

*Weatherization
Works*

**CORE COMPETENCIES FOR THE
WEATHERIZATION ASSISTANCE PROGRAM**

**DEVELOPED
BY:**

THE WEATHERIZATION TRAINERS CONSORTIUM

FOR:

**U.S. DEPARTMENT OF ENERGY
WEATHERIZATION ASSISTANCE PROGRAM**

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OVERVIEW

The Weatherization Trainers Consortium developed this document for the U.S. Department of Energy's (DOE's) Weatherization Assistance Program for Low-Income Persons. The Weatherization Trainers Consortium represents weatherization training centers, independent trainers, state program managers, and state monitors from across the country.

The Weatherization *Plus* Committee is a group the weatherization stakeholders charged with helping DOE to strategically plan the evolution of the Weatherization Assistance Program. A Weatherization Plus subcommittee organized a conference call among a group of weatherization trainers to obtain their input on a Weatherization *Plus* initiative to ensure the consistent delivery of high-quality weatherization services nationwide. The trainers saw the benefit of regular communication to network and share training resources. An initial face-to-face meeting of weatherization trainers was organized at the 2005 National Weatherization Technical Training Conference in Atlanta, Georgia, and monthly conference calls have been conducted ever since.

From these conversations, the Weatherization Trainers Consortium was formalized and the need identified for a set of core competencies for the various staff positions that implement the Weatherization Program. The Consortium believes this working document can:

- Increase awareness of the specialized skills and knowledge that are required to run an effective weatherization program;
- Help state and local weatherization agencies hire staff with a strong potential to perform well and prosper in the program;
- Serve as a foundation in establishing standardized curricula to ensure the consistent delivery of high-quality weatherization services nationwide; and
- Put upward pressure on salaries to reduce staff turnover.

As a working document, suggestions for improvement are continually sought. Please forward suggestions to:

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CORE COMPETENCIES FOR THE WEATHERIZATION ASSISTANCE PROGRAM

INTRODUCTION

Specialized knowledge and skills are required at the local, state, and federal level to run an effective Weatherization Program. While there is a general understanding of the competencies required, these have not been articulated on a national scale.

As part of the Weatherization *Plus* effort to plan the continued evolution of the Weatherization Program, a subcommittee was formed to increase the consistency of quality weatherization services delivered to low-income homes across the country. The goal is that every house that is weatherized receives all appropriate, cost-effective measures installed properly to provide long-term savings.

As a first step, this means recognizing the varying approaches states use to train staff.

- Some states require technical staff at local agencies to obtain certification from an organization such as the Building Performance Institute, while other states have developed their own certification criteria.
- Many states do not have formal certification requirements, but instead require local weatherization staff to attend standardized training courses offered on a regular basis.
- Others have no standardized certification or training requirements, but offer training periodically as the need is perceived and funds allow.

Technical weatherization training for auditors, technicians, and monitors is available from many training centers and independent trainers across the country. Only a few states have developed administrative training for weatherization program managers at the local level. In-depth administrative training for state weatherization staff is even harder to find outside National Association for State Community Services Programs (NASCSPP) conference “newcomer” sessions.

The Weatherization *Plus* subcommittee and the Weatherization Trainers Consortium believe that publishing a set of core competencies will increase awareness and raise expectations. Not all the competencies will be appropriate for every state. Workers repairing or replacing heating and cooling systems often require certification or licensing from the state. Therefore, this work may be subcontracted to licensed contractors outside the Weatherization Program. However, just because a heating, ventilation, and air conditioning (HVAC) contractor is licensed by the state does not mean they possess the HVAC competencies required by the Weatherization Program. Someone at the local agency must be competent to specify what work the contractor is to do and to verify that the completed work complies with state and local codes as well as the technical standards of the Weatherization Program.

The competencies that a weatherization worker should possess depend on their position. For example, an auditor needs to conduct diagnostic testing that may not be required of an installer. The point of entry also dictates which core competencies are required. An

entry-level installer requires a minimum set of competencies. This installer must acquire additional skills to become a crew chief, and still more to become an auditor. A new auditor hired off the street must already possess auditor-level competencies as a condition of hire. These increasing levels of competency also provide a career or development path for agency and contractor personnel.

