

# **AGRICULTURAL ELECTRICITY**

## Curriculum Content Frameworks

**Please note: All assessment questions will be taken from the knowledge portion of these frameworks.**

*Prepared by*

Patrick Breeding, Greenbrier High School  
Chad Burkett, Springdale High School  
Keith Gresham, Rison High School  
Dr. Jeff Horne, Southern Arkansas University  
Josh Rice, Springdale High School  
Larry Robertson, Batesville High School  
Michael Vines, Mena High School  
Dr. Jasper S. Lee, Ronald J. Biondo, and Daniel J. Pentony  
Center for Agricultural and Environmental Research & Training (CAERT) Inc.  
Danville, IL 61832

*Facilitated by*

Karen Chisholm, Program Manager  
Office of Assessment and Curriculum  
Arkansas Department of Workforce Education

*Edited by*

Marion Fletcher, Program Manager  
Bruce Lazarus, Program Advisor  
Dr. Ann Horne, Program Advisor  
Bart Draper, Program Advisor

*Disseminated by*

Career and Technical Education  
Office of Assessment and Curriculum  
Arkansas Department of Workforce Education

# Curriculum Content Frameworks

## Agricultural Electricity

Grade Levels: 10, 11, 12  
Course Code: 491040

Prerequisite: Agricultural Mechanics

Course Description: This course develops knowledge and skills in areas of electricity as applies to agriculture, including electrical terms and theory, safety, careers, electrical plans and diagrams, wire selection and connection, circuit planning and protection, service entrance panels, outlet and switch boxes, conduit, and tools. Students will learn the meaning and use of the National Electric Code. FFA and supervised experience will be integrated into the course, as appropriate.

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# Unit 1: Introduction to Agricultural Electricity

## Hours: 5

Terminology: Career Development Event (CDE), Electric Current, Proficiency Award, Supervised experience

<b>CAREER and TECHNICAL SKILLS</b>		<b>ACADEMIC and WORKPLACE SKILLS</b>			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
1.1 Define terminology	1.1.1 Prepare a list of terms with definitions	Foundation	Reading	Comprehends written information for main ideas [1.3.7]	
			Writing	Applies/Uses technical words and concepts [1.6.4]	
1.2 Examine the importance of agricultural electricity	1.2.1 List uses of electricity in the agricultural industry, including animal and plant production (farming and ranching), supplies and services, and processing and marketing	Foundation	Reading	Draws conclusions from what is read [1.3.12]	
			Speaking	Uses written resources (books, dictionaries, directories) to obtain factual information [1.3.23]	
	1.2.2 Use a local directory to identify businesses that do work in agricultural electricity	Interpersonal	Teamwork	Participates in conversation, discussion, and group presentations [1.5.8]	
			Personal Management	Takes an interest in what others say and do [2.6.5]	
1.2.3 Investigate the source of electrical power in the local area	1.2.4 Invite a resource person from a local electrical source, such as the electric power association, to speak to the class about the role of electricity in agriculture	Personal Management	Career Awareness, Development, and Mobility	Comprehends ideas and concepts related to the role of electricity in agriculture [3.1.3]	

CAREER and TECHNICAL SKILLS		ACADEMIC and WORKPLACE SKILLS			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
1.3 Discuss appropriate FFA activities and supervised experiences in agricultural electricity	1.3.1 List FFA activities available in agricultural electricity and explain the nature of the activities, including Career Development Events and Proficiency Awards	Foundation	Arithmetic/ Mathematics	Applies computational skills to keeping records [1.1.5]	
	1.3.2 Plan and/or expand supervised experiences in agricultural electricity	Personal Management	Listening	Comprehends ideas and concepts related to FFA activities in agricultural electricity [1.2.1]	
	1.3.3 Maintain records on FFA and supervised experience participation		Career Awareness, Development, and Mobility	Establishes and implements a plan of action [3.1.5]  Meets defined goals and objectives [3.1.9]  Monitors progress toward goal attainment [3.1.10]	

## Unit 2: Safety with Agricultural Electricity

### Hours: 8

Terminology: Arc Fault Circuit Interrupter (AFCI), Conductor, Continuous ground, Ground Fault Circuit Interrupter (GFCI), Ground wire, Hazard, Insulator, Milliampere, National Electric Code (NEC®), Occupational Safety and Health Act (OSHA), Risk, Safety, Surge suppressor, Underwriters Laboratories (UL®)

