

AFNR - Power, Structural and Technical Systems

Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural and technical systems. [PST.01.](#)

- 1 Apply physical science and engineering principles to assess and select energy sources for AFNR power, structural and technical systems.** [PST.01.01.](#)
 - 1a** Research and identify renewable and nonrenewable energy sources used in AFNR. [PST.01.01.01.A.](#)
 - 1b** Assess the environmental impacts of renewable and nonrenewable energy sources used in AFNR. [PST.01.01.01.B.](#)
 - 1c** Design and implement methods to evaluate the efficiency of renewable and nonrenewable energy sources used in AFNR. [PST.01.01.01.C.](#)
- 2a** Compare and contrast the pathways of delivery for renewable and nonrenewable energy sources in an AFNR enterprise or business. [PST.01.01.02.A.](#)
- 2b** Calculate the costs of using renewable and nonrenewable energy sources in an AFNR enterprise or business. [PST.01.01.02.B.](#)
- 2c** Devise a strategy to incorporate the use of selected energy sources in an ANFR enterprise or business. [PST.01.01.02.C.](#)
- 3a** Summarize methods and compare and contrast units used to benchmark energy use of AFNR structures (e.g., EUIs, BTUs, etc.). [PST.01.01.03.A.](#)
- 3b** Convert energy utilized in an AFNR structure to an energy utilization index (e.g., convert CCF, KWH, etc. to Btu consumption per square foot, etc.). [PST.01.01.03.B.](#)
- 3c** Apply energy benchmarking data to examine and select methods to conserve energy in AFNR structures. [PST.01.01.03.C.](#)

2 Apply physical science and engineering principles to design, implement and improve safe and efficient mechanical systems in AFNR situations. PST.01.02.

- 1a** Compare and contrast applications of simple machines in AFNR related mechanical systems. PST.01.02.01.A.
- 1b** Perform mathematical calculations to determine the mechanical advantage of simple machines in AFNR related mechanical systems. PST.01.02.01.B.
- 1c** Apply the scientific method to devise strategies to improve the efficiency of operation of AFNR related mechanical systems. PST.01.02.01.C.
- 2a** Identify the tools, machines and equipment needed to construct and/or fabricate a project in AFNR. PST.01.02.02.A.
- 2b** Calculate the maintenance and purchase cost of tools, machines and equipment used in AFNR. PST.01.02.02.B.
- 2c** Devise and document processes to safely implement and evaluate the safe use of AFNR related tools, machinery and equipment. PST.01.02.02.C.
- 3a** Examine owner's manuals to classify the types of safety hazards associated with different mechanical systems used in AFNR (e.g., caution, warning, danger, etc.). PST.01.02.03.A.
- 3b** Select, maintain and demonstrate the proper use of tools, machines and equipment used in different AFNR related mechanical systems. PST.01.02.03.B.
- 3c** Conduct a safety inspection of tools, machines and equipment used in different AFNR related mechanical systems. PST.01.02.03.C.

3 Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.). PST.01.03.

- 1a** Compare and contrast the principles and procedures of different welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.). PST.01.03.01.A.
 - 1b** Analyze the situation and determine the best welding and cutting process to be used in metal fabrication. PST.01.03.01.B.
 - 1c** Evaluate the quality of metal fabrication procedures (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.). PST.01.03.01.C.
 - 2a** Compare and contrast the properties of different metals used in AFNR power, structural and technical systems (e.g., malleability, conductivity, optical properties, chemical composition, etc.). PST.01.03.02.A.
 - 2b** Assess and select the proper electrode for use in various shielded metal arc welding situations. PST.01.03.02.B.
 - 2c** Construct and/or repair metal structures and equipment using metal fabrication procedures. PST.01.03.02.C.
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Operate and maintain AFNR mechanical equipment and power systems. PST.02.

- 1 Perform preventative maintenance and scheduled service to maintain equipment, machinery and power units used in AFNR settings. PST.02.01.**
 - 1a** Maintain the cleanliness and appearance of equipment, machinery and power units used in AFNR power, structural and technical systems to assure proper functionality. PST.02.01.01.A.
 - 1b** Develop a preventative maintenance schedule for equipment, machinery and power units used in AFNR power, structural and technical systems. PST.02.01.01.B.
 - 1c** Devise a strategy to communicate to different audiences, preventative maintenance and service schedule for equipment, machinery and power units used in AFNR power, structural and technical systems. PST.02.01.01.C.
 - 2a** Examine operator's manuals to determine recommendations for servicing filtration systems and maintaining fluid levels on equipment, machinery and power units used in AFNR power, structural and technical systems. PST.02.01.02.A.
 - 2b** Service filtration systems and maintain fluid levels on equipment, machinery and power units in accordance with operator's manuals. PST.02.01.02.B.
 - 2c** Assess and adjust equipment (e.g., belts and drives, chains, sprockets, etc.) and maintain fluid conveyance components (e.g., hoses, lines, nozzles, etc.) to ensure proper functioning. PST.02.01.02.C.

