

INSTRUMENTATION SAFETY PRACTICES

Module One (12115-14) covers safety guidelines and practices that instrument fitters and technicians must follow on the job. It describes safety precautions associated with electrical hazards, including lockout/tagout procedures. It reviews safe use of tools and materials in detail, focusing on safety practices to follow when using hand tools and power tools, potentially hazardous process fluids and solvents, and batteries.

Objectives

Learning Objective 1

- Describe the electrical hazards that might be encountered by instrument fitters and technicians.
 - a. Describe the effects of electrical shock and how to reduce the risk.
 - b. Identify and describe common personal and general electrical protective equipment.
 - c. Identify specific requirements for electrical safety.
 - d. Describe the various approach boundaries related to electrical hazards.
 - e. Describe how to conduct a shock hazard analysis.

Learning Objective 2

- Describe how lockout/tagout procedures are used to prevent energy-related injury.
 - a. Describe the lockout/tagout procedure for electrical and non-electrical equipment.
 - b. Describe the voltage testing requirements to be applied before beginning work.

Learning Objective 3

- Identify safety practices related to potentially hazardous tools and materials.
 - a. Identify basic hand and power tool safety practices.
 - b. Identify the hazards associated with various process fluids and solvents.
 - c. Identify safety practices related to batteries.

Performance Tasks

Performance Task 1 (Learning Objective 1)

- Complete a shock hazard analysis based on an activity assigned by the instructor.

Performance Task 2 (Learning Objective 2)

- Complete a lockout procedure for an electrical and/or non-electrical energy source(s).

Teaching Time: 12.5 hours

(Five 2.5-Hour Classroom Sessions)

Session time may be adjusted to accommodate your class size, schedule, and teaching style.

Prerequisites

Core Curriculum

Before You Begin

As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the written examinations and performance profile sheets from www.nccerirc.com. The passing score for submission into NCCER's Registry is 70 percent or above for the written examination; performance testing is graded pass or fail.



Safety Considerations

This module requires that trainees work with energy sources and potentially hazardous tools, equipment, and materials. In those instances, trainees should be carefully observed to ensure that they wear the proper PPE, follow safe practices, and give due respect to the hazards associated with the energy sources, tools, equipment, and materials. Any work performed on energized equipment must be done under the direct supervision of the instructor.

Classroom Equipment and Materials

Whiteboard/chalkboard
Markers/chalk
Pencils and paper
Instrumentation Level One
PowerPoint® Presentation
DVD player
LCD projector and screen
Computer
Internet access during class (optional)
Copies of the Module Examination and Performance Profile Sheets
Protective rubber gloves with markings (new or damaged)
A shorting probe
Fuse pulling tool(s)
One or more copies of the *National Electrical Code® (NEC®)*
Multiple copies of *NFPA 70E®*
One or more power distribution drawings for a work site
One or more LOTO devices for electrically or pneumatically operated equipment
Several copies of the NIOSH Pocket Guide to Chemical Hazards
Copies of MSDS/SDS for a variety of common process fluids

Equipment and Materials for Laboratories and Performance Testing

PPE:

Standard eye protection
Additional eye and face protection as designated by the instructor or training facility provider
Work gloves
Proper footwear as designated by the instructor or training facility provider
Hearing protection as designated by the instructor or training facility provided

Specific tools and materials required for instructor demonstration of performing a shock hazard analysis (the relevant power distribution drawings and technical documentation, facility's LOTO procedures, appropriate PPE, appropriate hand tools, power tools, etc.)

Specific tools and materials required for trainee performance of a shock hazard analysis for an activity assigned by the instructor (the relevant power distribution drawings and technical documentation, facility's LOTO procedures, appropriate PPE, appropriate hand tools, power tools, etc.)

Multiple copies of the Shock Hazard Analysis Checklist (provided herein at the end of the lesson plan)

Multimeter

Appropriate locks and tags to lockout energy sources

Multiple copies of an Energized Work Permit form, for the recording of the Shock Hazard Analysis results; use a form from your employer.

Alternatively, various versions of the form can be located on the internet.

Additional Resources

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

Arc Flash Hazard Incident Energy Calculations: A Historical Perspective and Comparative Study of the Standards IEEE 1584 and of NFPA 70E®. Latest Edition. R. F. Ammerman, P.K. Sen, and J.P. Nelson: Calgary, Canada.

IEEE 1584-2002, IEEE Guide for Performing Arc-Flash Hazard Calculations. Institute of Electrical and Electronics Engineers: New York, NY.

Improved Models for Predicting Incident Thermal Energy Exposures Caused by High Energy Arcing Faults In Low- and Medium-Voltage Power Systems. Latest Edition. R. F. Ammerman, Colorado School of Mines: Golden, CO.

NFPA 70E®, Standard for Electrical Safety in the Workplace. Latest Edition. National Fire Protection Association: Quincy, MA.

29 CFR Parts 1900-1910, *Standards for General Industry.* Occupational Safety and Health Administration, US Department of Labor.

29 CFR Part 1926, *Standards for the Construction Industry.* Occupational Safety and Health Administration, US Department of Labor.

Managing Electrical Hazards. Latest Edition. Upper Saddle River, NJ: NCCER/Pearson Education, Inc.

National Electrical Code® Handbook. Latest Edition. National Fire Protection Association: Quincy, MA.

29 CFR Part 1910, Subpart P, *Standards for General Industry.* Occupational Safety and Health Administration, US Department of Labor.

29 CFR Part 1926, Subpart I, *Standards for the Construction Industry.* Occupational Safety and Health Administration, US Department of Labor.

