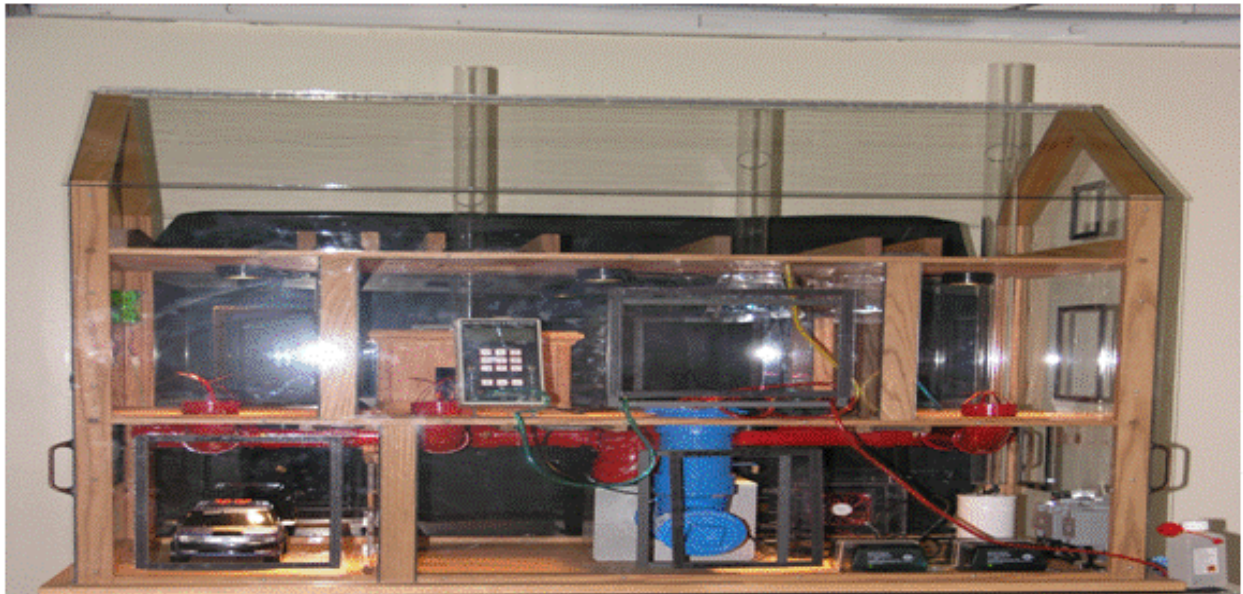




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# WEATHERIZATION TRAINING CENTER



## Course Catalog

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## Overview

The Weatherization Training Center (WTC) offers a full range of competency-based training courses and seminars for persons or organizations that provide home energy conservation assistance industry wide.

WTC is a department of the Green Technology Division of the United Planning Organization (UPO). UPO is committed to applied technology education. Its resources and physical plans provide an excellent training environment.

Consistent with its technical orientation, WTC offers a broad-based education in many aspects of building science along with the technical skills necessary to meet the program goals of reduced energy consumption, health, safety and comfort for home occupants. WTC's primary mission is to serve District of Columbia residents' weatherization providers, but its doors are open to the private sector, utility programs and any other interested groups in the District and surrounding states.

### Facilities

- WTC has two lab areas complete with construction mark-ups and demonstrators;
- Two classrooms located at 915 Girard Street NE featuring state-of-the-art computer-enhanced lecture capabilities;
- In-field training at agency or other off-site locations;



## **Courses and Seminars**

Conducted by BPI certified instructors, WTC courses feature both theory and hands-on application at our training facility. Training manuals, tools and lab materials relevant to specific assignments are provided. Each course contains specific competency requirements. Certificates are awarded to students based upon successful completion of written exams and lab exercises. Participants who attend special seminars receive a certificate of attendance.



## Continuing Education Standards

The following Continuing Education Standards are currently in place at WTC. They form the basis for educational protocols consistent with college policy and the District of Columbia Department of Community and Economic Development (DCED) requirements for training of the Weatherization network in the District of Columbia:

### Definitions:

- Competency Based Course – a course where a student must demonstrate specific types of written and hands-on skill through testing protocols established by the WTC.
- Passing Grade – a measure of success whereby a student achieves a minimum grade of 70% in a written test and 70% in a lab test, where applicable.
- Prerequisite Course – a course that must be completed prior to taking another as published by the WTC.
- Course Completion – a student has achieved the following:
  - A minimum passing grade of 70% in both written and lab tests, where applicable.
  - 100% attendance for the duration of the course.

### Certificates:

The three categories of certificates currently offered by WTC are as follows:

- Course Completion – A certificate awarded based on successful completion of a WTC competency based course.  
**Note:** A student may make up missed portions of a course, but will not be issued a certificate until the entire course has been completed.
- Workshop Completion – A certificate awarded based on attendance in a non-competency based WTC sponsored workshop or seminar.
- Testing Out of a Course – A certificate awarded based on successful completion of a course exam.  
**Note:** The option of testing out of a course is intended for those individuals who have a considerable amount of field experience in heating systems or building shell diagnostics as verified by a sponsoring weatherization sub-grantee. A person will be given only one opportunity to successfully test-out of a course. The following courses qualify for the test-out option:



- Introduction to Heat
- Combustion Analysis (Gas)
- Combustion Analysis (Oil)
- Diagnostic Approaches to Weatherization

**Notifications:**

At the conclusion of a course, workshop or exam the WTC will forward relevant student competencies, grades and certificates to the sub-grantee agency or private individuals and companies, who should then distribute them to their participating staff or subcontractors.

