

## Module Overview

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A power line worker's primary duty is to safely install and maintain electrical transmission and distribution systems. Power line workers are exposed to hazards, including exposure to high voltages, confined space work, working in trenches, working underground, and working at heights. As a line worker, it is your responsibility to perform your duties safely and to ensure that your co-workers perform their jobs safely. This module establishes and explains the minimum safety standards that you are required to meet.

## Prerequisites

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Prior to training with this module, it is recommended that the trainee shall have successfully completed *Power Industry Fundamentals*.

## Objectives

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Upon completion of this module, the trainee will be able to do the following:

1. Identify, inspect, maintain, and use craft-specific PPE and identify its limitations.
2. Inspect rubber insulating blankets, line hoses, covers, and guards.
3. Describe the safety practices associated with high-voltage work, including:
  - Step and touch potential
  - Minimum approach distance
  - Protection from arc flash and arc blast
  - Procedures for entering substations
4. Explain work zone safety requirements.
5. Describe traffic control methods.
6. Identify the signs and causes of unstable trenches and describe the safety practices associated with trench work.
7. Identify hazards related to working near horizontal drilling operations.
8. Identify hazards and safeguards associated with confined-space work.
9. Explain the purposes of, and differences between, job safety analyses and task safety analyses.
10. Describe how to mitigate environmental impacts.

## Performance Tasks

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Under the supervision of the instructor, the trainee should be able to do the following:

1. Inspect and put on craft-specific PPE.
2. Inspect rubber insulating blankets, line hoses, covers, and guards, and install them on deactivated power lines.

## Materials and Equipment

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Multimedia projector and screen  
*Power Line Worker Level 1 PowerPoint*<sup>®</sup>  
Presentation Slides (ISBN 978-0-13-257136-4)

Computer

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Access to a variety of PPE, including:

Hard hats

Footwear

Chaps

Eye protection

Hearing protection

Hand and arm protection

Flame-resistant clothing

Face protection

Access to a variety of TTC equipment,  
including:

Barricades, cones, and signs

Traffic signaling devices, such as paddles  
or flags

High-visibility safety apparel

Approved flashlight or battery-powered  
lantern

Access to a variety of safety equipment and tools, including:	Rubber line hoses, covers, and guards
Lockout/tagout devices	Non-conductive clamps
Temporary protective grounds	Copy of MUTCD (if available)
Live-line tools	Module Examinations*
Rubber insulating equipment	Performance Profile Sheets*
Protective shields	
Physical or mechanical barriers	

\*Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

## Safety Considerations

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Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Review safety guidelines associated with accomplishing performance tasks. Emphasize the importance of proper housekeeping.

## Additional Resources

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This module presents thorough resources for task training. The following resource material is suggested for further study.

*ASTM F1506, Standard Performance Specification for Flame-Resistant Textile Materials for Wearing Apparel for Use by Electrical Workers Exposed to Momentary Electric Arc and Related Thermal Hazards.*

*ASTM F1505, Standards for Insulated Electrical Tools.*

*ASTM D1048, Standard Specification for Rubber Insulating Blankets.*

*ASTM F479, Standard Specification for In-Service Care of Insulating Blankets.*

*NFPA 70®, National Electrical Code® (NEC®).*

*NFPA 70E®, Standard for Electrical Safety in the Workplace.*

*OSHA Standard 29, Part 1910, Subpart R, Section 269.*

*National Electrical Safety Code® (NESC®), supplied by the IEEE provides requirements for electrical installations.*

*ASTM Z87.1 Standards for Safety Glasses.*

*ANSI/ASSE Z87.1-2003, Occupational and Educational Personal Eye and Face Protection Devices.*

*OSHA Standard 29, Section 1910.147 identifies conditions for simple lockout procedures for non-electrical work.*

*Federal Highway Administration, Manual on Uniform Traffic Control Devices (MUTCD) for Streets and Highways.*

## Teaching Time for This Module

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An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 22½ hours are suggested to cover *Power Line Worker Safety*. You will need to adjust the time required for testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
<b>Session I. Introduction; Introduction to Electrical Power and Hazards; Electrical Safety</b>	
A. Introduction	_____
1. Industry Standards	_____
2. Line Worker Safety	_____
B. Introduction to Electrical Power and Hazards	_____
1. Electrical Power	_____
2. Electrical Hazards	_____
C. Electrical Safety	_____
1. Hazard Boundaries	_____
2. De-Energized Equipment	_____
3. Substation Entry	_____
<b>Sessions II and III. Protective Equipment</b>	
A. Protective Equipment	_____
1. Personal Protective Equipment	_____
B. Laboratory	_____
1. Have trainees inspect and correctly put on PPE. This laboratory corresponds to Performance Task 1.	_____
C. Lockout/Tagout Devices	_____
D. Temporary Protective Grounds	_____
E. Live-Line Tools	_____
F. Other Tools and Protective Equipment	_____
G. Laboratory	_____
1. Have trainees inspect and correctly install protective equipment on deactivated power lines. This laboratory corresponds to Performance Task 2.	_____
<b>Session IV. Traffic Control</b>	
A. Traffic Control	_____
<b>Session V. Trenching Safety</b>	
A. Trenching Safety	_____
1. Preparation	_____
2. Trenching Hazards	_____
3. Trenching Safety Guidelines	_____
4. Indications of an Unstable Trench	_____
5. Making the Trench Safe	_____
6. Soil Hazards	_____
<b>Session VI. Horizontal Directional Drilling</b>	
A. Horizontal Directional Drilling	_____
1. Setting up the Drilling Site and Equipment	_____
2. Boring Operations Safety	_____
<b>Session VII. Confined Spaces</b>	
A. Confined Spaces	_____
1. Confined-Space Classification	_____
2. Entry Permits	_____
3. Confined Space Hazards	_____
4. Responsibilities and Duties	_____
5. Safeguards	_____
6. Substation Entry	_____

Topic	Planned Time
<b>Session VIII. Environmental Concerns; Job Safety Analyses and Task Safety Analyses; Work Zone and Personal Safety</b>	
A. Environmental Concerns	_____
1. Clean Water Act	_____
2. Endangered Species Act	_____
3. Good Housekeeping Practices	_____
B. Job and Task Safety Analyses	_____
C. Work-Zone and Personal Safety	_____
1. Work-Zone Safety	_____
2. Emergency Response	_____
3. Personal Safety	_____
<b>Session IX. Review and Testing</b>	
A. Review	_____
B. Module Examination	_____
1. Trainees must score 70 percent or higher to receive recognition from NCCER.	
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.	
C. Performance Testing	_____
1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.	
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.	

## Module Overview

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This module introduces the trainee to electrical circuits. It offers a general introduction to electrical concepts used in Ohm's law, including atomic theory, electromagnetic force, resistance, and electric power equations. It also covers series, parallel, and series-parallel circuits.

## Prerequisites

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Prior to training with this module, it is recommended that the trainee shall have successfully completed *Power Industry Fundamentals* and *Power Line Worker Level One*, Module 49102-11.

## Objectives

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Upon completion of this module, the trainee will be able to do the following:

1. Explain the difference between conductors and insulators.
2. Define voltage and identify the ways that it can be produced.
3. Define the units of measurement that are used to measure the properties of electricity.
4. Explain the basic characteristics of series and parallel circuits.
5. Identify the meters used to measure voltage, current, and resistance.
6. Identify specialized test instruments used by power line workers.

## Performance Tasks

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This is a knowledge-based module; there are no performance tasks.