29 CFR Part 1910, Subpart H, *Standards for General Industry.* Occupational Safety and Health Administration, US Department of Labor.

29 CFR Part 1926, Subpart D, *Standards for the Construction Industry.* Occupational Safety and Health Administration, US Department of Labor.

NIOSH Pocket Guide to Chemical Hazards. National Institute for Occupational Safety and Health (NIOSH), a division of the Centers for Disease Control and Prevention, US Department of Health and Human Services.

There are a number of on-line resources available for trainees who would like more information on safety practices, guidelines, and requirements related to the hazards that instrument fitters and technicians may encounter on the job. A search for additional information may be assigned as homework to interested trainees.

Instructors should view any videos that may be identified in the lesson plan before using them to ensure their suitability. The videos can provide teachable moments in both proper and improper work processes and behaviors. Be prepared to stop the videos at appropriate times to point out and discuss both proper and improper conduct and techniques.

Instructors are also encouraged to locate additional audiovisual aids available on the internet, make personal videos, and take still pictures related to the subject matter and add them to the PowerPoint® presentations throughout the program.



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The Lesson Plan for this module is divided into five 2.5-hour sessions. This time includes 10 minutes for administrative tasks and a 10-minute break per session.

SESSION ONE

Session One discusses electrical hazards. It describes how electrical shock affects the human body and reviews various means that individuals can use to reduce their risk of electrical shock.

1. Show the Session One PowerPoint® presentation.
2. Use the Kickoff Activity to introduce the subjects that will be covered in this module and stimulate trainee interest in the material to be covered.
3. Describe the effects of electrical shock on the human body and how the risk of electrical shock can be reduced.
4. Review the equipment, clothing, personal protective equipment (PPE), and tools that individuals can use to protect themselves from electrical shock and general hazards on the job.

SESSION TWO

Session Two introduces national consensus safety requirements, describes the use of hazard boundaries, and explains how to analyze electrical hazards.

1. Show the Session Two PowerPoint® presentation.
2. Use the Kickoff Activity to encourage trainees to consider why workers may fail to follow the proper safety practices for electrical hazards.
3. Review OSHA and *NFPA 70E*® safety requirements.
4. Describe the following hazard boundaries: limited approach boundary, restricted approach boundary, prohibited approach boundary, arc flash boundary.
4. Describe how to perform a shock hazard analysis.
5. Describe how to perform an arc flash hazard analysis.

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SESSION THREE

Session Three describes lockout/tagout procedures and reviews safety practices for working with tools, hazardous materials, and batteries.

1. Show the Session Three PowerPoint® presentation.
2. Use the Kickoff Activity to review the material that was covered in the first two classroom sessions.
3. Explain how to perform lockouts/tagouts and test for voltage.
4. Review basic hand tool and power tool safety.
5. Describe safety precautions, resources, and equipment for working with hazardous process fluids and solvents.
6. Review safety concerns and protections associated with the use of batteries.

SESSION FOUR

Session Four is a lab session devoted to the practice and completion of Performance Tasks 1 and 2.

1. Note that there is no PowerPoint® presentation associated with this session.
2. Demonstrate how to conduct a shock hazard analysis and how to complete a lockout procedure on an energized energy source(s).
3. Have trainees practice and/or complete the tasks associated with Performance Tasks 1 and 2 in this hands-on session.

SESSION FIVE

Session Five is a review and testing session. Have trainees complete the Module Review and Trade Terms Quiz. Go over the Module Review and Trade Terms Quiz in class prior to the exam and answer any questions that the trainees may have.

1. Have trainees complete the written examination. Any outstanding performance testing must be completed during this session as well.
2. Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.



Materials Checklist for Module 12115-14, Instrumentation Safety Practices

Equipment and Materials					
Personal protective equipment:		Multiple copies of <i>NFPA 70E</i> [®]		Multimeter	
Standard eye protection		Appropriate locks and tags to lockout energy sources		Multiple copies of the Shock Hazard Analysis Checklist (provided herein at the end of the lesson plan)	
Additional eye and face protection as designated by the instructor or training facility provider		Protective rubber gloves with markings (new or damaged)		Copies of MSDS/SDS for a variety of common process fluids	
Work gloves		Fuse pulling tool(s)		A shorting probe	
Proper footwear as designated by the instructor or training facility provider		One or more copies of the <i>National Electrical Code</i> [®] (<i>NEC</i> [®])		One or more power distribution drawings for a work site	
Hearing protection as designated by the instructor or training facility provided		One or more LOTO devices for electrically or pneumatically operated equipment		Several copies of the NIOSH Pocket Guide to Chemical Hazards	
Whiteboard/chalkboard		Specific tools and materials required for instructor demonstration of performing a shock hazard analysis (the relevant power distribution drawings and technical documentation, facility's LOTO procedures, appropriate PPE, appropriate hand tools, power tools, etc.)		Specific tools and materials required for trainee performance of a shock hazard analysis for an activity assigned by the instructor (the relevant power distribution drawings and technical documentation, facility's LOTO procedures, appropriate PPE, appropriate hand tools, power tools, etc.)	
Markers/chalk		Multiple copies of an Energized Work Permit form, for the recording of the Shock Hazard Analysis results; use a form from your employer. Alternatively, various versions of the form can be located on the internet.			
Pencils and paper					
<i>Instrumentation Level One</i> PowerPoint [®] Presentation Slides					
DVD player					
LCD projector and screen					
Computer					
Internet access during class (optional)					
Copies of the Module Examination and Performance Profile Sheets					

To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.