CAREER and TECHNICAL SKILLS What the Student Should be Able to Do		ACADEMIC and WORKPLACE SKILLS What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
2.1 Define terminology	2.1.1 Prepare a list of terms with definitions	Foundation	Reading	Comprehends written information for main ideas [1.3.7]	
			Writing	Applies/Uses technical words and concepts [1.6.4]	
2.2 Discuss the meaning and importance of safety in agricultural electricity	2.2.1 List hazards associated with agricultural electricity	Foundation	Science	Follows safety guidelines [1.4.15]	
	2.2.2 List safety practices that should be followed with agricultural electricity work	Personal Management	Integrity/Honesty/Work Ethic	Follows established rules, regulations, and policies [3.2.5]	
	2.2.3 List precautions to take to prevent personal injuries		Responsibility	Pays close attention to details [3.4.8]	
	2.2.4 Distinguish between personal safety and grounding safety in working with electricity	Thinking	Decision Making	Accepts responsibility for decisions [4.2.1]	
2.3 Describe the use of Personal Protective Equipment (PPE) in agricultural electricity	2.3.1 Identify protective clothing and equipment that should be worn/used when doing work in agricultural electricity	Foundation	Reading	Applies/Understands technical words that pertain to agricultural electricity [1.3.6]	
	2.3.2 Demonstrate how personal protective equipment is used	Personal Management	Integrity/Honesty/Work Ethic	Follows written directions [1.3.13]	
	2.3.3 Demonstrate proper storage of personal protective equipment when it is not in use			Complies with safety and health rules in a given work environment [3.2.2]	
2.4 Describe the meaning and use of grounding safety	2.4.1 List reasons for proper grounding safety	Foundation	Reading	Uses appropriate materials and techniques as specified [1.3.20]	
	2.4.2 Identify the use of GFCI and AFCI in agricultural electricity	Personal Management	Science	Applies scientific principles related to grounding electrical circuits [1.4.5]	
	2.4.3 Identify locations where grounding protection is needed		Responsibility	Comprehends ideas and concepts related to electrical grounding [3.4.2]	

## Unit 3: Careers and Licensing in Agricultural Electricity

### Hours: 5

Terminology: Arkansas Borad of Electrical Examiners, Career, Journeyman electrician, License, Master electrician, Occupation

CAREER and TECHNICAL SKILLS		ACADEMIC and WORKPLACE SKILLS			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
3.1 Define terminology	3.1.1 Prepare a list of terms with definitions	Foundation	Reading	Comprehends written information for main ideas [1.3.7]	
			Writing	Applies/Uses technical words and concepts [1.6.4]	
3.2 Explain the meaning and importance of licensing in electrical careers	3.2.1 Research and report the licensing requirements to perform electrical work	Foundation	Reading	Comprehends written information for main ideas (1.3.7)	
	3.2.2 Investigate electrician licensing requirements in Arkansas, including the role of the Arkansas Board of Electrical Examiners			Locates pertinent information in documents such as manuals, graphs, and schedules to perform tasks [1.3.18]	
	3.2.3 List requirements of experience and education needed for the classes of electrician license offered in Arkansas	Personal Management	Speaking	Asks questions to obtain information [1.5.4]	
	3.2.4 List the mailing address and web site of the Arkansas Board of Electrical Examiners		Career Awareness, Development, and Mobility	Develops skills to locate, evaluate, and interpret career information[3.1.4]	
3.3 Discuss employment opportunities in agricultural electricity	3.3.1 List and distinguish between the electrical occupations, including master electrician, journeyman electrician, industrial maintenance electrician, residential master electrician, residential journeyman, and air conditioning electrician	Foundation	Reading	Comprehends written information and applies it to specific task [1.3.2]	
			Speaking	Applies/Uses technical terms as appropriate to audience [1.5.2]	
	3.3.2 Identify education, skill preparation and license needed for entering an electrical occupation in agriculture	Personal Management	Writing	Completes form correctly [1.6.7]	
3.3.3 Identify personal attributes for success in an agricultural electricity occupation	Career Awareness, Development, and Mobility		Develops skills to locate, evaluate, and interpret career information [3.1.4]		
				Establishes and implements a plan of action [3.1.5]	
				Explores career opportunities [3.1.6]	

## Unit 4: Identifying and Using Equipment and Tools

### Hours: 8

Terminology: Box, Cable, Conduit, Connector, Electrician's pliers, Ground rod, Ground rod clamp, Junction box, Multipurpose tool, Outlet box, Receptacle, Switch, Voltage tester, Wire nut

<b>CAREER and TECHNICAL SKILLS</b>		<b>ACADEMIC and WORKPLACE SKILLS</b>			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
4.1 Define terminology	4.1.1 Prepare a list of terms with definitions	Foundation	Reading	Comprehends written information for main ideas [1.3.7]	
			Writing	Applies/Uses technical words and concepts [1.6.4]	
4.2 Discuss the selection and use of tools for electrical work	4.2.1 Identify common electrical hand tools	Foundation	Listening	Listens for content [1.2.3]	
	4.2.2 Demonstrate the proper use of common electrical hand tools	Thinking	Creative Thinking	Uses imagination to create new ideas [4.1.1]	
		Personal Management	Responsibility	Pays close attention to details [3.4.8]	
4.3 Discuss the selection of cables, wires, conduit, and connectors	4.3.1 Identify common electrical devices used in wiring, such as switches, boxes, and receptacles	Foundation	Listening	Listens for content [1.2.3]	
	4.3.2 Demonstrate the selection of appropriate devices for an electrical job	Thinking	Creative Thinking	Uses imagination to create new ideas [4.1.1]	
4.4 Discuss the selection of cables, wires, conduit, and connectors	4.4.1 Identify cables, wire, conduit, and connectors	Foundation	Listening	Listens for content [1.2.3]	
	4.4.2 Develop a display board identifying cables, wires, conduit, and connectors	Personal Management	Responsibility	Pays close attention to details [3.4.8]	

## Unit 5: Electricity Theory and Measurement

### Hours: 10

**Terminology:** Alternating Current (AC), Ampere, Cycle, Direct Current (DC), Electric field, Electric power, Electrical energy, Horsepower, Kilowatt (KW), Kilowatt-hour, Ohm, Ohm's Law, Single phase, Three phase, Volt (V), Watt (W)