## Materials and Equipment

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Multimedia projector and screen  
*Power Line Worker Level 1* PowerPoint®  
Presentation Slides (ISBN 978-0-13-257136-4)  
Computer  
Whiteboard/chalkboard  
Markers/chalk  
Pencils and scratch paper  
Appropriate personal protective equipment  
Basic electrical circuit, including:  
    Battery/power source  
    Wiring  
    Loads  
    Switches  
Samples of conductors, insulators, and resistors  
Magnets/electromagnet  
Metal sheet

Iron filings  
Battery  
Simple schematic  
Color-coded resistors  
Various meters, including:  
    Multimeter  
    Voltmeter/voltage tester  
    Clamp-on ammeter  
    Ohmmeter  
    Continuity tester  
    Secondary service tester  
    Phase rotation tester  
    Non-contact high-voltage tester  
    Transformer tester  
Module Examinations\*

\* Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

## Safety Considerations

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Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Trainees may work with electrical test equipment. Make sure that all trainees are briefed on appropriate safety procedures. Emphasize electrical safety.

## Additional Resources

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This module presents thorough resources for task training. The following resource material is suggested for further study.

*Electronics Fundamentals: Circuits, Devices, and Applications*. 8th ed. Thomas L. Floyd. Upper Saddle River, NJ: Prentice Hall, 2009.

*Principles of Electric Circuits: Electron Flow Version*. 8th ed. Thomas L. Floyd. Upper Saddle River, NJ: Prentice Hall, 2006.

## Teaching Time for This Module

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An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 7½ hours are suggested to cover *Introduction to Electrical Circuits*. You will need to adjust the time required for testing based on your class size and resources.

Topic	Planned Time
<b>Session I. Introduction; Atomic Theory; Electrical Power Generation and Distribution; Electric Charge and Current</b>	
A. Introduction	_____
B. Atomic Theory	_____
1. The Atom	_____
2. Conductors and Insulators	_____
3. Magnetism	_____
C. Electrical Power Generation and Distribution	_____
D. Electric Charge and Current	_____
1. Current Flow	_____
2. Voltage	_____
3. Resistance	_____
<b>Session II. Ohm's Law; Schematic Representation of Circuit Elements; Resistors; Electrical Circuits; Electrical Measuring Instruments; Specialized Power Transmission and Distribution System Test Instruments</b>	
A. Ohm's Law	_____
B. Schematic Representation of Circuit Elements	_____
C. Resistors	_____
D. Electrical Circuits	_____
1. Series Circuits	_____
2. Parallel Circuits	_____
3. Series-Parallel Circuits	_____
E. Electrical Measuring Instruments	_____
1. Measuring Current	_____
2. Measuring Voltage	_____
3. Measuring Resistance	_____
4. Voltage Testers	_____
F. Specialized Power Transmission and Distribution Test Instruments	_____
1. Secondary Service Conductor Tester	_____
2. Phase Sequence Rotation Tester	_____
3. Non-Contact High-Voltage Detector	_____
4. Transformer Tester	_____

Topic	Planned Time
<b>Session III. Electrical Power; Review and Testing</b>	
A. Electrical Power	_____
1. Power Equation	_____
2. Power Rating of Resistors	_____
B. Review	_____
C. Module Examination	_____
1. Trainees must score 70 percent or higher to receive recognition from NCCER.	
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.	

### Module Overview

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This module introduces trainees to circuit calculations involving the application of Ohm's and Kirchhoff's laws. Bonding and grounding are also covered.

### Prerequisites

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Prior to training with this module, it is recommended that the trainee shall have successfully completed *Power Industry Fundamentals* and *Power Line Worker Level One*, Modules 49102-11 and 49103-11.

### Objectives

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Upon completion of this module, the trainee will be able to do the following:

1. Explain the basic characteristics of series, parallel, and combination circuits.
2. Using Ohm's law, find the unknown values in series, parallel, and series-parallel circuits.
3. Explain the purpose of bonding and grounding.

### Performance Tasks

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This is a performance-based module; there are no performance tasks.

### Materials and Equipment

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Multimedia projector and screen  
Power Line Worker Level 1  
PowerPoint® Presentation Slides  
(ISBN 978-0-13-257136-4)  
Computer  
Whiteboard/chalkboard

Markers/chalk  
Pencils and scratch paper  
Appropriate personal protective equipment  
Handheld advanced function calculator  
Module Examinations\*

\* Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

### Safety Considerations

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Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Trainees may work with electrical test equipment. Make sure that all trainees are briefed on appropriate safety procedures. Emphasize electrical safety.

### Additional Resources

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This module presents thorough resources for task training. The following resource material is suggested for further study.

*Electronics Fundamentals: Circuits, Devices, and Applications*. 8th ed. Thomas L. Floyd. Upper Saddle River, NJ: Prentice Hall, 2009.

*Principles of Electric Circuits: Electron Flow Version*. 8th ed. Thomas L. Floyd. Upper Saddle River, NJ: Prentice Hall, 2006.



## Teaching Time for This Module

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An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 7½ hours are suggested to cover *Introduction to Electrical Theory*. You will need to adjust the time required for testing based on your class size and resources.

Topic	Planned Time
<b>Sessions I and II. Introduction; Resistive Circuits</b>	
A. Introduction	_____
B. Resistive Circuits	_____
1. Resistances in Series	_____
2. Resistances in Parallel	_____
3. Series-Parallel Circuits	_____
4. Applying Ohm's Law	_____
<b>Session III. Kirchhoff's Laws; Grounding and Bonding; Review and Testing</b>	
A. Kirchhoff's Laws	_____
B. Grounding and Bonding	_____
1. Protective Grounding	_____
C. Review	_____
D. Module Examination	_____
1. Trainees must score 70 percent or higher to receive recognition from NCCER.	
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.	

## Module Overview

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Utility workers frequently install and maintain equipment on top of power poles. The worker must be able to climb the poles safely and be comfortable working at heights. This module introduces the trainee to climbing wooden poles.

## Prerequisites

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Prior to training with this module, it is recommended that the trainee shall have successfully completed *Power Industry Fundamentals* and *Power Line Worker Level One*, Modules 49102-11 through 49104-11.

## Objectives

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Upon completion of this module, the trainee will be able to do the following:

1. Identify all required and recommended safety equipment.
2. Demonstrate the knowledge and proper use of required climbing equipment.
3. Demonstrate the ability to inspect climbing equipment prior to climbing.
4. Identify the hazards associated with climbing wooden poles.
5. Demonstrate the ability to inspect a wooden pole for defects prior to climbing.
6. Identify and demonstrate proper climbing ascent, descent, and lateral positioning techniques.
7. Demonstrate the ability to safely climb over obstructions.
8. Demonstrate the ability to withstand working at heights above 32 feet.
9. Demonstrate the ability to perform pole-top rescue with and without the presence of a cross arm.

## Performance Tasks

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Under the supervision of the instructor, the trainee should be able to do the following:

1. Demonstrate the ability to inspect climbing equipment prior to climbing.
2. Demonstrate the ability to inspect a wooden pole for defects and hazards prior to climbing.
3. Demonstrate proper climbing ascent, descent, and lateral positioning techniques.
4. Demonstrate the ability to safely climb over obstructions.
5. Demonstrate the ability to withstand working at heights above 32 feet.
6. Demonstrate the ability to perform pole-top rescue with and without the presence of a cross arm.

