

Colorado AFNR Course Scope and Sequence

Course Name	Industrial Maintenance Technology		Course Details	Level 3 course in the Power, Structure, & Technology pathway. This course aligns with content in any strand of the pathway.	
			Course = 0.50 Carnegie Unit Credit		
Course Description	This course covers application of power and technical systems in industrial settings. Content covers basic application of electrical circuitry, motors & controls, hydraulics & pneumatic, and mechanical systems.				
Note:	This is a suggested scope and sequence for the course content. The content will work with any textbook or instructional resource. If locally adapted, make sure all essential knowledge and skills are covered.				
SCED Identification #	18402	Schedule calculation based on 60% of a semester instructional time. Scope and sequence allows for additional time for guest speakers, student presentations, field trips, remediation, or other content topics.			
All courses taught in an approved CTE program must include Essential Skills embedded into the course content. The Essential Skills Framework for this course can be found at https://www.cde.state.co.us/standardsandinstruction/essentialskills					
Unit Number, Title and Brief Description	Suggested % of Instructional Time	CTE or Academic Standard Alignment	Competency / Performance Indicator	Outcome / Measurement	CTSO Integration
Unit 1: Workplace Equipment Safety	2%	PST.02. Operate and maintain AFNR mechanical equipment and power systems.	PST.02.02. Operate machinery and equipment while observing all safety precautions in AFNR settings.	PST.02.02.02.a. 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.).	
Unit 2: Engine Troubleshooting - Isolation of problem techniques - Application of engine operation knowledge to solve issue	4%	PST.03. Service and repair AFNR mechanical equipment and power systems.	PST.03.01. Troubleshoot, service and repair components of internal combustion engines using manufacturers' guidelines.	PST.03.01.01.c. Evaluate service and repair needs for internal combustion engines using a variety of performance tests (e.g., manuals, computer-based diagnostics, etc.).	

Unit 3: Engine Maintenance & Service Intervals Identifying & following service recommendations	2%	PST.03. Service and repair AFNR mechanical equipment and power systems.	PST.03.01. Troubleshoot, service and repair components of internal combustion engines using manufacturers' guidelines.	PST.03.01.01.c. Evaluate service and repair needs for internal combustion engines using a variety of performance tests (e.g., manuals, computer-based diagnostics, etc.).	
Unit 4: Equipment manual & use – Service Intervals & lubrication	3%	PST.02.: Operate and maintain AFNR mechanical equipment and power systems. PST.03. Service and repair AFNR mechanical equipment and power systems	PST.02.01. Perform preventative maintenance and scheduled service to maintain equipment, machinery and power units used in AFNR settings. PST.03.01. Troubleshoot, service and repair components of internal combustion engines using manufacturers' guidelines.	PST.02.01.02.a. 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.03.01.02.b. 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.	
Unit 5: Power Transmission - Gears & Pulley belts - PTS Drives - Pitch, speed ratio, belt profile & types - Gear types & applications	4%	PST.02. Operate and maintain AFNR mechanical equipment and power systems. PST.03. Service and repair AFNR mechanical equipment and power systems.	PST.02.01. Perform preventative maintenance and scheduled service to maintain equipment, machinery and power units used in AFNR settings. PST.03.03. Utilize manufacturers' guidelines to diagnose and troubleshoot malfunctions in machinery, equipment and	PST.02.01.02.c. 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.03.03.02.a. Compare and contrast operation	

