

**Process/Skill Questions**
- What measuring tool is needed to adjust armature air gap?
- What conditions could cause the armature air gap to change?
- Why is an armature air gap needed?
- What tool would be used in testing ignition wires?
- What conditions would warrant replacement of ignition wires?
- What type of conductors are used in ignition wires?

**Equipment and Engine Training Council**
500 Four Stroke Engine Diagnosis–14

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**Task Number 95**

**Service the safety switch.**

**Definition**
Service should include

- following manufacturer’s specifications and instructor’s guidelines
- determining whether the switch is being actuated properly
- testing continuity of the switch.

**Process/Skill Questions**
- Why are wiring schematics necessary in the process of testing safety switches?
- Why are there federal laws regarding safety switches on outdoor power equipment?
- What are the consequences for bypassing safety switches on outdoor power equipment?
Understanding Two-Stroke Operation
Theory and Components

Task Number 96

Explain two-stroke engine theory.

Definition
Explanation should include

- intake/compression and power/exhaust
- events taking place during each of these two-stroke cycles
- exhaust/expansion chamber theory
- detonation and preignition and their effects.

Process/Skill Questions

- What are some ways two-stroke theory differs from four-stroke theory?
- Why is so much importance placed on the proper understanding of two-stroke theory?
- Why can a two-stroke engine run on its side and not a four-stroke?
Task Number 97

Describe valving systems commonly found in two-stroke engines.

Definition
Description should include the components and operation of various valving systems.

Process/Skill Questions
- How does positive and negative air pressure influence the operation of valving systems on two-stroke engines?
- What valving systems are most common?

Equipment and Engine Training Council
100 Small Engine Fundamentals
102 Two Stroke Engine–2

Task Number 98

Disassemble a two-stroke engine.

Definition
Disassembly should include
- removal and storage of components/fasteners
- disposing of fluids per governmental regulations
- cleaning of engine components
- inspection according to manufacturer’s specifications and instructor’s guidelines.

Process/Skill Questions
- What safety issues apply to the removal and disassembly of a two-stroke engine?
- What special tools are used in the removal of a two-stroke engine?
Where would one find the proper procedures to follow in disassembly of a two-stroke engine?

**Equipment and Engine Training Council**

400 Two Stroke Engine Overhaul

401 Disassembly, Inspection, Repair–1

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**Task Number 99**

**Replace oil seals.**

**Definition**

Replacement should include

- following manufacturer’s specifications and instructor’s guidelines
- determining appropriate gasket sealers, if needed
- using appropriate tools to install seals to prevent damage to sealing surface
- aligning gaskets before installing related parts.

**Process/Skill Questions**

- Why are oil seals so important on a two-stroke engine?
- How does one test a crankcase for leaks?
- Why is a two-way seal used on the crankshaft of a two-stroke engine?

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**Task Number 100**

**Replace a crankshaft.**
**Definition**
Replacement should include lubricating wear surfaces with appropriate lubricant, according to manufacturer’s specifications and instructor’s guidelines.

**Process/Skill Questions**
- What would determine if a crankshaft would need to be replaced?
- How does one undersize a crankshaft?
- Why is cleanliness an important part of crankshaft replacement?

**Equipment and Engine Training Council**
400 Two Stroke Engine Overhaul
401 Disassembly, Inspection, Repair–2, 3, 4

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**Task Number 101**

**Install piston rings.**

**Definition**
Installation should include reinstallation and assuring proper alignment of piston ring and ring pin, according to manufacturer’s specifications and instructor’s guidelines.

**Process/Skill Questions**
- What special tools are needed in the installation of piston rings?
- What safety related issues are involved in the installation of piston rings?
- How is the need for piston ring replacement determined?

**Equipment and Engine Training Council**
400 Two Stroke Engine Overhaul
401 Disassembly, Inspection, Repair–2, 3, 4, 5

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**Task Number 102**
Install a piston.