## Materials and Equipment

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Multimedia projector and screen  
*Power Line Worker Level 1* PowerPoint®  
Presentation Slides (ISBN 978-0-13-257136-4)  
Computer  
Whiteboard/chalkboard  
Markers/chalk  
Pencils and scratch paper  
Appropriate personal protective equipment  
Pair of pole-climbing gaffs  
Gaff gauge  
Body belt with D-rings  
Fall restraint belt  
Fall arrest belt

Positioning lanyards  
Sufficient number of climbers and gaffs in good condition  
Worn or damaged climbers and gaffs  
Worn webbing  
Selection of D-rings and O-rings, some damaged and some in good condition  
Damaged or otherwise unsafe pole  
Rescue rope  
Pulley  
8- to 10-inch screwdriver  
Module Examinations\*  
Performance Profile Sheets\*

\* Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

## Safety Considerations

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Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Review safety guidelines associated with climbing wooden poles. Emphasize the importance of proper technique.

## Additional Resources

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This module presents thorough resources for task training. The following resource material is suggested for further study.

*OSHA Regulation 1926, Subpart M, Fall Protection*, Latest edition. Occupational Health and Safety Administration. [www.osha.gov](http://www.osha.gov).

## Teaching Time for This Module

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An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 80 hours are suggested to cover *Climbing Wooden Poles*. You will need to adjust the time required for testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
<b>Session I. Introduction; Safety Equipment; Climbing Equipment</b>	
A. Introduction	_____
B. Safety Equipment	_____
1. Additional Safety Gear	_____
2. Additional Safety Concerns	_____
C. Climbing Equipment	_____
1. Pole-Climbing Gaffs	_____
2. Body Belt	_____
3. Safety Belts	_____
4. Positioning Lanyards	_____
D. Laboratory	_____
Have the trainees identify all required and recommended safety equipment.	
<b>Sessions II and III. Pre-Climb Equipment Inspection; Checking the Pole Condition Before Climbing</b>	
A. Pre-Climb Equipment Inspection	_____
1. Pole-Climbing Gaffs	_____
2. Belts and Lanyards	_____
B. Laboratory	_____
Have the trainees demonstrate the ability to inspect climbing equipment prior to climbing. This laboratory corresponds to Performance Task 1.	
C. Checking the Pole Condition Before Climbing	_____
1. Inspecting the Pole	_____
D. Laboratory	_____
Have the trainees demonstrate the ability to inspect a wooden pole for defects and hazards prior to climbing. This laboratory corresponds to Performance Task 2.	

<b>Topic</b>	<b>Planned Time</b>
<b>Sessions IV through XVII. Climbing the Pole</b>	
A. Climbing the Pole	_____
1. Putting on the Climbing Gaffs	_____
2. Ascending the Pole	_____
3. Maneuvering Laterally on the Pole	_____
4. Climbing over Obstructions	_____
5. Descending the Pole	_____
6. Pole Steps	_____
B. Laboratory	_____
1. Have the trainees demonstrate proper climbing ascent, descent, and lateral positioning techniques. This laboratory corresponds to Performance Task 3.	
2. Have the trainees demonstrate the ability to safely climb over obstructions. This laboratory corresponds to Performance Task 4.	
3. Have the trainees demonstrate the ability to withstand working at heights above 32 feet. This laboratory corresponds to Performance Task 5.	
<b>Sessions XVIII through XXXI. Pole-Top Rescue</b>	
A. Pole-Top Rescue	_____
1. Rescue Equipment	_____
B. Laboratory	_____
Have the trainees demonstrate the ability to perform pole-top rescue with and without the presence of a cross arm. This laboratory corresponds to Performance Task 6.	
<b>Session XXXII. Review and Testing</b>	
A. Review	_____
B. Module Examination	_____
1. Trainees must score 70 percent or higher to receive recognition from NCCER.	
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.	
C. Performance Testing	_____
1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.	
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.	

# Climbing Structures Other Than Wood Module 49106-11 Annotated Instructor's Guide

## Module Overview

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Transmission line workers are frequently required to climb poles and towers to install and repair conductor and components. The workers must know how to do it safely. This module introduces the trainee to the proper climbing procedures and safety requirements for climbing steel poles and towers.

## Prerequisites

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Prior to training with this module, it is recommended that the trainee shall have successfully completed *Power Industry Fundamentals* and *Power Line Worker Level One*, Modules 49102-11 through 49105-11.

## Objectives

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Upon completion of this module, the trainee will be able to do the following:

1. Identify the required safety equipment for proper climbing.
2. Demonstrate the ability to inspect required safety equipment before use.
3. Identify the various environmental hazards requiring consistent attention from the worker.
4. Conduct a proper pre-climb inspection of steel poles and towers and the surrounding area.
5. Identify the appropriate climbing routes of various structures.
6. State the practices for safely ascending and descending steel poles and towers.
7. Demonstrate the physical and mental ability to endure the unique stresses of working at high elevations.
8. Safely ascend and descend a steel tower.

## Performance Tasks

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Under the supervision of the instructor, the trainee should be able to do the following:

1. Demonstrate the ability to inspect required safety equipment before use.
2. Identify the various environmental hazards requiring consistent attention from the worker.
3. Conduct a proper pre-climb inspection of steel poles and towers and the surrounding area.
4. Identify the appropriate climbing routes of various structures.
5. Demonstrate the physical and mental ability to endure the unique stresses of working at high elevations.
6. Safely ascend and descend a steel tower.

## Materials and Equipment

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Multimedia projector and screen  
*Power Line Worker Level 1* PowerPoint®  
Presentation Slides (ISBN 978-0-13-257136-4)  
Computer  
Whiteboard/chalkboard  
Markers/chalk  
Pencils and scratch paper  
Appropriate personal protective equipment  
Sufficient number of full body harnesses  
A low structure with anchor points for practice  
Access to a typical structure with anchor points  
Sufficient selection of hooks and carabiners with safety gates  
Assortment of D-rings  
Selection of lanyards, shock absorbing and non-shock absorbing

Several lengths of wire or aircraft cable for padding lanyards  
Anchor points  
Y-configured lanyard  
Self-retracting lanyard  
Section of cable for routing climbing path on structure  
Sliding puck installed on structure  
Cable grab installed on structure  
Temporary vertical lines  
Rope grabs  
Worn webbing  
Selection of fall protection equipment for inspection  
Selection of worn, frayed, or damaged fall protection equipment for inspection

Access to a typical tower for inspection purposes  
Standard blank form for documenting a pre-climb meeting  
Actual filled-in form documenting a pre-climb meeting

Access to a tower for identifying climbing routes  
Access to a structure for climbing  
Module Examinations\*  
Performance Profile Sheets\*

\* Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

## Safety Considerations

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Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Review safety guidelines associated with climbing structures other than wood. Emphasize the importance of proper housekeeping.

## Additional Resources

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This module presents thorough resources for task training. The following resource material is suggested for further study.

*OSHA Regulation 1926, Subpart M, Fall Protection*, Latest edition. Occupational Health and Safety Administration. [www.osha.gov](http://www.osha.gov).

*108 Ft Tower Install*. Video. (1:03 minutes) [www.youtube.com](http://www.youtube.com).

*What's the Fall Distance?* Video. (22 minutes) [www.osha.gov](http://www.osha.gov).

## Teaching Time for This Module

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An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 40 hours are suggested to cover *Climbing Structures Other Than Wood*. You will need to adjust the time required for testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
<b>Sessions I and II. Introduction; Safety Equipment</b>	
A. Introduction	_____
B. Safety Equipment	_____
1. Personal Fall Arrest Systems	_____
a. Laboratory	_____
Have the trainees put on and adjust a full body harness.	
b. Laboratory	_____
Allow the trainees to practice attaching carabiners and hooks.	
2. Lanyards	_____
a. Laboratory	_____
Have the trainees practice wrapping a lanyard around an anchor point and padding it.	
b. Laboratory	_____
Have the trainees put on a PFAS and practice horizontal movements across a structure, positioning the D-ring and connecting and disconnecting a lanyard.	
3. Safe Climbing Assistance Devices	_____
a. Laboratory	_____
Have the trainees don the PFAS and practice climbing, using a sliding puck, a cable grab, and temporary vertical lines with rope grabs.	

