Small Engine Technology II

8726/36 weeks

Table of Contents

Acknowledgments.......................................................................................................................... 1
Course Description......................................................................................................................... 2
Task Essentials Table.................................................................................................................... 3
Curriculum Framework................................................................................................................. 5
Applying Safety Practices on the Job .......................................................................................... 5
Performing Lab Operations........................................................................................................... 16
Diagnosing and Troubleshooting a Four-Stroke Engine.............................................................. 23
Diagnosing and Troubleshooting the Fuel System ...................................................................... 27
Diagnosing and Troubleshooting the General Electrical System............................................... 29
Diagnosing and Troubleshooting the Ignition System................................................................. 35
Diagnosing and Troubleshooting Two-Stroke Engines............................................................... 36
Diagnosing and Troubleshooting Small-Engine Equipment....................................................... 38
Performing Thermal Cutting Processes and Welding Operations .......................................... 40
Maintaining Wheels and Tires..................................................................................................... 42
Repairing Fasteners..................................................................................................................... 44
SOL Correlation by Task.............................................................................................................. 45
Appendix: Credentials, Course Sequences, and Career Cluster Information ............................. 51

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
Course Description

Suggested Grade Level: 11 or 12

Prerequisite: Small Engine Technology I 8725

Students continue to 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, ATVs). Students analyze causes of engine failure and perform diagnostic and troubleshooting operations. This program leads to potential certifications in Equipment and Engine Training Council (EETC) and qualifies students for positions in small engine labs, technical schools, or the military.

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.