CAREER and TECHNICAL SKILLS		ACADEMIC and WORKPLACE SKILLS			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
5.1 Define terminology	5.1.1 Prepare a list of terms with definitions	Foundation	Reading	Comprehends written information for main ideas [1.3.7]	
			Writing	Applies/Uses technical words and concepts [1.6.4]	
5.2 Discuss the meaning and kinds of electricity	5.2.1 Identify how electricity is an interaction known as electromagnetism and harnessed to do work as electrical energy and electric power	Foundation	Arithmetic/ Mathematics	Applies addition, subtraction, and division to real-world situations [1.1.1]	
	5.2.2 Contrast Alternating Current (AC) and Direct Current (DC)			Calculates measurements taken from measuring devices [1.1.9]	
	5.2.3 Relate electric fields to practical uses in electric motors and other agricultural devices			Computes using a formula [1.1.14]	
		Thinking	Science	Applies scientific principles related to agricultural electricity [1.4.5]	
			Problem Solving	Records data related to electric power measurement [1.4.21]	
5.3 Explain the measurement of electricity and how rates are calculated	5.3.1 Describe the relationship between Volts (V), Watts (W), and Amps (A); relate these to Ohm's Law	Foundation	Arithmetic/ Mathematics	Applies addition, subtraction, and division to real-world situations [1.1.1]	
	5.3.2 Demonstrate the use of a multimeter		Reading	Applies/Understands technical words that pertain to a subject [1.3.6]	
	5.3.3 Calculate electrical load for a variety of agricultural devices used separately and in various combinations	Personal Management	Responsibility	Comprehends ideas and concepts related to the measurement of electric current [3.4.2]	
	5.3.4 Calculate electrical power costs				
	5.3.5 Solve an electrical cost problem				

## Unit 6: Using Electrical Plans and Diagrams

### Hours: 8

Terminology: Electric symbols, Energized wire, Grounding wire, Neutral wire, Parallel circuit, Series circuit, Split circuit, Split-wired duplex receptacle, Switch loop

CAREER and TECHNICAL SKILLS What the Student Should be Able to Do		ACADEMIC and WORKPLACE SKILLS What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
6.1 Define terminology	6.1.1 Prepare a list of terms with definitions	Foundation	Reading	Comprehends written information for main ideas [1.3.7]	
			Writing	Applies/Uses technical words and concepts [1.6.4]	
6.2 Discuss the meaning and use of plans in agricultural electricity	6.2.1 Identify electrical symbols used in plans	Foundation	Science	Follows safety guidelines [1.4.15]	
	6.2.2 Identify the kinds of circuits in an electrical plan	Interpersonal	Writing	Uses technical words and symbols [1.6.20]	
	6.2.3 Identify the locations of switches, lights, outlets, and other common devices in an electrical plan as related to the service entrance panel		Teamwork	Works effectively with others to reach a common goal [2.6.6]	
	6.2.4 Perform the installations shown in an agricultural electrical plan	Personal Management	Responsibility	Maintains a high level of concentration in completion of a task [3.4.7]  Sets high standards for self in completion of a task [3.4.9]	
6.3 Discuss the meaning and use of circuit diagrams	6.3.1 Identify the meaning of color in a circuit diagram, including red, black, blue, and green	Foundation	Reading	Uses graphs/charts/tables to obtain factual information [1.3.21]	
	6.3.2 Demonstrate the preparation of a circuit diagram for switches, receptacles, and lights	Personal Management	Responsibility	Exerts a high level of effort and perseverance towards goal attainment [3.4.4]	

## Unit 7: Selecting and Connecting Wire

**Hours: 18**

Terminology: Ampacity, Armored cable (AC), Connector, End splice, Non-metallic box (NMB), Non-metallic sheathed cable corrosive resistance (NMC), Pigtail splice, Splice, Tap splice, Underground feeder, Underground service entrance, Voltage drop

<b>CAREER and TECHNICAL SKILLS</b>		<b>ACADEMIC and WORKPLACE SKILLS</b>			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
7.1 Define terminology	7.1.1 Prepare a list of terms with definitions	Foundation	Reading	Comprehends written information for main ideas [1.3.7]	
			Writing	Applies/Uses technical words and concepts [1.6.4]	
7.2 Discuss the meaning and importance of wire materials, size, and insulation	7.2.1 List the kinds of wire insulation and the uses of each	Foundation	Listening	Listens for content [1.2.3]	
	7.2.2 Visually observe the different wire insulation types	Personal Management	Writing	Analyzes data, summarizes results, and makes conclusions [1.6.2]	
	7.2.3 Describe how wire is sized and why size is important in electrical wiring		Responsibility	Comprehends ideas and concepts related to electrical wire types and sizes [3.4.2]	
	7.2.4 State relationships between wire size and amperage		Thinking	Reasoning	Uses logic to draw conclusions from available information [4.5.6]
	7.2.5 Compare copper conductors to those made of other kinds of metal materials				
7.3 Discuss the meaning and importance of voltage drop	7.3.1 List causes of voltage drop	Foundation	Reading	Comprehends written information for main ideas [1.3.7]	
	7.3.2 Use a voltmeter to demonstrate voltage drop	Personal Management	Science	Applies scientific principles related to voltage and electrical current [1.4.5]	
	7.3.3 List procedures to overcome problems with voltage drop		Responsibility	Pays close attention to details [3.4.8]	