<b>Topic</b>	<b>Planned Time</b>
4. Other Safety Gear	_____
5. Equipment Inspection	_____
a. Laboratory	_____
Provide a selection of fall protection equipment and have the trainees practice inspecting it.	
C. Laboratory	_____
Have trainees demonstrate the ability to inspect required safety equipment before use. This laboratory corresponds to Performance Task 1.	
<b>Session III. Hazards of the Environment</b>	
A. Hazards of the Environment	_____
1. Noise and Communication	_____
2. Living Dangers	_____
3. Weather	_____
B. Laboratory	_____
Have trainees identify the various environmental hazards requiring consistent attention from the worker. This laboratory corresponds to Performance Task 2.	
<b>Sessions IV and V. Climb Preparations</b>	
A. Climb Preparations	_____
1. Site and Tower Assessment	_____
2. The Pre-Climb Meeting	_____
B. Laboratory	_____
Have trainees conduct a proper pre-climb inspection of steel poles and towers and the surrounding area. This laboratory corresponds to Performance Task 3.	
<b>Sessions VI and VII. Basic Climbing Skills, Part One</b>	
A. Basic Climbing Skills	_____
1. Preliminary Considerations	_____
a. Laboratory	_____
Have the trainees practice identifying appropriate climbing routes.	
B. Laboratory	_____
Have trainees identify the appropriate climbing routes of various structures. This laboratory corresponds to Performance Task 4.	
<b>Sessions VIII through XV. Basic Climbing Skills, Part Two</b>	
A. Basic Climbing Skills	_____
1. Ascent	_____
2. Maneuvering and Positioning	_____
a. Laboratory	_____
Have the trainees climb a short distance and practice maneuvering and positioning at a specific location.	
3. Descent	_____
a. Laboratory	_____
Allow the trainees to practice ascending and descending a steel tower.	
B. Laboratory	_____
Have trainees safely ascend and descend a steel tower and demonstrate the physical and mental ability to endure the unique stresses of working at high elevations. This laboratory corresponds to Performance Tasks 5 and 6.	

**Topic**

**Planned Time**

**Session XVI. Review and Testing**

A. Review

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B. Module Examination

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1. Trainees must score 70 percent or higher to receive recognition from NCCER.
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.

\_\_\_\_\_

C. Performance Testing

1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.



### Module Overview

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Every day, the line worker uses many tools to install and maintain power lines, and it is important that those tools be inspected and maintained properly. Line workers must also be able to use those tools effectively. This module introduces the trainee to many of the tools used on a job site.

### Prerequisites

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Prior to training with this module, it is recommended that the trainee shall have successfully completed *Power Industry Fundamentals* and *Power Line Worker Level One*, Modules 49102-11 through 49106-11.

### Objectives

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Upon completion of this module, the trainee will be able to do the following:

1. Identify and explain the use of common insulated hand tools.
2. Identify and explain the use of line workers' ladders.
3. Identify and explain the use of line workers' specialty tools.
4. Demonstrate the ability to use line workers' tools specified by the instructor.

### Performance Tasks

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Under the supervision of the instructor, the trainee should be able to do the following:

1. Demonstrate the ability to use five line worker tools specified by the instructor. These tools may include the following:
  - Clamp stick
  - Loadbuster®
  - Web hoist (Jack strap)
  - Hand line
  - Crimping tool

### Materials and Equipment

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Multimedia projector and screen	Pointed disconnect tool
<i>Power Line Worker Level 1</i> PowerPoint®	Spiral disconnect
Presentation Slides (ISBN 978-0-13-257136-4)	Fixed-blade tie stick head
Computer	Flexible wrench head
Whiteboard/chalkboard	Rotary-prong tie stick head
Markers/chalk	Stationary blade tie stick head
Pencils and scratch paper	Skinning knife
Appropriate personal protective equipment	Conductor-cleaning brush
Hot stick with universal tool head	Tubular line cleaner
Clamp stick with hook	Blanket pin tool
Extendo stick	Pruning saw
Selection of tool head adaptors for clamp sticks:	Tree pruner
Quick-change adaptor	Loadbuster®
Universal adaptor	Access to an insulated aerial platform
Grip-all adaptor	Hook ladder
Selection of tool heads for clamp sticks:	Three-rail ladder
Disconnect tool	Spliced ladder
Chuck blank	Battery-powered crimper
Fixed-prong tie stick head	Cable cutters
Ratchet wrench	Hole-Hog®

\* Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

## Safety Considerations

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Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Review safety guidelines associated with working with tools of the line workers' trade. Emphasize the importance of proper housekeeping.

## Additional Resources

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This module presents thorough resources for task training. The following resource material is suggested for further study.

*Construction Equipment Guide*. New York, NY: John Wiley & Sons.

*Allied Construction Products*, LLC, Cleveland, OH. [www.alliedcp.com](http://www.alliedcp.com).

*Hubble Power Systems*, Centralia, MO. [www.hubbellpowersystems.com](http://www.hubbellpowersystems.com).

*Salisbury by Honeywell*, Bolingbrook, IL. [www.whsalisbury.com](http://www.whsalisbury.com).

## Teaching Time for This Module

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An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 10 hours are suggested to cover *Tools of the Trade*. You will need to adjust the time required for testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
<b>Session I. Introduction; Insulated Tools</b>	
A. Introduction	_____
B. Insulated Tools	_____
1. Hot Sticks	_____
2. Grab-All Hot Stick (Shotgun Stick)	_____
3. Extendo Stick	_____
4. Telescoping Measuring Sticks	_____
5. Insulated Rescue Hook	_____
6. Universal Tool Accessories	_____
7. Loadbuster® Tool	_____
C. Laboratory	_____
1. Have trainees practice inspecting and using line worker tools.	_____
<b>Session II. Ladders and Work Platforms</b>	
A. Ladders and Work Platforms	_____
1. Work Platforms	_____
2. Hook Ladders	_____
3. Three-Rail Ladders	_____
4. Spliced Ladders	_____
B. Laboratory	_____
1. Have trainees practice inspecting and using ladders.	_____

<b>Topic</b>	<b>Planned Time</b>
<b>Session III. Specialty Tools</b>	
A. Specialty Tools	_____
1. Battery-Powered Tools	_____
2. Pneumatic-Powered Tools	_____
3. Hydraulic-Powered Tools	_____
4. Powder-Actuated Tools	_____
5. Capstan Winch	_____
6. Strap Hoists	_____
7. Chain Saws	_____
8. Hand Lines	_____
B. Laboratory	_____
Have trainees demonstrate the ability to use five line worker tools specified by the instructor. These tools may include the following:	
• Clamp stick	
• Loadbuster®	
• Web hoist (jack strap)	
• Hand line	
• Crimping tool	
This laboratory corresponds to Performance Task 1.	
<b>Session IV. Review and Testing</b>	
A. Review	_____
B. Module Examination	_____
1. Trainees must score 70 percent or higher to receive recognition from NCCER.	
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.	
C. Performance Testing	_____
1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.	
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.	

### Module Overview

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The installation of equipment on power poles is called aerial framing. Line workers must be able to install the support hardware and the components, and install conductor. This module introduces the trainee to aerial framing and its associated hardware.