Adjustments, universal joints & phasing			power source systems (e.g., hydraulic, pneumatic, transmission, steering, suspension, etc.).	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.b. 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.c. Inspect, analyze and repair the components of power transmission systems used in AFNR power, structural and technical systems.	
Unit 6: Bearing types, lubrication & repair	2%	PST.03. Service and repair AFNR mechanical equipment and power systems	PST.03.03. Utilize manufacturers' guidelines to diagnose and troubleshoot malfunctions in machinery, equipment and power source systems (e.g., hydraulic, pneumatic, transmission, steering, suspension, etc.).	PST.03.03.02.a. 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.b. 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.c. Inspect, analyze and repair the components of power transmission systems used in AFNR power, structural and technical systems.	
Unit 7: Equipment specific tools, ID, use Dial indicators, feeler indicators, caliper, torque wrench, feeler gage	2%	PST.01 Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural, and technical systems.	PST.01.02 Apply physical science and engineering principles to design, implement, and improve safe and efficient mechanical systems in AFNR situation. <i>SCIENCE: SC.HS.1.6</i> <i>SC.HS.1.7</i> <i>SC.HS.1.9</i>	PST.01.02.03.b Select, maintain, and demonstrate the proper use of tools, machines, and equipment used in different AFNR related mechanical systems.	
Unit 8: Types, purposes & operations of clutches, transitions & final drives	2%	PST.03 Service and repair AFNR mechanical equipment and power systems.	PST.03.03 Utilize manufacturer's guidelines to diagnose and troubleshoot malfunctions in machinery, equipment, and power source systems (e.g. hydraulic, pneumatic, transmission, steering, suspension, etc.)	PST.03.03.02.a 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)	
Unit 9: Equipment setup, adjustment, & calibration • Setup to manual specifications, operation	3%	PST.02.: Operate and maintain AFNR mechanical equipment and power systems.	PST.02.02. Operate machinery and equipment while observing all safety precautions in AFNR settings.	PST.02.02.02.c. Adjust equipment, machinery and power units for safe and efficient operation in AFNR power, structural and technical systems.	

adjustment, and critical calibration					
Unit 10: Theory of hydraulic operation-thermodynamic laws	2%	PSTS.08 Understand and operate power and mechanical systems for agriculture use. PST.03. Service and repair AFNR mechanical equipment and power systems.	PSTS .08.04 Apply theory & operation of hydraulic systems PST.03.03. Utilize manufacturers' guidelines to diagnose and troubleshoot malfunctions in machinery, equipment and power source systems (e.g., hydraulic, pneumatic, transmission, steering, suspension, etc.).	PSTS.08.04.a Understand the theory and principle of operation of hydraulic systems PST.03.03.01.a. Research and summarize the applications of common types of hydraulic and pneumatic systems used in AFNR power, structural and technical systems.	
Unit 11: Hydraulic Vocabulary & terms	1%	PST.03 Service and repair AFNR mechanical equipment and power systems.	PST.03.03 Utilize manufacturers' guidelines to diagnose and troubleshoot malfunction in machinery, equipment and power source systems (e.g. hydraulic, pneumatic, transmission, steering, suspension, etc)	PST.03.03.01.a Research and summarize the applications of common types of hydraulic and pneumatic systems used in AFNR power, structural, and technical systems.	
Unit 12: Understand basic hydraulic system components & function Pumps, cylinders, flow controls, connectors, hoses, pipping, schematics & symbols	3%	PST.03. Service and repair AFNR mechanical equipment and power systems.	PST.03.03. Utilize manufacturers' guidelines to diagnose and troubleshoot malfunctions in machinery, equipment and power source systems (e.g., hydraulic, pneumatic, transmission, steering, suspension, etc.).	PST.03.03.01.a. Research and summarize the applications of common types of hydraulic and pneumatic systems used in AFNR power, structural and technical systems.	
Unit 13: Hydraulic Schematics	2%	PST.03. Service and repair AFNR mechanical equipment and power systems.	PST.03.03. Utilize manufacturers' guidelines to diagnose and troubleshoot malfunctions in	PST.03.03.01.b. Analyze and interpret hydraulic and pneumatic system symbols and diagrams	

			machinery, equipment and power source systems (e.g., hydraulic, pneumatic, transmission, steering, suspension, etc.).	used in AFNR power, structural and technical systems.	
Unit 14: Understanding difference between open/closed systems, fixed, variable positive and non-positive pumps, and identification of hydraulic pumps	2%	PST.03. Service and repair AFNR mechanical equipment and power systems	PST.03.03. Utilize manufacturers' guidelines to diagnose and troubleshoot malfunctions in machinery, equipment and power source systems (e.g., hydraulic, pneumatic, transmission, steering, suspension, etc.).	PST.03.03.01.a. Research and summarize the applications of common types of hydraulic and pneumatic systems used in AFNR power, structural and technical systems.	
Unit 15: Flow, Directional & Pressure Control Values	1%	PST.03. Service and repair AFNR mechanical equipment and power systems.	PST.03.03. Utilize manufacturers' guidelines to diagnose and troubleshoot malfunctions in machinery, equipment and power source systems (e.g., hydraulic, pneumatic, transmission, steering, suspension, etc.).	PST.03.03.01.a. Research and summarize the applications of common types of hydraulic and pneumatic systems used in AFNR power, structural and technical systems.	
Unit 16: Hydraulic Motor Applications & Design	1%	PST.03. Service and repair AFNR mechanical equipment and power systems.	PST.03.03. Utilize manufacturers' guidelines to diagnose and troubleshoot malfunctions in machinery, equipment and power source systems (e.g., hydraulic, pneumatic, transmission, steering, suspension, etc.).	PST.03.03.01.a. Research and summarize the applications of common types of hydraulic and pneumatic systems used in AFNR power, structural and technical systems.	
Unit 17: Hydraulic Calculations	2%	PST.03. Service and repair AFNR mechanical equipment and power systems.	PST.03.03. Utilize manufacturers' guidelines to diagnose and troubleshoot malfunctions in machinery, equipment and power source systems (e.g., hydraulic, pneumatic, transmission, steering, suspension, etc.).	PST.03.03.01.a. Research and summarize the applications of common types of hydraulic and pneumatic systems used in AFNR power, structural and technical systems.	