<b>CAREER and TECHNICAL SKILLS</b>		<b>ACADEMIC and WORKPLACE SKILLS</b>			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
<b>Knowledge</b>	<b>Application</b>	<b>Skill Group</b>	<b>Skill</b>	<b>Description</b>	
7.4 Discuss the meaning and importance of quality connections between wires	7.4.1 List ways wires may be connected	Foundation	Arithmetic/ Mathematics	Makes rough measurements [1.1.28]	
	7.4.2 Demonstrate the construction of end, rattail, and tap splices	Personal Management	Responsibility	Maintains a high level of concentration in completion of a task [3.4.7]	
	7.4.3 Demonstrate the use of connectors such as wire nuts				
	7.4.4 Demonstrate the use of appropriate insulation materials on splices				

## Unit 8: Planning and Protecting Circuits

### Hours: 10

Terminology: Branch circuit, Breaker, Circuit, Feeder circuit, Fuse, General lighting circuit, Individual circuit, Motor circuit, Parallel circuit, Series circuit, Small appliance circuit

CAREER and TECHNICAL SKILLS What the Student Should be Able to Do		ACADEMIC and WORKPLACE SKILLS What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
8.1 Define terminology	8.1.1 Prepare a list of terms with definitions	Foundation	Reading  Writing	Comprehends written information for main ideas [1.3.7]  Applies/Uses technical words and concepts [1.6.4]	
8.2 Describe the meaning and importance of protection devices in agricultural electricity	8.2.1 List the various circuit protection devices and indicate the advantages and disadvantages of each	Foundation	Listening  Writing	Listens for content [1.2.3]  Analyzes data, summarizes results, and makes conclusions [1.6.2]	
	8.2.2 Identify the meaning and use of surge arresters/suppressors/protectors	Thinking	Reasoning	Uses logic to draw conclusions from available information [4.5.6]	
8.3 Discuss the types, design, and installation of circuits	8.3.1 List and distinguish between the types of circuits, including feeder, branch, appliance, and individual circuits	Foundation	Listening  Writing	Listens for content [1.2.3]  Analyzes data, summarizes results, and makes conclusions [1.6.2]	
	8.3.2 Prepare and/or use a circuit diagram in planning and installing a circuit	Thinking	Reasoning	Uses logic to draw conclusions from available information [4.5.6]	

## Unit 9: Installing the Service Entrance Panel (SEP)

**Hours: 10**

Terminology: Emergency generator, Meter base, Service entrance cable, Service Entrance Panel (SEP), Service head, Service insulators

CAREER and TECHNICAL SKILLS What the Student Should be Able to Do		ACADEMIC and WORKPLACE SKILLS What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
9.1 Define terminology	9.1.1 Prepare a list of terms with definitions	Foundation	Reading	Comprehends written information for main ideas [1.3.7]	
			Writing	Applies/Uses technical words and concepts [1.6.4]	
9.2 Discuss the meaning and importance of a service entrance	9.2.1 Identify the major parts (components) of a service entrance panel	Foundation    Personal Management	Speaking	Applies/Uses technical terms as appropriate to audience [1.5.2]	
	9.2.2 List factors in the proper installation of a service entrance panel		Science	Speaks in a clear, concise manner [1.5.12]	
	9.2.3 Distinguish between 120V and 240V service		Responsibility	Follows safety guidelines [1.4.15]	
	9.2.4 Discuss overhead clearance for service wires			Maintains a high level of concentration in completion of a task [3.4.7]	
	9.2.5 Identify factors to consider in the location of a service entrance			Pays close attention to details [3.4.8]	
9.3 Discuss the meaning and importance of a distribution board	9.3.1 Name the components of a distribution board	Foundation	Arithmetic/ Mathematics	Applies a mathematical formula to solve a problem [1.1.3]	
	9.3.2 Identify breaker arrangement in a distribution board			Calculates different units of measurement [1.1.6]	
	9.3.3 Determine the size of distribution board needed by calculating the load for an agricultural structure		Listening	Performs basic computations [1.1.31]	
				Listens for content [1.2.3]	
				Receives and interprets verbal messages [1.2.8]	

CAREER and TECHNICAL SKILLS			ACADEMIC and WORKPLACE SKILLS		
What the Student Should be Able to Do			What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description	
9.4 Describe the meaning and importance of grounding for a service entrance	9.4.1 Identify why grounding is important with service entrance installation	Foundation	Speaking	Applies/Uses technical terms as appropriate to audience [1.5.2]	
	9.4.2 Demonstrate proper way of grounding a service entrance		Writing	Communicates thoughts, ideas, or facts in written form in a clear, concise manner [1.6.6]  Uses technical words and symbols [1.6.20]	
9.5 Discuss the meaning and importance of the electric meter	9.5.1 Demonstrate how to read an electric meter	Foundation	Arithmetic/ Mathematics	Applies computation skills to read an electric meter [1.1.5]	
	9.5.2 Identify factors to consider in locating an electric meter		Reading	Determines what information is needed [1.3.10]	
	9.5.3 Determine the requirements of meter base location from the local electric power provider		Writing	Writes appropriate entries [1.6.22]	
9.6 Discuss the meaning and importance of emergency generators	9.6.1 Identify considerations in hooking up an emergency generator	Personal Management	Responsibility	Pays close attention to details [3.4.8]	
	9.6.2 List kinds, sizes, and sources of fuel for emergency generators		Foundation	Speaking	Applies/Uses technical terms as appropriate to audience [1.5.2]
	9.6.3 Identify circuits to be included with an emergency generator		Writing	Communicates thoughts, ideas, or facts in written form in a clear, concise manner [1.6.6]  Uses technical words and symbols [1.6.20]	
		Personal Management	Organizational Effectiveness	Applies knowledge to implement work-related system or practice [3.3.4]	