The following core competencies were compiled from course offerings of several weatherization training centers and from the technical program standards of a handful of states. Core competencies for the following topical areas are listed:

- Basic competencies,
- Safe work practices,
- Building evaluation,
- Measure installation,
- Final inspection,
- Consumer education,
- Monitoring,
- Program management, and
- Training.

Definitions

- **Competency** means the possession of a minimum level of knowledge and proficiency required to collect appropriate information, make informed decisions, and physically take the needed actions to deliver the high-quality weatherization service in question.
- **Possess a working knowledge of** means to:
 - ◆ Know how a particular topic impacts the weatherization process;
 - ◆ Have the relevant information committed to memory or be able to locate it in readily available sources; and
 - ◆ Use the knowledge to make informed decisions and guide weatherization work.
- **Demonstrate the ability to** means to:
 - ◆ Physically conduct a test, procedure, or technique on an actual house, a prop, or in a training lab in the presence of someone qualified to assess the particular competency.

BASIC COMPETENCIES

All weatherization workers must possess the following Basic Competencies:

- Ability to read and write legibly;
- Basic verbal and written communication skills;
- Basic construction knowledge;
- Basic math skills (see appendix for a test to verify basic math skills); and
- Basic computer skills (see appendix for a test to verify basic computer skills).

Depending on the position of the weatherization worker, the following Core Competencies help ensure the delivery of effective weatherization services.

SAFE WORK PRACTICES

All field workers must exhibit safe work practices by possess the following competencies.

- Possess a working knowledge of:
 - ◆ U.S. Department of Energy (DOE) program regulations/policy and Environmental Protection Agency (EPA) guidelines for asbestos, lead, mold, and other health hazards;
 - ◆ Material Safety Data Sheets; and
 - ◆ Occupational Safety and Health Act (OSHA) standards:
 - Ladder safety;
 - Fall protection;
 - Personal protective equipment;
 - Respiratory protection;
 - Motor vehicles;
 - Power-operated hand tools;
 - Fire prevention;
 - Permit-required confined spaces;
 - Other worker-related OSHA standards.
- Demonstrate the ability to:
 - ◆ Select, fit, and use the appropriate Personal Protection Equipment for a particular task;
 - ◆ Safely use basic hand and power tools;
 - ◆ Use a basic first aid kit to treat common job-site injuries;
 - ◆ Work lead safe;
 - ◆ Identify serious mold conditions; and
 - ◆ Assess work area safety hazards.

INSTALLER

The following competencies are required by workers that install weatherization measures.

- ***Prerequisites***
 - ◆ Possess *Safe Work Practices* competencies
- ***Air Sealing***
 - ◆ Possess a working knowledge of:
 - Proper materials selection based on location of leakage areas
 - Minimum ventilation rates.
 - ◆ Demonstrate the ability to:
 - Use the blower door to locate leakage sites within the building
 - Seal attic and floor bypasses at penetrations for plumbing, electrical wiring, flue vents, ducts; dropped soffits, and balloon-framed walls;
 - Seal typical bypasses in kneewalls and finished attic spaces;
 - Seal basement band joists;
 - Properly apply caulk and spray foam insulation;
 - Identify, select, and install weatherstripping on doors, windows, and attic hatches;
 - Cut glass, replace broken window panes, and apply glazing compound;

- Repair plaster and sheetrock (drywall); and
- Modify or install mechanical ventilation to ensure acceptable indoor air quality for post-air-sealing conditions.
- **Duct Sealing**
 - ◆ Demonstrate the ability to:
 - Properly seal duct connections with mastic and fiberglass mesh tape or other approved material; and
 - Repair or modify duct systems as specified in a work order.
- **Insulation**
 - ◆ Possess a working knowledge of:
 - Properties and appropriate application of different insulation materials; and
 - Potential hazards of insulating around knob-and-tube wiring.
 - ◆ Demonstrate the ability to:
 - Install blown and batt attic insulation;
 - Access closed wall cavities and properly install dense-packed wall insulation including removing and replacing siding;
 - Install blown insulation and batt insulation in a floor;
 - Install water heater insulation blankets;
 - Install insulation on ducts, hydronic distribution pipes, and domestic hot water pipes; and
 - Safely operate and properly maintain insulation blowing machines and generators.
- **Base-Load Measures**
 - ◆ Demonstrate the ability to:
 - Replace incandescent light bulbs with compact fluorescent lamps while maintaining or improving lighting levels; and
 - Install low-flow showerheads and faucet aerators;
 - Assess the existing condition of plumbing pipes and faucets that may prohibit these measures.