**Course Prerequisites:**

The following WTC courses for which certificate of course completion is awarded include topic areas where specific types of competencies must be demonstrated by the student:

Weatherization Tactics	No required prerequisites
Weatherization Crew Safety	No required prerequisites
Basic Residential Safety	No required prerequisites
Diagnostic Approaches to Weatherization	No required prerequisites
Advanced Diagnostics	Must have completed Diagnostics Approaches to Weatherization
Introduction to Residential Heat Systems	No required prerequisites
Combustion Analysis & Retrofit (Gas)	Must have completed Introduction to Heat
Combustion Analysis & Retrofit (Oil)	Must have completed Introduction to Heat
Home Energy Audition (HEA)	Must have completed the following courses: Introduction to Heat, Combustion Analysis (Gas), Combustion Analysis (Oil), Diagnostic Approaches, and Advances Diagnostic
Lead Safe Work Practices	No required prerequisites



### **Seminars:**

The following are examples of seminars developed or sponsored by the WTC where no testing is involved and a certificate of attendance is awarded:

- Closed Cavity Insulation
- Diagnosing and Solving Moisture Problems
- Ductwork Solutions
- Base Load Auditing
- Mobile Home Weatherization
- In-Field Training

### **Required Courses:**

The following courses are required for the weatherization personnel listed below:

Weatherization Tactics	All crew workers and crew chiefs
Weatherization Crew Safety	All crew workers and crew chiefs
Diagnostic Approaches to Weatherization	All crew workers, crew chiefs and auditors
Advanced Diagnostics	All crew workers, crew chiefs and auditors
Introduction to Residential Heat Systems	All heating technicians and auditors
Combustion Analysis & Retrofit (Gas)	All heating technicians and auditors
Combustion Analysis & Retrofit (Oil)	All heating technicians and auditors
Home Energy Audition (HEA)	All auditors
Lead Safe Work Practices (required by DOE and DC)	All crew workers, crew chiefs and auditors



Competency Based Courses

Diagnostic Approaches to Weatherization

**Course Description:**

Participants will learn principles of air leakage and how houses perform as influenced by pressure differences caused by increased air tightening, mechanical exhaust devices, moisture movement, etc. This course includes classroom and lab work associated with equipment set-up procedures and field analysis for finding and measuring air leakage using the Blower Door. Also, incorporated into this course are methods for determining cost effective and minimum ventilation guidelines. Advanced techniques using pressure gauges to determine potential for back-drafting, pressure balancing of duct work on forced air distribution systems will be discussed.

**Prerequisites:** None

**DIAGNOSTIC APPROACHES TO WEATHERIZATION  
COMPETENCY LIST**

- ❖ Discuss the principles of air movement and how they relate to heat loss in houses.
- ❖ Understand some basic building types and some typical air leakage problems associated with each.
- ❖ Discuss the function of a blower door as a leak locator and measuring device.
- ❖ Demonstrate the ability to set-up a blower door.
- ❖ Understand how to define the conditioned space and how to determine the conditioned volume.
- ❖ Prepare a building for a blower door test.
- ❖ Understand principles of moisture dynamics and indoor air quality issues.
- ❖ Demonstrate ability to find and analyze air leakage.
- ❖ Demonstrate ability to take house and fan pressure readings.
- ❖ Understand the factors involved in determining the minimum ventilation guideline.
- ❖ Understand how to prioritize an air sealing strategy.
- ❖ Be aware of the various air sealing techniques and appropriate materials.
- ❖ Understand how to estimate air leakage with a one point test.
- ❖ Introduce the causes of house pressure imbalances as a function of the interacting relationships of the house shell and its mechanical systems.
- ❖ Be able to interpret values derived from a blower door test.
- ❖ Be aware of DDOE Field Standards and Field Guide.

**AGENDA**

**Day 1**

Registration and Introductions

Course goals, agenda, manual, student competencies, student testing, ground rules, etc.

Pre-Test

Some Basic Concepts (What do we want to diagnose?)

Health, Safety, Building Integrity, Comfort, Energy Savings  
House as System

Principles of Air Movement

Air Leakage

Difference between intentional leaks and unintentional leaks

Types and relative importance of leaks

Air Leakage as a Function of Construction Type

**Lunch**

Defining the Thermal Envelope



Introduction to the Blower Door  
Function

**Day 2**

Indoor Air Quality/Moisture Concerns

Pollution Sources  
RH and Dew Point  
Mechanics of Moisture  
Types of Moisture Movement

Blower Door Math/Building Tightness Limits (BTL)

One Point and Five Point Blower Door Testing  
Can't Reach 50 Factor

**Lunch**

Devising an Air Sealing Strategy (Classroom and Lab)

Solutions, Techniques, Materials

Student Lab Exercises

Review of Pretest

**Day 3**

Blower Door Software Demo Post-Test

**Advance Diagnostics**

**Course Description:**

Presented against a backdrop of the interaction of the building shell and mechanical systems, students will learn how to use a manometer and other tools to evaluate chimney safety performance and pressure imbalances of forced air systems. Detecting air leakage paths through zonal testing and duct leakage through pressure pan testing will also be covered. The course will utilize both lecture and hands-on activities. This is a competency based course where certificates of completion will be offered to those who successfully complete the written and lab tests.

**Prerequisites:** Diagnostic Approaches to Weatherization

**ADVANCED DIAGNOSTIC APPROACHES TO WEATHERIZATION  
COURSE COMPETENCY LIST**

- ❖ Understand the causes of house pressure imbalances as a function of the interacting relationship of the house shell and its mechanical system.
- ❖ Understand the causes of poor chimney performance.
- ❖ Know how to conduct a worst case chimney safety performance test.
- ❖ Know how to conduct a worst case pressure balancing test on a forced-air system.
- ❖ Know how to conduct tests for other duct induced pressure imbalances.
- ❖ Understand the difference between types and uses of different pressure diagnostic techniques.
- ❖ Understand the importance of aligning the thermal envelope and the pressure envelope in a house.
- ❖ Understand the difference between primary and intermediate zones in a house.
- ❖ Demonstrate the ability to perform a zonal pressure test.
- ❖ Demonstrate the ability to perform a pressure pan test.
- ❖ Become aware of DDOE Field Standards and Field Guide as it applies to the material presented.
- ❖ Become aware of methods for CO safety testing on gas-fired cook stoves.