<table>
<thead>
<tr>
<th>Task Number</th>
<th>8726</th>
<th>Tasks/Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Applying Safety Practices on the Job</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>⊕</td>
<td>Identify marked safety areas.</td>
</tr>
<tr>
<td>40</td>
<td>⊕</td>
<td>Identify the location and use of industry-accepted safety devices.</td>
</tr>
<tr>
<td>41</td>
<td>⊕</td>
<td>Identify the location of the posted evacuation routes.</td>
</tr>
<tr>
<td>42</td>
<td>⊕</td>
<td>Demonstrate knowledge of safety data sheets (SDS).</td>
</tr>
<tr>
<td>43</td>
<td>⊕</td>
<td>Demonstrate the safe use of chemicals.</td>
</tr>
<tr>
<td>44</td>
<td>⊕</td>
<td>Demonstrate the safe use of standard and metric hand tools.</td>
</tr>
<tr>
<td>45</td>
<td>⊕</td>
<td>Demonstrate the safe use of power tools.</td>
</tr>
<tr>
<td>46</td>
<td>⊕</td>
<td>Demonstrate the safe use of lab equipment, lifting equipment, and blocking equipment.</td>
</tr>
<tr>
<td>47</td>
<td>⊕</td>
<td>Demonstrate the safe use of diagnostic and testing equipment.</td>
</tr>
<tr>
<td>48</td>
<td>⊕</td>
<td>Demonstrate the safe use of standard and metric precision measuring tools.</td>
</tr>
<tr>
<td>49</td>
<td>⊕</td>
<td>Demonstrate the safe use of protective clothing and equipment.</td>
</tr>
<tr>
<td>50</td>
<td>⊕</td>
<td>Demonstrate the safe use of fire protection equipment.</td>
</tr>
<tr>
<td>51</td>
<td>⊕</td>
<td>Demonstrate the safe use of outdoor power equipment.</td>
</tr>
<tr>
<td>52</td>
<td>⊕</td>
<td>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).</td>
</tr>
<tr>
<td><strong>Performing Lab Operations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>53</td>
<td>⊕</td>
<td>Maintain a daily and weekly work schedule.</td>
</tr>
<tr>
<td>54</td>
<td>⊕</td>
<td>Maintain a time record for each lab job.</td>
</tr>
<tr>
<td>55</td>
<td>⊕</td>
<td>Determine economic feasibility of repair.</td>
</tr>
<tr>
<td>56</td>
<td>⊕</td>
<td>Write a service order.</td>
</tr>
<tr>
<td>57</td>
<td>⊕</td>
<td>Calculate labor cost using a flat rate manual.</td>
</tr>
<tr>
<td>58</td>
<td>⊕</td>
<td>Identify the importance of a work order.</td>
</tr>
<tr>
<td>59</td>
<td>⊕</td>
<td>Interpret manufacturer’s illustrated parts lists (IPL) and schematics.</td>
</tr>
<tr>
<td>60</td>
<td>⊕</td>
<td>Prepare warranty reports.</td>
</tr>
<tr>
<td>61</td>
<td>◯</td>
<td>Adhere to inventory controls.</td>
</tr>
<tr>
<td>62</td>
<td>⊕</td>
<td>Maintain a clean and orderly lab and work area according to OSHA standards.</td>
</tr>
<tr>
<td>Task Number</td>
<td>8726</td>
<td>Tasks/Competencies</td>
</tr>
<tr>
<td>-------------</td>
<td>------</td>
<td>--------------------</td>
</tr>
<tr>
<td>63</td>
<td></td>
<td>Demonstrate understanding of cutting attachment operation, replacement, and sharpening.</td>
</tr>
<tr>
<td>64</td>
<td></td>
<td>Prepare equipment for delivery.</td>
</tr>
<tr>
<td><strong>Diagnosing and Troubleshooting a Four-Stroke Engine</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>65</td>
<td></td>
<td>Determine wear on internal engine parts using precision standard and metric measuring tools.</td>
</tr>
<tr>
<td>66</td>
<td></td>
<td>Service engine cylinder.</td>
</tr>
<tr>
<td>67</td>
<td></td>
<td>Diagnose compression problems.</td>
</tr>
<tr>
<td>68</td>
<td></td>
<td>Reassemble a long block.</td>
</tr>
<tr>
<td>69</td>
<td></td>
<td>Diagnose needed repair on four-stroke engine components.</td>
</tr>
<tr>
<td><strong>Diagnosing and Troubleshooting the Fuel System</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70</td>
<td></td>
<td>Service the fuel pump.</td>
</tr>
<tr>
<td>71</td>
<td></td>
<td>Service the fuel system.</td>
</tr>
<tr>
<td>72</td>
<td></td>
<td>Describe the components and operation of an electronic fuel injection system.</td>
</tr>
<tr>
<td><strong>Diagnosing and Troubleshooting the General Electrical System</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>73</td>
<td></td>
<td>Service a direct current (DC) electric starter/generator.</td>
</tr>
<tr>
<td>74</td>
<td></td>
<td>Troubleshoot the charging circuit, using a manufacturer's guide.</td>
</tr>
<tr>
<td>75</td>
<td></td>
<td>Service the starter/generator pulley and belt.</td>
</tr>
<tr>
<td>76</td>
<td></td>
<td>Service the alternator.</td>
</tr>
<tr>
<td>77</td>
<td></td>
<td>Explain how alternating current (AC) is converted to DC voltage.</td>
</tr>
<tr>
<td>78</td>
<td></td>
<td>Service alternator components.</td>
</tr>
<tr>
<td>79</td>
<td></td>
<td>Service the starting circuit.</td>
</tr>
<tr>
<td>80</td>
<td></td>
<td>Repair signs of corrosion or damage in an electrical system.</td>
</tr>
<tr>
<td><strong>Diagnosing and Troubleshooting the Ignition System</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>81</td>
<td></td>
<td>Service a coil/magneto.</td>
</tr>
<tr>
<td>82</td>
<td></td>
<td>Explain the operation of an electronic ignition system.</td>
</tr>
<tr>
<td><strong>Diagnosing and Troubleshooting Two-Stroke Engines</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>83</td>
<td></td>
<td>Diagnose two-stroke engine components.</td>
</tr>
<tr>
<td>84</td>
<td></td>
<td>Determine wear on internal engine parts using precision standard and metric measuring tools.</td>
</tr>
<tr>
<td><strong>Diagnosing and Troubleshooting Small-Engine Equipment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>85</td>
<td></td>
<td>Adjust controls (i.e., cables, rods, and springs).</td>
</tr>
<tr>
<td>86</td>
<td></td>
<td>Service drive trains and power take-off (PTO) systems.</td>
</tr>
<tr>
<td>87</td>
<td></td>
<td>Identify the five major categories of failure analysis for two- and four-stroke engines.</td>
</tr>
<tr>
<td><strong>Performing Thermal Cutting Processes and Welding Operations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>88</td>
<td></td>
<td>Use an oxy-acetylene torch.</td>
</tr>
<tr>
<td>89</td>
<td></td>
<td>Operate gas metal arc welding equipment.</td>
</tr>
<tr>
<td>90</td>
<td></td>
<td>Operate manual plasma arc cutting equipment.</td>
</tr>
<tr>
<td><strong>Maintaining Wheels and Tires</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>91</td>
<td></td>
<td>Inspect tire condition.</td>
</tr>
<tr>
<td>Task Number</td>
<td>Tasks/Competencies</td>
<td></td>
</tr>
<tr>
<td>-------------</td>
<td>--------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>92</td>
<td>Service a wheel.</td>
<td></td>
</tr>
<tr>
<td>93</td>
<td>Repair an off-road tire, using an internal patch or plug.</td>
<td></td>
</tr>
<tr>
<td>94</td>
<td>Repair an on-road tire.</td>
<td></td>
</tr>
<tr>
<td><strong>Repairing Fasteners</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>95</td>
<td>Repair damaged thread using a tap and die set.</td>
<td></td>
</tr>
<tr>
<td>96</td>
<td>Repair damaged thread using thread inserts (i.e., helicoil thread insert).</td>
<td></td>
</tr>
</tbody>
</table>

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:

- Eye-wash station
- Lockout/tagout
- Universal spill kit
- Fire/First-aid blanket

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?

Equipment and Engine Training Council
104 Emergency Awareness—2

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?

Equipment and Engine Training Council
105 Regulations–3

Task Number 43

Demonstrate the safe use of chemicals.

Definition
Demonstration should include the different types of solvents, soaps, cleaning solutions, fuel, oils, greases, specialty additives, and gases. 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
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

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

---

**Performing Lab Operations**

---

**Task Number 53**

Maintain a daily and weekly work schedule.

**Definition**
Maintaining a work schedule should
- encourage integrity on the part of the employee/employer
- facilitate the delegation of jobs.
Process/Skill Questions
- What are the benefits of posting both a daily and weekly work schedule in a shop?
- Who assigns the job positions?

Task Number 54
Maintain a time record for each lab job.

Definition
Maintenance of a time record for each job should emphasize the need for detail, accuracy, and honesty on the part of the employee, both to meet the customer’s satisfaction and to chart the employee's history of service.