### Prerequisites

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Prior to training with this module, it is recommended that the trainee shall have successfully completed *Power Industry Fundamentals* and *Power Line Worker Level One*, Modules 49102-11 through 49107-11.

### Objectives

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Upon completion of this module, the trainee will be able to do the following:

1. Describe the difference between single-phase and three-phase construction.
2. Identify the hardware used in aerial framing.
3. Using the standards manual, identify materials, assorted pole hardware, and support arms needed to perform aerial framing on:
  - A single cross-arm
  - A double cross-arm
  - A dead triple cross-arm set
  - An outrig arm
  - An alley arm
4. Describe, assemble, and install guys.
5. Perform an aerial framing procedure as defined by the instructor.
6. Hand-pull single-phase and three-phase primary conductors, dead end, and sag.
7. Explain how to install a transformer and connect conductors.

### Performance Tasks

---

Under the supervision of the instructor, the trainee should be able to do the following:

1. Assemble and install guys.
2. Perform an aerial framing procedure as defined by the instructor.
  - Single cross-arm
  - Double cross-arm
  - Triple dead-end cross-arm
  - Double alley arm
3. Hand-pull single-phase and three-phase primary conductors, sag, and dead end.

### Materials and Equipment

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Multimedia projector and screen  
*Power Line Worker Level 1* PowerPoint®  
Presentation Slides (ISBN 978-0-13-257136-4)  
Computer  
Whiteboard/chalkboard  
Markers/chalk  
Pencils and scratch paper  
Appropriate personal protective equipment  
Wood utility poles

Selection of commonly used bolts:  
Easy-out  
Gimlet  
Pilot carriage  
Double-arm  
Flat washer  
Insulator pin  
Automatic splice  
Crimping tool

Wire mesh	Various sizes of wire mesh grips
Sufficient number of cross-arms:	Various sizes of conductor in short lengths
Single	If available, a bullwheel tensioner with a tensioner indicator
Double	Drum puller
Dead triple cross-arm	Dynamometer and pull tension chart
Outrig arm	Sufficient selection of ties:
Alley arm	Single-arm side
Insulators	Straight
Lightning arrestor	Double-arm top
Sufficient number of guy clamps and anchors	A sufficient number of grooves for wrapping ties
Helically wound wire wrap	Metal gin pole
Section of damaged primary conductor	Fiberglass gin pole
Sufficient short lengths of conductor	Hot stick
Dead-end clamp	Module Examinations*
Cross-arm	Performance Profile Sheets*
Pair of bulldog grips	

\* Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

## Safety Considerations

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Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Review safety guidelines associated with performing aerial framing. Emphasize the importance of proper housekeeping.

## Additional Resources

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This module presents thorough resources for task training. The following resource material is suggested for further study.

*OSHA Regulation 1926, Subpart M, Fall Protection*, Latest edition. Occupational Health and Safety Administration. [www.osha.gov](http://www.osha.gov).

*The Lineman's and Cableman's Handbook*, 11th Edition. New York, NY: McGraw-Hill.

Lineman installing shield wire bond. Video. (1:04 minutes). [www.youtube.com](http://www.youtube.com).

Lineman At Work. Slideshow. (4:06 minutes). [www.youtube.com](http://www.youtube.com).

## Teaching Time for This Module

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An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 80 hours are suggested to cover *Aerial Framing and Associated Hardware*. You will need to adjust the time required for testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
<b>Sessions I–XI. Introduction; Safety; Aerial Framing Hardware; Aerial Framing Components; Cross-Arms</b>	
A. Introduction	_____
1. Three-Phase and Single-Phase Power	_____
B. Safety	_____
1. General Safety Precautions	_____

Topic	Planned Time
C. Aerial Framing Hardware	_____
1. Attaching Hardware	_____
2. Mounting Hardware	_____
3. Supporting Hardware	_____
4. Repair Hardware	_____
5. Laboratory	
a. Have trainees practice making compression and automatic splices using a length of conductor, a crimping tool, and wire mesh.	
D. Aerial Framing Components	_____
F. Cross-Arms	_____
1. Laboratory	_____
a. Provide a sufficient number of poles and cross-arms, including single, double, triple, dead triple, and alley arms. Allow the trainees to practice installing the cross-arms on the ground.	
G. Laboratory	_____
1. Under your supervision, have trainees perform an aerial framing procedure, including the following:	
• Single cross-arms	
• Double cross-arms	
• Triple dead-end cross-arms	
• Double alley arms	
Note the proficiency of each trainee. This laboratory corresponds to Performance Task 2.	
<b>Sessions XII–XVIII. Guys</b>	
A. Guys	_____
1. Guy Anchors	_____
2. Installing Guys	_____
B. Laboratory	_____
1. Have the trainees assemble and install guys. This laboratory corresponds to Performance Task 1.	
<b>Sessions XIX–XXX. Installing Primary Conductors</b>	
A. Installing Primary Conductors	_____
1. Slack/Layout Method	_____
2. Laboratory	_____
a. Give each trainee a length of conductor and allow them to practice securing the end to the cross-arm.	
b. Allow the trainees to practice stringing conductor using the slack/layout method.	
3. Tension Method	_____
4. Laboratory	_____
a. Allow the trainees to practice gripping conductor with the wire mesh grips.	
b. Allow the trainees to practice stringing conductors using the tension method.	
5. Tensioning and Sagging Conductors	_____

Topic	Planned Time
6. Laboratory <ul style="list-style-type: none"> <li>a. Allow the trainees to practice tensioning conductor on the pre-set poles.</li> <li>b. Allow the trainees to practice over-tensioning the conductor.</li> </ul>	<hr/> <hr/>
7. Tying in the Conductors	<hr/>
8. Laboratory <ul style="list-style-type: none"> <li>a. Provide each trainee with a tie and have them wrap a groove.</li> </ul>	<hr/>
9. Connecting the Conductors	<hr/>
10. Neutral Line	<hr/>
B. Laboratory Have the trainees pull single-phase and three-phase primary conductors, sag, and dead end. This laboratory corresponds to Performance Task 3.	
<b>Session XXXI. Transformers</b>	
A. Transformers <ul style="list-style-type: none"> <li>1. Installing a Single-Phase Transformer with a Gin Pole</li> <li>2. Connecting the Transformer</li> <li>3. Connecting Secondary Conductors</li> </ul>	<hr/> <hr/> <hr/> <hr/>
<b>Session XXXII. Review and Testing</b>	
A. Review	<hr/>
B. Module Examination <ul style="list-style-type: none"> <li>1. Trainees must score 70 percent or higher to receive recognition from NCCER.</li> <li>2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.</li> </ul>	<hr/>
C. Performance Testing <ul style="list-style-type: none"> <li>1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.</li> <li>2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.</li> </ul>	<hr/>

### Module Overview

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This module introduces the trainee to bucket trucks, crane trucks, and aerial lifts that allow line workers to access overhead transmission and distribution lines. It also introduces trainees to digger derricks, which are used to place and erect power poles.

### Prerequisites

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Prior to training with this module, it is recommended that the trainee shall have successfully completed *Power Industry Fundamentals* and *Power Line Worker Level One*, Modules 49102-11 through 49108-11.