**AGENDA**

**Day 1**



## Registration and Introductions

Course goals, agenda, manual, student competencies, student testing, ground rules, etc.

Review of House as a System of building shell and mechanical systems interaction

## Types and Purposes of Advanced Pressure Diagnostics

Pressure Diagnostics with mechanical systems operating (chimney, vent, fans, forced air systems)  
Pressure Diagnostics with blower door operating (zonal and pressure pan testing)

## Chimney Safety

Chimney Basics  
Physical Problems with Chimneys  
Chimney Competition with Exhaust Devices  
Back-Drafting Potential

## Diagnosing Chimneys

Identifying physical problems  
Worst case draft testing

Lab Demo on Diagnosing Chimneys

## **Lunch**

## Problems with Forced Air Distribution Systems (FADS)

How they are supposed to work  
Effects of out of balance FADS

Worst Case Pressure Balancing in CAZ

## Measuring other Duct Induced Pressures

Whole house pressure differences  
Room-to-Room pressure differences

Lab Demo on Pressure Balancing FADS

## **Basic Residential Electricity**

### **Course Description:**

Participants will be introduced to residential electrical systems. The course will feature basic electrical theory including a discussion on the concepts of voltage, current, resistance and watts. In addition, the student will gain an understanding of the following:

- Calculating electrical usage
- Diagnostics through the use of a multi-meter
- Electrical service components, fuse types and sizes
- Differences in electrical loads and circuits
- Job-site electrical safety
- Insulation machine maintenance and repair

**Prerequisites:** None

### **BASIC RESIDENTIAL ELECTRICITY COMPETENCY LIST**

- ❖ Understand basic electrical theory.
- ❖ Demonstrate the ability to calculate electrical usage.
- ❖ Demonstrate the ability to use test equipment.
- ❖ Understand how to find issues in the NEC Book.
- ❖ Demonstrate the ability to identify service components.



- ❖ Identify different wiring practices.
- ❖ Identify fuse types, sizes, and uses.
- ❖ Demonstrate the ability to identify lighting and appliance loads.
- ❖ Understand Ground Fault Protection and uses.
- ❖ Understand job site safety.
- ❖ Understand proper procedures for insulating around K-&-T.
- ❖ Identify wire size and current relationships.
- ❖ Identify proper polarity of receptacle and lighting circuits.
- ❖ Evaluate hazardous wiring conditions.
- ❖ Understand basic repair methods.

## AGENDA

### Day 1

Registration/Introduction

Electrical Safety

Pre-Test

Theory

Ohms Law

Voltage

Current/Amperage

Power/Watts

Resistance/Ohms

Voltage Drop

Electric Shock

### Day 2

Service Identification (size) Components

Weatherhead

Service Drop

Drip Loop

Meter Base

Service Panel: fuse, breaker boxes

Grounding

Receptacle and Lighting Circuits & Appliance Circuits

Range, dryer, kitchen, air conditioning, heating equipment

Wire Identification Types

Knob and Tube

2 wire Non-Metallic (NM)

2 wire with Ground (Romex)

BX Cable

### Day 3

Evaluate Hazardous Wiring Conditions

Case Studies

National Electrical Code (NEC)

Proper Procedures for Insulating Around Knob-and-Tub Wiring

### Day 4

Basic Repair Methods/Boxing Around Recess Can Light Fixtures

Testers

Plug-in Type

Volt Sticks



Volt/OHM  
Volt Meter

Job Site Requirements/Ground Fault Circuit Interrupters (GFCI)

**Day 5**

Review

Post-Test

**Introduction to Residential Systems**

**Course Description:**

Designed to familiarize participants with fundamentals of common residential central space heating systems. It includes a discussion of the oil and gas combustion process, chimneys, appliance types, operating and safety controls, electricity and fuel delivery.

**Prerequisites:** None

**INTRODUCTION TO RESIDENTIAL HEAT SYSTEMS  
COMPETENCY LIST**

- ❖ Identify boilers and furnaces.
- ❖ Describe the conditions for proper combustion.
- ❖ Describe the products of combustion.
- ❖ Describe the heating value of different fuels.
- ❖ Identify the type of burner and fuel used.
- ❖ Identify central system controls.
- ❖ Identify central system gauges and safety devices.
- ❖ Identify central warm air duct systems.
- ❖ Identify central hot water piping systems.
- ❖ Identify central steam piping systems.
- ❖ Identify zoning equipment.
- ❖ Identify and describe the function of steam traps.
- ❖ Identify warm air supply and return registers.
- ❖ Identify safe and acceptable fuel piping.
- ❖ Identify proper fusing and switching.
- ❖ Describe common chimney malfunctions.
- ❖ Describe problems with unbalanced air distribution systems.
- ❖ Describe proper vent piping procedures.
- ❖ Describe the importance of proper chimney draft.
- ❖ Identify steam and steam system components.
- ❖ Identify forced-air systems components.

