# Agricultural and Environmental Systems Career Field

## Outdoor Power Technology

**Subject Code: 010235**

**Outcome & Competency Descriptions**

**Course Description:**

Students will perform preventive maintenance, diagnose, and repair outdoor power equipment. Students will learn the theory of power and examine the aspects of repairing various engines, driving trains, and ancillary systems that make up modern compact powered equipment. Students will develop troubleshooting skills for 2-and 4-stroke engines, electrical and fuel systems. Throughout the course, students will maintain site and follow personal safety procedures along with developing an understanding of business.

**Strand 1. Business Operations/21st Century Skills**

Learners apply principles of economics, business management, marketing and employability in an entrepreneur, manager and employee role to the leadership, planning, developing and analyzing of business enterprises related to the career field.

**Outcome: 1.1. Employability Skills**

Develop career awareness and employability skills (e.g., face-to-face, online) needed for gaining and maintaining employment in diverse business settings.

**Competencies**

1.1.2. Identify the scope of career opportunities and the requirements for education, training, certification, licensure and experience.

1.1.3. Develop a career plan that reflects career interests, pathways and secondary and postsecondary options.

1.1.4. Describe the role and function of professional organizations, industry associations and organized labor and use networking techniques to develop and maintain professional relationships.

1.1.5. Develop strategies for self-promotion in the hiring process (e.g., filling out job applications, resumé writing, interviewing skills, portfolio development).

1.1.6. Explain the importance of work ethic, accountability and responsibility and demonstrate associated behaviors in fulfilling personal, community and workplace roles.

1.1.7. Apply problem-solving and critical-thinking skills to work-related issues when making decisions and formulating solutions.

**Outcome: 1.2. Leadership and Communications**

Process, maintain, evaluate and disseminate information in a business. Develop leadership and team building to promote collaboration.

**Competencies**

1.2.1. Extract relevant, valid information from materials and cite sources of information.

1.2.3. Identify and use verbal, nonverbal and active listening skills to communicate effectively.

1.2.4. Use negotiation and conflict-resolution skills to reach solutions.

1.2.5. Communicate information (e.g., directions, ideas, vision, workplace expectations) for an intended audience and purpose.

1.2.6. Use proper grammar and expression in all aspects of communication.

1.2.7. Use problem-solving and consensus-building techniques to draw conclusions and determine next steps.

1.2.12. Use technical writing skills to complete forms and create reports.

**Outcome: 1.3. Business Ethics and Law**

Analyze how professional, ethical and legal behavior contributes to continuous improvement in organizational performance and regulatory compliance.

**Competencies**

1.3.1. Analyze how regulatory compliance (e.g., United States Department of Agriculture [USDA], Food and Drug Administration [FDA], United States Department of Interior [USDI], Ohio Livestock Care Standards, water quality standards, local water regulations, building codes) affects business operations and organizational performance.

1.3.2. Follow protocols and practices necessary to maintain a clean, safe and healthy work environment.

1.3.3. Use ethical character traits consistent with workplace standards (e.g., honesty, personal integrity, compassion, justice).

1.3.4. Identify how federal and state consumer protection laws affect products and services.

1.3.5. Access and implement safety compliance measures (e.g., quality assurance information, safety data sheets [SDSs], product safety data sheets [PSDSs], United States Environmental Protection Agency [EPA], United States Occupational Safety and Health Administration [OSHA]) that contribute to the continuous improvement of the organization.

1.3.6. Identify deceptive practices (e.g., bait and switch, identity theft, unlawful door-to-door sales, deceptive service estimates, fraudulent misrepresentations) and their overall impact on organizational performance.

1.3.7. Identify the labor laws that affect employment and the consequences of noncompliance for both employee and employer (e.g., harassment, labor, employment, employment interview, testing, minor labor laws, Americans with Disabilities Act, Fair Labor Standards Acts, Equal Employment Opportunity Commission [EEOC]).

**Outcome: 1.4. Knowledge Management and Information Technology**

Demonstrate current and emerging strategies and technologies used to collect, analyze, record and share information in business operations.

**Competencies**

1.4.1. Use office equipment to communicate (e.g., phone, radio equipment, fax machine, scanner, public address systems).

1.4.2. Select and use software applications to locate, record, analyze and present information (e.g., word processing, e-mail, spreadsheet, databases, presentation, Internet search engines).

1.4.4. Use system hardware to support software applications.

1.4.5. Use information technology tools to maintain, secure and monitor business records.

1.4.6. Use an electronic database to access and create business and technical information.

**Outcome: 1.6. Business Literacy**

Develop foundational skills and knowledge in entrepreneurship, financial literacy and business operations.

**Competencies**

1.6.1. Identify business opportunities.

1.6.5. Describe organizational structure, chain of command, the roles and responsibilities of the organizational departments and interdepartmental interactions.

1.6.6. Identify the target market served by the organization, the niche that the organization fills and an outlook of the industry.