CREW CHIEF

Personnel that supervise field workers such as *Installers* must possess the following competencies.

- **Prerequisites**
 - ◆ Possess *Safe Work Practices* and *Installer* competencies.
 - ◆ Possess a working knowledge of building science principles.
- **Project Management**
 - ◆ Demonstrate the ability to:
 - Manage a crew of *Installers* so weatherization work is conducted safely, effectively, and efficiently;
 - Ensure that the job site and *Installers* comply with the *Safe Work Practices* described previously;
 - Maintain quality control of weatherization work and ensure it meets program standards;
 - Understand a work order;

- Order and obtain materials, supplies, and equipment in time to avoid delays and wasted time on the job site; and
- Warehouse materials as necessary to avoid delays in completing weatherization work.
- ***Inspection and Measurement***
 - ◆ Possess a working knowledge of:
 - Air and heat flow in buildings;
 - Factors that affect building heat loss;
 - Construction features and critical junction points of common housing types;
 - Insulation R-values;
 - Different insulation materials and installation techniques;
 - Various air-sealing techniques and appropriate materials;
 - Causes of and remedies for existing and potential moisture problems;
 - Causes of and remedies for other existing and potential indoor air quality problems;
 - Residential mechanical ventilation systems;
 - Minimum ventilation rates/building tightness limits based on the appropriate ASHRAE 62 standard; and
 - Electric base-load usage.
 - ◆ Demonstrate the ability to:
 - Measure the dimensions of floors, walls, ceilings, windows, and doors, and compute surface areas;
 - Compute the volume of conditioned space of a building;
 - Define the thermal envelope of a building; and
 - Assess the effectiveness of existing insulation and the effective R-values.
- ***Diagnostic Testing***
 - ◆ Blower door
 - Possess a working knowledge of:
 - Principles of air movement and how they relate to building heat loss;
 - Typical air leakage problems in common housing types; and
 - Minimum ventilation rates.
 - Demonstrate the ability to:
 - Set up a blower door;
 - Prepare a building for a blower door test; and
 - Take blower door reading and interpret results.
 - ◆ Zone pressure diagnostics
 - Possess a working knowledge of:
 - The air barrier of a building and the importance of aligning it with the thermal barrier; and
 - Primary and intermediate zones of a house.
 - Demonstrate the ability to:
 - Conduct zone pressure diagnostics and interpret results; and
 - Determine the location and effectiveness of the air barrier of a house.
 - ◆ Duct testing
 - Possess a working knowledge of:
 - Problems associated with different types of duct leakage.

- Demonstrate the ability to:
 - Determine dominant duct leakage;
 - Determine the amount of duct leakage or at least the existence of significant duct leakage by conducting pressure pan, duct blaster, or delta Q tests.
 - Measure room pressure imbalances in houses with forced-air systems.
 - Resolve room pressure imbalances.
- **Combustion Appliance Safety**
 - ◆ Possess a working knowledge of:
 - CO action levels;
 - Common code requirements related to:
 - Vent system sizing, materials, clearances, and installation;
 - Safety shut-off devices;
 - Gas line sizing; and
 - Combustion air;
 - Causes of and remedies to common vent system problems.
 - ◆ Demonstrate the ability to:
 - Measure the CO level in ambient air;
 - Measure the CO level of vented and unvented combustion appliances;
 - Measure the CO levels of gas- or propane-fired cook stoves (oven and burners) and remedy high CO levels through basic cleaning and adjustments;
 - Understand the difference between as-measured and air-free CO readings;
 - Detect gas, propane, and fuel oil leaks; and
 - Conduct a worst-case draft test of a combustion appliance zone; and
 - Measure the steady-state efficiency of a vented combustion appliance.
- **Insulation**
 - ◆ In addition to the insulation-related *Installer* competencies, possess a working knowledge of:
 - Local codes relating to attic ventilation.
- **Training**
 - ◆ Possess a working knowledge of:
 - Adult learning concepts; and
 - Benefits of cross training on-site personnel.
 - ◆ Demonstrate the ability to:
 - Provide on-site training to *Installers* in a positive environment to strengthen competency in existing skills and increase the number of skill areas.