**AGENDA**

**Day 1**

Course Overview and Introduction  
Why We Work on Heating Systems  
Safety  
Reliability  
Energy Conservation  
PA Field Standards



Combustion Basics

The Combustion Triangle  
Incomplete Combustion  
Heat Value of Fuel  
Combustion By-Products

Heating System Efficiency Ratings

On-Cycle and Off-Cycle Losses  
Steady State Efficiency  
Annual Fuel Utilization Efficiency  
Seasonal Efficiency

Introduction to Heating System Sizing

**Day 2**

Chimneys and Flues

Function of a Chimney  
Chimney Components  
Draft  
Inspection and Assessment  
Physical Problems  
Effect of House Depressurization

Appliance Identification

Types of Distribution Systems

Air (Gravity forced)  
Water (Hydronic)  
Steam

Function of Heat Exchanger

**Day 3**

Review and Quiz

Oil Furnaces and Boilers

Fuel, Piping and Boilers  
Burner  
Combustion Chamber  
Heat Exchange  
Safety Controls  
Draft Controls  
Safety and Efficiency Improvements

**Break**

Gas Furnaces and Boilers

Fuel Piping and Gas Valve  
Atmospheric Burners  
Primary and Secondary Air  
Dilution Air and Draft Diverters  
Safety and Efficiency Improvements

**Day 4**

Operating Controls

Thermostats and Anticipators  
Fan Controls  
Aquastats  
Boiler Limit Controls  
Circulator Controls

Distribution Systems

Hot Air  
Supply and Return Ducts



	Potential Problems and Improvements
Hot Water	Two-Pipe System and Components Series Loop System and Components Potential Problems and Improvements
Steam	One-Pipe System and Components Two-Pipe system and Components Potential Problems and Improvements

**Day 5**

Review and Final Test

**Combustion Analysis & Retrofit (GAS)**

**Course Description:**

This course is designed to train participants to perform tests particular to all types of gas-fired systems and to recommend retrofits. Besides topics of combustion analysis, safety controls, vent safety, carbon monoxide measurement, and heat-rise measurements, the treatment of on and off-cycle losses will be covered. High efficiency, mid-efficiency, atmospheric and power burner units will be discussed.

**Prerequisites:** Introduction to Residential Heat Systems

**COMBUSTION ANALYSIS & RETROFIT (GAS)  
COMPETENCY LIST**

- ❖ Describe how to do routine maintenance on your combustion analysis equipment.
- ❖ Describe how to test the calibration of your test equipment.
- ❖ Perform the "Heating Unit Test" Procedure.
- ❖ Describe how to do a heat exchanger leakage test on a forced-air furnace.
- ❖ Describe how to evaluate combustion and venting safety.
- ❖ List the differences between Steady State Efficiency, annual fuel utilization efficiency and seasonal efficiency.
- ❖ Be able to identify the various methods for venting flue gas from a combustion appliance.
- ❖ Describe the combustion process, the by-products, and the effects of excess air.
- ❖ Describe how flue gas temperature is related to chimney and flue construction, draft and efficiency.
- ❖ Describe the various solutions for deficiencies in the combustion process.
- ❖ Describe the special features of mobile home furnaces and know the procedures used to assess their operation.
- ❖ Describe the term "off cycle losses" and list solutions that can be applied to minimize these losses.
- ❖ Be able to recognize properly operating safety controls.
- ❖ Describe piped distribution systems, common problems and their solutions.
- ❖ Describe the significance of boiler mass.
- ❖ Be aware of system retrofits that are appropriate for boilers and furnaces.
- ❖ Describe operating controls and their adjustment.
- ❖ Measure and assess heat rise on forced-air furnaces and list the solutions for high heat rise.
- ❖ Be aware of the potential for air leakage, backdrafting and poor comfort that may be caused by duct work defects.
- ❖ Describe how to evaluate a gas fuel piping system for safety.
- ❖ Describe how to measure actual fuel input and how to calculate output.
- ❖ Be able to distinguish the differences between standard efficiency; mid-efficiency and condensing gas appliances.
- ❖ Know where to take combustion and draft measurements on the different appliance type.
- ❖ Describe the various parts and controls that are involved in the gas combustion process.
- ❖ Describe how to assess gas appliances for carbon monoxide production.
- ❖ List the recommended combustion parameters that will provide good combustion and safe, dependable operation.
- ❖ Understand the meaning and the limits of the term de-rating.

**AGENDA**

**Day 1**



Course Overview and Introduction

Pre-Test

Gas Combustion  
Fuel Characteristics  
Combustion By-Products

**Efficiency Ratings**  
SSE  
AFUE  
Seasonal System Efficiency

**Day 2**

Gas Appliance Design  
Natural Draft/Low Efficiency  
    Induced Draft/Mid Efficiency  
    Induced Draft/Hi-Efficiency (Condensing)

Discussion on Flue Gas and Venting  
Pressure  
Temperature  
Vent Materials

Test Equipment  
Maintenance  
Calibration

**Day 3**

Review and Quiz

Testing Gas Appliances  
Draft  
Efficiency  
Carbon Monoxide  
Fuel Leaks  
Heat Exchanger Leakage Test

Mobile Home Furnace Design and Testing  
Gas Combustion Parameters

Field Testing

**Day 4**

Quiz and Review

Gas Combustion Math

Calculating Input and Output

Timing Gas Meters

Reducing Off-Cycle Losses Using Vent Damper

System Controls and Adjustments  
Boiler Aquastat  
Furnace Fan Control  
Thermostat Anticipator

**Day 5**

Distribution System Improvements  
Boilers



Pipe Insulation  
Air Vents  
Furnaces  
Improving Air Flow  
Duct Sealing  
Duct Insulation  
Pressure Balancing  
Ducts  
House

Combustion Testing Practice

Review Using Case Studies

**Day 6**

Final  
Written Test  
Lab Test

**Combustion Analysis & Retrofit (Oil)**

**Course Description:**

This course is designed to train participants to perform tests particular to oil-fired systems and to recommend retrofits. Topics covered include combustion analysis, safety controls, venting, heat-rise testing as well as tune-ups and burner replacements. New developments in oil-fired units will be discussed.