## Unit 10: Installing Outlet and Switch Boxes

### Hours: 10

Terminology: Bar-hanger, Fixture stud, Knock-out, Knock-out seal

<b>CAREER and TECHNICAL SKILLS</b> What the Student Should be Able to Do		<b>ACADEMIC and WORKPLACE SKILLS</b> What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description
10.1 Define terminology	10.1.1 Prepare a list of terms with definitions	Foundation	Reading	Comprehends written information for main ideas [1.3.7]
			Writing	Applies/Uses technical words and concepts [1.6.4]
10.2 Discuss the importance and use of outlet and switch boxes	10.2.1 Name and identify the types of electrical boxes	Foundation	Speaking	Applies/Uses technical terms as appropriate to audience [1.5.2]
	10.2.2 Name the materials used in manufacturing boxes		Writing	Applies/Uses technical words and concepts [1.6.4]
	10.2.3 Identify the different face plates for boxes			
10.3 Discuss the installation of boxes	10.3.1 List the requirements for installing boxes	Foundation	Speaking	Applies/Uses technical terms as appropriate to audience [1.5.2]
	10.3.2 Demonstrate the proper installation of a switch box, outlet box, and light box using code standards			

## Unit 11: Installing Switches and Outlets

**Hours: 10**

Terminology: 240 Volt outlet, Clock outlet, Dimmer switch, Duplex outlet with ground, Duplex outlet without ground, Four-way switch, Ground plug adaptor, Keyless receptacle, Single-pole switch, Three-way switch

<b>CAREER and TECHNICAL SKILLS</b> What the Student Should be Able to Do		<b>ACADEMIC and WORKPLACE SKILLS</b> What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description
11.1 Define terminology	11.1.1 Prepare a list of terms with definitions	Foundation	Reading	Comprehends written information for main ideas [1.3.7]
			Writing	Applies/Uses technical words and concepts [1.6.4]
11.2 Discuss the meaning and importance of switches and outlets	11.2.1 Identify the different kinds of outlets and switches	Foundation	Listening	Listens for content [1.2.3]
	11.2.2 Explain the uses of the three kinds of switches		Science	Follows safety guidelines [1.4.15]
11.3 Describe the proper selection and installation of switches and receptacles	11.3.1 Discuss the capacity (amps) of switches and outlets	Foundation	Speaking	Communicates a thought in spoken form [1.5.5]
	11.3.2 List factors to consider in selecting switches and receptacles	Personal Management	Responsibility	Maintains a high level of concentration in completion of a task [3.4.7]
	11.3.3 Demonstrate the installation of switches and receptacles following electric code regulations			

## Unit 12: Using Conduit

### Hours: 8

Terminology: Bushing, Conduit bender, Conduit support hardware, Coupling, Electrical Metallic Tubing (EMT), Electrical Non-metallic Tubing (ENT), Fish tape, Flexible Metal Conduit (FMC), Intermediate metal conduit, Liquid tight conduit, Lock nut, Rigid Metal Conduit (RMC)

<b>CAREER and TECHNICAL SKILLS</b> What the Student Should be Able to Do		<b>ACADEMIC and WORKPLACE SKILLS</b> What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description
12.1 Define terminology	12.1.1 Prepare a list of terms with definitions	Foundation	Reading	Comprehends written information for main ideas [1.3.7]
			Writing	Applies/Uses technical words and concepts [1.6.4]
12.2 Discuss the meaning and kinds of conduit	12.2.1 List reasons conduit is used	Foundation	Listening	Evaluates oral information/presentation [1.2.2]
	12.2.2 Identify the different types of conduit	Thinking	Reading	Analyzes and applies information and concepts derived from printed materials [1.3.2]
	12.2.3 List the sizes of conduit and explain how the size of conduit to use is determined		Decision Making	Evaluates information/data to make best decisions [4.2.5]
	12.2.4 Explain how the number of wires to be run in conduit is determined			
12.3 Describe the installation of conduit	12.3.1 Demonstrate how conduit is measured, cut, and bent	Foundation	Reading	Analyzes and applies information and concepts derived from printed materials [1.3.2]
	12.3.2 Demonstrate how conduit is connected to boxes and mounted to structures using conduit support hardware	Thinking	Problem Solving	Demonstrates logical reasoning to reach a conclusion [4.4.2]
	12.3.3 Demonstrate how metallic conduit is grounded			Interprets drawings to solve design problems [4.4.7]
	12.3.4 Demonstrate how cable and/or wire is pulled in conduit			

## Unit 13: Selecting and Using Electric Motors and Appliances

**Hours: 10**

Terminology: Appliance, Capacitor Motor, Fastened in place, Name plate, Permanently connected, Repulsion-induction motor, Single-phase motor, Split-phase motor, Three-phase motor, Universal motor