AUDITOR

- **Prerequisites**
 - ◆ Possess *Safe Work Practices, Installer, and Crew Chief* competencies.
 - ◆ Possess a working knowledge of building science principles.
- **Inspection and Measurement**
 - ◆ Possess a working knowledge of:
 - Air and heat flow in buildings;
 - Factors that affect building heat loss;
 - Construction features and critical junction points of common housing types;
 - Insulation R-values;
 - Different insulation materials and installation techniques;
 - Various air-sealing techniques and appropriate materials;
 - Causes of and remedies for existing and potential moisture problems;
 - Causes of and remedies for other existing and potential indoor air quality problems;
 - Residential mechanical ventilation systems;
 - Minimum ventilation rates/building tightness limits based on the appropriate ASHRAE 62 standard; and
 - Electric base-load usage.
 - ◆ Demonstrate the ability to:
 - Measure the dimensions of floors, walls, ceilings, windows, and doors, and compute surface areas;
 - Compute the volume of conditioned space of a building;
 - Define the thermal envelope of a building;
 - Assess the effectiveness of existing insulation and the effective R-values; and
 - Analyze utility bills including breaking out base-load usage from heating and cooling usage.
- **Diagnostic Testing**
 - ◆ Blower door
 - Possess a working knowledge of:
 - Principles of air movement and how they relate to building heat loss;
 - Typical air leakage problems in common housing types; and
 - Minimum ventilation rates.
 - Demonstrate the ability to:
 - Set up a blower door;
 - Prepare a building for a blower door test; and
 - Take blower door reading and interpret results.
 - ◆ Zone pressure diagnostics
 - Possess a working knowledge of:
 - The air barrier of a building and the importance of aligning it with the thermal barrier; and
 - Primary and intermediate zones of a house.
 - Demonstrate the ability to:
 - Conduct zone pressure diagnostics and interpret results;
 - Determine the location and effectiveness of the air barrier of a house; and
 - ◆ Duct testing

- Possess a working knowledge of:
 - Problems associated with different types of duct leakage.
- Demonstrate the ability to:
 - Determine dominant duct leakage; and
 - Conduct pressure tests. Potential tests include:
 - , Pressure pan
 - , Duct Blaster
 - , Delta-Q
 - Seal duct leaks with appropriate materials and good workmanship.
 - Measure room pressure imbalances in houses with forced-air systems.
- ◆ Steam and hot water distribution system testing
 - Possess a working knowledge of:
 - The components of typical steam and hot water distribution systems and the characteristics of their proper operation.
 - Demonstrate the ability to:
 - Test air vents, steam traps, thermostatic radiator valves, and hot water zone valves; and
 - Estimate the energy impacts of existing overheating problems.
- ◆ Base-load systems
 - Demonstrate the ability to:
 - Meter electrical devices to determine their annual energy consumption.
- ***Combustion Appliance Safety***
 - ◆ Possess a working knowledge of:
 - CO action levels;
 - Common code requirements related to:
 - Vent system sizing, materials, clearances, and installation;
 - Safety shut-off devices;
 - Gas line sizing; and
 - Combustion air;
 - Causes of and remedies to common vent system problems.
 - ◆ Demonstrate the ability to:
 - Measure the CO level in ambient air;
 - Measure the CO level of vented and unvented combustion appliances;
 - Measure the CO levels of gas- or propane-fired cook stoves (oven and burners);
 - Understand the difference between as-measured and air-free CO readings;
 - Detect and natural gas, propane, and fuel oil leaks;
 - Conduct a worst-case draft test of a combustion appliance zone;
 - Measure the CAZ to assure sufficient volume for combustion air;
 - Clock a gas meter to determine the actual input of a gas-fired combustion appliance;
 - Conduct basic temperature-rise and static-pressure-drop tests on forced-air furnaces;
 - Measure the steady-state efficiency of a vented combustion appliance; and
 - Assess the potential inadequacy of supply and return plenum and duct sizes for forced-air systems.

