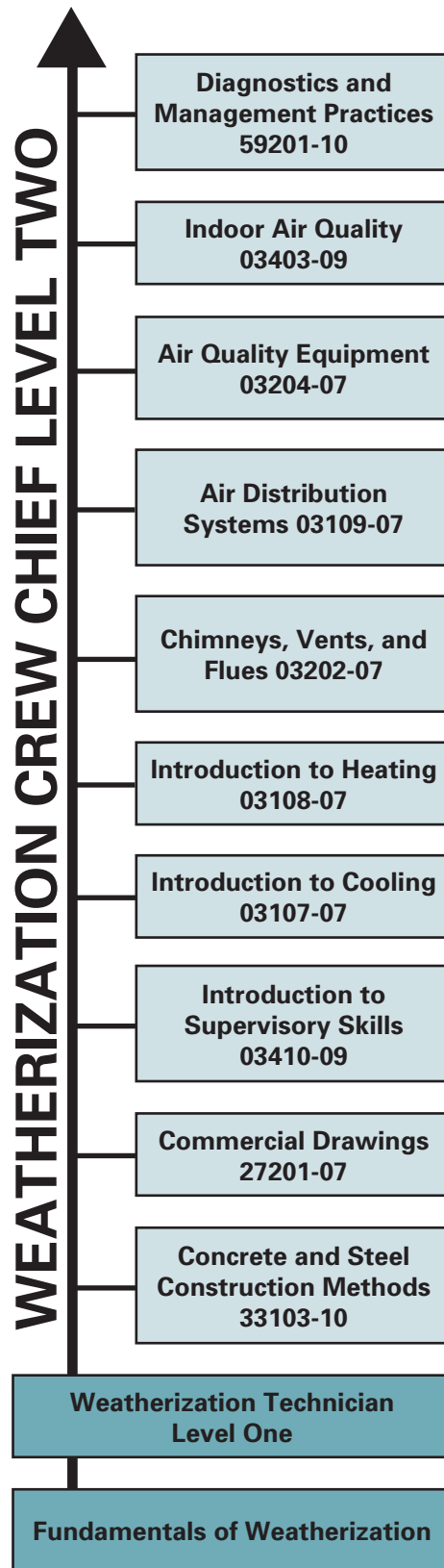


# COMPETENCIES, OBJECTIVES, AND PERFORMANCE TASKS



This course map shows all of the modules in *Weatherization Crew Chief Level Two*. The suggested training order begins at the bottom and proceeds up. Skill levels increase as you advance on the course map. The local Training Program Sponsor may adjust the training order.

## Module Overview

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This module presents information on the materials and techniques used to construct commercial buildings. It covers fasteners, anchors, and tools used to run cable in concrete and steel structures. Fire- and sound-rated walls and suspended ceilings are also discussed.

## Prerequisites

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Prior to training with this module, it is recommended that the trainee shall have successfully completed *Fundamentals of Weatherization* and *Weatherization Technician Level One*.

## Objectives

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

1. Describe the composition and uses of the common types of commercial building materials.
2. Describe the common methods of commercial construction.
3. Explain common terms used in commercial construction.
4. Identify various types of suspended ceilings.
5. Identify the tools used to make openings in concrete and steel.
6. Select the appropriate drill bits and bore openings in concrete and steel.
7. Select and install appropriate fasteners and anchors in the following:
  - Concrete
  - Steel

## Performance Tasks

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

1. Select the appropriate drill bits and bore openings in concrete and steel.
2. Select and install appropriate fasteners and anchors in the following:
  - Concrete
  - Steel

## Materials and Equipment

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Multimedia projector and screen  
*Weatherization Crew Chief Level Two*  
PowerPoint® Presentation Slides  
(ISBN 978-013-257685-7)

Computer

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Samples of the following construction materials:

Metal studs

Mechanical firestop devices

Firestopping materials

Operator's manuals for selected power tools

Torque wrench

Drill

Rotary hammer

Selection of concrete drill bits

Selection of concrete fasteners

Selection of screws, nuts, and washers

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 that trainees use power tools for cutting and drilling. Brief all trainees on shop safety procedures and point out the location of fire extinguishers, first aid stations, and other emergency equipment. Review basic electrical safety and power tool safety. Emphasize the use of personal protective equipment. This module may require that the trainees visit job sites. Ensure that trainees are briefed on site safety policies prior to any site visits.

## Additional Resources

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

*Basic Construction Materials*, 6th Edition. 2002. Theodore W. Marotta. Upper Saddle River, NJ: Prentice Hall.

*Principles and Practices of Light Construction*, 6th Edition. 2004. Ronald C. Smith, Ted L. Honkala, and Malcolm W. Sharp. Upper Saddle River, NJ: Prentice Hall.

*Principles and Practices of Commercial Construction*, 7th Edition. 2004. Cameron K. Andres and Ronald C. Smith. Upper Saddle River, NJ: Prentice Hall.

## 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 *Concrete and Steel Construction Methods*. You will need to adjust the time required for hands-on activity and 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; Building Materials</b>	
A. Introduction	_____
B. Building Materials	_____
1. Concrete	_____
2. Metal	_____
<b>Session II. Commercial Construction Methods; Fire-Rated and Sound-Rated Walls</b>	
A. Commercial Construction Methods	_____
1. Floors	_____
2. Exterior Walls	_____
3. Interior Walls and Partitions	_____
4. Roof Structure	_____
5. Ceilings	_____
B. Fire-Rated and Sound-Rated Walls	_____
1. Fire-Rated Construction	_____
2. Sound-Isolation Construction	_____

### Session III. Fasteners and Anchors; Special Tools

#### A. Fasteners and Anchors

1. Threaded Fasteners
2. Bolts and Screws
3. Nuts and Washers
4. Installing Fasteners
5. Eye Bolts
6. Hammer-Driven Pins and Studs
7. Mechanical and Self-Drilling Anchors
8. Guidelines for Drilling Anchor Holes in Hardened Concrete and Masonry
9. Epoxy Anchoring Systems

#### B. Special Tools

1. Hammer Drills and Rotary Hammers
2. Core Drills
3. Metal Stud Punches
4. Powder-Actuated Tools and Fasteners

### Session IV. Laboratories

#### A. Laboratory

Have trainees practice selecting the appropriate drill bits and boring openings in concrete and steel. This laboratory corresponds to Performance Task 1.