1.6.7. Identify the effect of supply and demand on products and services.

1.6.8. Identify the features and benefits that make an organization’s product or service competitive

1.6.9. Explain how the performance of an employee, a department and an organization is assessed.

**Outcome: 1.8. Operations Management**

Plan, organize and monitor an organization or department to maximize contribution to organizational goals and objectives.

**Competencies**

1.8.5. Use inventory and control systems to purchase materials, supplies and equipment (e.g., Last In, First Out [LIFO]; First In, First Out [FIFO]; Just in Time [JIT]; LEAN).

1.8.6. Identify the advantages and disadvantages of carrying cost and Just-in-Time (JIT) production systems and the effects of maintaining inventory (e.g., perishable, shrinkage, insurance) on profitability.

1.8.8. Identify routine activities for maintaining business facilities and equipment.

**Outcome: 1.10. Sales and Marketing**

Manage pricing, place, promotion, packaging, positioning and public relations to improve quality customer service.

**Competencies**

1.10.1. Identify how the roles of sales, advertising and public relations contribute to a company’s brand.

1.10.2. Determine the customer's needs and identify solutions.

1.10.3. Communicate features, benefits and warranties of a product or service to the customer.

1.10.4. Identify the company policies and procedures for initiating product and service improvements.

1.10.5. Monitor customer expectations and determine product/service satisfaction by using measurement tools.

**Outcome: 1.12. Site and Personal Safety Procedures**

Follow site and personal safety procedures in specific situations with specialized tools and equipment, evaluate the situation and take corrective action.

**Competencies**

1.12.1. Use Occupational Safety and Health Administration (OSHA) defined procedures for identifying employer and employee responsibilities, working in confined spaces, managing worker safety programs, using ground fault circuit interrupters (GFCIs), maintaining clearance and boundaries and labeling.

1.12.2. Interpret safety signs and symbols.

1.12.4. Describe how working under the influence of drugs and alcohol increases the risk of accident, lowers productivity, raises insurance costs and reduces profits.

1.12.5. Identify the location of emergency flush showers, eyewash fountains, Safety Data Sheets (SDSs), fire alarms and exits.

1.12.6. Identify procedures for the handling, storage and disposal of hazardous materials.

1.12.7. Select, use, store, maintain and dispose of personal protective equipment (PPE), appropriate to job tasks, conditions and materials.

1.12.8. Identify safety hazards and take corrective measures.

1.12.9. Identify, inspect and use safety equipment appropriate for the task.

1.12.10. Follow established procedures for the administration of first aid and contact emergency medical personnel when necessary.

1.12.15. Select and operate fire extinguishers based on the class of fire.

**Strand 4. Power Systems**

Learners apply principles of tool use, power transmission, hydraulics, pneumatics, two- and four-stroke cycle combustion, exhaust, ignition, fuel, starting and charging, steering, HVAC and lubrication systems to operate, to maintain and repair equipment.

**Outcome: 4.1. Tool, Stationary and Mobile Equipment Maintenance**

Inspect, clean, maintain and perform planned preventative maintenance on equipment.

**Competencies**

4.1.1. Inspect, clean, maintain and perform preventative maintenance on equipment.

4.1.2. Identify the types of hand tools, power tools and equipment and describe their functions.

4.1.3. Ensure the presence and functionality of safety equipment.

4.1.4. Identify potential hazards and limitations related to the use of equipment.

4.1.5. Maintain organization, and cleanliness of facilities, machinery, equipment, and tools for safety and appearance.

4.1.6. Inspect and service the electrical systems and components.

4.1.7. Inspect fluid leakage, fluid levels and the condition of fluids.

4.1.8. Inspect, clean, lubricate and adjust equipment for safe operation.

4.1.9. Select fluids, maintain fluid levels and replace system filters per original equipment manufacturer (OEM) specification.

4.1.10. Inspect and maintain fluid conveyance and storage components.

4.1.11. Identify and maintain accuracy of tooling, machinery, and equipment when performing preventive maintenance and repairs.

4.1.12. Compare alternative sources of power for equipment.

**Outcome: 4.2. Equipment Operations**

Operate and maintain mechanical equipment and power systems.

**Competencies**

4.2.1. Follow original equipment manufacturer (OEM) recommended operating procedures and adjustment specifications as found in the operator's manual.

4.2.2. Differentiate among the functions, limitations and proper use of equipment, equipment controls and instrumentation.

4.2.3. Perform pre- and post-operation inspections and adjustments and report malfunctions.

4.2.4. Perform appropriate start-up, operating and shut-down procedures.

4.2.5. Select and operate equipment and attachments needed to complete the task per the original equipment manufacturer (OEM) operator's manual.

**Outcome: 4.3. Engines**

Apply concepts to service components of both small and large internal combustion engines per the OEM (original equipment manufacturer) operators manual.

**Competencies**

4.3.1. Assess the physical and mechanical principles of engine operation, including motion, friction, and thermodynamics.

4.3.2. Retrieve and record stored on-board diagnostics (OBD) trouble codes and clear codes were

applicable.

4.3.3. Locate the data plate and determine engine specifications.

4.3.4. Analyze, evaluate and troubleshoot an engine.

4.3.5. Compare and contrast two-cycle and four-cycle engines and their operating principles.

4.3.6. Evaluate engine head and engine block components to determine serviceability per the original equipment manufacturer (OEM) specification.