### Objectives

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Upon completion of this module, the trainee will be able to do the following:

1. Identify the types of bucket trucks and digger derricks used by power line workers.
2. Identify the operator safety requirements that must be followed when operating a bucket truck or digger derrick.
3. Explain how to perform a pre-start inspection on a service vehicle.
4. Describe the safety considerations associated with setting up a service vehicle at a job site.
5. Describe the safety considerations and basic operations procedures associated with using a bucket truck at a job site.
6. Describe the safety considerations and basic operations procedures associated with using a digger derrick at a job site.
7. Describe ways that a crew can prepare for and react to a bucket truck or digger derrick related emergency.
8. Inspect, set up, and operate utility service equipment:
  - Bucket truck
  - Digger derrick
  - Crane truck
  - Aerial lift

### Performance Tasks

---

Under the supervision of the instructor, the trainee should be able to do the following:

1. Inspect, set up, and operate a bucket truck.
2. Inspect, set up, and operate a digger derrick.
3. Inspect, set up, and operate a crane truck.
4. Inspect, set up, and operate an aerial lift.

### Materials and Equipment

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Multimedia projector and screen  
*Power Line Worker Level 1* PowerPoint®  
Presentation Slides (ISBN 978-0-13-257136-4)  
Computer  
Whiteboard/chalkboard  
Markers/chalk  
Pencils and scratch paper  
Appropriate personal protective equipment

Manufacturer's manual with PM inspections and checks  
Manufacturer's manual showing hydraulic inspections and checks  
Auger manufacturer's operating procedure  
Bucket manufacturer's instructions for emergency bucket evacuation  
Length of hydraulic hose  
Crane manufacturer's operating instructions



\* Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

## Safety Considerations

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Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Review safety guidelines associated with working on or around utility equipment and power lines.

## Additional Resources

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This module presents thorough resources for task training. The following resource material is suggested for further study.

*OSHA 1910.269, Electric Power Generation, Transmission, and Distribution.*

*OSHA 1917.45, Cranes and Derricks.*

*OSHA 1910.67, Vehicle Mounted Elevating and Rotating Work Platforms.*

*OSHA 29 CFR 1926, Subpart N, Cranes, Derricks, Hoists, Elevators, and Conveyors.*

*ANSI A10.31, Safety Requirements, Definitions and Specifications for Digger Derricks.*

*ANSI A92.2, Vehicle Mounted Elevating and Rotating Aerial Devices.*

[www.buckettrucks.org](http://www.buckettrucks.org) for information and safety updates on bucket trucks.

[www.diggerderricks.org](http://www.diggerderricks.org) for information and safety updates on digger derrick trucks.

[www.photolibrary.fema.gov](http://www.photolibrary.fema.gov) for examples of where line workers may have to work.

[www.genielift.com](http://www.genielift.com) for miscellaneous types of lifts.

[www.jlg.com](http://www.jlg.com) for miscellaneous types of lifts.

## Teaching Time for This Module

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An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 15 hours are suggested to cover *Utility Service Equipment*. You will need to adjust the time required for testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
<b>Session I. Introduction; Bucket Truck Overview; Digger Derrick Truck Overview; Operator Safety Requirements; Inspection and Maintenance; Driving and Setting Up at Worksites; Bucket Truck Operations</b>	
A. Introduction	_____
B. Bucket Truck Overview	_____
1. Telescopic Boom Bucket Trucks	_____
2. Articulating Boom Bucket Trucks	_____
3. Combination Boom Bucket Trucks	_____
C. Digger Derrick Truck Overview	_____
D. Operator Safety Requirements	_____
1. Federally Mandated Training Requirements	_____
2. Bucket Truck Operator Safety Requirements	_____
3. Digger Derrick Operator Safety Requirements	_____

<b>Topic</b>	<b>Planned Time</b>
E. Inspection and Maintenance	_____
1. Daily Prestart Vehicle Inspections	_____
2. Periodic Vehicle Inspections	_____
3. Hydraulic Systems Inspections	_____
F. Driving and Setting Up at Worksites	_____
1. Worksite Preparation	_____
2. Stabilize the Vehicle for Operation	_____
3. Installing the Vehicle Ground	_____
4. Final Walk-Around Inspection	_____
G. Bucket Truck Operations	_____
1. Weight Limitations	_____
2. Boarding the Truck and Bucket Properly	_____
3. Using a Fall Arrest System	_____
4. Operating the Bucket	_____

**Session II. Digger Derrick Operations; Job Completion and Preparation for Transport; In Case of Emergency; Other Utility Service Equipment**

A. Digger Derrick Operations	_____
1. Locate Underground Utilities	_____
2. Rupturing Underground Utilities	_____
3. Digger Derrick Controls	_____
4. Operating the Auger	_____
5. Lifting a Load Safely	_____
6. Installing Poles and Anchors	_____
7. Pulling Existing Poles from Ground	_____
B. Job Completion and Preparation for Transport	_____
1. Bucket Truck Preparations	_____
2. Digger Derrick Preparations	_____
C. In Case of Emergency	_____
1. Exiting Raised Inoperable Bucket	_____
2. Emergency Bucket Truck Rescue	_____
3. Performing First Aid	_____
D. Other Utility Service Equipment	_____
1. Crane Trucks	_____
2. Aerial Lifts	_____

**Sessions III – V. Laboratory**

A. Laboratory	
1. Have trainees inspect, set up, and operate a bucket truck. This laboratory corresponds to Performance Task 1.	_____
2. Have trainees inspect, set up, and operate a digger derrick. This laboratory corresponds to Performance Task 2.	_____
3. Have trainees inspect, set up, and operate a crane truck. This laboratory corresponds to Performance Task 3.	_____
4. Have trainees inspect, set up, and operate an aerial lift. This laboratory corresponds to Performance Task 4.	_____

Topic	Planned Time
<b>Session VI. Review and Testing</b>	
A. Review	<hr/>
B. Module Examination	<hr/>
<ol style="list-style-type: none"> <li>1. Trainees must score 70 percent or higher to receive recognition from NCCER.</li> <li>2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.</li> </ol>	
C. Performance Testing	<hr/>
<ol style="list-style-type: none"> <li>1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.</li> <li>2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.</li> </ol>	

## Module Overview

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A rigger must be able to safely attach lifting equipment and communicate instructions to other workers. This module introduces the trainee to rigging safety considerations, knot-tying techniques, and lifting procedures that may be used on a work site.

## Prerequisites

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Prior to training with this module, it is recommended that the trainee shall have successfully completed *Power Industry Fundamentals* and *Power Line Worker Level One*, Modules 49102-11 through 49109-11.

## Objectives

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Upon completion of this module, the trainee will be able to do the following:

1. Describe and demonstrate hand signals and other communication methods used in rigging work.
2. Describe safety hazards and safety practices associated with rigging work.
3. Identify safety procedures associated with the use of cranes in rigging work.
4. Describe how cranes are used to lift and move loads.
5. Tie knots used in rigging:
  - Square
  - Figure 8
  - Clove hitch
  - Double half hitch
  - Bowline
  - Bowline on a bight
  - Timber hitch
  - Sheet bend
  - Running bowline
  - Back splice
  - Sheep shank
6. Reeve a set of blocks.

## Performance Tasks

---

Under the supervision of the instructor, the trainee should be able to do the following:

1. Demonstrate hand signals and other communication methods used in rigging work.
2. Tie a minimum of six of the following knots:
  - Square
  - Figure 8
  - Clove hitch
  - Double half hitch
  - Bowline
  - Bowline on a bight
  - Timber hitch
  - Sheet bend
  - Running bowline
  - Back splice
  - Sheep shank
3. Reeve a set of blocks.