#### B. Laboratory

Have trainees practice selecting and installing appropriate fasteners and anchors in concrete and steel. This laboratory corresponds to Performance Task 2.

### Session V. Project Schedules; Review and Testing

#### A. Project Schedules

#### B. Module 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.

#### D. Performance Testing

1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from the 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 describes the types and uses of drawings prepared for commercial structures. It provides information about the format and content of commercial drawings and their use in conveying specific construction requirements. It describes the standard format for specifications.

## Prerequisites

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Prior to training with this module, it is recommended that the trainee shall have successfully completed *Fundamentals of Weatherization*; *Weatherization Technician Level One*; and *Weatherization Crew Chief Level Two*, Module 33103-10.

## Objectives

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

1. Recognize the difference between commercial and residential construction drawings.
2. Identify the basic keys, abbreviations, and other references contained in a set of commercial drawings.
3. Accurately read a set of commercial drawings.
4. Identify and document specific items from a door and window schedule.
5. Explain basic construction details and concepts employed in commercial construction.
6. Calculate the floor area of each room in a floor plan.

## Performance Tasks

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

1. Locate 10 items contained in a set of commercial drawings. (The instructor will select the 10 items.)
2. Using a door and window schedule, identify the hardware, ratings, and finishing for each door and window.
3. Calculate the floor area in a floor plan.

## Materials and Equipment

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Multimedia projector and screen  
*Weatherization Crew Chief Level Two*  
PowerPoint® Presentation Slides  
(ISBN 978-013-257685-7)  
Computer  
Whiteboard/chalkboard  
Markers/chalk

Pencils and scratch paper  
Appropriate personal protective equipment  
Set of commercial drawings  
Set of residential drawings  
Quick Quizzes\*  
Module Examination\*\*  
Performance Profile Sheet\*\*

\* Located at the back of this module.

\*\* 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. Emphasize basic site safety. This module may require trainees to visit job sites. Make sure that all trainees are briefed on site safety procedures.

## Additional Resources

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

The American Institute of Architects, *Architectural Graphic Standards*, Eighth Edition. New York: Wiley, 1988.

Wayne J. DelPico, *Basics for Builders: Plan Reading & Material Takeoff*. Kingston, MA: R.S. Means Company, Inc., 1994.

## 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 25 hours are suggested to cover *Commercial Drawings*. You will need to adjust the time required for hands-on activity and 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 to the Drawing Set</b>	
A. Introduction	_____
B. Requirements for Commercial Plans	_____
<b>Sessions II-IV. Reading and Understanding Drawings I</b>	
A. Architectural Drawings	_____
B. Laboratory Have trainees practice calculating the area of each room in a floor plan in a set of commercial drawings. This laboratory corresponds to Performance Task 3.	_____
C. Schedules	_____
D. Laboratory Have trainees practice using a door and window schedule. This laboratory corresponds to Performance Task 2.	_____
<b>Sessions V and VI. Reading and Understanding Drawings II</b>	
A. Structural Drawings	_____
<b>Sessions VII and VIII. Reading and Understanding Drawings III</b>	
A. Mechanical Drawings	_____
B. Electrical Drawings	_____
C. Laboratory Have trainees practice identifying and documenting the design and location of ten items contained in a set of commercial drawings. This laboratory corresponds to Performance Task 1.	_____
<b>Session IX. Understanding Written Specifications</b>	
A. Written Specifications	_____

## Session X. Review and Testing

A. Module 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 the 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 explains many of the skills needed to become a supervisor. Issues covered include those related to leadership, gender and culture, problem solving/decision making, and safety.

## Prerequisites

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Prior to training with this module, it is recommended that the trainee shall have successfully completed *Fundamentals of Weatherization*; *Weatherization Technician Level One*; and *Weatherization Crew Chief Level Two*, Modules 33103-10 and 27201-07.

## Objectives

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

1. Describe the skills necessary to be a supervisor.
2. List the characteristics and behavior of effective leaders, as well as the different leadership styles.
3. Explain the difference between problem solving and decision making.
4. Describe ways to deal with common leadership problems, such as absenteeism and turnover.
5. Identify a supervisor's safety responsibilities.
6. Describe the signals of substance abuse.
7. List the essential parts of an accident investigation.

## 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  
*Weatherization Crew Chief Level Two*  
PowerPoint® Presentation Slides  
(ISBN 978-013-257685-7)  
Computer

Whiteboard/chalkboard  
Markers/chalk  
Pencils and scratch paper  
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.



## 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 *Introduction to Supervisory Skills*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources.

Topic	Planned Time
<b>Session I. Introduction to Supervision; Becoming a Leader</b>	
A. Introduction to Supervision	_____
B. Becoming a Leader	_____
1. Characteristics of Effective Leaders	_____
2. Leadership Behavior	_____
3. Functions of a Leader	_____
4. Leadership Styles	_____
5. Ethics in Leadership	_____
<b>Session II. Gender and Cultural Issues</b>	
A. Communication Styles of Men and Women	_____
B. Language Barriers	_____
C. Cultural Differences	_____
D. Sexual Harassment	_____
E. Gender and Minority Discrimination	_____
<b>Session III. Problem Solving and Decision Making</b>	
A. Types of Decisions	_____
B. Formal Problem-Solving Techniques	_____
C. Dealing with Leadership Problems	_____
<b>Session IV. Supervisors and Safety; Supervisor Involvement in Safety</b>	
A. Supervisors and Safety	_____
1. Safety Responsibilities, Programs, and Policies/Procedures	_____
2. Hazard Identification and Safety Training	_____
B. Supervisor Involvement in Safety	_____
1. Safety Meetings and Inspections	_____
2. Substance Abuse	_____
3. Accident Investigation	_____
<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.	

## Module Overview

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This module covers the basic principles of heat transfer, refrigeration, and pressure-temperature relationships and describes the components and accessories used in air conditioned systems.

## Prerequisites

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Prior to training with this module, it is recommended that the trainee shall have successfully completed *Fundamentals of Weatherization*; *Weatherization Technician Level One*; and *Weatherization Crew Chief Level Two*, Module 33103-10, 27201-07, and 03410-09.