Process/Skill Questions
- Who keeps a time record?
- Why keep a time record? What is a time record?

Task Number 55
Determine economic feasibility of repair.

Definition
Determination should include feasibility of repair and must be made based on

- extent of damage
- age of engine
- cost of full replacement versus the cost of labor and parts necessary for repair.

These factors must be communicated clearly to the customer/owner so that he/she can make an informed decision.

Process/Skill Questions
- How is economic feasibility determined?
- What are the benefits of accurately estimating prices and repairs?
Task Number 56

Write a service order.

Definition
Writing process should include

- listening carefully to the customer
- listing all required unit identification information prior to inspection
- performing an initial examination to identify the problem
- writing in a clear, accurate, and professional manner, according to industry practice and instructor’s guidelines
- communicating with the customer regarding the cause and the prevention of future problems.

Process/Skill Questions

- Who writes a service order?
- What is the purpose of a service order?
- When would a service order include an estimate of the cost for the repair?
- Why is it beneficial to practice writing service orders?
- What is a service order?

Equipment and Engine Training Council
200 Shop Practices–1

600 Four Stroke Engine Service–21

Task Number 57

Calculate labor cost using a flat rate manual.
Definition
Calculation should be made based on engine evaluation and the required repair tasks using an up-to-date manual.

Process/Skill Questions
- Why use a flat rate manual?
- Who uses a flat rate manual?
- Does a small engine repair shop have to use a flat rate manual?

Equipment and Engine Training Council
300 Technical Publications–3

Task Number 58
Identify the importance of a work order.

Definition
Identification should include

- correct interpretation of work orders written by another technician
- proper use of technical terms.

Process/Skill Questions
- What is the difference between a work order and an invoice?
- What is the deficiency listed on the work order along with the work performed?
- What happens to the original work order if it is incorrect and a deficiency is discovered?

Equipment and Engine Training Council
200 Shop Practices–1

Task Number 59
Interpret manufacturer’s illustrated parts lists (IPL) and schematics.

Definition
Interpretation should include

- identification of the types of lab manuals (e.g., manufacturer, professional general, after-market specialty)
- the formats of manuals (e.g., printed and electronic)
- the methods of locating information in them (e.g., table of contents, index, special numbering systems)
- identification of superseded and no longer available replacement parts.

Process/Skill Questions
- What is the purpose of schematics?
- What happens when schematics in the manual are unclear or confusing?
- What should a repair technician do if superseded or replacement parts are not the same size?
- What is needed to replace parts?

Equipment and Engine Training Council
300 Technical Publications–4

Task Number 60

Prepare warranty reports.

Definition
Preparation should include reports made according to industry standards and should reflect deficiencies encountered.

Process/Skill Questions
- Whose responsibility is it to prepare warranty reports?
- What is the process for replacing a part by warranty?
Task Number 61  Optional

Adhere to inventory controls.

Definition
Adherence should be based on

- type of inventory system
- marketing information
- anticipated rate of business
- use of new technologies in the small engine industry.

Process/Skill Questions
- What is generally inventoried in a small engine repair lab?
- When should new parts and supplies be ordered?
- Who is responsible for maintaining a well-stocked inventory?
- What is the general process for recording an inventory change when stock is used for repair?

Task Number 62

Maintain a clean and orderly lab and work area according to OSHA standards.

Definition
Maintenance should ensure

- neat and well-maintained office, storage, customer, lab, and grounds areas
clean and regularly maintained tools and equipment

precautions for keeping the 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 tidy 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
100 Shop Safety

102 Work Environment–1

Task Number 63 Optional

Demonstrate understanding of cutting attachment operation, replacement, and sharpening.

Definition
The demonstration should include use of the following types of cutters:

- Rotary blade
- Saw chain
- String trimmer line

Process/Skill Questions

- How does one secure the rotary blade to loosen the hardware?
- What tool is used to hand-sharpen a saw chain?
- What is the purpose of a depth gauge for a saw chain?

Equipment and Engine Training Council
300 Two Stroke Engine
Task Number 64

Prepare equipment for delivery.

Definition
Preparation should include, after making repairs,

- retesting and verifying correct operation
- inspecting the work completed
- completing paperwork, making delivery arrangements.

Process/Skill Questions

- How should a service job be prepared for delivery or pickup after completion?
- Who handles the final paperwork, such as billing and packing?
- Who is responsible for performing the final inspection on the repair?

Diagnosing and Troubleshooting a Four-Stroke Engine

Task Number 65

Determine wear on internal engine parts using precision standard and metric measuring tools.

Definition
Determination should include
identifying wear points of internal engine parts

checking parts for wear

using appropriate tools and precision measuring devices, according to manufacturer’s specifications and instructor’s guidelines.

**Process/Skill Questions**

- What precision tools are used to measure internal engine parts?
- Why are precise measurements critical in the process of rebuilding a four-stroke engine?
- Why must extreme care be given to precision measuring instruments?

**Equipment and Engine Training Council**

400 Tools and Equipment

403 Precision Measuring Tools –1, 2, 3

---

**Task Number 66**

**Service engine cylinder.**

**Definition**

Process should include

- inspecting cylinder walls for damage
  - honing
  - deglazing
  - resizing
- using appropriate tools, according to manufacturer’s specifications and instructor’s guidelines.