- **Measure Selection**
 - ◆ Possess a working knowledge of:
 - What materials are allowed to be installed based on 10 CFR 440 Appendix A;
 - The regulatory and policy requirements for selecting weatherization measures using DOE-approved energy audit software or priority lists; and
 - The interaction between typical weatherization measures (e.g., the impact of air-sealing and insulation measures on the potential savings of heating efficiency improvements).
 - ◆ Demonstrate the ability to:
 - Use a DOE-approved energy audit to input accurate building data and recommend appropriate, cost-effective weatherization measures;
 - If required, use a DOE-approved priority list to select appropriate, cost-effective weatherization measures;
 - Prioritize air-sealing efforts;
 - Estimate the heating and/or cooling load of a dwelling to ensure proper equipment sizing if the heating or cooling system is to be replaced;
 - Select the proper CFL to replace an incandescent lamp while maintaining or improving lighting levels; and
 - Meter an existing refrigerator or locate its DOE tested usage in a database to estimate annual energy consumption.
- **Work Scope Development**
 - ◆ Demonstrate the ability to:
 - Accurately estimate the type and quantity of materials required to cost-effectively weatherize an eligible dwelling unit; and
 - Prepare clearly written work orders for work crews or contractors.

CONTRACTOR

Contractors hired by local weatherization agencies to perform weatherization work must possess the following competencies. See *HVAC Installer/Contractor* for the competencies required of these specialty contractors.

- **Prerequisites**
 - ◆ Possess *Safe Work Practices, Installer, and Crew Chief* competencies.
 - ◆ Possess a working knowledge of building science principles.
- **Business Management**
 - ◆ Demonstrate the ability to:
 - Maintain the licenses required by the state and local jurisdiction for the type of work the *Contractor* is hired to perform;
 - Possess adequate insurance;
 - Employ U.S. citizens or properly documented aliens; and
 - Bid, negotiate, and sign contracts, as necessary.

- ***Project Management***
 - ◆ Demonstrate the ability to:
 - Manage a crew of *Contractor*-employed *Installers* so weatherization work is conducted safely, effectively, and efficiently;
 - Ensure that the job site and *Contractor*-employed *Installers* comply with the *Safe Work Practices* described previously;
 - Understand a work order;
 - Maintain quality control of weatherization work and ensure it meets program standards;
 - Order and obtain materials, supplies, and equipment in time to avoid delays and wasted time on the job site; and
 - Warehouse materials as necessary to avoid delays in completing weatherization work.

Depending on the type of work the *Contractor* is hired to perform, the following inspection, diagnostic testing, combustion appliance safety, and/or insulation competencies may be required.

- ***Inspection and Measurement***
 - ◆ Possess a working knowledge of:
 - Air and heat flow in buildings;
 - Factors that affect building heat loss;
 - Construction features and critical junction points of common housing types;
 - Insulation R-values;
 - Different insulation materials and installation techniques;
 - Various air-sealing techniques and appropriate materials;
 - Causes of and remedies for existing and potential moisture problems;
 - Causes of and remedies for other existing and potential indoor air quality problems;
 - Residential mechanical ventilation systems;
 - Minimum ventilation rates/building tightness limits based on the appropriate ASHRAE 62 standard; and
 - Electric base-load usage.
 - ◆ Demonstrate the ability to:
 - Measure the dimensions of floors, walls, ceilings, windows, and doors, and compute surface areas;
 - Compute the volume of conditioned space of a building;
 - Define the thermal envelope of a building; and
 - Assess the effectiveness of existing insulation and the effective R-values.
- ***Diagnostic Testing***
 - ◆ Blower door
 - Possess a working knowledge of:
 - Principles of air movement and how they relate to building heat loss;
 - Typical air leakage problems in common housing types; and
 - Minimum ventilation rates.
 - Demonstrate the ability to:
 - Set up a blower door;
 - Prepare a building for a blower door test; and