**Prerequisites:** Introduction to Residential Heat Systems

**COMBUSTION ANALYSIS & RETROFIT (OIL)  
COMPETENCY LIST**

- ❖ Describe how to do routine maintenance on your combustion analysis equipment.
- ❖ Describe how to test the calibration of your test equipment.
- ❖ Perform the "Heating Unit Test" Procedure.
- ❖ Be able to do a heat exchanger leakage test on a forced-air furnace.
- ❖ Describe how to evaluate combustion and venting safety.
- ❖ List the differences between Steady State Efficiency, Annual Fuel Utilization Efficiency and Seasonal Efficiency.
- ❖ Identify the various methods for venting flue gas from a combustion appliance.
- ❖ Describe the combustion process, the by-products and the effects of excess air.
- ❖ Describe how the flue gas temperature is related to chimney and flue construction, draft and efficiency.
- ❖ Describe the various solutions for deficiencies in the combustion process.
- ❖ Describe the special features of mobile home furnaces and be knowledgeable in the procedures used to assess their operation.
- ❖ Describe the term "off cycle losses" and the solutions that can be applied to minimize these losses.
- ❖ Be able to recognize properly operating safety controls.
- ❖ Describe piped distribution systems, common problems and their solutions.
- ❖ Describe the significance of boiler mass.
- ❖ Be aware of system retrofits that are appropriate for boilers and furnaces.
- ❖ Describe operating controls and their adjustment.
- ❖ Measure and assess heat rise on forced-air furnaces.
- ❖ Describe the possible solutions for high heat rise.
- ❖ Be aware of the potential for air leakage, backdrafting and poor comfort that may be caused by duct work defects.
- ❖ Calculate BTU input and output.
- ❖ Describe the differences between flame retention and non-flame retention burners.
- ❖ Describe what barometric draft control does and how it is to be installed.
- ❖ Describe the qualities of #2 fuel oil and kerosene.
- ❖ Describe the recommended combustion parameters that will result in high oil combustion efficiency and dependable and safe operation.
- ❖ Describe the effect that oil pump pressure has on the fuel input rate and fuel atomization.



**AGENDA**

**Day 1**

Course Overview and Introduction

Pre-Test

Combustion Process Discussion

Basic Needs

By-Products

Flame Retention Burner vs. Non-Flame Retention Burner

What Does Efficiency Mean?

SSE

AFUE

Seasonal System Efficiency

**Lunch**

Oil Combustion Parameters

Flame Retention Burners

Demonstration and Discuss

**Day 2**

Testing Equipment

Maintenance

Calibration

Review of Oil Burning Equipment

Testing and Adjusting Oil Burners

Test Procedures

Heat Exchanger Leakage Test

Chimney Safety Performance Test

**Lunch**

Field Testing

**Day 3**

Mobile Home Furnace Design and Testing

Calculating Input and Output

Control Adjustments

Boiler Aquastat

Furnace Fan Control

Thermostat/Anticipator

Miscellaneous

Derating

Oil Pump Pressure

Oil Line Solenoid

Direct Vent/High Static Pressure Burners

Oil Line Heaters

Special Nozzles

**Lunch**



Distribution System Improvements

Boilers

- Pipe Insulation
- Air Vents

Furnaces

- Improving Air Flow
- Duct Sealing
- Duct Insulation
- Pressure Balancing
- Ducts
- House

Combustion Testing Practice/Review Using Case Studies

(Class will split into two separate groups.)

**Day 4**

Final

- Written Test
- Lab Test

**Lead Safe Work Practices**

**Course Description:**

This course is designed to make weatherization workers aware of the hazards of exposure to lead based paint both to themselves and their clients. Methods, techniques personal protection, engineering controls and proper clean-up procedures while working in homes that contain lead based paint will be covered.

**Prerequisites:** None

**LEAD SAFE WORK PRACTICES  
COMPETENCY LIST**

- ❖ Become aware of the history of lead based paint.
- ❖ Be aware of the health effects of lead exposure.
- ❖ Be aware of Lead Based Paint Regulations.
- ❖ Know how to implement Lead Safe Weatherization Practices for a variety of WX activities.
- ❖ Know what kinds of engineering controls need to be in place before WX work may begin.
- ❖ Be aware of clearance test protocols.
- ❖ Become familiar with personal protection requirements.
- ❖ Know what kinds of tools are acceptable and recommended.
- ❖ Know how to contain lead dust on the work site.
- ❖ Be aware of proper clean-up and disposal techniques.

**AGENDA**

**Day 1**

Registration and Introductions

Video: "Moving Toward A Lead-Safe America"

Module 1: Why Should I Be Concerned About Lead-Contaminated Dust?

Module 2: Talking to Clients and Planning Work

Module 3: Set-Up Your Work Space to Contain Lead-Dust

**Day 2**

Module 4: Safe Work Practices

Module 5: Clean-Up and Check Your Work



Review

Exam and Evaluation

**Weatherization/OSHA Crew Safety**

**Course Description:**

This course is designed to give the student a working knowledge of safety equipment and systems used to perform weatherization work. Personal safety issues, along with issues specific to individual pieces of construction equipment, will be addressed. OSHA requirements/guidelines specific to the construction industry will be thoroughly reviewed. Students will receive OSHA mandated training on Respiratory Protection, Hearing Protection, Fall Protection and Ladder Safety.