**Process/Skill Questions**

- When should a ridge reamer be used on a cylinder block?
- What causes the ridge to form around the top of a cylinder?
- What safety issues are related to ridge reaming?
- Why would a cylinder require deglazing?
- Why would a cylinder require boring?
- What precision tools are used in the boring process?

**Equipment and Engine Training Council**

600 Four Stroke Engine Service–4, 5

---

**Task Number 67**

**Diagnose compression problems.**

**Definition**

Diagnosis should include following manufacturer’s specifications and instructor’s guidelines and should include

- inspecting and testing valve springs for squareness, pressure, and free height comparison; replacing as needed
- replacing valve stem seals
- inspecting valve guides for wear; checking valve lash; reconditioning as needed
- inspecting valves for replacement
- inspecting valve seats; resurfacing or replacing
- checking valve face-to-seat contact and 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?
Task Number 68

Reassemble a long block.

Definition

Reassembly should include

- reinstalling cylinder head, remaining gasket pans, covers, and shielding
- torquing all fasteners, according to manufacturer’s specifications and instructor’s guidelines.

Process/Skill Questions

- What resources do repair technicians use to determine reassembly clearances and tolerances?
- Why is cleanliness an important part of engine reassembly?
- How can proper reassembly prevent future problems for the customer?

Equipment and Engine Training Council

600 Four Stroke Engine Service–11

Task Number 69

Diagnose needed repair on four-stroke engine components.

Definition

Diagnosis should include

- interpreting and verifying complaint; determining needed repairs
- inspecting engine assembly for fuel, oil, coolant, and other leaks; determining needed repairs
- listening to engine noises; determining needed repairs
- identifying problem area for no-start condition
• diagnosing the cause of excessive oil consumption and unusual engine exhaust color, odor, and sound; determining needed repairs
• performing engine vacuum tests; determining needed repairs
• performing cylinder compression tests; determining needed repairs
• performing cylinder leakage tests; determining needed repairs.

Process/Skill Questions
• What procedure is used to diagnose problems with a four-stroke engine?
• How is the economic feasibility of repairing a four-stroke engine determined?
• What customer-related issues are involved with determining needed repairs?

Equipment and Engine Training Council
500 Four Stroke Engine Diagnosis – 4, 5, 6, 7, 22

Diagnosing and Troubleshooting the Fuel System

Task Number 70

Service the fuel pump.

Definition
Service should include inspecting the condition of

• needle valve and seat function
• diaphragm function
• spring condition
• body housing for warping, according to manufacturer's specifications and instructor's guidelines.
Process/Skill Questions
- What is the function of the fuel pump?
- What tools are needed to disassemble a fuel pump?
- How is a fuel pump cleaned?
- What type of fuel pump works the most efficiently?
- How is fuel pressure checked?

Task Number 71
Service the fuel system.

Definition
Service should include inspecting the condition of
- fuel tank
- fuel lines
- fuel filter
- evaporative emission system.

Process/Skill Questions
- How should one dispose of used gasoline?
- How often should fuel be tested for spoilage?
- Why should a fuel system maintain good fuel pressure?
- How does ethanol affect fuel system components?

Equipment and Engine Training Council
200 Maintenance

204 Fuel System Engine Maintenance–10, 11

Task Number 72
Describe the components and operation of an electronic fuel injection system.

**Definition**
Description should include

- high-pressure fuel pump
- high-pressure fuel lines
- injectors
- fuel pressure regulators
- fuel pressure test
- sensors control module.

**Process/Skill Questions**
- What are the advantages of a fuel injection system compared to carburetion?
- What are safety considerations when working with high-pressure fuel systems?
- What are the components of a fuel injection system?

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

104 Engine Components–36

---

**Diagnosing and Troubleshooting the General Electrical System**

**Task Number 73**

Service a direct current (DC) electric starter/generator.
**Definition**
Service should include following manufacturer’s specifications and instructor’s guidelines, cleaning starter/generator, and checking for

- open- or short-circuits
- commentator with growler
- condition of brushes
- condition of bearings.

**Process/Skill Questions**
- What conditions would lead to service or repair of a DC starter/generator?
- How would the repair procedure be determined?
- What is the difference in servicing and repairing a DC starter/generator?

---

**Task Number 74**

**Troubleshoot the charging circuit, using a manufacturer's guide.**

**Definition**
Troubleshooting should include using a manufacturer's guide to check for open- and short-circuits and malfunction of electrical components and should be done according to manufacturer's specifications and instructor's guidelines.

**Process/Skill Questions**
- What process is used in troubleshooting?
- When would troubleshooting be necessary?
- Where would one find the starting point for determining the problem?

**Equipment and Engine Training Council**
100 Electrical Systems
101 Electrical Theory–30
Task Number 75

Service the starter/generator pulley and belt.

Definition
Service should include

- checking the pulley, the keyway, and the belt for wear, according to manufacturer’s specifications and instructor’s guidelines
- reinstalling the starter/generation pulley and belt and torque pulley nut, according to manufacturer’s specifications and instruction’s guidelines.

Process/Skill Questions
- Why would the starter/generator pulley and belt need cleaning and inspecting?
- What problems could this inspection prevent?
- Why do we clean before inspecting?
- What conditions would lead to replacement of the pulley or belt?
- Why is proper belt tension important when replacing the belt?
- What safety procedures would apply to replacement of the pulley/belt?

Task Number 76

Service the alternator.