## Objectives

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

1. Explain how heat transfer occurs in a cooling system, demonstrating an understanding of the terms and concepts used in the refrigeration cycle.
2. Calculate the temperature and pressure relationships at key points in the refrigeration cycle.
3. Under supervision, use temperature- and pressure-measuring instruments to make readings at key points in the refrigeration cycle.
4. Identify commonly used refrigerants and demonstrate the proper procedures for handling these refrigerants.
5. Identify the major components of a cooling system and explain how each type works.
6. Identify the major accessories available for cooling systems and explain how each works.
7. Identify the control devices used in cooling systems and explain how each works.
8. State the correct methods to be used when piping a refrigeration system.

## Performance Tasks

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

1. Measure temperatures in an operating air conditioning system.
2. Use cylinder color codes to identify refrigerants.
3. Identify compressors, condensers, evaporators, metering devices, controls, and accessories.
4. Use service valves to gain access to an air conditioning system in order to measure pressures using a gauge manifold set.

## Materials and Equipment

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Multimedia projector and screen	Material Safety Data Sheets for refrigerants
<i>Weatherization Crew Chief Level Two</i>	One or more operating refrigeration and/or air conditioning systems
PowerPoint® Presentation Slides (ISBN 978-013-257685-7)	Compressors
Computer	Condensers
Whiteboard/chalkboard	Evaporators
Markers/chalk	Gauge manifold sets
Pencils and scratch paper	Metering devices
Appropriate personal protective equipment	Service valves
Barometers	Refrigerant cylinders
Temperature-pressure charts	Accessories
Various types of thermometers, including infrared	Primary controls

*continued*

Secondary controls  
Portable hot plate and suitable container for boiling water  
Multimeters

Manometers  
Copies of the Quick Quiz\*  
Module Examinations\*\*  
Performance Profile Sheets\*\*

\* Located at the back of this module.

\*\* 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 on equipment that is operating and to operate testing equipment. Ensure that they are briefed on shop safety procedures and emphasize electrical safety precautions.

## Additional Resources

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

*Air Conditioning Systems, Principles, Equipment, and Service*, Latest Edition. Upper Saddle River, NJ: Prentice Hall.

*Basic Refrigeration* (Slides and Student Handbook), Latest Edition. York, PA: York International Corporation, Publications Distribution Center.

*General Training Air Conditioning (Fundamentals)*–GTAC-I, Latest Edition. Syracuse, NY: Carrier Corporation, Literature Services.

## 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 30 hours are suggested to cover *Introduction to Cooling*. You will need to adjust the time required for hands-on activity and 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. Fundamentals of Cooling</b>	
A. Introduction	_____
B. Heat	_____
C. Heat Transfer	_____
D. Pressure	_____
E. Instruments Used to Measure Temperature and Pressure	_____
F. Laboratory	_____
Have trainees practice measuring temperatures in an operating air conditioning system. This laboratory corresponds to Performance Task 1.	
<b>Session III. Mechanical Refrigeration System</b>	
A. System Components	_____
B. Refrigeration Cycle	_____

**Session IV. Refrigerants**

- A. Trade Names \_\_\_\_\_
- B. Ammonia \_\_\_\_\_
- C. Fluorocarbon Refrigerants \_\_\_\_\_
- D. Refrigerant Containers \_\_\_\_\_
- E. Identifying Refrigerants \_\_\_\_\_
- F. Laboratory \_\_\_\_\_

Have trainees practice identifying refrigerants. This laboratory corresponds to Performance Task 2.

- G. Refrigerant Safety Precautions \_\_\_\_\_

**Session V. Compressors**

- A. Reciprocating Compressors \_\_\_\_\_
- B. Rotary Compressors \_\_\_\_\_
- C. Scroll Compressors \_\_\_\_\_
- D. Screw Compressors \_\_\_\_\_
- E. Centrifugal Compressors \_\_\_\_\_

**Session VI. Condensers**

- A. Air-Cooled Condensers \_\_\_\_\_
- B. Water-Cooled Condensers \_\_\_\_\_
- C. Evaporative Condensers \_\_\_\_\_

**Session VII. Evaporators**

- A. Direct Expansion (DX) Evaporators \_\_\_\_\_
- B. Flooded Evaporators \_\_\_\_\_
- C. Evaporator Construction \_\_\_\_\_

**Session VIII. Expansion (Metering) Devices**

- A. Fixed Metering Devices \_\_\_\_\_
- B. Adjustable Metering Devices \_\_\_\_\_

**Session IX. Other Components**

- A. Filter-Drier \_\_\_\_\_
- B. Sight-Glass Moisture Liquid Indicator \_\_\_\_\_
- C. Suction Line Accumulator \_\_\_\_\_
- D. Crankcase Heater \_\_\_\_\_
- E. Oil Separator \_\_\_\_\_
- F. Heat Exchanger \_\_\_\_\_
- G. Receiver \_\_\_\_\_
- H. Service Valves \_\_\_\_\_
- I. Laboratory \_\_\_\_\_

Trainees practice using service valves to gain access to air conditioning systems to measure pressure. This laboratory corresponds to Performance Task 4.

- J. Compressor Muffler \_\_\_\_\_

**Session X. Controls**

- A. Primary Controls \_\_\_\_\_
- B. Secondary Controls \_\_\_\_\_

**Session XI. Piping**

- A. Basic Principles
- B. Suction Line
- C. Hot Gas Line
- D. Liquid Line Layout
- E. Pipe Supports
- F. Insulation
- G. Laboratory

Have trainees practice identifying air conditioning components.  
This laboratory corresponds to Performance Task 3.

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**Session XII. Review and Testing**

- A. Module Review
- B. Module Examination

- 1. Trainees must score 70% 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. Classroom

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## Module Overview

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This module covers heating fundamentals, types and designs of furnaces and their components, and basic procedures for installing and servicing furnaces.

## Prerequisites

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Prior to training with this module, it is recommended that the trainee shall have successfully completed *Fundamentals of Weatherization*; *Weatherization Technician Level One*; and *Weatherization Crew Chief Level Two*, Modules 33103-10, 27201-07, 03410-09, and 03107-07.