Definition
Installation should include reinstallation, according to manufacturer’s specifications and instructor’s guidelines.

Process/Skill Questions
- What special tools are needed in the installation of a piston?
- What safety issues are related to the installation of a piston?
- Why is cleanliness an important aspect of piston installation?

Task Number 103

Replace connecting rods.

Definition
Replacement should include installing crankshaft and piston pin according to manufacturer’s specifications and instructor’s guidelines.

Process/Skill Questions
- Under what conditions would a connecting rod require replacing?
- What precision tools are needed to determine wear on a connecting rod?
- What special tools would be required in the installation of a connection rod?
Task Number 104

Replace a cylinder.

Replacement should include removal of cylinder, using appropriate tools, according to manufacturer's specifications and instructor's guidelines.

Equipment and Engine Training Council
400 Two Stroke Engine Overhaul

401 Disassembly, Inspection, Repair–2, 3, 4

Task Number 105

Mix fuel at appropriate ratio.

Definition
Mixture should include

- use of appropriate type of oil and type/grade of fuel at an appropriate ratio, according to manufacturer's specifications
- consideration of fuel stabilization methods for winter or long-term storage
- identification of potential problems resulting from improper oil/fuel mixture and use of alcohol blended fuels.

Process/Skill Questions
- What ratios are used on two-stroke engines?
- Which type of oil is suited for mixing with a given grade of fuel?
- Why use different ratios?
- Why is E10 the only approved fuel for outdoor power equipment?
- What can be added to fuel for winter storage?

Equipment and Engine Training Council
200 Maintenance,
Servicing Cooling Systems

Task Number 106

Explain cooling system theory.

Definition
Explanation should include maintaining engine operation temperature within desired range and according to manufacturer’s specifications and instructor’s guidelines.

Process/Skill Questions
- How does heat move through an engine?
- Why does heat need to be removed from an engine?
- What are the two main types of cooling systems?
- What are the advantages and disadvantages of a liquid cooled engine?

Equipment and Engine Training Council
100 Small Engine Fundamentals

104 Engine Components–15, 16

Task Number 107

Identify liquid cooling system components.

Definition
Identification should include
• water jackets
• pumps
• hoses
• radiators
• coolant
• thermostat.

**Process/Skill Questions**
• What are the functions of the components?
• What is the risk of being burned by a liquid cooling system?
• How can pressure in the system help a technician troubleshoot repairs?
• What are the significant causes of liquid-cooling failures?
• What standard service/cleaning procedures are performed on a liquid-cooled engine?

**Equipment and Engine Training Council**
100 Small Engine Fundamentals

104 Engine Components—21, 22

200 Maintenance

203 Cooling System –3

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**Task Number 108**

**Identify air cooling system components.**

**Definition**
Identification should include

• filtering screen
• blower housing
• deflector shields
- engine fins
- flywheel fins.

Process/Skill Questions
- How does air cool the engine?
- How is air channeled through the cooling system?
- Why should air be kept clean or filtered?
- What are the significant causes of air-cooled engine overheating?
- What standard service/cleaning procedures are performed on an air-cooled engine?

Equipment and Engine Training Council
100 Small Engine Fundamentals

104 Engine Components–17

Servicing Governor Systems

Task Number 109

Explain governor system theory.

Definition
Explanation should include the need to maintain constant desired engine speed according to instructor’s guidelines.

Process/Skill Questions
- What are the two most common governor systems on small engines?
- Why is a governor necessary?
- How does a governor work with a spring?

Equipment and Engine Training Council
100 Small Engine Fundamentals
Task Number 110

Service governor system.

Definition
Service should include

- identifying type of system (i.e., pneumatic, mechanical, electronic)
- inspecting air intake screen
- checking for debris or binding of linkage
- replacing worn or broken parts
- adjusting the governor to operate according to manufacturer’s specifications and instructor’s guidelines.

