## Agricultural and Environmental Systems Career Field

## Agricultural and Industrial Power

**Subject Code: 010210**

**Outcome & Competency Descriptions**

**Course Description:**

Students will apply their knowledge and skills of troubleshooting and diagnostics to ensure the safe operation, maintenance, and repair of agricultural and industrial power equipment. Students will apply the principles of power technology equipment systems when making repairs, which include electronic and electrical systems, engines and fuels, hydraulic and pneumatic systems and power trains. Additionally, students will learn to safely operate and maintain equipment.

**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**

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

1.1.8. Identify the correlation between emotions, behavior and appearance and manage those to establish and maintain professionalism.

1.1.9. Give and receive constructive feedback to improve work habits.

1.1.10. Adapt personal coping skills to adjust to taxing workplace demands.

1.1.11. Recognize different cultural beliefs and practices in the workplace and demonstrate respect for them.

1.1.12. Identify healthy lifestyles that reduce the risk of chronic disease, unsafe habits and abusive behavior.

**Outcome: 1.2. Leadership and Communications**

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

**Competencies**

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

1.2.10. Use interpersonal skills to provide group leadership, promote collaboration, and work in a team.

1.2.11. Write professional correspondence, documents, job applications and resumés.

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**

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

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.

1.3.7. 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**

1.4.4. 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**

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

**Outcome: 1.8. Operations Management**

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

**Competencies**

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**

1.10.2. 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 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 for fluid leakage, fluid levels and the condition of fluids.

4.1.8. Inspect, clean, lubricate, and 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 operators’ 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 original equipment manufacturer (OEM) operators manual.

**Competencies**

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

and thermodynamics.

4.3.2. Retrieve, record, and interpret stored on-board diagnostics (OBD) trouble codes and clear codes where applicable.

4.3.3. Locate the data plate and determine engine specifications.

4.3.4. Analyze, evaluate and troubleshoot an engine.

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 emission requirements.

4.3.9. Identify onboard diagnostic procedures per original equipment manufacturer (OEM)

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 designs and operations.

4.5.8. Explain fuel injection theory.

4.5.13. Check and refill the diesel exhaust fluid and service the diesel particulate filter per original equipment manufacturer (OEM) specification.

**Outcome: 4.6. Ignition System**

Perform ignition system diagnostics and repair.

**Competencies**

4.6.1. Explain basic ignition system theory.

4.6.2. Use wiring diagrams and schematics to troubleshoot and repair ignition system components.

**Outcome: 4.7. Transmission of Power**

Diagnose and service power train components.

**Competencies**

4.7.1. Identify and describe the features, benefits and applications of power transmission components.

4.7.2. Identify and describe the physical and mechanical principles of mechanical, hydraulic, pneumatic and electrical power transfer.

4.7.8. Remove, replace, and adjust damaged and non-functioning power train components.

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

Identify, inspect and repair starting and charging system components.

**Competencies**

4.8.1. Identify and differentiate between electrical and engine problems that cause a slow crank or no crank condition.

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

4.8.3. Inspect, test, and replace fuses, relays, circuit breakers, and solenoids.

**Outcome: 4.9. Steering, Suspension, and Traction**

Diagnose and repair steering, suspension and traction systems.

**Competencies**

4.9.1. Evaluate traction, ballasting and weight transfer of equipment, including towing and trailering systems per gross vehicle weight rating (GVWR).

4.9.2. Evaluate and formulate solutions for vehicle stability to include automatic leveling devices, center of gravity, roll-over potential and wheelbase dimensions.

4.9.3. Remove, inspect, repair or replace steering systems components.

4.9.4. Align steering components, including tires and tracks.

4.9.5. Interpret tire and track wear patterns and evaluate replacement needs per original equipment manufacturer (OEM) specification.

4.9.6. Identify and differentiate bearing noise, vehicle pull and wheel vibration, shimmy and noise.

4.9.8. Remove, inspect, repair/replace and reinstall the tire and wheel or track assembly per original equipment manufacturer (OEM) specification.

**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.

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

4.11.4. Identify and describe the applications and operations of major hydraulic systems and components.

**Outcome: 4.12. Brakes**

Identify, inspect and replace components of braking systems.

**Competencies**

4.12.1. Identify and locate components of braking systems.

4.12.6. Remove, inspect and replace brake components and inspect for leaks.

**Outcome: 4.13. Heating and Air Conditioning Systems**

Diagnose and repair heating, ventilating and air conditioning systems (HVAC).

**Competencies**

4.13.1. Identify and describe the physical and mechanical principles of heating, ventilating and air conditioning (HVAC) systems.

4.13.2. Use schematics and diagrams to troubleshoot heating, ventilating, and air conditioning (HVAC) systems.

4.13.3. Identify and describe refrigerant types, major components and functions in the overall operation of the heating, ventilating, and air conditioning (HVAC) system.

**Outcome: 4.14. Pneumatic Systems**

Diagnose, repair and rebuild pneumatic systems.

**Competencies**

4.14.1. Interpret symbols and schematic drawings related to pneumatic system design.

4.14.3. Identify and describe the features, benefits and applications of the different types of pneumatic systems.

4.14.4. Identify and describe the applications and operations of major pneumatic system components.

**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.

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

**Outcome: 5.9. Physics and Metallurgy of Welding**

Apply the physics and metallurgy of welding in joining materials.

**Competencies**

5.9.1. Assess how the welding arc produces a weld.

5.9.2. Identify the factors that affect the deposit of weld metal and melting (e.g. speed, metal type, travel speed, amps, voltage, angles of electrode).

5.9.3. Describe the effects of arc length and shielding gases on the arc.

5.9.5. Analyze the relationship between wire feed speed and welding current.

5.9.9. Explain conditions when arc blow occurs and how to reduce arc blow.

**Outcome: 5.10. Joining and Cutting** **Ferrous and Non-Ferrous Materials Heat**

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

**Competencies**

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.

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

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 Materials**

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

**Competencies**

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

5.11.2. Lay out and cut ferrous and non-ferrous material.

5.11.3. Shape stock through bending, cutting, drilling and filing.

5.11.9. Analyze the surface condition and select and apply abrasives and fillers for ferrous and non-ferrous material.

5.11.10. Contrast surface coatings and apply them under appropriate environmental conditions.