## Objectives

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

1. Explain the three methods by which heat is transferred and give an example of each.
2. Describe how combustion occurs and identify the byproducts of combustion.
3. Identify various types of fuels used in heating.
4. Identify the major components and accessories of an induced draft and condensing gas furnace and explain the function of each component.
5. State the factors that must be considered when installing a furnace.
6. Identify the major components of a gas furnace and describe how each works.
7. With supervision, use a manometer to measure and adjust manifold pressure on a gas furnace.
8. Identify the major components of an oil furnace and describe how each works.
9. Describe how an electric furnace works.
10. With supervision, perform basic furnace preventive maintenance procedures such as cleaning and filter replacement.

## Performance Tasks

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

1. Identify the components of an induced draft and condensing gas furnace and state their purpose.
2. With supervision, turn on and check a gas furnace.
3. Identify symptoms of combustion problems in a gas furnace and adjust the manifold pressure.
4. With supervision, perform preventive maintenance procedures on a gas furnace, including filter replacement, cleaning of components, and temperature measurements.
5. Identify the components of an oil furnace and state their purpose.
6. With supervision, turn on and check an oil furnace.
7. With supervision, perform preventive maintenance procedures on an oil furnace, including filter replacement, cleaning of components, and temperature measurements.

## Materials and Equipment

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Multimedia projector and screen  
*Weatherization Crew Chief Level Two*  
PowerPoint® Presentation Slides  
(ISBN 978-013-257685-7)

Computer

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

GAMA venting tables

Copper pipe and light plastic bags for heat transfer experiments

Hair dryer for heat transfer experiments

Thermometers or temperature probes

Operating gas-fired furnace

Operating oil-fired furnace

Pressure-type oil burner

Gas manifold

Drill and brush

Manometer

Various grades of oil

Manufacturer's literature on various types of forced-air furnaces

Manufacturer's literature on multi-poise furnaces

(continued)

Manufacturer's literature on condensing furnaces  
 Furnace air filters  
 Nozzles  
 Safety switches

Hydronic heat radiators  
 Copies of the Quick Quizzes\*  
 Module Examinations\*\*  
 Performance Profile Sheets\*\*

\* Located at the back of this module.

\*\* 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 on equipment that is operating and to operate testing equipment. Ensure that they are briefed on shop safety procedures and emphasize electrical safety precautions.

## Additional Resources

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

*Fundamentals of Gas Heating*, Latest Edition. Tyler, TX: The Trane Company.

*General Training—Heating (GTH)*, Latest Edition. Syracuse, NY: Carrier Corporation.

*Heating, Ventilating, and Air Conditioning Fundamentals*, Latest Edition. Upper Saddle River, NJ: Prentice Hall.

## 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 *Introduction to Heating*. You will need to adjust the time required for hands-on activity and 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. Fundamentals of Heating</b>	
A. Introduction	_____
B. Heat Transfer	_____
C. Temperature and Heat Measurement	_____
D. Combustion	_____
<b>Session II. Forced-Air Furnaces</b>	
A. Types	_____
B. Heat Exchangers	_____
C. Condensing Furnaces	_____
D. Fans, Motors, Air Filters, and Blowers	_____
E. Humidifiers	_____
F. Installation	_____
G. Laboratory	_____
Have trainees practice identifying the components of an induced draft and condensing gas furnace and state their purpose. This laboratory corresponds to Performance Task 1.	

### Session III. Gas Furnaces

- A. Flame Ignition \_\_\_\_\_
- B. Laboratory \_\_\_\_\_  
Have trainees practice turning on and checking a gas furnace. This laboratory corresponds to Performance Task 2. \_\_\_\_\_
- C. Gas Valve Assembly \_\_\_\_\_
- D. Components \_\_\_\_\_
- E. Safety Switches \_\_\_\_\_
- F. Maintenance \_\_\_\_\_
- G. Laboratory \_\_\_\_\_  
Have trainees practice performing preventive maintenance procedures on a gas furnace. This laboratory corresponds to Performance Task 4. \_\_\_\_\_
- H. Manifold Pressure \_\_\_\_\_
- I. Laboratory \_\_\_\_\_  
Have trainees practice identifying symptoms of combustion problems in a gas furnace and adjusting the manifold pressure. This laboratory corresponds to Performance Task 3. \_\_\_\_\_

### Session IV. Oil Furnaces

- A. Oil Burner Operation \_\_\_\_\_
- B. Laboratory \_\_\_\_\_  
Have trainees practice turning on and checking an oil furnace. This laboratory corresponds to Performance Task 6. \_\_\_\_\_
- C. Combustion Chamber \_\_\_\_\_
- D. Regulators and Safety Controls \_\_\_\_\_
- E. Oil Storage \_\_\_\_\_
- F. Laboratory \_\_\_\_\_  
Have trainees practice identifying the components of an oil furnace. This laboratory corresponds to Performance Task 5. \_\_\_\_\_
- G. Maintenance \_\_\_\_\_
- H. Laboratory \_\_\_\_\_  
Have trainees practice performing preventive maintenance procedures on an oil furnace. This laboratory corresponds to Performance Task 7. \_\_\_\_\_

### Session V. Electric Heating

- A. Heating Elements \_\_\_\_\_
- B. Components \_\_\_\_\_
- C. Power Supply \_\_\_\_\_
- D. Hydronic Heating Systems \_\_\_\_\_
- E. Summary \_\_\_\_\_

### Session VI. Review and Testing

- A. Module 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 the 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 covers proper venting of fossil-fuel furnaces and the procedures for selecting and installing vents in all types of gas furnaces.

## Prerequisites

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Prior to training with this module, it is recommended that the trainee shall have successfully completed *Fundamentals of Weatherization*; *Weatherization Technician Level One*; and *Weatherization Crew Chief Level Two*, Modules 33103-10, 27201-07, 03410-09, 03107-07, and 03108-07.

## Objectives

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

1. Describe the principles of combustion and explain complete and incomplete combustion.
2. Describe the content of flue gas and explain how it is vented.
3. Identify the components of a furnace vent system.
4. Describe how to select and install a vent system.
5. Perform the adjustments necessary to achieve proper combustion in a gas furnace.
6. Describe the techniques for venting different types of furnaces.
7. Explain the various draft control devices used with natural-draft furnaces.
8. Calculate the size of a vent required for a given application.
9. Adjust a thermostat heat anticipator.