 - 2 Operate machinery and equipment while observing all safety precautions in AFNR settings. PST.02.02.**
 - 1a** Research and summarize the use of equipment, machinery and power units for AFNR power, structural and technical systems. PST.02.02.01.A.
 - 1b** Analyze and calculate the cost of using equipment, machinery, and power units for AFNR power, structural and technical systems. PST.02.02.01.B.
 - 1c** Perform pre-operation inspections, start-up & shut-down procedures on equipment, machinery and power units as specified in owner's manuals. PST.02.02.01.C.
 - 2a** Examine and identify safety hazards associated with equipment, machinery and power units used in AFNR power, structural, and technical systems (e.g., caution, warning, danger, etc.). PST.02.02.02.A.
 - 2b** Apply safety principles and applicable regulations to operate equipment, machinery and power units used in AFNR power, structural and technical systems. PST.02.02.02.B.
 - 2c** Adjust equipment, machinery and power units for safe and efficient operation in AFNR power, structural and technical systems. PST.02.02.02.C.
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Service and repair AFNR mechanical equipment and power systems. PST.03.

1 Troubleshoot, service and repair components of internal combustion engines using manufacturers' guidelines. PST.03.01.

- 1a Identify and classify components of internal combustion engines used in AFNR power, structural and technical systems. PST.03.01.01.A.
- 1b Analyze and explain how the components of internal combustion engines interrelate during operation. PST.03.01.01.B.
- 1c Evaluate service and repair needs for internal combustion engines using a variety of performance tests (e.g., manuals, computer-based diagnostics, etc.). PST.03.01.01.C.
- 2a Distinguish the characteristics of spark-and-compression internal combustion engines used in AFNR power, structural and technical systems. PST.03.01.02.A.
- 2b Utilize technical manuals and diagnostic tools to determine service and repair needs of spark-and-compression internal combustion engines used in AFNR power, structural and technical systems. PST.03.01.02.B.
- 2c Inspect, analyze and repair spark-and-compression internal combustion engines used in AFNR power, structural and technical systems. PST.03.01.02.C.

2 Service electrical systems and components of mechanical equipment and power systems using a variety of troubleshooting and/or diagnostic methods. PST.03.02.

- 1a Compare and contrast basic units of electricity (e.g., volts, amps, watts, and ohms) and the principles that describe their relationship (e.g., Ohm's Law, Power Law, etc.). PST.03.02.01.A.
- 1b Assess the tools used to measure the basic units of electrical circuits in AFNR power, structural and technical systems, and perform the measurements. PST.03.02.01.B.
- 1c Analyze and design electrical circuits for AFNR power, structural and technical systems using knowledge of the basic units of electricity. PST.03.02.01.C.
- 2a Compare and contrast the characteristics of electronic components used in AFNR power, structural and technical systems (e.g., battery, resistor, diode, transistor, capacitor, etc.). PST.03.02.02.A.
- 2b Analyze and interpret electrical system symbols and diagrams. PST.03.02.02.B.
- 2c Conduct testing procedures to evaluate and repair malfunctioning electrical components and systems used in AFNR power, structural and technical systems. PST.03.02.02.C.
- 3a Classify the uses of electrical sensors and controls in AFNR power, structural and technical systems. PST.03.02.03.A.
- 3b Distinguish and select materials and tools used in electrical control circuit installation. PST.03.02.03.B.
- 3c Plan and install electrical control circuits and/or circuit boards to assure proper operation within AFNR power, structural and technical systems. PST.03.02.03.C.

3 Utilize manufacturers' guidelines to diagnose and troubleshoot malfunctions in machinery, equipment and power source systems (e.g., hydraulic, pneumatic, transmission, steering, suspension, etc.). PST.03.03.