Definition
Service should include following manufacturer’s specifications and instructor’s guidelines; visual inspection should include checking for

- broken or loose components
- burned wiring
- melted components.

Process/Skill Questions
- Why would the alternator need cleaning/inspecting?
What problems would we be looking for in a visual inspection?

What problems could this inspection prevent?

Equipment and Engine Training Council
100 Electrical Systems

101 Electrical Theory–41

Task Number 77

Explain how alternating current (AC) is converted to DC voltage.

Definition
Explanation should include a description of voltage regulation and various methods used to convert AC to DC (e.g., diodes, full wave and half wave rectifiers).

Process/Skill Questions

● When would AC need to be converted to DC?

● What regulates the voltage on an air-cooled four-stroke engine?

Equipment and Engine Training Council
100 Electrical Systems

101 Electrical Theory–28, 29, 31, 32

Task Number 78

Service alternator components.

Definition
Service should include following manufacturer’s specifications and instructor’s guidelines; process should include disassembling alternator and testing

● diodes and bridge
- tetrodes
- slip rings
- brushes
- starter windings
- rotor
- bearings
- capacitors.

**Process/Skill Questions**

- Under what conditions would we choose to replace rather than repair components of the alternator?
- What procedure would be used to determine if a component needs replacing?
- What safety procedures would be followed in repair of an alternator?

**Equipment and Engine Training Council**

100 Electrical Systems

101 Electrical Theory–41

---

**Task Number 79**

**Service the starting circuit.**

**Definition**

Service should include following manufacturer's specifications and instructor's guidelines; repair should include checking for

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

Process/Skill Questions
• Why is using the correct procedure important in troubleshooting electrical starting circuit problems?
• What potential problems could develop from improper troubleshooting of a starting circuit problem?
• How could improper diagnosis of a starting circuit problem lead to customer dissatisfaction?

Equipment and Engine Training Council
100 Small Engine Fundamentals,

100 Electrical Systems

101 Electrical Theory—13, 20, 23, 39, 42, 43,

104 Engine Components—49, 50

500 Four Stroke Engine Diagnosis—21

Task Number 80

Repair signs of corrosion or damage in an electrical system.

Definition
Repair should include cleaning corrosion from connectors, terminals, and wire ends and replacing a terminal or connector on a wiring harness.

Process/Skill Questions
• How does one remove corrosion from a terminal/connector?
• What is the purpose of heat shrink?
• What is dielectric grease?
• What type of tape is used for electrical connections or repairs?
• What is soldering?
Diagnosing and Troubleshooting the Ignition System

Task Number 81

Service a coil/magneto.

Definition
Service should include

- testing for proper output
- testing primary and secondary circuits
- removing and replacing parts, according to manufacturer’s specifications and instructor’s guidelines.

Process/Skill Questions
- What tool is used to determine whether a magneto/coil needs replacing?
- What part does magnetism play in the production of spark from a magneto/coil?
- Under what conditions would a magneto/coil be replaced?
Explain the operation of an electronic ignition system.

**Definition**

Explanation should include

- examples of electronic ignition systems (e.g., capacitor discharge ignition, silicon-controlled rectifier, transistorized ignition)
- components of electronic ignition systems
- theory of operation
- voltage requirements
- triggering devices for each type
- the difference between standard or advancing magnetron systems.

**Process/Skill Questions**

- What types of engines typically use electronic ignitions?
- What are the most common problems with the operation of electronic ignition systems?

---

**Equipment and Engine Training Council**

500 Four Stroke Engine Diagnosis –9, 12, 14, 16, 19

---

Diagnosing and Troubleshooting Two-Stroke Engines

---

**Task Number 83**

Diagnose two-stroke engine components.

**Definition**

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

- interpreting and verifying complaint
• inspecting engine assembly for leaks
• listening to engine noises
• inspecting reed valves
• inspecting piston skirt and cylinder walls for scoring and wear
• diagnosing the cause of excessive oil consumption, unusual engine exhaust color, odor, and sound
• performing engine vacuum tests
• performing cylinder compression tests
• performing cylinder leakage tests
• determining needed repairs for each component.

Process/Skill Questions
• What procedure would one use to diagnose problems with a two-stroke engine?
• How would one determine the economic feasibility of repairing a two-stroke engine?
• What customer-related issues are involved with determining needed repairs?

Equipment and Engine Training Council

300 Two Stroke Engine

301 Two Stroke Engine–1, 3, 6, 7, 12

Task Number 84

Determine wear on internal engine parts using precision standard and metric measuring tools.

Definition
Determination should be made by identifying wear points of internal engine parts and checking them for wear, using appropriate tools and precision measuring devices, according to manufacturer's specifications and instructor's guidelines.

Process/Skill Questions
• What precision tools are used in the measurement of internal engine parts?
Why are precision measurements critical in the process of rebuilding a two-stroke engine?

Why must extreme care be given to precision measuring instruments?

Equipment and Engine Training Council
400 Two Stroke Engine Overhaul

401 Disassembly, Inspection, and Repair–1, 4

Diagnosing and Troubleshooting Small-Engine Equipment

Task Number 85

Adjust controls (i.e., cables, rods, and springs).

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

- adjusting for proper releasing
- adjusting to proper full engagement
- inspecting for any sticking or binding to impede function of related part.

Process/Skill Questions
- Where does one find how to make control adjustments?
- What part does safety play in all adjustments?
- What types of adjusters will one find on lawn and garden equipment?