- Take blower door reading and interpret results.
 - ◆ Zone pressure diagnostics
 - Possess a working knowledge of:
 - The air barrier of a building and the importance of aligning it with the thermal barrier; and
 - Primary and intermediate zones of a house.
 - Demonstrate the ability to:
 - Conduct zone pressure diagnostics and interpret results; and
 - Determine the location and effectiveness of the air barrier of a house.
 - ◆ Duct testing
 - Possess a working knowledge of:
 - Problems associated with different types of duct leakage.
 - Demonstrate the ability to:
 - Determine dominant duct leakage;
 - Determine the amount of duct leakage or least the existence of significant duct leakage by conducting pressure pan, duct blaster, or delta Q tests;
 - Measure room pressure imbalances in houses with forced-air systems; and
 - Resolve room pressure imbalances.
- **Combustion Appliance Safety**
 - ◆ Possess a working knowledge of:
 - CO action levels;
 - Common code requirements related to:
 - Vent system sizing, materials, clearances, and installation;
 - Safety shut-off devices;
 - Gas line sizing; and
 - Combustion air;
 - Causes of and remedies to common vent system problems.
 - ◆ Demonstrate the ability to:
 - Measure the CO level in ambient air;
 - Measure the CO level of vented and unvented combustion appliances;
 - Measure the CO levels of gas- or propane-fired cook stoves (oven and burners) and remedy high CO levels through basic cleaning and adjustments;
 - Understand the difference between as-measured and air-free CO readings;
 - Detect gas, propane, and fuel oil leaks; and
 - Conduct a worst-case draft test of a combustion appliance zone; and
 - Measure the steady-state efficiency of a vented combustion appliance.
- **Insulation**
 - ◆ In addition to the insulation-related *Installer* competencies, possess a working knowledge of:
 - Local codes relating to attic ventilation.

HEATING, VENTILATION, AND AIR CONDITIONING (HVAC) INSTALLER/CONTRACTOR

• *Heating and Cooling Equipment*

- ◆ Prerequisites:
 - Possess *Auditor/Combustion Appliance Safety* and *Safe Work Practices* competencies; and
 - Possess the HVAC certifications and licenses required by the state and local jurisdiction.
- ◆ Possess a working knowledge of:
 - The components of typical steam and hot water distribution systems and the characteristics of their proper operation.
- ◆ Demonstrate the ability to:
 - Maintain quality control of weatherization work and ensure it meets program standards;
 - Repair or replace heating and cooling equipment in a code-compliant manner;
 - Estimate the heating and/or cooling load of a dwelling per Manual J to ensure proper sizing of replacement heating or cooling systems;
 - Repair or replace vent systems of combustion appliances in a code-compliant manner;
 - Repair or replace a water heater in a code-compliant manner (some states may require a licensed plumber to replace a water heater);
 - Ensure proper sizing of gas lines;
 - Assess the adequacy of supply and return plenum and duct sizes for forced-air systems;
 - Add return and supply plenums and ducts as required;
 - Determine dominate duct leakage;
 - Conduct duct pressure tests, which could include:
 - Pressure pan;
 - Duct Blaster; and
 - Delta-Q;
 - Measure and solve room pressure imbalances in houses with forced-air systems;
 - Test air vents, steam traps, thermostatic radiator valves, and hot water zone valves;
 - Bleed unwanted air from a hot water distribution system;
 - Estimate the energy impacts of existing overheating problems in steam and hot water heating systems;
 - Warehouse materials as necessary to avoid delays in completing weatherization work; and
 - Test out to assure system is operating properly and safely.

INSPECTOR

- Prerequisites:
 - ◆ Inspectors should possess *Safe Work Practices, Installer, and Auditor* competencies.
- Possess a working knowledge of:
 - ◆ Relevant DOE Weatherization Program regulations and policy;
 - ◆ Building science principles; and
 - ◆ Relevant local codes.
- Demonstrate the ability to:
 - ◆ Verify that the weatherized house is safe by conducting all appropriate combustion appliance safety tests;
 - ◆ Evaluate the allowability and appropriateness of the installed weatherization measures taking into consideration program regulations, policy, energy audit results, and/or priority lists;
 - ◆ Assess whether the measures were installed with good workmanship, proper materials, and in such a manner to comply with local code and ensure long-term energy savings over the life of the measures;
 - ◆ Ensure that all measures charged to the job were actually installed; and
 - ◆ Verify the effectiveness of air-sealing efforts by conducting a blower door test and zone pressure diagnostics.