**Prerequisites:** None

**WEATHERIZATION CREW SAFETY  
COMPETENCY LIST**

- ❖ Demonstrate personal safety.
- ❖ Demonstrate safe equipment usage.
- ❖ Able to select correct Personal Protective Equipment.
- ❖ Understand the need for PPE
- ❖ Understand ladder safety.
- ❖ Demonstrate ladder identification and safety inspections.
- ❖ Understand Fall Protection Systems.
- ❖ Demonstrate the ability to choose the correct fall protection system.
- ❖ Understand respirator categories.
- ❖ Understand the use of the correct respirator.
- ❖ Able to correctly fit a respirator.
- ❖ Demonstrate the ability to correctly clean and store a respirator.
- ❖ Understand the importance of Lead Safe Work Practices.

**AGENDA**

**Day 1**

Introduction and Registration

General Safety

OSHA Construction Regulations

Common Construction Hazards

Common OSHA Violations

Training Requirements

PPE (Personal Protective Equipment)

Eye and Hearing Protection

Tool and Electrical Safety

Ladder Safety

Classification

Inspection

Maintenance and Cleaning

**Day 2**

Fall Protection

What is Fall Protection?

Types and Applications



Respirators  
Types and Uses  
Medical Evaluation  
Replacement Cartridges  
Fit Testing  
Cleaning and Maintenance

Lead Safe Work Practices Overview

Review and Post Test

### **Weatherization Tactics**

#### **Course Description:**

This course includes theory, methods and techniques for the installation of weatherization materials. This course will focus on demonstration and hands-on application of weather stripping, insulation, ventilation, glazing, caulking, hand and power tools, measuring, safety measures, ductwork solutions, air sealing measures, accessing attics, etc. Weatherization Tactics include lecture material on building science and construction technology as well as lab exercises.

**Prerequisites:** None

This course is required for all newly hired field workers and on-site supervisors.

#### **WEATHERIZATION TACTICS COMPETENCY LIST**

- ❖ Show responsibility for tools and equipment.
- ❖ Identify building components.
- ❖ Understand principles of heat movement.
- ❖ Identify areas of air loss within a structure.
- ❖ Understand air sealing techniques.
- ❖ Understand how R-values are used.
- ❖ Understand basic insulation materials and uses.
- ❖ Understand the principles of ventilation and moisture control.
- ❖ Demonstrate job and personal safety.
- ❖ Demonstrate the care and safe use and maintenance of hand and power tools.
- ❖ Demonstrate the ability to cut glass.
- ❖ Demonstrate the ability to install glazing compound.
- ❖ Demonstrate the proper use and installation of caulking material.
- ❖ Identify and select weather-stripping materials (DEMO).
- ❖ Demonstrate the ability to repair plaster and sheet rock.
- ❖ Understand the proper installation of materials to different hot water heaters.
- ❖ Understand the installation of hot water pipe and heat duct insulation.
- ❖ Understand methods to insulate and weather-strip attic trap doors (DEMO).
- ❖ Understand how to install fiberglass insulation.
- ❖ Demonstrate how to install open blown and under floor cellulose insulation.
- ❖ Demonstrate the ability to install window and roof ventilation materials.
- ❖ Demonstrate the ability to seal top plates and knee walls.
- ❖ Demonstrate the ability to seal basement band joist.
- ❖ Understand methods and materials for duct work sealing.

#### **AGENDA**

##### **Day 1**

Introduction and Registration

Pre-Test  
Weatherization Principles and Theory  
Goals of WX Program  
Priorities



Heat Movement

Crew Health and Safety

Eye Protection  
Electrical  
Respirators  
Ladders

**Day 2**

Building Components

Balloon  
Platform  
Brick  
Knee Wall

Lab/Demo

Building Components Identification

Identifying Air Loss

Blower Door Components and Installation  
What Causes Air Leakage  
Air Barrier/Thermal Barrier

**Day 3**

Air Sealing Materials and Techniques

Video

Lab/Hands-On

Knee Wall  
Basement Band Joist

Types of Weather-Stripping and Their Uses

**Demo**

Weather-Stripping  
Thresholds  
Door Sweeps

Lab/Demo

Caulking

**Day 4**

Ventilation and Moisture Control

Moisture Movement  
Identifying Moisture Problems  
Vapor Barriers  
Crawl Spaces

Attics

Calculating Minimum Ventilation Guidelines

Attics

How Vents Work  
Types  
Sizes  
Calculating Attic Ventilation Needs

Lab/Hands-On

Installing a Gable Window Vent  
Installing Roof Vents

Accessing Building Cavities

Lab/Hands-On



Demo-Hole Patch

Demo-Access Door

Construct and Install Access Door  
Install Dry Wall  
Patch Dry Wall

Review Pre-Test

Questions/Answers

**Day 5**

Insulation Materials

R-Values  
Types  
Uses

Attic Preparation

Baffles  
Electrical  
Dams

Insulating Under Floors

Fiberglass Batt  
Loose Blown  
Dense Pack  
Loose fill coverage chart

Lab/Demo

Insulating hot water tanks  
Insulating hot water pipes

**Day 6**

Ducts

Supply and return Ducts  
Vented crawl spaces  
Attics  
Basements

Video – “Duct Sealing”

Lab/Demo

Duct sealing supply and returns

Lab/Demo

Proper use of insulation machine

Lab/Hands-On

Wall cavity  
Dense pack floored attic

**Day 7**

Lab/Hands-On

**Demo**

Replacement and Glazing  
Glass Replacement  
Glazing Exercise/ Post Test



**Home Energy Auditing**

**Course Description:**

Presented against a backdrop of degree day theory, concepts behind calculating by measure energy saving payback's building science, infiltration theory, approved retrofit lists and codes the participant will learn home energy auditing techniques and apply them in lab exercises. Those techniques will include blower door guided air leakage tests, heat systems testing and analysis, material estimating, measuring and working with a field data collection form.