## Performance Tasks

---

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

1. Measure supply and return temperature and determine the temperature rise of a furnace.
2. Adjust a thermostat heat anticipator.
3. Calculate the correct size and type of PVC pipe using manufacturer's instructions or *National Fuel Gas Code* or American Gas Association specifications.
4. Calculate the correct size and type of furnace vent connector and metal vent using manufacturer's instructions or *National Fuel Gas Code* or American Gas Association specifications.

## Materials and Equipment

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Multimedia projector and screen  
*Weatherization Crew Chief Level Two*  
PowerPoint® Presentation Slides  
(ISBN 978-013-257685-7)

Computer

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Copy of latest edition of the *National Fuel Gas Code*  
or American Gas Association specifications

Various vent manufacturers' product data and  
catalogs

Videotape (optional) *Principles of Gas Combustion*

Videotape (optional) *Ventinox Chimney Solution*

TV/VCR/DVD player

Thermometer

Selection of vent piping:

Double wall (Types B, L, and B-W)

Single wall

Schedule 40 PVC

High-temperature plastic

PVC and metal tubes

Smoke source

Flame source

Concentric vent termination

Temperature probes

Operating gas-fired furnace

Copies of the Quick Quiz\*

Module Examinations\*\*

Performance Profile Sheets\*\*

\* Located in the back of this module.

\*\* 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. The module requires that trainees work with operating gas-fired furnaces. Ensure that all trainees are briefed on fire safety procedures.

## Additional Resources

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

*Mid-Efficiency Furnace Installation Awareness*. Latest Edition. Syracuse, NY: Carrier Corporation.

*National Fuel Gas Code (NFPA 54/ANSI/Z223.1)*. Latest Edition. Quincy, MA: National Fire Protection Association.

## 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 5 hours are suggested to cover *Chimneys, Vents, and Flues*. You will need to adjust the time required for hands-on activity and 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 to Chimneys and Venting Requirements</b>	
A. Introduction	_____
B. Combustion	_____
C. Flue Gases	_____
D. Furnace Venting	_____
E. Vent System Components	_____
F. Natural-Draft Furnaces	_____
G. Induced-Draft Furnaces	_____
H. Laboratory	_____
Have trainees practice measuring the temperature and determining the temperature rise. This laboratory corresponds to Performance Task 1.	
I. Laboratory	_____
Have trainees practice adjusting the thermostat anticipator. This laboratory corresponds to Performance Task 2.	

## Session II. Vent Calculations; Review and Testing

A. Venting Considerations \_\_\_\_\_

B. Laboratory \_\_\_\_\_

Have trainees practice calculating the correct size and type of vent connector and metal vent. This laboratory corresponds to Performance Task 4.

C. Condensing Gas Furnaces \_\_\_\_\_

D. Laboratory \_\_\_\_\_

Have trainees practice calculating the correct size and type of PVC pipe. This laboratory corresponds to Performance Task 3.

E. Draft Controls \_\_\_\_\_

F. Review \_\_\_\_\_

G. 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.

H. Performance Testing \_\_\_\_\_

1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from the 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 describes air distribution systems and their components, air flow measurement, duct work installation principles, and the use of instruments for measuring temperature, humidity, pressure, and velocity.

## Prerequisites

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Prior to training with this module, it is recommended that the trainee shall have successfully completed *Fundamentals of Weatherization*; *Weatherization Technician Level One*; and *Weatherization Crew Chief Level Two*, Modules 33103-10, 27201-07, 03410-09, 03107-07, 03108-07, and 03202-07.

## Objectives

---

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

1. Describe the airflow and pressures in a basic forced-air distribution system.
2. Explain the differences between propeller and centrifugal fans and blowers.
3. Identify the various types of duct systems and explain why and where each type is used.
4. Demonstrate or explain the installation of metal, fiberboard, and flexible duct.
5. Demonstrate or explain the installation of fittings and transitions used in duct systems.
6. Demonstrate or explain the use and installation of diffusers, registers, and grilles used in duct systems.
7. Demonstrate or explain the use and installation of dampers used in duct systems.
8. Demonstrate or explain the use and installation of insulation and vapor barriers used in duct systems.
9. Identify instruments used to make measurements in air systems and explain the use of each instrument.
10. Make basic temperature, air pressure, and velocity measurements in an air distribution system.

## Performance Tasks

---

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

1. Use a tachometer to measure blower motor rpm.
2. Read and interpret equivalent length charts and required air volume/duct size charts.
3. Assemble duct and fittings.
4. Assemble flexible duct.
5. Install insulation and vapor barriers on metal ducts.
6. Use a manometer to measure static pressure in a duct system.
7. Use a velometer to measure the velocity of airflow at the output of air system supply diffusers and registers.

## Materials and Equipment

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Multimedia projector and screen  
*Weatherization Crew Chief Level Two*  
PowerPoint® Presentation Slides  
(ISBN 978-013-257685-7)

Computer

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Operating air distribution duct system

Various examples of blowers and fans  
Manufacturer's literature on various types of  
blowers and fans

Various examples of diffusers, registers, and  
grilles

Manufacturer's literature on various types of dif-  
fusers, registers, and grilles

Metal duct sections of various sizes and types

Metal duct installation fasteners and attaching  
hardware

*continued*

Ductboard sections of various sizes and shapes  
 Ductboard installation materials and attaching hardware  
 Fan curve charts  
 Metal duct fasteners  
 Fiberglass ductboard  
 Duct fittings and transitions  
 Duct hangers and supports  
 Flexible duct of various sizes and shapes  
 Flexible duct materials and attaching hardware  
 Duct tape  
 Samples of foil- and/or vinyl-backed fiberglass duct insulation  
 Samples of metal duct with insulation inside  
 Examples of equivalent length charts  
 Psychrometric charts  
 Psychrometers  
 Hygrometers  
 Tachometers

Manometers (as available):  
 U-tube  
 Inclined  
 Inclined-vertical  
 Electronic  
 Pitot tubes  
 Static pressure tips  
 Velometers (as available):  
 Rotating vane  
 Swing vane  
 Hot wire  
 Flow hood  
 Thermometers  
 Differential pressure gauges  
 Air volume balancer  
 Copies of Quick Quiz \*  
 Module Examinations\*\*  
 Performance Profile Sheets\*\*

\* Located at the back of this module.