CAREER and TECHNICAL SKILLS What the Student Should be Able to Do		ACADEMIC and WORKPLACE SKILLS What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description
13.1 Define terminology	13.1.1 Prepare a list of terms with definitions	Foundation	Reading	Comprehends written information for main ideas [1.3.7]
			Writing	Applies/Uses technical words and concepts [1.6.4]
13.2 Discuss the types and uses of electric motors	13.2.1 List the types of electric motors	Foundation  Personal Management	Reading	Uses standard occupational resource materials [1.3.22]
	13.2.2 List uses of electric motors		Science	Describes/Explains scientific principles related to magnetism and electric motors [1.4.13]
	13.2.3 Explain how electric motors are classified on the basis of power		Responsibility	Sets high standards for self in completion of a task [3.4.9]
	13.2.4 Calculate pulley/speed ratio on electric motors			
13.3 Discuss the meaning and importance of electrical appliances	13.3.1 List common electrical appliances used in agriculture	Foundation  Personal Management	Listening	Listens for content [1.2.3]
	13.3.2 Indicate how appliances are classified on the basis of connection, such as permanently connected, cord-and-plug connected, and fastened in place		Reading	Analyzes and applies what has been read to specific task [1.3.2]
	13.3.3 Classify appliances based on electrical power needs		Responsibility	Sets high standards for self in completion of a task [3.4.9]
13.4 Describe the importance of nameplates on motors and appliances	13.4.1 List the information found on an electric nameplate	Foundation	Reading	Comprehends written information and applies it to a task [1.3.8]
	13.4.2 Identify uses of information on a nameplate	Thinking	Problem Solving	Recognizes/Defines problem [4.4.8]

<b>CAREER and TECHNICAL SKILLS</b>		<b>ACADEMIC and WORKPLACE SKILLS</b>			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
<b>Knowledge</b>	<b>Application</b>	<b>Skill Group</b>	<b>Skill</b>	<b>Description</b>	
13.5 Discuss the maintenance and operating costs of electric motors and appliances	13.5.1 List common maintenance practices with electric motors	Foundation	Listening	Comprehends ideas and concepts related to motor/appliance maintenance [1.2.1]	
	13.5.2 List benefits of performing maintenance practices on electric motors and appliances		Reading	Analyzes and applies information and concepts derived from printed materials [1.3.2]	
	13.5.3 Demonstrate common maintenance practices on electric motors and appliances		Speaking	Comprehends written specifications and applies them to a task [1.3.9] Participates in conversation, discussion, and group presentations [1.5.8]	
		Personal Management	Integrity/Honesty/Work Ethic	Follows established rules, regulations, and policies [3.2.5]	

## **Glossary**

### **Unit 1: Introduction to Agricultural Electricity**

1. Career Development Event (CDE) – an activity in which FFA members demonstrates their skills in competition
2. Electric Current – movement or flow of electrically charged particles; typically measured in amperes
3. Proficiency Award – a program that allows FFA members to achieve honors through success in supervised experience
4. Supervised experience – a component of agricultural education in which students apply and enhance skills learned in class through part-time employment, entrepreneurship, directed laboratory activities, and other ways

## Unit 2: Safety with Agricultural Electricity

1. Arc Fault Circuit Interrupter (AFCI) – a protective device that recognizes an arcing fault in progress and opens a circuit to prevent fires, injuries or other losses
2. Conductor – any material that will permit electrons (electricity) to move through it
3. Continuous ground – a bare un-insulated grounding wire which is run from outlet to outlet with no interruptions in the wire
4. Ground Fault Circuit Interrupter (GFCI) – a device that protects against ground-fault currents by instantly opening a circuit when a fault is beginning to occur
5. Ground wire – a wire that is bonded within the service equipment closure to the neutral conductor and the equipment grounding conductor that connects them to the grounding electrode system
6. Hazard – a situation where risk of injury or loss is present; danger
7. Insulator – material that provides great resistance to the flow of electrons
8. Milliampere – an electron flow measurement equal to 1/1000th of an ampere
9. National Electric Code (NEC®) – a set of guidelines on wire sizes and other standards for safe, efficient electrical installations; updated every three years and published by the National Fire Protection Association
10. Occupational Safety and Health Act (OSHA) – a federal law designed to ensure that employers provide workers with an environment free from dangers to safety and health; OSHA is an agency of the U. S. Federal government
11. Risk – possibility of a loss or injury
12. Safety – freedom from accidents
13. Surge suppressor – a device which protects sensitive electronic equipment from voltage surges (sudden increases)
14. Underwriters Laboratory (UL®) – a testing laboratory that generates standards for most electrical products in the United States

## **Unit 3: Careers and Licensing in Agricultural Electricity**

1. Arkansas Board of Electrical Examiners – the state agency which administers license for electricians, including establishing requirements and administering tests
2. Career – the direction of a person's life as related to work
3. Journeyman electrician – a level of electrician licensing based on training, experience, and passing a test; requirement includes completion of an electrician training program, four years or 8,000 hours of electrical work experience, and satisfactory test score
4. License – permission granted by an authority with the power to do so that allows an individual to engage in an occupation or other beneficial practice
5. Master electrician – the highest level of electrician licensing that involves education, training, experience, and satisfactory test performance
6. Occupation – an area of work with specific duties