- 1a Research and summarize the applications of common types of hydraulic and pneumatic systems used in AFNR power, structural and technical systems. PST.03.03.01.A.
- 1b Analyze and interpret hydraulic and pneumatic system symbols and diagrams used in AFNR power, structural and technical systems. PST.03.03.01.B.
- 1c Inspect, analyze and repair hydraulic and pneumatic system components used in AFNR power, structural and technical systems. PST.03.03.01.C.
- 2a Compare and contrast operation principles and features of mechanical transmission systems used in AFNR power, structural and technical systems (e.g., belts, chains, gears, bearings, seals, universals, drive shafts, etc.). PST.03.03.02.A.
- 2b Utilize speed, torque and power measurements to calculate efficiency in power transmission systems used in AFNR power, structural and technical systems. PST.03.03.02.B.
- 2c Inspect, analyze and repair the components of power transmission systems used in AFNR power, structural and technical systems. PST.03.03.02.C.
- 3a Identify and examine the components of suspension and steering systems used in AFNR power, structural and technical systems. PST.03.03.03.A.
- 3b Assess and analyze vehicle and machinery performance related to suspension and steering systems used in AFNR power, structural and technical systems. PST.03.03.03.B.
- 3c Inspect, analyze and repair vehicle suspension and steering systems used in AFNR power, structural and technical systems. PST.03.03.03.C.

Plan, build and maintain AFNR structures. PST.04.

1 Create sketches and plans for AFNR structures. PST.04.01.

- 1a Interpret and explain the meaning of symbols used in sketches of agricultural structures. PST.04.01.01.A.
- 1b Apply scale measurement and dimension to develop sketches of agricultural structures. PST.04.01.01.B.
- 1c Create sketches of an agricultural structure by applying principles of design. PST.04.01.01.C.
- 2a Read and interpret the parts and/or views of plans for agricultural structures. PST.04.01.02.A.
- 2b Construct plans for agricultural structures using current technology (e.g., drafting software, computer-aided design, etc.). PST.04.01.02.B.
- 2c Evaluate, plan and design functional and efficient facilities for use in AFNR power, structural and technical systems. PST.04.01.02.C.

2 Determine structural requirements, specifications and estimate costs for AFNR structures. PST.04.02.

- 1a** Summarize and categorize the information needed to complete a bill of materials and cost estimate for an AFNR structure. PST.04.02.01.A.
- 1b** Analyze a project plan to prepare a bill of materials and an estimate of material costs. PST.04.02.01.B.
- 1c** Create a project cost estimate, including materials, labor and management for an AFNR structure. PST.04.02.01.C.
- 2a** Research and summarize sources of industry construction and materials standards and their importance (e.g., American National Standards Institute, ANSI, Underwriters' Laboratories, UL, etc.). PST.04.02.02.A.
- 2b** Assess and analyze local building code requirements for agriculture structures. PST.04.02.02.B.
- 2c** Design and conduct a building functionality and safety assessment on an agricultural structure using knowledge of industry standards and local code requirements. PST.04.02.02.C.

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- 3 Follow architectural and mechanical plans to construct, maintain and/or repair AFNR structures (e.g., material selection, site preparation and/or layout, plumbing, concrete/ masonry, etc.).** PST.04.03.
- 1a Examine the criteria in selecting materials for constructing, maintaining, and/or repairing AFNR structures. PST.04.03.01.A.
 - 1b Analyze and assess samples of materials or products for quality and efficiency of workmanship. PST.04.03.01.B.
 - 1c Select materials for a project based upon an analysis of the project and the quality of the materials. PST.04.03.01.C.
 - 2a Summarize the characteristics needed for an ideal building site. PST.04.03.02.A.
 - 2b Complete a building site analysis checklist to select an ideal building site. PST.04.03.02.B.
 - 2c Assess site characteristics, identify adjustments, and demonstrate procedures for preparing a building site. PST.04.03.02.C.
 - 3a Compare and contrast the characteristics of wood and/or metal products used in AFNR structures. PST.04.03.03.A.
 - 3b Calculate costs associated with the repair and replacement of wood and/or metal components an AFNR structure. PST.04.04.03.B.
 - 3c Construct AFNR structures using wood and/or metal materials. PST.04.03.03.C.
 - 4a Compare and contrast the characteristics of materials used in plumbing and water systems (e.g., copper, PVC, PEX, etc.). PST.04.03.04.A.
 - 4b Calculate the cost of a water system in an AFNR structure (e.g., copper, PVC, etc.). PST.04.03.04.B.
 - 4c Install and/or repair pipes and plumbing equipment and fixtures in AFNR structures. PST.04.03.04.C.
 - 5a Compare and contrast the characteristics of fencing materials, including government regulations and applicable installation codes. PST.04.03.05.A.
 - 5b Measure and calculate the cost of fencing materials. PST.04.03.05.B.
 - 5c Construct, maintain, and/or repair fencing, including wood, static wire, electrical wire and other fencing materials. PST.04.03.05.C.
 - 6a Summarize the characteristics of the components found in concrete. PST.04.03.06.A.
 - 6b Calculate volume for concrete projects. PST.04.03.06.B.
 - 6c Construct, maintain and/or repair AFNR structures with concrete, brick, stone or masonry. PST.04.03.06.C.
 - 7a Differentiate between types of insulation materials used in AFNR structures. PST.04.03.07.A.
 - 7b Calculate BTU loss in an AFNR structure. PST.04.03.07.B.
 - 7c Insulate a structure and estimate reduced BTU loss. PST.04.03.07.C.