\*\* 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

---

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. This module requires trainees to work on equipment that is operating and to operate testing equipment. Ensure that they are briefed on shop safety procedures and emphasize electrical safety precautions.

## Additional Resources

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

*Residential Air System Design*, 1993. Syracuse, NY: Carrier Corporation.

## Teaching Time For This Module

---

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 *Air Distribution Systems*. You will need to adjust the time required for hands-on activity and 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 to Air Distribution Systems</b>	
A. Introduction	_____
B. Air Distribution Systems	_____
C. Fans and Blowers	_____
D. Laboratory	_____
Have trainees practice using a tachometer to measure blower rpm. This laboratory corresponds to Performance Task 1.	

## Session II. Duct Systems

- A. Duct Systems Used in Cold Climates \_\_\_\_\_
- B. Duct Systems Used in Warm Climates \_\_\_\_\_
- C. Duct System Components \_\_\_\_\_
- D. Duct Hangers and Supports \_\_\_\_\_
- E. Laboratory \_\_\_\_\_  
Have trainees practice reading and interpreting equivalent length charts.  
This laboratory corresponds to Performance Task 2.
- F. Laboratory \_\_\_\_\_  
Have trainees practice installing various types of ductwork, including  
installation of insulation and vapor barriers. This laboratory corresponds to  
Performance Tasks 3 through 5.

## Session III. Instruments and Measurements

- A. Temperature and Humidity Measurements \_\_\_\_\_
- B. Air Distribution System Measurements \_\_\_\_\_
- C. Laboratory \_\_\_\_\_  
Have trainees practice using a manometer. This laboratory corresponds to  
Performance Task 6.
- D. Air Velocity Measurements \_\_\_\_\_
- E. Laboratory \_\_\_\_\_  
Have trainees practice using a velometer. This laboratory corresponds to  
Performance Task 7.
- F. Summary \_\_\_\_\_

## Session IV. Review and Testing

- A. Module 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 the 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 covers common accessories used to control air quality, including dehumidifiers, humidifiers, and filters. It also covers energy conservation equipment.

## Prerequisites

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Prior to training with this module, it is recommended that the trainee shall have successfully completed *Fundamentals of Weatherization*; *Weatherization Technician Level One*; and *Weatherization Crew Chief Level Two*, Modules 33103-10, 27201-07, 03410-09, 03107-07, 03108-07, 03202-07, and 03109-07.

## Objectives

---

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

1. Explain why it is important to control humidity in a building.
2. Recognize the various kinds of humidifiers used with HVAC systems and explain why each is used.
3. Demonstrate how to install and service the humidifiers used in HVAC systems.
4. Recognize the kinds of air filters used with HVAC systems and explain why each is used.
5. Demonstrate how to install and service the filters used in HVAC systems.
6. Use a manometer or differential pressure gauge to measure the friction loss of an air filter.
7. Identify accessories commonly used with air conditioning systems to improve indoor air quality and reduce energy cost, and explain the function of each, including:
  - Humidity control devices
  - Air filtration devices
  - Energy conservation devices
8. Demonstrate or describe how to clean an electronic air cleaner.

## Performance Tasks

---

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

1. Demonstrate how to inspect, clean, and replace humidifiers.
2. Inspect disposable/permanent air filters for mechanical damage and cleanliness.
3. Clean permanent-type air filters.
4. Measure the differential pressure drop across an air filter with a manometer.

## Materials and Equipment

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Multimedia projector and screen  
*Weatherization Crew Chief Level Two*  
PowerPoint® Presentation Slides  
(ISBN 978-013-257685-7)

Computer  
Whiteboard/chalkboard  
Markers/chalk  
Pencils and scratch paper  
Humidifiers  
Disposable air filters  
Electronic air cleaner

Various types of air filters  
Tools for removing and cleaning air filters  
Manometer  
Operating air filtration system  
Manufacturers' literature on energy and heat  
recovery ventilators  
Ultraviolet light purification system  
Carbon monoxide and carbon dioxide monitors  
Copies of the Quick Quiz\*  
Module Examinations\*\*  
Performance Profile Sheets\*\*

\* Located in the back of this module.

\*\* 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. The module requires that trainees work with air filters and testing equipment. Ensure that all trainees are briefed on appropriate safety procedures.

## Additional Resources

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

*Air Conditioning Systems, Principles, Equipment, and Service*. 2000. Prentice Hall.

*Refrigeration and Air Conditioning: An Introduction to HVAC*. 2003. Prentice Hall.

## Teaching Time For This Module

---

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 5 hours are suggested to cover *Air Quality Equipment*. You will need to adjust the time required for hands-on activity and 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; Humidity Control; Indoor Air Quality</b>	
A. Introduction	_____
B. Process and Comfort Air Conditioning	_____
C. Humidity Control	_____
D. Laboratory	_____
Have trainees practice inspecting, cleaning, and replacing humidifiers. This laboratory corresponds to Performance Task 1.	
E. Mechanical Air Filters	_____
F. Laboratory	_____
Have trainees practice inspecting disposable/permanent air filters. This laboratory corresponds to Performance Task 2.	
G. Laboratory	_____
Have trainees practice cleaning permanent air filters. This laboratory corresponds to Performance Task 3.	



## Session II. Indoor Air Quality Part Two; Review and Testing

### A. Laboratory

Have trainees practice measuring the differential pressure drop across an air filter with a manometer. This laboratory corresponds to Performance Task 4.

### B. Air Conditioning Energy Conservation Equipment

### C. Ultraviolet Light Air Purification Systems

### D. Carbon Monoxide and Carbon Dioxide Monitors

### E. Review

### F. Module Examination

1. Trainees must score 70% 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.

### G. 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

---

This module covers indoor air quality and its effect on the health and comfort of building occupants. It provides guidelines for performing a building IAQ survey and identifies the equipment and methods used to test and control indoor air quality.

## Prerequisites

---

Prior to training with this module, it is recommended that the trainee shall have successfully completed *Fundamentals of Weatherization*; *Weatherization Technician Level One*; and *Weatherization Crew Chief Level Two*, Modules 33103-10, 27201-07, 03410-09, 03107-07, 03108-07, 03202-07, 03109-07, and 03204-07.