**Prerequisites:** Diagnostic Approaches to Weatherization, Advanced Diagnostics, Systems, Combustion Analysis & Retrofit (Oil), Combustion Analysis & Retrofit (Gas)

Introduction to Heat

**HOME ENERGY AUDITING  
COMPETENCY LIST**

- ❖ Understand the role of the Weatherization Energy Auditor
- ❖ Understand the measure selection based on the PA Priority List.
- ❖ Understand the PA Standards for Blower Door and Mechanical Systems Retrofit.
- ❖ Understand the factors that determine building heat loss.
- ❖ Demonstrate knowledge of insulation R-values.
- ❖ Understand the impact of conductive heat loss and air leakage.
- ❖ Demonstrate the ability to assess indoor air quality problems.
- ❖ Demonstrate the ability to interpret blower door tests results.
- ❖ Understand how to prioritize air sealing efforts.
- ❖ Demonstrate knowledge of different insulation materials and material installation techniques.
- ❖ Demonstrate the ability to assess the safety and efficiency of both central and space heating systems.
- ❖ Understand how to perform the chimney safety performance test.
- ❖ Demonstrate the ability to measure buildings and their components.
- ❖ Demonstrate the ability to accurately estimate weatherization materials.
- ❖ Demonstrate the ability to give clearly written work orders to work crews or contractors.
- ❖ Demonstrate the ability to determine the Thermal Envelope.
- ❖ Demonstrate the ability to prescribe house treatments that will have a significant impact on energy and safety problems.

**AGENDA**

**Day 1**

Introduction

Role of an Auditor

Assess the House  
Assess the Issues of Health and Safety (Mechanical Systems)  
Determine Conservation Measures

Pre-Test

DCED Field Standards Review

Measure Selection (PA Priority List)

Mechanical Systems (PA Field Standards)

Health and Safety Survey

Moisture/IAQ  
Chimney Safety  
Combustion Safety  
Electrical Assessment  
Crew Working Conditions

**Lunch**



Performing an Energy Audit  
Defining the Thermal Envelope  
Performing Volume and Area Calculations  
Using Sketches  
Estimating Material

**Day 2**

Virtual Home Energy Audit and Case Studies  
Pre-Test Review

**Day 3**

In-Field House Visit and Audit  
  
HOMEWORK ASSIGNMENT: Write Audit

**Day 4**

Hand-In Written Audit  
Review  
Final Exam

**Building Performance Institute Certification-Building Analyst**

**Course Description:**

**Prerequisites:**

**BUILDING PERFORMANCE INSTITUTE CERTIFICATION- BUILDING ANALYST  
COMPETENCY LIST**

**AGENDA**

**Building Performance Institute Certification-Envelope**

**Course Description:**

**Prerequisites:**

**BUILDING PERFORMANCE INSTITUTE CERTIFICATION- ENVELOPE  
COMPETENCY LIST**

**AGENDA**



**Carpentry 101**

**Course Description:**

**Prerequisites:**

**CARPENTRY 101  
COMPETENCY LIST**

**AGENDA**

**Workshops and Seminars**

**Closed Cavity Insulation**

**Workshop Description:**

This is a one-day tutorial which will cover the principles of insulating floored attics, walls and other closed cavity situations. Methods, techniques, equipment requirements and safety issues will be covered. The workshop will feature both lecture and lab demos.

**AGENDA**

**Day 1**

Introduction

Goals/Objectives

Insulation Principles

R-Value as a Function of Density  
Open Blow vs. Closed Blow  
Importance of Air Sealing  
Coverage Charts

Principles of Closed Cavity Fill Insulation

Housing Types  
Major Building Components  
Defining the Thermal Envelope  
Initial Assessment

- Existing Insulation
- Moisture Problems
- Structural Considerations
- HVAC
- Potential Spill Locations

Access

Siding Removal  
Interior Access  
Special Situations  
Overview of Technique  
Exterior 2 Hole Method  
Exterior 1 Hole Tube-Fill Method  
Interior Tub Fill and Finishing



**Day 2**

Estimating Material

Quality Control

Safety

Worker Safety  
Electrical Hazards  
Dust and Lead Hazards

Insulation Demonstration

Specialized Tools  
Insulation Machines and Maintenance  
Siding Removal  
Lab Demonstration of Sidewall Insulation

Questions/Answers and End

**Diagnosing and Solving Moisture Problems**

**Workshop Description:**

This workshop is designed to provide a framework for diagnosing and preventing problems. With a background in moisture theory and actual Weatherization Case Studies, participants will learn to recognize potential or existing moisture problems and help prevent their occurrence. Mechanical ventilation strategies, client education strategies and diagnostic techniques will be provided.

**AGENDA**

**Day 1**

Introduction

Goals/Objectives and Participant Case Studies

Scope of the Problem

National Level  
Local Level

Principles and Theory

Moisture and IAQ  
Relative Humidity/Dew Point  
Moisture Movement  
Affected Building Components

**Day 2**

Mold

Conditions for Mold Growth  
Health Effects  
Mitigation

Case Studies

Rain Management  
Tight House

Crawl Spaces

Air Leakage

Tools and Diagnostics

Psychrometer/Moisture Meters/Manometers, etc.

Introduction to Ventilation Strategies



**Day 3**

Ventilation Strategies  
Types/Controls/Installation

Ventilation Strategies (Continued)

Questions/Answers/Evaluation

**Baseload Auditing**

**Workshop Description:**

In this two-day workshop, theory and application in Baseload Auditing Techniques will be presented against a backdrop of DCED standards and DOE Protocols. Methods for selection of measures will be discussed. Workshop will contain both lecture and demonstration.

**Objectives:**

- Understand Baseload Energy Saving Opportunities.
- Experience using testing protocols, databases.
- Learn how to determine cost-effectiveness.
- Become familiar with the PA Baseload Standards.
- Compare with utility programs.