## Materials and Equipment

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Multimedia projector and screen

*Power Line Worker Level 1 PowerPoint*<sup>®</sup>

Presentation Slides (ISBN 978-0-13-257136-4)

Computer

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Samples of worn rigging equipment:

Ropes

Slings

Belts

Samples of electronic communication devices:

Microphone

Headphones

Radio system devices

Sample signal flags

Gloves, high-visibility

Sound device, such as horn or siren

Safe-load indicator

Sample of manufacturer's literature

Tag line, standard

Tag line, nonconductive

Knot samples:

Square

Figure 8

Clove hitch

Double half hitch

Bowline

Bowline on a bight

Timber hitch

Sheet bend

Running bowline

Back splice

Sheep shank

Lengths of rope for tying knots

Bridle sling with master link

Bridle sling with shackle

Block and tackle, simple

Block and tackle, compound

Slings

Rigging signals chart handouts (if available)

Module Examinations\*

Performance Profile Sheets\*

\* Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

## Safety Considerations

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Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Review safety guidelines associated with working on or around rigging equipment. Emphasize the importance of proper housekeeping.

## Additional Resources

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This module presents thorough resources for task training. The following resource material is suggested for further study.

*Bob's Overhead Crane and Rigging Handbook*, Pellow Engineering Services, Leawood, KS.

Refer to the Associated General Contractors web site for a list of training materials and video programs on crane safety. [www.agc.org](http://www.agc.org).

*Occupational Safety and Health Standards for the Construction Industry, 29 CFR Part 1926*. Washington, DC: OSHA Department of Labor, U.S. Government Printing Office.

## Teaching Time for This Module

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An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 12½ hours are suggested to cover *Rigging*. You will need to adjust the time required for testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
<b>Session I. Introduction; Methods and Modes of Communication; General Rigging Safety, Part One</b>	
A. Introduction	_____
B. Methods and Modes of Communication	_____
1. Verbal Modes of Communication	_____
2. Nonverbal Modes of Communication	_____
C. Laboratory	_____
1. Have the trainees read and demonstrate hand signals and other communication methods. This laboratory corresponds to Performance Task 1.	
D. General Rigging Safety	_____
1. Personal Protection	_____
2. Equipment and Supervision	_____
3. Rigging Precautions	_____
<b>Session II. General Rigging Safety, Part Two; Working Around Power Lines; Site Safety</b>	
A. General Rigging Safety	_____
1. Load Control	_____
2. Barricades	_____
3. Load-Handling Safety	_____
B. Laboratory	_____
Have the trainees identify and tie rigging knots. This laboratory corresponds to Performance Task 2.	
C. Working Around Power Lines	_____
D. Site Safety	_____
1. Site Hazards and Restrictions	_____
<b>Session III. Emergency Response; Using Cranes to Lift Personnel</b>	
A. Emergency Response	_____
1. Fire	_____
2. Malfunctions During Lifting Operations	_____
3. Hazardous Weather	_____
B. Using Cranes to Lift Personnel	_____
1. Personnel Platform Loading	_____
2. Personnel Platform Rigging	_____

Topic	Planned Time
<b>Session IV. Block and Tackle; Guidelines for Unloading and Yarding Materials</b>	
A. Block and Tackle	_____
1. Simple Block and Tackle	_____
2. Compound Block and Tackle	_____
3. Reeving a Block and Tackle	_____
B. Laboratory	_____
Have the trainees reeve a set of blocks. This laboratory corresponds to Performance Task 3.	
C. Guidelines for Unloading and Yarding Materials	_____
1. Unloading	_____
2. Using Slings	_____
<b>Session V. Review and Testing</b>	
A. Review	_____
B. Module Examination	_____
1. Trainees must score 70 percent or higher to receive recognition from NCCER.	
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.	
C. Performance Testing	_____
1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.	
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.	

## Module Overview

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Power line workers must install and maintain the wood utility poles that carry overhead power lines. New poles are needed for new customers, and damaged or weakened power poles must be replaced. This module introduces the trainee to methods and procedures for setting new poles and pulling old ones.

## Prerequisites

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Prior to training with this module, it is recommended that the trainee shall have successfully completed *Power Industry Fundamentals* and *Power Line Worker Level One*, Modules 49102-11 through 49110-11.

## Objectives

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Upon completion of this module, the trainee will be able to do the following:

1. Describe and demonstrate how to load and unload wood poles in preparation for installation.
2. Explain and demonstrate the importance of using the proper hand signals when setting a pole.
3. Describe and demonstrate how to set a wood utility pole using a digger derrick.
4. Describe and demonstrate how to set a wood utility pole by hand.
5. Describe and demonstrate how to pull a wood utility pole from the ground.

## Performance Tasks

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Under the supervision of the instructor, the trainee should be able to do the following:

1. Load and unload wood poles in preparation for installation.
2. Demonstrate the proper use of ASME hand signals.
3. Pull a wood pole with a hydraulic pole puller.
4. Set a wood pole with a digger derrick.

## Materials and Equipment

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Multimedia projector and screen	Digger derrick and auger
<i>Power Line Worker Level 1</i> PowerPoint®	Hydraulic pole puller
Presentation Slides (ISBN 978-0-13-257136-4)	A number of wood poles
Computer	Chocks
Whiteboard/chalkboard	Plumb bob
Markers/chalk	Manual digging tools
Pencils and scratch paper	Hydraulic tamper
Appropriate personal protective equipment	Module Examinations*
Lift chart	Performance Profile Sheets*

\* Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

## Safety Considerations

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Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Review safety guidelines associated with installing and pulling wood utility poles.



## Additional Resources

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This module presents thorough resources for task training. The following resource material is suggested for further study.

*The Lineman's and Cableman's Handbook*, 11th Edition. New York, NY: McGraw-Hill.  
[www.diggerderricks.org](http://www.diggerderricks.org).

## Teaching Time for This Module

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An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 20 hours are suggested to cover *Setting and Pulling Poles*. You will need to adjust the time required for testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
<b>Sessions I and II. Introduction; Safety; Storage of Wood Poles</b>	
A. Introduction	_____
B. Safety	_____
C. Storage of Wood Poles	_____
1. Loading Wood Poles for Transport	_____
2. Unloading Wood Poles	_____
D. Laboratory	_____
Have the trainees load and unload wood poled in preparation for installation. This laboratory corresponds to Performance Task 1.	
<b>Session III. Setting Wood Poles with Mechanized Equipment; Load Control</b>	
A. Setting Wood Poles with Mechanized Equipment	_____
1. Digger Derrick Operation	_____
B. Load Control	_____
1. American Society of Mechanical Engineers (ASME) Hand Signals	_____
2. Load Handling Safety	_____
C. Laboratory	_____
Have the trainees demonstrate the proper use of ASME hand signals. This laboratory corresponds to Performance Task 2.	
<b>Session IV. Site Preparation</b>	
A. Site Preparation	_____
1. Placement and Sizing of the Hole	_____
2. Digging the Hole	_____

Topic	Planned Time
<b>Sessions V–VII. Setting the Pole with A Digger Derrick; Setting the Pole by Hand (Piking Method); Setting the Pole by Hand (Block and Tackle Method)</b>	
A. Setting the Pole with a Digger Derrick	_____
B. Setting the Pole by Hand (Piking Method)	_____
C. Setting the Pole by Hand (Block and Tackle Method)	_____
D. Laboratory	_____
1. Have the trainees pull a wood pole with a hydraulic pole puller. This laboratory corresponds to Performance Task 3.	
2. Have the trainees set a wood pole with a digger derrick. This laboratory corresponds to Performance Task 4.	
<b>Session VIII. Review and Testing</b>	
A. Review	_____
B. Module Examination	_____
1. Trainees must score 70 percent or higher to receive recognition from NCCER.	
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.	
C. Performance Testing	_____
1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.	
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.	