Unit 18: Electrical Theory & Ohm's Law	2%	PST.03. Service and repair AFNR mechanical equipment and power systems.	PST.03.02. Service electrical systems and components of mechanical equipment and power systems using a variety of troubleshooting and/or diagnostic methods.	PST.03.02.01.a 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.).	
Unit 19: DC Current Circuits	2%	PST.03. Service and repair AFNR mechanical equipment and power systems.	PST.03.02. Service electrical systems and components of mechanical equipment and power systems using a variety of troubleshooting and/or diagnostic methods.	PST.03.02.01.c. Analyze and design electrical circuits for AFNR power, structural and technical systems using knowledge of the basic units of electricity.	
Unit 20: Electrical Schematics/Diagrams	2%	PST.03. Service and repair AFNR mechanical equipment and power systems	PST.03.02. Service electrical systems and components of mechanical equipment and power systems using a variety of troubleshooting and/or diagnostic methods.	PST.03.02.02.b. Analyze and interpret electrical system symbols and diagrams.	
Unit 21: Electrical Motor Power Systems	3%	PST.03. Service and repair AFNR mechanical equipment and power systems	PST.03.02. Service electrical systems and components of mechanical equipment and power systems using a variety of troubleshooting and/or diagnostic methods.	PST.03.02.02.a. Compare and contrast the characteristics of electronic components used in AFNR power, structural and technical systems (e.g., battery, resistor, diode, transistor, capacitor, etc.).	
Unit 22: Electrical Components	2%	PST.03. Service and repair AFNR mechanical equipment and power systems	PST.03.02. Service electrical systems and components of mechanical equipment and power systems using a variety of troubleshooting and/or diagnostic methods.	PST.03.02.02.a. Compare and contrast the characteristics of electronic components used in AFNR power, structural and technical systems (e.g., battery, resistor, diode, transistor, capacitor, etc.).	

Unit 23: Air compressors- Pneumatic Theory of Operation	2%	PST.03. Service and repair AFNR mechanical equipment and power systems	PST.03.03. Utilize manufacturers' guidelines to diagnose and troubleshoot malfunctions in machinery, equipment and power source systems (e.g., hydraulic, pneumatic, transmission, steering, suspension, etc.).	PST.03.03.01.a. Research and summarize the applications of common types of hydraulic and pneumatic systems used in AFNR power, structural and technical systems.	
Unit 24: AC Circuits – 120 & higher voltage	2%	PST.04. Plan, build and maintain AFNR structures.	PST.04.04. Apply electrical wiring principles in AFNR structures.	PST.04.04.02.a. Distinguish electrical circuits and the components of each.	
Unit 25: AC & DC low voltage control systems	3%	PST.04. Plan, build and maintain AFNR structures.	PST.04.04. Apply electrical wiring principles in AFNR structures. PST.05.02. Performance Indicator: Prepare and/or use electrical drawings to design, install and troubleshoot electronic control systems in AFNR.	PST.04.04.01.c. Install and/or repair fixtures following appropriate codes and standards. PST.05.02.01.a. Examine and categorize electrical control system components used in AFNR systems (e.g., transistors, relays, HVAC, logic controllers, etc.). PST.05.02.01.b. Analyze schematic drawings for electrical control systems used in AFNR systems. PST.05.02.02.a. Differentiate between the purpose of electrical sensors and controls used in AFNR power, structural and technical systems. PST.05.02.02.b. Interpret maintenance schedules for electrical control systems used in AFNR	