## Unit 4: Identifying and Using Equipment and Tools

1. Box – a box-shaped device used in electrical wiring to hold splices and connections; several types are used including junction box, switch box, and outlet box
2. Cable – an assembly of two or more insulated wires in a non-metallic sheathed or armored cable; used in wiring electrical circuits that holds insulation and wires in a bundle
3. Conduit – a tube used to contain and protect individual electric wires or cable
4. Connector – a device that securely attaches electrical wires
5. Electrician's pliers – a common tool used by electricians in wiring installation
6. Ground rod – a rod that is at least 5/8-inch in diameter that is driven at least 8 feet into the ground to provide a ground connection to the earth
7. Ground rod clamp – a device that connects the grounding wire to the ground rod
8. Junction box – electrical outlet box with a blank cover that contains wire splices
9. Multipurpose tool – a useful electrician device for cutting, stripping, bending, and other uses
10. Outlet box – an electrical box that contains splices and connections to an electrical outlet or receptacle
11. Receptacle – electrical devices installed to provide safe and easy connection of appliances
12. Switch – device that opens and closes an electrical circuit
13. Voltage tester – an instrument for testing the voltage in a circuit
14. Wire nut – a type of connector that screws onto an electrical splice; also known as a twist-on connector

## Unit 5: Electricity Theory and Measurement

1. Alternating Current (AC) – alternating flow of electrons that reverses direction 60 times a second
2. Ampere (A) (amp) – a measure of the rate of flow of current in a conductor
3. Cycle – in alternating current, the time is usually 1/60th of a second, during which the voltage goes from zero to + maximum and back
4. Direct Current (DC) – continuous flow of electrons in one direction
5. Electric field – an effect produced by an electric charge that exerts a force on charged objects in its vicinity
6. Electric power – the rate at which electric energy is converted to or from another form of energy
7. Electrical energy – the energy made available by the flow of an electric charge in a conductor
8. Horsepower – force needed to lift 550 pounds one foot in one second
9. Kilowatt (KW) – a measure of electricity equal to 1000 watts
10. Kilowatt-hour – the use of 1000 watts for one hour
11. Ohm – a measure of the resistance of a material to the flow of electrical current
12. Ohm's law – the relationship between electric current (I), electromotive force (E), and resistance
13. Single phase – the current produced from a single alternating source, using two wires (120-volt only) or three wires (120/240 volts)
14. Three phase – current produced from three separate alternating sources, each in a different phase or cycle
15. Volt (V) – a measure of electrical pressure
16. Watt (W) – a measure of energy available or work that can be done using one ampere at one volt

## Unit 6: Using Electrical Plans and Diagrams

1. Electric symbol – a graphic representation of an electrical device
2. Energized wire – any wire carrying electric current
3. Grounding wire – the wire in a circuit that must be connected to every metal box and device in the circuit to ensure that safety of the circuit; it may be bare, green, or green with yellow stripes
4. Neutral wire – commonly it is one of three service wires; a neutral wire has white insulation, goes to every electrical device in a circuit except switches, and is grounded to the service entrance panel or other connection
5. Parallel circuit – the connection of two or more devices or loads across the same conductors of a circuit, with current flow through each being independent of the others
6. Series circuit – the connection of two or more devices or loads in tandem so that the current flowing through each also flows through all the others; rarely used in agricultural wiring
7. Split circuit – an outlet where each half is controlled by separate circuit breakers
8. Split-wired duplex receptacle – a receptacle where one half is energized constantly and the other is controlled by a switch
9. Switch loop – a wire between a switch and the device it is controlling

## Unit 7: Selecting and Connecting Wire

1. Ampacity – the safe current carrying capacity of a wire in amps
2. Armored Cable (AC) – two or more conductors, paper wrapped, enclosed in a flexible, spiral interlocked armor of steel or aluminum, often referred to as "BX"
3. Connector - a device used to connect EMT conduit using a pressure fitting.
4. End Splice - a common type of electrical splice that joins the ends of two wires made by crossing, hooking, and twisting the two ends.
5. Non-metallic box (NMB) – a box made of non-metallic material, an example being plastic
6. Non-metallic sheathed cable (NM) – a type of cable which can only be used in dry locations; also know as Romex
7. Non-Metallic sheathed cable corrosive resistant (NMC) – a type of cable which can be used in damp corrosive locations; also known as Romex
8. Pigtail splice – a type of splice or connection on which a twist-on connector (wire nut) is used
9. Splice – the joining together of two wires of the same color and used in a circuit (Note: NEC restricts the use of splices; get the details before using a splice)
10. Tap splice – a type of splice that connects one wire to another continuing wire to create a branch
11. Underground feeder (UF) – wire which may be buried directly into the earth and must be protected by a fuse or breaker at the source
12. Underground Service Entrance (USE) – a cable which may be buried directly into the earth without a breaker or fuse protection
13. Voltage drop – the loss of voltage in a wire between a source and its intended use