Task Number 86
Service drive trains and power take-off (PTO) systems.

Definition
Service should include

- recognizing evidence of wear
- gathering appropriate information regarding recommended replacement.

Process/Skill Questions

- What is a V-belt, and why is it in the shape of a V?
- What grade of belts do mowers need?
- When is a belt too loose or too tight?

Equipment and Engine Training Council
100 Small Engine Fundamentals

104 Engine Components—48

Task Number 87

Identify the five major categories of failure analysis for two- and four-stroke engines.

Definition
Identification should include the following categories of failure analysis on various engines and engine components:

- Abrasives
- Insufficient lubrication
- Breakage
- Overspeeding
  - Overheating
- Fuel quality two stroke
**Process/Skill Questions**

- What is meant by *failure*?
- After the failure is identified, how is its cause determined?
- What are the objectives of conducting a failure analysis?
- What are the entrance paths for abrasives on small engines?

**Equipment and Engine Training Council**

700 Failure Analysis – 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17

---

**Performing Thermal Cutting Processes and Welding Operations**

---

**Task Number 88  Optional**

**Use an oxy-acetylene torch.**

**Definition**

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

- torch safety (emergency shutdown)
- setting of gauges
- lighting and adjusting flame
- proper use of torch head
- proper use of cutting attachments
- proper shut down to eliminate backfire.

**Process/Skill Questions**

- What is an oxy-acetylene torch?
- Why do we need eye protection?
- What other safety factors are involved?
Task Number 89 Optional

Operate gas metal arc welding equipment.

Definition
Operation should include

- adhering to a welding assignment or op sheet
- selecting proper material
- using protective clothing and accessories.

Process/Skill Questions

- What are the safety concerns regarding gas metal arc welding equipment?
- What is the proper PPE for gas metal arc welding equipment?

Task Number 90 Optional

Operate manual plasma arc cutting equipment.

Definition
Operation should include

- adhering to a welding assignment or op sheet
- wearing protective clothing and selecting appropriate accessories
- beginning and maintaining the plasma arc on carbon steel.

Process/Skill Questions

- What are the safety concerns regarding manual plasma arc equipment?
- What is the proper PPE for plasma arc cutting equipment?
Maintaining Wheels and Tires

Task Number 91

Inspect tire condition.

Definition
Inspection should include conducting a visual inspection according to state inspection procedures and using specialized tools according to manufacturer guidelines to

- identify tire wear patterns
- check for correct size and application (load and speed ratings)
- adjust air pressure
- determine necessary action.

Process/Skill Questions
- How can tire wear patterns indicate under-inflation? Over-inflation? Camber problems? Toe problems?
- How can tire wear patterns indicate loose suspension parts? Faulty shocks/struts? Out of balance?
- Where does one find tire-pressure specifications?

Task Number 92  Optional

Service a wheel.

Definition
Service should include conducting a visual inspection according to state inspection procedures and using specialized tools (e.g., tire machine, tire balancer) according to manufacturer guidelines.

Process/Skill Questions
- What is the difference between static and dynamic balance?
• What is the purpose of the drop-center rim?
• How are tires removed from AH2 rims?
• What is the maximum bead seating pressure of typical automobile radial tires? Run-flat tires?

---

**Task Number 93**

**Repair an off-road tire, using an internal patch or plug.**

**Definition**

Repair should include

• reaming injury hole
• cleaning area
• applying glue
• installing patch or plug
• verifying integrity of patch or plug.

**Process/Skill Questions**

• What are the advantages of a plug rather than a patch?
• What is the repairable area of the tire?
• What is the largest hole that can be successfully repaired?

---

**Task Number 94  Optional**

**Repair an on-road tire.**

**Definition**

Repair should include

• removing tire from wheel
• reaming injury hole
- cleaning area
- applying glue
- installing patch
- stitching patch
- applying liner sealer
- reinstalling tire
- verifying integrity of patch.

**Process/Skill Questions**
- Why should one use a patch as opposed to a plug?
- What is the repairable area of the tire?
- What is the largest hole that can be successfully repaired?

---

**Repairing Fasteners**

**Task Number 95**

**Repair damaged thread using a tap and die set.**

**Definition**
Repair should follow industry standards and instructor’s guidelines and should include

- identifying thread (pitch and size, metric or S.A.E.)
- correlating to proper tap or die.

**Process/Skill Questions**
- What is the difference between a tap and a die?
- When drilling for a given thread size, how is the correct hole size determined?
- When repairing a damaged thread, is a tapping fluid always used?
- When using a tap wrench, is there a pattern to follow?
Task Number 96

Repair damaged thread using thread inserts (i.e., helicoil thread insert).

Definition
Repair should follow manufacturer’s instructions and instructor’s guidelines and should include

- determining appropriate size of threads to be installed
- using the appropriate kit
- following kit instructions.

Process/Skill Questions

- Where can thread inserts be found?
- What materials are used in thread inserts?
- Why are thread inserts used?