4 Apply electrical wiring principles in AFNR structures. PST.04.04.

- 1a Compare and contrast direct and alternating current. PST.04.04.01.A.
 - 1b Assess and analyze the electrical requirements of an AFNR structure. PST.04.04.01.B.
 - 1c Install and/or repair fixtures following appropriate codes and standards. PST.04.04.01.C.
 - 2a Distinguish electrical circuits and the components of each. PST.04.04.02.A.
 - 2b Calculate the cost of operating an electrical motor. PST.04.04.02.B.
 - 2c Plan and wire electrical circuits (i.e., single pole switch, three-way switch, duplex outlet, etc.). PST.04.04.02.C.
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Use control, monitoring, geospatial and other technologies in AFNR power, structural and technical systems. PST.05.

1 Apply computer and other technologies (e.g., robotics, CNC, UAS, etc.) to solve problems and increase the efficiency of AFNR systems. PST.05.01.

- 1a Research and categorize computer technologies used to solve problems and increase efficiency in AFNR systems. PST.05.01.01.A.
- 1b Analyze data using computer programs and other current technologies used in AFNR systems. PST.05.01.01.B.
- 1c Solve problems and calculate changes in efficiency using computer technologies for AFNR systems. PST.05.01.01.C.
- 2a Examine and summarize the specific intent of technologies used to solve problems and increase the efficiency of AFNR systems (e.g., robotics, UAS, CNC, etc.). PST.05.03.02.A.
- 2b Calculate the change in efficiency after using technologies in AFNR systems. PST.05.03.02.B.
- 2c Solve problems and evaluate changes in efficiency and create recommendations for the use of technologies in AFNR systems. PST.05.03.02.C.

2 Prepare and/or use electrical drawings to design, install and troubleshoot electronic control systems in AFNR settings. PST.05.02.

- 1a** Examine and categorize electrical control system components used in AFNR systems (e.g., transistors, relays, HVAC, logic controllers, etc.). PST.05.02.01.A.
- 1b** Analyze schematic drawings for electrical control systems used in AFNR systems. PST.05.02.01.B.
- 1c** Design schematic drawings for electrical control systems used in AFNR systems. PST.05.02.01.C.
- 2a** Differentiate between the purpose of electrical sensors and controls used in AFNR power, structural and technical systems. PST.05.02.02.A.
- 2b** Interpret maintenance schedules for electrical control systems used in AFNR power, structural and technical systems. PST.05.02.02.B.
- 2c** Troubleshoot electrical control system performance problems found in AFNR power, structural and technical systems. PST.05.02.02.C.
- 3a** Research and summarize the importance of AFNR power, structural and technical control systems using programmable logic controllers (PLC) and/or other computer-based systems. PST.05.02.03.A.
- 3b** Assess the functions of AFNR power, structural and technical control systems using programmable logic controllers (PLC) in agricultural production and manufacturing. PST.05.02.03.B.
- 3c** Develop and implement AFNR power, structural and technical control systems using programmable logic controllers (PLC) and/or other computer-based systems. PST.05.02.03.C.

3 Apply geospatial technologies to solve problems and increase the efficiency of AFNR systems. PST.05.03.

- 1a** Research and summarize the impact of utilizing geospatial technologies (i.e., GPS, GIS, remote sensing, telematics, etc.) in AFNR systems. PST.05.03.01.A.
- 1b** Analyze and interpret trends in data collected utilizing geospatial technologies. PST.05.03.01.B.
- 1c** Collect data and create maps utilizing geospatial technologies. PST.05.03.01.C.
- 2a** Examine the components of precision technologies used in AFNR systems. PST.05.03.02.A.
- 2b** Analyze and calculate the economic impact of utilizing precision technologies (e.g., GPS/GIS) in AFNR systems. PST.05.03.02.B.
- 2c** Install, maintain and service instrumentation and equipment used for precision technologies (i.e., GPS receivers, yield monitors, remote sensors, etc.) used in AFNR systems. PST.05.03.02.C.