				power, structural and technical systems.	
Unit 26: Sensing Devices & PLC	2%	PST.04. Plan, build and maintain AFNR structures PST.05. Use control, monitoring, geospatial and other technologies in AFNR power, structural and technical systems	PST.04.04 Apply electrical wiring principles in AFNR structures. <i><u>SCIENCE: SC.HS.1.8</u></i> PST.05.01. Apply computer and other technologies (e.g., robotics, CNC, UAS, etc.) to solve problems and increase the efficiency of AFNR systems. <i><u>SCIENCE: NGSS.HS.ETS.1.3</u></i> <i><u>SC.HS.3.9</u></i> PST.05.02. Prepare and/or use electrical drawings to design, install and troubleshoot electronic control systems in AFNR settings.	PST.04.04.01.c. Install and/or repair fixtures following appropriate codes and standards. PST.05.01.01.a. Research and categorize computer technologies used to solve problems and increase efficiency in AFNR systems. PST.05.02.01.a. Examine and categorize electrical control system components used in AFNR systems (e.g., transistors, relays, HVAC, logic controllers, etc.). PST.05.02.01.b. Analyze schematic drawings for electrical control systems used in AFNR systems. PST.05.02.03.a. 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.b. Assess the functions of AFNR power, structural and technical control systems using programmable logic	

				controllers (PLC) in agricultural production and manufacturing.	
Unit 27: Plumbing component & application	2%	PST.04. Plan, build and maintain AFNR structures.	PST.04.03 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.04.03.04.c. Install and/or repair pipes and plumbing equipment and fixtures in AFNR structures.	

Academic Standards Alignment

Colorado CTE courses are required to integrate academic and essential skills into course content. The following academic standards have been identified as aligned to this course and should be integrated throughout instruction.

[CO CTE Academic Standards Resources](#) (Rubrics, integration strategies, etc)

[CDE Colorado Academic Standards Online](#) (Online standards lookup tool)

Standard 1: Oral Expression and Listening

Prepared Graduate 1: Collaborate effectively as group members or leaders who listen actively and respectfully; pose thoughtful questions, acknowledge the ideas of others; and contribute ideas to further the group's attainment of an objective.

Students collaborate to inspect, troubleshoot, repair, and maintain industrial equipment while following safety procedures, interpreting technical information, and working as members of a maintenance team.

Prepared Graduate 2: Deliver effective oral presentations for varied audiences and varied purposes.

Students communicate maintenance procedures, equipment diagnostics, troubleshooting processes, and repair recommendations through demonstrations, technical discussions, and project presentations using appropriate industry terminology.

Standard 2: Reading for All Purposes

Prepared Graduate 4: Read a wide range of informational texts to build knowledge and to better understand the human experience.

Students interpret equipment manuals, electrical schematics, hydraulic and pneumatic diagrams, maintenance procedures, manufacturer specifications, and safety documentation to diagnose and maintain industrial systems.

Prepared Graduate 5: Understand how language functions in different contexts, command a variety of word-learning strategies to assist comprehension, and make effective choices for meaning or style when writing and speaking.

Students apply industry-specific vocabulary while interpreting technical documentation, following maintenance procedures, documenting repairs, and communicating with team members about equipment operation and maintenance.

Prepared Graduate 3 (literary texts) is not directly addressed by this course.

Standard 3: Writing and Composition

Prepared Graduate 7: Craft informational/explanatory texts using techniques specific to the genre.

Students prepare preventive maintenance records, equipment inspection reports, troubleshooting documentation, repair summaries, and technical reports that explain maintenance procedures and equipment performance.

Prepared Graduate 9: Demonstrate mastery of their own writing process with clear, coherent, and error-free polished products.

Students produce organized maintenance logs, repair documentation, inspection reports, and technical records that accurately communicate equipment conditions, maintenance activities, and completed repairs.

Prepared Graduate 6 (argument writing) and Prepared Graduate 8 (narrative writing) are not explicitly supported by the course standards.

Standard 4: Research Inquiry and Design

Prepared Graduate 10: Gather information from a variety of sources; analyze and evaluate its quality and relevance; and use it ethically to answer complex questions.

Students research equipment specifications, maintenance procedures, manufacturer recommendations, safety requirements, and industrial technologies to diagnose equipment problems, develop preventive maintenance plans, and improve the performance and reliability of industrial systems.

Note: *Mathematics and Science standards will be added in the future. Visit the [Colorado Academic Standards](#) page for the most current version.*