**AGENDA**

**Day 1**

Review Objectives of the Course

Introduction to Baseload Auditing

What does Baseload mean?

Why address Baseload opportunities?

What is the savings potential?

Who should address baseload opportunities?

What are the allowable measures? Introduce PAWAP Baseload Standards.

Baseload Auditing as a Client Education Opportunity

Baseload Analysis

Refrigerator Assessment

Using Tools

Using Databases

**Lunch**

Lab Exercise

Residential Lighting Assessment

Lighting Display

**Day 2**

Dryer Assessment

Water Heater Basics and Hot Water Measures

Other Baseload Opportunities

Baseload Audit form

Review Resources/Handouts/Manual



Questions and Answers

**Mobile Home Weatherization**

**Workshop Description:**

Participants will learn theory and application of weatherization principles applied to mobile homes. Specific construction details, materials, diagnostic and insulation techniques, unique to mobile homes, will be covered. The course includes classroom and in-field demonstration, which features belly, roof, wall and heat systems retrofit.

**AGENDA**

**Day 1**

Classroom

Registration and Introductions

History and Nature of Mobile Homes

Structural and Thermal Features

Problems and Opportunities

Conductive Losses

Air Losses

Duct Losses

PA Mobile Home Priority List

Heating System Overview

Complete Mobile Home Belly Retrofit

Floor Framing

Duct System

Belly Patch

Insulating

**Lunch**

Classroom

**Day 2**

Mobile Home Roof Insulation Retrofit

Sidewall Insulation Retrofit

Other Mobile Home Retrofit Measures

Hot Water Conservation

Windows and Doors

Moisture and IAQ Issues

Client Education Highlights

**Day 3**

Field Site

Mobile Home Belly Retrofit Demo

Mobile Home Walk-Through

Diagnostics



Discuss Retrofit Strategies

Demonstrate/Prep, Tools Materials and Safety Equipment

Mobile Home Belly Retrofit Demo

**Day 4**

Continued Belly Retrofit Demo

Roof Insulation Demo

Sidewall Insulation Demo

Evaluation and Wrap-Up

**Duct Work Solutions**

**Workshop Description:**

This workshop will introduce participants to the principles of forced-air distribution systems, diagnosing problems and providing solutions. Special emphasis will be placed on the use of specialized diagnostic tools such as digital manometers and pressure plans. Materials and techniques associated with fixing ducts will also be covered.

**AGENDA**

**Day 1**

Problems with Forced-Air Distribution Systems

Health and Safety

Energy Loss as a Function of Leaks, Restrictions, Etc.

Result of Recent Research

Basic System Design and Flow

Combustion

Venting

Heat Exchange

Distribution

System Components

Interaction of Air Handler and Building Shell

Causes and Effects of Pressure Imbalances

Diagnostics and Mitigation Strategies

\*Review of gauge Use \*Testing Protocols

Pressure Balancing the CAZ

Pressure Pan Testing Other Duct Induced Pressures

Heat Rise Testing

Duct Blaster

**Day 2**

Duct Work Solutions as a Function of Duct Location & Housing \_\_\_\_\_ Type

Duct Work Inside the Building Envelope

Duct Work outside the Building Envelope

Materials, Tools and Techniques for Sealing and Installing Ducts

Other Measures

Dehumidifiers

Blower Cleaning

Filter Replacement

Installing Additional Duct Work

Changing Blower Speeds



## Course Descriptions

### **Weatherization Tactics (4.5 Days)**

Theory, methods, and techniques used for the installation of weatherization materials. This course will focus on hand/power tool safety, demonstration and hands-on application of caulking, foam, weatherstripping, insulation, ventilation, sheet rock, and window/door repair.

### **Weatherization Diagnostics (4.5 Days)**

Participants will learn principles of air leakage, i.e. how houses perform when influenced by pressure differences caused by increased air tightening, mechanical exhaust devices, moisture movement, etc. Detecting air leakage paths through zonal testing, and duct leakage through pressure pan testing will be covered. In addition, participants will learn how to utilize a blower door, manometer, and other diagnostic tools to evaluate chimney safety performance and pressure imbalances of forced air systems.

### **Air Sealing (2 Days)**

Participants will learn how to identify primary air leakage areas within the building enclosure utilizing the blower door. Hands-on training in the application of air sealing materials such as caulking, one part foam, rigid foam board, sheet rock, plywood, etc., will be provided. Classroom discussions in building science, regarding “defining the thermal envelope” will also be discussed.

**NOTE: An advanced air sealing course will be offered that will provide additional training in the application of two-part (expanding foam), and dense-packing of cellulose insulation in closed building cavities, e.g. sidewalls, porch overhangs, floored attics, etc.**

### **Energy Auditing w/BPI (5 Days)**

Participants will learn to utilize the degree day theory, math concepts as related to building composition/dimensions/volume, and calculating by measure to determine payback. Classroom instruction will include discussions in building science, infiltration theory, approved retrofit lists and codes. Home energy auditing techniques will include blower door guided air leakage tests, heating system testing and analysis, material estimation, and measuring and working with a field data collection form.



**This comprehensive training fully prepares participants for the BPI Building Analyst certification exam.**

### **Green Advantage Residential Training (1-2 Days)**

Green home construction training geared toward builders, developers, building trade contractors, real estate professionals, building code officials, and other interested building-related professionals. This comprehensive workshop will provide information on green construction practices and the use of green building materials. Discussions will also include site considerations, passive solar building design, energy and water efficient building technologies that enhance resistance to disaster and biological hazards. We will also explore environmentally sound construction operations to reduce negative impacts and enhance indoor environmental quality.