# Trenching, Excavating, and Boring Equipment Annotated Instructor's Guide

Module 49112-11

## Module Overview

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This module introduces the trainee to the trenching, excavating, and boring equipment that may be used on a site when installing power lines underground.

## Prerequisites

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Prior to training with this module, it is recommended that the trainee shall have successfully completed *Power Industry Fundamentals* and *Power Line Worker Level One*, Modules 49102-11 through 49111-11.

## Objectives

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Upon completion of this module, the trainee will be able to do the following:

1. Identify the trenching, excavating, and boring safety guidelines.
2. Identify and explain the use and operation of compact and pedestrian trenchers.
3. Identify and explain the use and operation of a backhoe.
4. Identify and explain the use and operation of a horizontal directional drilling machine.

## Performance Tasks

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This is a knowledge-based module; there are no performance tasks.

## Materials and Equipment

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Multimedia projector and screen	AEM safety manuals for trenching equipment and backhoe
<i>Power Line Worker Level 1</i> PowerPoint® Presentation Slides (ISBN 978-0-13-257136-4)	Manufacturer's operating manuals for trencher and backhoe/loader
Computer	Trencher lube chart
Whiteboard/chalkboard	HDD rig warning sign
Markers/chalk	Module Examinations*
Pencils and scratch paper	Performance Profile Sheets*
Appropriate personal protective equipment	

\* Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

## Safety Considerations

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Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Review safety guidelines associated with working on or around trenching, excavating, and boring equipment. Emphasize the importance of proper housekeeping.

## Additional Resources

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This module presents thorough resources for task training. The following resource material is suggested for further study.

*Construction Equipment Guide*. New York, NY: John Wiley & Sons.

*Engineering Trenchless Solutions*. Mesa, CO. [www.hdd-consult.com](http://www.hdd-consult.com).

*North American Society for Trenchless Technology*. Liverpool, NY. [www.nastt.org](http://www.nastt.org).

## Teaching Time for This Module

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An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 7½ hours are suggested to cover *Trenching, Excavating, and Boring Equipment*. You will need to adjust the time required for testing based on your class size and resources.

Topic	Planned Time
<b>Session I. Introduction; Trenching, Excavating, and Boring Safety Guidelines; Trenchers</b>	
A. Introduction	_____
B. Trenching, Excavating, and Boring Safety Guidelines	_____
1. General Safety Guidelines	_____
2. Locate Underground Utilities	_____
3. In Case of a Rupture	_____
C. Trenchers	_____
1. Trencher Assemblies	_____
2. Trencher Operator Qualifications	_____
3. Typical Trencher Controls	_____
4. Trencher Safety Precautions	_____
5. Pedestrian Trencher Operating Procedure	_____
6. Trencher Operator's Maintenance Responsibility	_____
<b>Session II. Backhoe/Loader; Directional Boring Equipment</b>	
A. Backhoe/Loader	_____
1. Backhoe/Loader Operator Qualifications	_____
2. Backhoe/Loader Controls	_____
3. Backhoe/Loader Safety Precautions	_____
4. Backhoe/Loader Operating Guidelines	_____
5. Backhoe/Loader Maintenance	_____
B. Directional Boring Equipment	_____
1. Directional Boring Process	_____
2. Directional Boring Safety Precautions	_____
<b>Session III. Review and Testing</b>	
A. Review	_____
B. Module Examination	_____
1. Trainees must score 70 percent or higher to receive recognition from NCCER.	
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.	

# Introduction to Electrical Test Equipment Annotated Instructor's Guide

Module 49113-11

## Module Overview

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This module describes the function and operation of voltmeters, high-voltage detectors, ohmmeters, clamp-on ammeters, multimeters, megohmmeters, motor and phase rotation testers, and phasing sticks. It also covers test equipment safety precautions and explains category ratings.

## Prerequisites

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Prior to training with this module, it is recommended that the trainee shall have successfully completed *Power Industry Fundamentals* and *Power Line Worker Level One*, Modules 49102-11 through 49112-11.

## Objectives

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Upon completion of this module, the trainee will be able to do the following:

1. Describe the following pieces of test equipment and explain their purpose:
  - Voltmeter
  - Ohmmeter
  - Clamp-on ammeter
  - Multimeter
  - Megohmmeter
  - Hi-pot tester (dielectric strength tester)
  - Motor and phase rotation testers
  - Recording instruments
  - High-voltage detector
  - Phasing sticks
2. Select the appropriate meter for a given work environment based on category ratings.
3. Identify the safety hazards associated with various types of test equipment.

## Performance Task

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Under the supervision of the instructor, the trainee should be able to do the following:

1. Select the appropriate meter for a given work environment based on category ratings.

## Materials and Equipment

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Multimedia projector and screen  
*Power Line Worker Level 1 PowerPoint*<sup>®</sup>  
Presentation Slides (ISBN 978-0-13-257136-4)  
Computer  
Whiteboard/chalkboard  
Markers/chalk  
Pencils and scratch paper  
Appropriate personal protective equipment  
Analog meter  
Voltmeter and operator's manual  
Voltage tester and operator's manual  
Ohmmeter and operator's manual  
Continuity tester

Clamp-on ammeter and operator's manual  
Multimeter and operator's manual  
Megohmmeter and operator's manual  
Motor and phase rotation testers and operator's  
manuals  
High-voltage detector and operator's manual  
Phasing sticks and operator's manual  
Resistors  
Safety video/DVD (optional)  
TV/Video/DVD player (optional)  
Module Examinations\*  
Performance Profile Sheets\*

\* Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

## Safety Considerations

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Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. This module requires trainees to work with electrical test equipment. Make sure that all trainees are briefed on appropriate safety procedures. Emphasize electrical safety.

## Additional Resources

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This module presents thorough resources for task training. The following resource material is suggested for further study.

*ABCs of Multimeter Safety: Multimeter Safety and You.* Everett, WA: Fluke Corporation, 2000.

*ABCs of DMMs: Multimeter Features and Functions Explained.* Everett, WA: Fluke Corporation, 2006.

*Clamp Meter ABCs.* Everett, WA: Fluke Corporation.

*Electronics Fundamentals: Circuits, Devices, and Applications.* 8th ed. Thomas L. Floyd. Upper Saddle River, NJ: Prentice Hall, 2009.

*Fluke Corporation:* [www.us.fluke.com](http://www.us.fluke.com).

*Principles of Electric Circuits: Electron Flow Version.* 8th ed. Thomas L. Floyd. Upper Saddle River, NJ: Prentice Hall, 2006.

## Teaching Time for This Module

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An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 7½ hours are suggested to cover *Introduction to Electrical Test Equipment*. You will need to adjust the time required for testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
<b>Sessions I and II. Introduction; Meters; Category Ratings; Safety</b>	
A. Introduction	_____
B. Meters	_____
1. Voltmeter	_____
2. High-Voltage Detectors	_____
3. Ohmmeter	_____
4. Ammeter	_____
5. Multimeter	_____
6. Megohmmeter	_____
7. Motor and Phase Rotation Testers	_____
8. Phasing Sticks	_____
9. Recording Instruments	_____
10. Hi-Pot Tester	_____
C. Category Ratings	_____
D. Safety	_____
E. Laboratory	_____
Have the trainees select the appropriate meter for a given work environment based on category ratings. This laboratory corresponds to Performance Task 1.	

**Topic**

**Planned Time**

**Session III. Review and Testing**

A. Review

\_\_\_\_\_

B. Module Examination

\_\_\_\_\_

1. Trainees must score 70 percent or higher to receive recognition from NCCER.
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.

C. Performance Testing

\_\_\_\_\_

1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.