Process/Skill Questions

- What is an air governor?
- How does a pneumatic governor work?
- How is RPM set?
- Where is the governor gear located, and how does it work?
- How is a governor set before starting an engine?
- How is RPM set?
Servicing Exhaust Systems

Task Number 111

Explain exhaust system theory of a two-stroke engine.

Definition
Explanation should include

- engine cooling
- back pressure
- noise pollution
- engine compression
- scavenging
- emissions.

Process/Skill Questions
- How does the exhaust system of a two-stroke engine function?
- What is the function of a muffler?
- What is back pressure?

Equipment and Engine Training Council
200 Maintenance

206 Exhaust System –1, 3

Task Number 112
Diagnose common equipment problems in a damaged exhaust system of a two-stroke engine.

Definition
Diagnosis should include

- exhaust system restrictions
- power loss
- overheating
- burned pistons.

Process/Skill Questions
- What typically obstructs the exhaust port or muffler on a two-stroke engine?
- How are exhaust ports and mufflers cleaned?

700 Failure Analysis – 6, 7, 8, 9, 10

Task Number 113

Identify exhaust components of a two-stroke engine.

Definition
Identification should include

- deflector
- spark arrestor
- baffles
- catalyst.

Process/Skill Questions
- What is an exhaust port?
- What is a muffler?
- What is a deflector?
Task Number 114

Explain exhaust system theory of a four-stroke engine.

Definition
Explanation should include

- engine cooling
- back pressure
- noise pollution
- scavenging
- emissions
- blower effect.

Process/Skill Questions
- Why is a muffler necessary? What is its function?
- What is back pressure?
- Why should exhaust be carried away from the engine?
- How does the exhaust system function on a four-stroke engine?
Identify cleaning procedures for exhaust ports and spark arrestor screens of a two-stroke engine.

**Definition**
Identification should include decarbonizing fluids and cleaning the port with non-abrasive instruments.

**Process/Skill Questions**
- What is a *spark arrestor screen*, and where is it needed?
- How is an exhaust port cleaned without putting carbon in the engine?
- How is a muffler cleaned without taking it apart?

**Equipment and Engine Training Council**
100 Small Engine Fundamentals

104 Engine Components–43

300 Two Stroke Engine

301 Test a Two Stroke Engine–5

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**Diagnosing and Troubleshooting Small-Engine Equipment**

**Task Number 116**

**Demonstrate the steps of diagnostics and troubleshooting.**

**Definition**
Demonstration should include the following steps:

- Receive information and equipment from customer.
- Verify complaint.
- Determine cause.
- Determine corrective action.
- Determine economic feasibility.

**Process/Skill Questions**

- How should an unverifiable complaint be handled?
- What factors influence the economic feasibility?

**Equipment and Engine Training Council**

500 Troubleshooting,

501 Methods–1

500 Troubleshooting

502 Information Gathering 1, 2, 3, 4, 5, 6, 7, 8

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**Task Number 117**

**Service supporting systems and components.**

**Definition**

Service should include

- inspecting for rust
- inspecting for corrosion
- inspecting pulleys, belts, and bearings (if equipped)
- inspecting for physical damage
- checking for missing shields or safety devices
- removing foreign material from equipment
- lubricating appropriate parts
- following manufacturer’s specifications and instructor’s guidelines.
**Process/Skill Questions**

- What are some signs of corrosion?
- What foreign material is commonly found in small engines?