4.3.7. Remove and replace components comprising the engine block and engine head.

4.3.8. Perform the requirements of engine servicing per original equipment manufacturer (OEM) specification to maintain emissions requirements.

4.3.9. Identify onboard diagnostic procedures per OEM (original equipment manufacturer) specifications to identify the causes of drivability and emissions concerns.

**Outcome: 4.4. Lubrication and Cooling Systems**

Inspect lubrication and cooling systems operation.

**Competencies**

4.4.1. Explain principles of engine lubrication and cooling.

4.4.2. Perform pressure and sensor test on lubrication and cooling systems.

**Outcome: 4.5. Fuel, Air Induction and Exhaust System**

Diagnose and repair fuel, air induction, exhaust systems, and aftertreatment devices (ATD)

**Competencies**

4.5.1. Explain principles of exhaust, intake, aftertreatment, and turbocharger design and operations.

4.5.2. Identify and understand starting and drivability issues or concerns.

4.5.8. Explain fuel injection theory.

4.5.14. Identify and describe alternative power systems.

**Outcome: 4.6. Ignition System**

Perform ignition system diagnostics and repair.

**Competencies**

4.6.1. Explain basic ignition system theory.

**Outcome: 4.7. Transmission of Power**

Diagnose and service power train components.

**Competencies**

4.7.5. Remove, replace, and adjust clutches and brakes.

**Outcome: 4.8. Starting and Charging Systems**

Identify, inspect and repair starting and charging system components.

**Competencies**

4.8.2. Use wiring diagrams and schematics to troubleshoot and starting and charging system components.

**Outcome: 4.11. Hydraulic Systems**

Diagnose, repair and rebuild hydraulic systems.

**Competencies**

4.11.1. Interpret symbols and schematic drawings related to hydraulic system design.

4.11.2. Describe the physical and mechanical principles of hydraulics.

4.11.3. Identify and describe the features, benefits and applications of the different types of hydraulic and hydrostatic systems.

4.11.4. Identify and describe the application and operation of major hydraulic systems and components.

4.11.5. Inspect, test, diagnose, repair, or replace hydraulic systems and components.

4.11.6. Test and diagnose electronic controls for hydraulic systems.

4.11.7. Identify and describe the purpose fluid sampling, perform fluid sampling procedures and interpret sample reporting.

4.11.8. Identify and describe hydraulic fitting types and sizes per international standard organization (ISO).

4.11.9. Measure flow rate, pressure and temperature.

**Strand 5. Elements of Production**

Learners apply principles of practice related to the management and maintenance of food, agriculture and natural resources systems

**Outcome: 5.1. Electrical Theory**

Interpret and apply electrical and electronic principles and theories.

**Competencies**

5.1.1. Read and interpret wiring diagrams and symbols.

5.1.4. Explain methods of producing electrical current.

5.1.5. Describe the differences between alternating current (AC) and direct current (DC).

5.1.6. Compare and contrast conductors and insulators.

5.1.7. Differentiate the relationships among voltage, current, resistance and power in circuits and understand the basics of transformers.

5.1.8. Measure the amperage of AC and DC electrical systems and system components.

5.1.10. Describe the purpose of grounding and common methods used for grounding.

5.1.12. Use a digital multimeter to determine voltage, current, frequency and phase.

**Outcome: 5.10. Joining and cutting ferrous and non-ferrous materials with heat**

Join and cut ferrous and non-ferrous materials using heat in horizontal and vertical positions.

**Competencies**

5.10.1. Classify, select, handle and store electrodes and match them to the job requirements based on the desired level of penetration and heat range.

5.10.2. Determine the correct welder type, wire diameter and gas to be used in a specific welding situation.

5.10.3. Compare and contrast ferrous and non-ferrous material welding operating characteristics and performance.

5.10.4. Identify and select the appropriate joint design, weld type and welding position.

5.10.5. Set up and adjust the welder according to the material being welded and influencing conditions.

5.10.6. Store, handle and install high pressure gas cylinders.

5.10.7. Clean, prepare, align, and secure post-weld material.

5.10.8. Compensate for the effects of expansion and contraction forces when joining ferrous and non-ferrous materials.

5.10.9. Employ protective methods for surrounding equipment and materials during welding and cutting operations.

5.10.10. Perform continuous, stitch, tack, plug and butt welds with and without backing and fillet welds.

5.10.11. Cut ferrous and non-ferrous materials using oxy fuel and plasma equipment based on the various applications.

**Outcome: 5.11. Fabricating with cold ferrous and non-ferrous material**

Repair ferrous and non-ferrous materials structures and equipment through cutting, shaping, forming and joining metal stock.

**Competencies**

5.11.1. Evaluate ferrous and non-ferrous materials structures and equipment and plan the method of repair.

5.11.7. Fasten ferrous and non-ferrous materials using a range of hardware.

5.11.8. Process ferrous and non-ferrous materials through tapping, threading, torquing and smoothing.