## Unit 8: Planning and Protecting Circuits

1. Branch circuit – wiring that connects an outlet or group of outlets to the last fuse or circuit breaker
2. Breaker – an over current device which automatically opens a circuit if a predetermined number of amps flows through it
3. Circuit – arrangement of conductors, devices, and utilization equipment (loads) such that a current will pass through it
4. Feeder circuit – a circuit extending between the service equipment and the final branch circuit and the over current device
5. Fuse – soft metal link that melts and opens a circuit at a predetermined level of over current
6. General lighting circuit – circuits which are dedicated to lights and receptacles
7. Individual circuit – circuit which serves individual appliances such as a range and clothes dryer
8. Motor circuit – a circuit which serves individual motors over 1/8th horsepower that are not a part of the appliance
9. Parallel circuit – connection of two or more devices or loads across the same conductors of the circuit current flows through each being independent of the others
10. Series circuit – connection of two or more devices or loads in tandem so that the current flowing through each also flows through all the others; rarely used in residential and farm wiring
11. Small appliance circuit – circuits which serve only small appliance outlets including refrigeration equipment in the kitchen, pantry, breakfast room, and dining room

## Unit 9: Installing the Service Entrance Panel (SEP)

1. Emergency generator – an engine-powered source of electricity used when the electric power fails; some are wired into the service entrance panel and automatically begin operating when the electricity goes off
2. Meter base – the socket which is usually provided by the power supplier and installed 5 feet above the ground which houses the electrical meter
3. Service entrance cable – the cable used to bring wires into the building; it runs from the service head to the service entrance panel
4. Service Entrance Panel (SEP) – the panel which is the main fixed control and cutoff of the electrical supply consisting of breakers or fuses and connected to the load end of the service conductors in a building
5. Service head – located on top of the service entrance to protect the installation from excess moisture; entrance cap or weather head
6. Service insulators – insulators located on the outside of the building which is the point where the power supplier's wires stop; they should be located as high as practical but lower than the service head

## Unit 10: Installing Outlet and Switch Boxes

1. Bar-hanger – an adjustable bar which has a fixture stud sliding on it that is used when a box must be mounted between studs or joists
2. Fixture stud – used to support heavy fixtures which need to be supported independent of the box
3. Knock-out – circular pieces of metal located on boxes which may be removed to permit wires to enter the box
4. Knock-out seal – insert used to plug a previously removed knock-out

## Unit 11: Installing Switches and Outlets

1. 240 volt outlet – point on a wiring system at which a 240 volt device or extension cord may be connected
2. Clock outlet – specially designed receptacle with a recessed face used for mounting clocks
3. Dimmer switch – a device which allows for control of the brightness of a light
4. Duplex-outlet with ground – an electrical device consisting of a pair of receptacles on a single yoke with a third opening for a ground wire
5. Duplex outlet without ground – an electrical device consisting of a pair of receptacles on a single yoke without a third opening for a ground wire
6. Four-way switch – device for turning electrical equipment on or off from more than two locations
7. Ground plug adaptor – allows for the connecting of three wire plugs to be used in a duplex, non-grounded receptacle; known as a two-to-three wire adaptor
8. Keyless receptacle – a lamp holder that anchors to an octagon box, round box, for incandescent light bulbs
9. Single-pole switch – device for turning electrical equipment on or off from one location
10. Three-way switch – device for turning electrical equipment on or off from two locations

## Unit 12: Using Conduit

1. Bushing – used to fasten conduit to boxes; used on the inside of the box
2. Conduit bender – a device used to bend conduit and prevents the collapsing of the conduit
3. Conduit Support Hardware - installation devices used to support and hold conduit in position.
4. Coupling – connector used to connect EMT conduit using a set-screw
5. Electrical Metallic Tubing (EMT) – may be used either indoors or outdoors and cannot be threaded; known as thin-walled tubing
6. Electrical Non-metallic Tubing (ENT) – made of PVC with a corrugated wall construction that allows it to be bent by hand without the application of heat
7. Fish Tape - a device used to route electrical wire through conduit, wall cavities, or other structural spaces.
7. Flexible Metal Conduit (FMC) – used when flexibility or movement is required such as an electric motor circuit; commonly referred to as Greenfield or Flex
8. Intermediate Metal Conduit – type of conduit which has a slightly smaller wall thickness than RMC and may be threaded
9. Liquid tight conduit – may be made of metallic or non-metallic material and is used in areas where moisture may be present
9. Lock nut – used to fasten conduit to boxes; used on the outside of the box
10. Rigid Metal Conduit (RMC) – a thick-walled conduit, which size-for-size has the same dimensions as standard water pipe, and may be threaded

## Unit 13: Selecting and Using Electric Motors and Appliances

1. Appliance – standardized equipment that performs one or more functions and is installed as a ready-to-use unit
2. Capacitor motor – motor which contains a capacitor or condenser that enables it to start heavy loads
3. Fastened in place – appliances that at a definition location because they cannot be easily moved due to requirements such as water or drainage
4. Name plate – a plate located on the motor which contains the necessary information for installation, repair, and maintenance of an electrical motor
5. Permanently connected – connected with circuits that terminate with that appliance
6. Repulsion-induction motor – motor with a very high starting capacity, used for heavier jobs; will "break loose" almost any kind of hard starting machine
7. Single-phase motor – motor that runs off of 120/240 volts, single phase current
8. Split-phase motor – simple type of motor that does not contain brushes or a commutator and draws very heavy amperage while starting
9. Three-phase motor – simplest and most trouble free and operates on three phase current
10. Universal motor – motor that may be used on Alternating Current (AC) or Direct Current (DC)