SOL Correlation by Task

<table>
<thead>
<tr>
<th>Task/Competency</th>
<th>SOL Correlations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applying Safety Practices on the Job</td>
<td></td>
</tr>
<tr>
<td>39 Identify marked safety areas.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td></td>
<td>History: WHII 8</td>
</tr>
<tr>
<td></td>
<td>VUS 8</td>
</tr>
<tr>
<td>Task/Competency</td>
<td>SOL Correlations</td>
</tr>
<tr>
<td>-----------------------------------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>40 Identify the location and use of industry-accepted safety devices.</td>
<td>Govt 7, 8, 9</td>
</tr>
<tr>
<td></td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td></td>
<td>History:</td>
</tr>
<tr>
<td></td>
<td>WHII 8</td>
</tr>
<tr>
<td></td>
<td>VUS 8</td>
</tr>
<tr>
<td></td>
<td>Govt 7, 8, 9</td>
</tr>
<tr>
<td>41 Identify the location of the posted evacuation routes.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td></td>
<td>History:</td>
</tr>
<tr>
<td></td>
<td>WHII 8</td>
</tr>
<tr>
<td></td>
<td>VUS 8</td>
</tr>
<tr>
<td></td>
<td>Govt 7, 8, 9</td>
</tr>
<tr>
<td>42 Demonstrate knowledge of safety data sheets (SDS).</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td></td>
<td>History:</td>
</tr>
<tr>
<td></td>
<td>WHII 8</td>
</tr>
<tr>
<td></td>
<td>VUS 8</td>
</tr>
<tr>
<td></td>
<td>Govt 7, 8, 9</td>
</tr>
<tr>
<td></td>
<td>Science:</td>
</tr>
<tr>
<td></td>
<td>CH.1</td>
</tr>
<tr>
<td>43 Demonstrate the safe use of chemicals.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td></td>
<td>History:</td>
</tr>
<tr>
<td></td>
<td>WHII 8</td>
</tr>
<tr>
<td></td>
<td>VUS 8</td>
</tr>
<tr>
<td></td>
<td>Govt 7, 8, 9</td>
</tr>
<tr>
<td></td>
<td>Science:</td>
</tr>
<tr>
<td></td>
<td>CH.1</td>
</tr>
<tr>
<td>44 Demonstrate the safe use of standard and metric hand tools.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td></td>
<td>History:</td>
</tr>
<tr>
<td></td>
<td>WHII 8</td>
</tr>
<tr>
<td></td>
<td>VUS 8</td>
</tr>
<tr>
<td></td>
<td>Govt 7, 8, 9</td>
</tr>
<tr>
<td>45 Demonstrate the safe use of power tools.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td></td>
<td>History:</td>
</tr>
<tr>
<td></td>
<td>WHII 8</td>
</tr>
<tr>
<td></td>
<td>VUS 8</td>
</tr>
<tr>
<td></td>
<td>Govt 7, 8, 9</td>
</tr>
<tr>
<td>Task/Competency</td>
<td>SOL Correlations</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td>46 Demonstrate the safe use of lab equipment, lifting equipment, and blocking equipment.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td></td>
<td>History:</td>
</tr>
<tr>
<td></td>
<td>WHII 8</td>
</tr>
<tr>
<td></td>
<td>VUS 8</td>
</tr>
<tr>
<td></td>
<td>Govt 7, 8, 9</td>
</tr>
<tr>
<td>47 Demonstrate the safe use of diagnostic and testing equipment.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td></td>
<td>History:</td>
</tr>
<tr>
<td></td>
<td>WHII 8</td>
</tr>
<tr>
<td></td>
<td>VUS 8</td>
</tr>
<tr>
<td></td>
<td>Govt 7, 8, 9</td>
</tr>
<tr>
<td>48 Demonstrate the safe use of standard and metric precision measuring tools.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td></td>
<td>History:</td>
</tr>
<tr>
<td></td>
<td>WHII 8</td>
</tr>
<tr>
<td></td>
<td>VUS 8</td>
</tr>
<tr>
<td></td>
<td>Govt 7, 8, 9</td>
</tr>
<tr>
<td>49 Demonstrate the safe use of protective clothing and equipment.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td></td>
<td>History:</td>
</tr>
<tr>
<td></td>
<td>WHII 8</td>
</tr>
<tr>
<td></td>
<td>VUS 8</td>
</tr>
<tr>
<td></td>
<td>Govt 7, 8, 9</td>
</tr>
<tr>
<td>50 Demonstrate the safe use of fire protection equipment.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td></td>
<td>History:</td>
</tr>
<tr>
<td></td>
<td>WHII 8</td>
</tr>
<tr>
<td></td>
<td>VUS 8</td>
</tr>
<tr>
<td></td>
<td>Govt 7, 8, 9</td>
</tr>
<tr>
<td></td>
<td>Science:</td>
</tr>
<tr>
<td></td>
<td>CH.1</td>
</tr>
<tr>
<td>51 Demonstrate the safe use of outdoor power equipment.</td>
<td>History:</td>
</tr>
<tr>
<td></td>
<td>WHII 8</td>
</tr>
<tr>
<td></td>
<td>VUS 8</td>
</tr>
<tr>
<td></td>
<td>Govt 7, 8, 9</td>
</tr>
<tr>
<td>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).</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td></td>
<td>History:</td>
</tr>
<tr>
<td></td>
<td>WHII 8</td>
</tr>
<tr>
<td></td>
<td>VUS 8</td>
</tr>
<tr>
<td>Task/Competency</td>
<td>SOL Correlations</td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------------</td>
</tr>
<tr>
<td></td>
<td>Govt 7, 8, 9</td>
</tr>
<tr>
<td></td>
<td>Science: CH.1</td>
</tr>
</tbody>
</table>