## Objectives

---

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

1. Explain the need for good indoor air quality.
2. List the symptoms of poor indoor air quality.
3. Perform an inspection/evaluation of a building's structure and equipment for potential causes of poor indoor air quality.
4. Identify the causes and corrective actions used to remedy common indoor air problems.
5. Identify the HVAC equipment and accessories that are used to sense, control, and/or enhance indoor air quality.
6. Use selected test instruments to measure or monitor the quality of indoor air.
7. Clean HVAC air system ductwork and components.

## Performance Tasks

---

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

1. Use selected radon monitors and/or test kits.
2. Perform a building indoor air quality (IAQ) inspection/evaluation.
3. Make air measurements using each of the following:
  - Carbon dioxide (CO<sub>2</sub>) detector/sensor
  - Carbon monoxide (CO) detector/sensor
  - Volatile organic compound (VOC) detector/sensor
  - Combustion analyzer
4. Use a manufacturer's humidifier capacity chart to find the humidifier capacity needed for various building types and sizes.
5. Use a manufacturer's portable dehumidifier capacity chart to find the dehumidifier capacity needed for various building types and sizes.
6. Clean and inspect ductwork using one or more approved methods:
  - Contact vacuum
  - Air washing
  - Power brushing

## Materials and Equipment

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Multimedia projector and screen  
*Weatherization Crew Chief Level Two*  
PowerPoint® Presentation Slides  
(ISBN 978-013-257685-7)  
Computer  
Whiteboard/chalkboard

Markers/chalk  
Pencils and scratch paper  
Appropriate personal protective equipment  
Copy of *ASHRAE Standard 62.1-2007, Ventilation  
for Acceptable Indoor Air Quality*

*continued*

Manufacturer's operation and service literature for demonstration equipment  
Radon monitors and/or test kits  
Access to a building to be IAQ inspected/surveyed  
Checklists for IAQ evaluation  
Set of building plans and specifications for the specific building to be IAQ inspected/surveyed  
Manufacturers' humidifier and dehumidifier capacity charts  
Access to a commercial or industrial facility with operating HVAC systems incorporating one or more of the following:  
Air handler units  
Unit ventilators  
Mechanical filters  
Conventional  
Extended surface  
Electrostatic permanent  
Steel/aluminum mesh  
Bag-type  
Box  
Close-pleated rigid  
HEPA  
Adsorption filters  
Electronic and nonelectronic air cleaners

Humidifiers  
Wetted-element  
Atomizing  
Infrared  
Steam  
Portable dehumidifiers  
Portable or stationary gas detectors and analyzers, including:  
Carbon dioxide detectors  
Carbon monoxide detectors  
VOC sensors/detectors  
Combustion analyzers  
Other gas detectors  
Access to a building with a radon control subslab depressurization system  
Ultraviolet light air purification equipment  
Duct cleaning equipment, including:  
Portable HEPA-filtered vacuuming equipment  
Power brushing, air washing, and power whip equipment  
Borescopes  
Black and white and/or color video cameras and portable videocassette recorder  
Copies of the Quick Quiz\*  
Module Examinations\*\*  
Performance Profile Sheets\*\*

\* Located at the back of this module

\*\* 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

---

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Trainees will be required to use radon monitors and/or test kits, perform building IAQ inspection/evaluation, use gas detectors and combustion analyzers to make air measurements, and clean and inspect ductwork.

## Additional Resources

---

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

*Building Air Quality, a Guide for Building Owners and Facility Managers*, Latest Edition. Washington, DC: U.S. Environmental Protection Agency.

*Indoor Air Quality*, Latest Edition. Chantilly, VA: Sheet Metal and Air Conditioning Contractors National Association (SMACNA).

*Indoor Air Quality in the Building Environment*. Troy, MI: Business News Publishing Company.

*ACR 2006, Assessment, Cleaning, and Restoration of HVAC Systems*, Latest Edition. Washington, DC: National Air Duct Cleaners Association.

## 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 *Indoor Air Quality*. You will need to adjust the time required for hands-on activity and 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 to Indoor Air Quality (IAQ)</b>	
A. Introduction	_____
B. Long-Term and Short-Term Effects of Poor IAQ	_____
C. Good Indoor Air Quality	_____
D. Sources of Building Contaminants	_____
1. Building Construction	_____
2. Human Occupancy	_____
3. Building Materials and Furnishings	_____
4. HVAC and Other Building Equipment	_____
5. Cleaning Compounds and Pesticides	_____
6. Contaminant Sources Located Outside the Building	_____
E. Laboratory	_____
Have trainees use selected radon monitors and/or test kits. This laboratory corresponds to Performance Task 1.	
<b>Session II. Elements of a Building IAQ Inspection Survey</b>	
A. Elements of a Building IAQ Inspection Survey	_____
1. Problem Description	_____
2. Site Visit and Building Walk-Through	_____
3. Building HVAC Equipment and Ventilation System Inspection	_____
4. Air Sampling and Testing for Specific Contaminants	_____
5. Interpreting Test Results and Corrective Actions	_____
B. Laboratory	_____
Have trainees perform a building indoor air quality (IAQ) inspection/evaluation. This laboratory corresponds to Performance Task 2.	
<b>Session III. Achieving Acceptable Indoor Air Quality; IAQ and Energy-Efficient Systems and Equipment</b>	
A. Achieving Acceptable Indoor Air Quality	_____
1. Initial Building Design	_____
2. Ventilation Control	_____
3. Thermal Comfort Control	_____
4. Controlling Chemical Contaminants	_____
5. Controlling Microbial Contaminants	_____
B. IAQ and Energy-Efficient Systems and Equipment	_____
1. Automated Building Management Systems	_____
2. Air Handling Units	_____
3. Unit Ventilators	_____
4. Air Filtration Equipment	_____
5. Humidifiers and Dehumidifiers	_____
6. Ozone Generators	_____
7. Ultraviolet Light Air Purification Systems	_____

C. Laboratory

Have trainees use manufacturers' capacity charts to find the humidifier and dehumidifier capacities needed for various building types and sizes. This laboratory corresponds to Performance Tasks 4 and 5.