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<td>95</td>
<td>Service the safety switch.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>96</td>
<td>Explain two-stroke engine theory.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>97</td>
<td>Describe valving systems commonly found in two-stroke engines.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>98</td>
<td>Disassemble a two-stroke engine.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>99</td>
<td>Replace oil seals.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>Task No.</td>
<td>Task/Competency</td>
<td>SOL Correlations</td>
</tr>
<tr>
<td>---------</td>
<td>-----------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>100</td>
<td>Replace a crankshaft.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>101</td>
<td>Install piston rings.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>102</td>
<td>Install a piston.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>103</td>
<td>Replace connecting rods.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>104</td>
<td>Replace a cylinder.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>105</td>
<td>Mix fuel at appropriate ratio.</td>
<td>English: 10.5, 11.5</td>
</tr>
</tbody>
</table>

**Servicing Cooling Systems**

<table>
<thead>
<tr>
<th>Task No.</th>
<th>Task/Competency</th>
<th>SOL Correlations</th>
</tr>
</thead>
<tbody>
<tr>
<td>106</td>
<td>Explain cooling system theory.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>107</td>
<td>Identify liquid cooling system components.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>108</td>
<td>Identify air cooling system components.</td>
<td>English: 10.5, 11.5</td>
</tr>
</tbody>
</table>

**Servicing Governor Systems**

<table>
<thead>
<tr>
<th>Task No.</th>
<th>Task/Competency</th>
<th>SOL Correlations</th>
</tr>
</thead>
<tbody>
<tr>
<td>109</td>
<td>Explain governor system theory.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>110</td>
<td>Service governor system.</td>
<td>English: 10.5, 11.5</td>
</tr>
</tbody>
</table>

**Servicing Exhaust Systems**

<table>
<thead>
<tr>
<th>Task No.</th>
<th>Task/Competency</th>
<th>SOL Correlations</th>
</tr>
</thead>
<tbody>
<tr>
<td>111</td>
<td>Explain exhaust system theory of a two-stroke engine.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>112</td>
<td>Diagnose common equipment problems in a damaged exhaust system of a two-stroke engine.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>113</td>
<td>Identify exhaust components of a two-stroke engine.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>114</td>
<td>Explain exhaust system theory of a four-stroke engine.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>115</td>
<td>Identify cleaning procedures for exhaust ports and spark arrestor screens of a two-stroke engine.</td>
<td>English: 10.5, 11.5</td>
</tr>
</tbody>
</table>

**Diagnosing and Troubleshooting Small-Engine Equipment**

<table>
<thead>
<tr>
<th>Task No.</th>
<th>Task/Competency</th>
<th>SOL Correlations</th>
</tr>
</thead>
<tbody>
<tr>
<td>116</td>
<td>Demonstrate the steps of diagnostics and troubleshooting.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>117</td>
<td>Service supporting systems and components.</td>
<td>English: 10.5, 11.5</td>
</tr>
</tbody>
</table>
Appendix: Credentials, Course Sequences, and Career Cluster Information

Industry Credentials: Only apply to 36-week courses

- Air Cooled Gasoline Engines Expert Technician Test
- College and Work Readiness Assessment (CWRA+)
- Customer Service Examination
- Customer Service Specialist (CSS) Examination
- EETC Technician Certification Tests
- Master Service Technician Examinations
- Motorcycle Service Technology Examination
- National Career Readiness Certificate Assessment
- Power Equipment Technology Examination
- Principles of Small Engine Technology Certification Examination
- Professional Communications Certification Examination
- Small Engine Technology Assessment
- Workplace Readiness Skills for the Commonwealth Examination

Concentration sequences: A combination of this course and those below, equivalent to two 36-week courses, is a concentration sequence. Students wishing to complete a specialization may take additional courses based on their career pathways. A program completer is a student who has met the requirements for a CTE concentration sequence and all other requirements for high school graduation or an approved alternative education program.

- Small Engine Repair (8082/36 weeks)
- Small Engine Technology II (8726/36 weeks, 280 hours)

Career Cluster: Transportation, Distribution and Logistics

<table>
<thead>
<tr>
<th>Pathway</th>
<th>Occupations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facility and Mobile Equipment Maintenance</td>
<td>Small Engine Mechanic</td>
</tr>
<tr>
<td>Transportation Operations</td>
<td>Aircraft Mechanic and Service Technician</td>
</tr>
<tr>
<td></td>
<td>Transportation Manager</td>
</tr>
</tbody>
</table>