### Performing Lab Operations

<table>
<thead>
<tr>
<th>Task/Competency</th>
<th>SOL Correlations</th>
</tr>
</thead>
<tbody>
<tr>
<td>53 Maintain a daily and weekly work schedule.</td>
<td>English: 11.1, 11.5, 12.1, 12.5</td>
</tr>
<tr>
<td>54 Maintain a time record for each lab job.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>55 Determine economic feasibility of repair.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>56 Write a service order.</td>
<td>English: 11.1, 11.5, 12.1, 12.5</td>
</tr>
<tr>
<td>57 Calculate labor cost using a flat rate manual.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>58 Identify the importance of a work order.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>59 Interpret manufacturer’s illustrated parts lists (IPL) and schematics.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>60 Prepare warranty reports.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>61 Adhere to inventory controls.</td>
<td>English: 11.5, 11.8, 12.5, 12.8</td>
</tr>
<tr>
<td>62 Maintain a clean and orderly lab and work area according to OSHA standards.</td>
<td>History: WHII 8 VUS 8 Govt 7, 8, 9</td>
</tr>
<tr>
<td>63 Demonstrate understanding of cutting attachment operation, replacement, and sharpening.</td>
<td></td>
</tr>
<tr>
<td>64 Prepare equipment for delivery.</td>
<td>English: 11.5, 11.6, 12.5, 12.6</td>
</tr>
</tbody>
</table>

### Diagnosing and Troubleshooting a Four-Stroke Engine

<table>
<thead>
<tr>
<th>Task/Competency</th>
<th>SOL Correlations</th>
</tr>
</thead>
<tbody>
<tr>
<td>65 Determine wear on internal engine parts using precision standard and metric measuring tools.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>66 Service engine cylinder.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>67 Diagnose compression problems.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>68 Reassemble a long block.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>69 Diagnose needed repair on four-stroke engine components.</td>
<td>English: 11.5, 12.5</td>
</tr>
</tbody>
</table>

### Diagnosing and Troubleshooting the Fuel System

<table>
<thead>
<tr>
<th>Task/Competency</th>
<th>SOL Correlations</th>
</tr>
</thead>
<tbody>
<tr>
<td>70 Service the fuel pump.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>71 Service the fuel system.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>72 Describe the components and operation of an electronic fuel injection system.</td>
<td>English: 11.5, 12.5</td>
</tr>
</tbody>
</table>

### Diagnosing and Troubleshooting the General Electrical System

<table>
<thead>
<tr>
<th>Task/Competency</th>
<th>SOL Correlations</th>
</tr>
</thead>
<tbody>
<tr>
<td>73 Service a direct current (DC) electric starter/generator.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>Task/Competency</td>
<td>SOL Correlations</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td><strong>74</strong> Troubleshoot the charging circuit, using a manufacturer’s guide.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td><strong>75</strong> Service the starter/generator pulley and belt.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td><strong>76</strong> Service the alternator.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td><strong>77</strong> Explain how alternating current (AC) is converted to DC voltage.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td></td>
<td>Science: PH.11</td>
</tr>
<tr>
<td><strong>78</strong> Service alternator components.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td><strong>79</strong> Service the starting circuit.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td><strong>80</strong> Repair signs of corrosion or damage in an electrical system.</td>
<td></td>
</tr>
<tr>
<td><strong>Diagnosing and Troubleshooting the Ignition System</strong></td>
<td></td>
</tr>
<tr>
<td><strong>81</strong> Service a coil/magneto.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td><strong>82</strong> Explain the operation of an electronic ignition system.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td><strong>Diagnosing and Troubleshooting Two-Stroke Engines</strong></td>
<td></td>
</tr>
<tr>
<td><strong>83</strong> Diagnose two-stroke engine components.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td><strong>84</strong> Determine wear on internal engine parts using precision standard and metric measuring tools.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td><strong>Diagnosing and Troubleshooting Small-Engine Equipment</strong></td>
<td></td>
</tr>
<tr>
<td><strong>85</strong> Adjust controls (i.e., cables, rods, and springs).</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td><strong>86</strong> Service drive trains and power take-off (PTO) systems.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td><strong>87</strong> Identify the five major categories of failure analysis for two- and four-stroke engines.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td><strong>Performing Thermal Cutting Processes and Welding Operations</strong></td>
<td></td>
</tr>
<tr>
<td><strong>88</strong> Use an oxy-acetylene torch.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td><strong>89</strong> Operate gas metal arc welding equipment.</td>
<td></td>
</tr>
<tr>
<td><strong>90</strong> Operate manual plasma arc cutting equipment.</td>
<td></td>
</tr>
<tr>
<td><strong>Maintaining Wheels and Tires</strong></td>
<td></td>
</tr>
<tr>
<td><strong>91</strong> Inspect tire condition.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td><strong>92</strong> Service a wheel.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td><strong>93</strong> Repair an off-road tire, using an internal patch or plug.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td><strong>94</strong> Repair an on-road tire.</td>
<td></td>
</tr>
<tr>
<td><strong>Repairing Fasteners</strong></td>
<td></td>
</tr>
<tr>
<td><strong>95</strong> Repair damaged thread using a tap and die set.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td><strong>96</strong> Repair damaged thread using thread inserts (i.e., helicoil thread insert).</td>
<td>English: 11.5, 12.5</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 Technology I (8725/36 weeks, 140 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>