\_\_\_\_\_

**Session IV. Gas Detectors and Analyzers**

A. Gas Detectors and Analyzers

1. Carbon Dioxide Detectors
2. Carbon Monoxide Detectors
3. Volatile Organic Compound Sensors
4. Other Gas Detectors/Analyzers

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

B. Laboratory

Have trainees make air measurements using selected detectors/sensors and combustion analyzers. This laboratory corresponds to Performance Task 3.

\_\_\_\_\_

**Session V. Duct Cleaning**

A. Duct Cleaning

1. Duct Cleaning Equipment
2. Duct Cleaning Methods

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

B. Laboratory

Trainees clean and inspect ductwork using one or more approved methods. This laboratory corresponds to Performance Task 6.

\_\_\_\_\_

**Session VI. IAQ and Forced-Air Duct Systems; HVAC Contractor Liability; Review and Testing**

A. IAQ and Forced-Air Duct Systems

1. Supply and Return Duct Leaks
2. Sealing Air Duct Leaks

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

B. HVAC Contractor Liability

\_\_\_\_\_

C. Review

\_\_\_\_\_

D. Module Examination

\_\_\_\_\_

1. Trainees must score 70% 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.

E. 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 shows trainees how to perform the diagnostic tests that must be done on a home before and during the weatherization process. Diagnostic information is contained in the weatherization work order. During the weatherization, the crew chief may have to repeat diagnostic tests to pinpoint problem areas or to check on the effectiveness of the weatherization as it progresses. In addition to having the skills to perform diagnostic tests, the crew chief must also have the skills to supervise the work crew to ensure the work is done in a safe and efficient manner.

## Prerequisites

---

Prior to training with this module, it is recommended that the trainee shall have successfully completed *Fundamentals of Weatherization*; *Weatherization Technician Level One*; and *Weatherization Crew Chief Level Two*, Modules 33103-10, 27201-07, 03410-09, 03107-07, 03108-07, 03202-07, 03109-07, 03204-07, and 03403-09.

## Objectives

---

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

1. Interpret building audit reports.
2. Perform lead-safe work practices.
3. Perform the following diagnostic tests:
  - Blower door test
  - Pressure pan test
  - Burner efficiency test
  - Carbon monoxide (CO) test
  - Draft test
  - Spillage test
4. Prioritize, schedule, and demonstrate air sealing.
5. Perform quality inspections of completed weatherization work.

## Performance Tasks

---

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

1. Demonstrate how to perform the following diagnostic tests:
  - Blower door test
  - Pressure pan test
  - Burner efficiency test
  - Carbon monoxide (CO) test
  - Draft test
  - Spillage test
2. Given a work order, instruct a crew on how to perform the required work.

## Materials and Equipment

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Multimedia projector and screen  
*Weatherization Crew Chief Level Two*  
PowerPoint® Presentation Slides  
(ISBN 978-013-257685-7)  
Computer  
Whiteboard/chalkboard  
Markers/chalk  
Pencils and scratch paper

Appropriate personal protective equipment  
*Renovate Right* pamphlets  
Blower door instruction manuals  
Blower door test apparatus with manometers  
Pressure pan accessory for blower door  
Combustion efficiency test kit  
Carbon monoxide (CO) tester  
Access to various appliances for testing

*continued*

Infrared camera  
 Draft gauge  
 Nontoxic smoke generator  
 Blank weatherization work orders  
 Lead paint test kits  
 Portable electric drill  
 Assorted drill bits  
 Assorted screwdrivers

Assorted wrenches  
 Assorted pliers  
 Step ladder  
 Flashlight  
 Inspection mirror  
 Trade Terms Quiz  
 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

---

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Trainees may be exposed to hazardous materials such as lead paint that requires special protective equipment. Make sure that all trainees are briefed on appropriate safety procedures.

## Additional Resources

---

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

*Residential Energy: Cost Savings and Comfort for Existing Buildings*, 5th Edition. Upper Saddle River, NJ: Prentice Hall.

*The First-Time Supervisor's Survival Guide*. Upper Saddle River, NJ: Prentice Hall.

*The Homeowner's Handbook to Energy Efficiency: A Guide to Big and Small Improvements*. Helena, MT: Saturn Resource Management.

## 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 30 hours are suggested to cover *Diagnostics and Management Practices*. 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</b>	
A. Introduction	_____
B. Safety	_____
1. Lead-Safe Work Practices	_____
2. Other Hazardous Materials and Conditions	_____
<b>Session II. Crew Chief Duties</b>	
A. Crew Chief Duties	_____
1. Review Building Audit Documents	_____
2. Scheduling	_____
3. Work Crew Supervision	_____
4. Performing Diagnostic Tests	_____

**Sessions III-V. Combustion Safety Testing**

A. Combustion Safety Testing

- 1. Carbon Monoxide (CO) Testing
- 2. Checking Flue Gas Spillage, Vent Draft Pressure, and CO Levels in Natural-Draft Appliances

B. Laboratory

Have trainees perform burner efficiency tests, carbon monoxide tests, and draft and spillage tests. This laboratory corresponds to Performance Task 1.

**Sessions VI-VII. Finding Building Air Leaks**

A. Finding Building Air Leaks

- 1. Whole-House Blower Door Testing

B. Laboratory

Have trainees practice performing a whole-house blower door test to determine building tightness. This laboratory corresponds to Performance Task 1.

**Sessions VIII-IX. Zone Leakage Tests**

A. Zone Leakage Tests

- 1. Room Pressure Difference Tests

B. Laboratory

Have trainees practice using a blower door and/or thermal imaging camera to find air leaks in barriers and building cavities. This laboratory corresponds to Performance Task 1.

**Session X. Zone Leakage Tests, Part Two**

A. Zone Leakage Tests

- 1. Finding Leaks in Air Ducts
- 2. Post-Weatherization Testing

B. Laboratory

Have trainees practice using a blower door pressure pan accessory to find leaks in air ducts. This laboratory corresponds to Performance Task 1.

**Session XI. Post-Weatherization Activities**

A. Post-Weatherization Activities

- 1. Inspection of the Work
- 2. Job Site Cleanup
- 3. Consulting the Homeowner/Tenant
- 4. Preparing Forms and Reports

B. Laboratory

Using a given work order, have trainees practice instructing a crew on how to perform the required work. This laboratory corresponds to Performance Task 2.

**Session XII. 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.