CONSUMER EDUCATION

- Competency
 - ◆ Principles of adult education
- Possess a working knowledge of:
 - ◆ What actions can be taken to reduce energy use in the home;
 - ◆ The basic steps in the Weatherization process from auditing, testing, installation, inspection, and monitoring;
 - ◆ The purpose of the basic equipment involved in weatherizing a house, including a blower door, pressure pan, combustion analyzer, gas leak detector, insulation blowing machine, and generator; and
 - ◆ What actions need to be taken to maintain a healthful indoor environment.
- Demonstrate the ability to:
 - ◆ Estimate the economic impacts of suggested actions to bolster customer commitment to change.

MONITOR (TECHNICAL)

- Prerequisites:
 - ♦ Monitors should possess all *Safe Work Practices, Auditor, and Inspector* competencies.
 - ♦ Monitors should be knowledgeable of *Installer* competencies.
- Possess a working knowledge of:
 - ♦ Principles of building science; and
 - ♦ Principles of adult education.
- Demonstrate the ability to:
 - ♦ Produce written reports that clearly identify weaknesses and provide sound solutions;
 - ♦ Provide on-site training and technical assistance; and
 - ♦ Solve complex technical problems.

MONITOR (ADMINISTRATIVE)

- Possess a working knowledge of:
 - ♦ Principles of adult education;
 - ♦ Enabling legislation governing the U.S. Department of Energy's (DOE's) Weatherization Assistance Program;
 - ♦ DOE program regulations 10 C.F.R. 440;
 - ♦ DOE program guidance and policy issued via Weatherization Program Notice or memoranda;
 - ♦ Federal, state, and local budget processes;
 - ♦ Federal financial assistance regulations 10 C.F.R. 600 and relevant OMB circulars;
 - ♦ Applicable state procurement regulations; and
 - ♦ State and local approaches to monitoring, training, and technical assistance.
- Demonstrate the ability to:
 - ♦ Produce written reports that can clearly identify weaknesses and provide sound solutions; and
 - ♦ Provide on-site training and technical assistance;

PROGRAM MANAGER

- Possess a working knowledge of:
 - ♦ Enabling legislation governing the U.S. Department of Energy's (DOE's) Weatherization Assistance Program;
 - ♦ DOE program regulations 10 C.F.R. 440;
 - ♦ DOE program guidance and policy issued via Weatherization Program Notice or memoranda;
 - ♦ Federal, state, and local budget process;
 - ♦ Federal financial assistance regulations 10 C.F.R. 600 and relevant OMB circulars;
 - ♦ Applicable state procurement regulations;
 - ♦ State and local approaches to monitoring, training, and technical assistance;

- ◆ Applicable computer databases and tracking systems and the importance that they remain up-to-date, are secured and backed-up, and are used effectively to manage the program; and
- ◆ Building science principles.
- For state staff:
 - ◆ Demonstrate the ability to:
 - Prepare an annual state plan;
 - Prepare an annual weatherization grant application;
 - Submit accurate financial and production reports in a timely manner;
 - Develop, maintain, and enforce state technical program standards;
 - Provide adequate technical and administrative training for coordinators, auditors, technicians, and inspectors directly employed by local agencies, and ensure that subcontractors receive appropriate technical training;
 - Develop and manage an effective monitoring program;
 - Coordinate resources;
 - Develop and implement innovative leveraging strategies; and
 - Process reimbursement requests in a timely manner.
- For local agency weatherization coordinators:
 - ◆ Demonstrate the ability to:
 - Effectively communicate and manage weatherization staff and subcontractors;
 - Prepare and track a budget for implementing a local weatherization program;
 - Maintain a purchase order system to track contracted services and materials and tool requisitions;
 - Maintain a coding system to assure expenditures are charged to the correct budget category;
 - Maintain inventory tracking system for materials, tools, and equipment;
 - Submit accurate financial and production reports in a timely manner;
 - Comply with federal limits on administrative expenses;
 - Manage a small construction/production-focused operation;
 - Ensure rigorous, unbiased, and accurate final inspection of all completed units;
 - Provide adequate technical training for auditors, technicians, and inspectors directly employed by the local agency, and ensure that subcontractors receive appropriate technical training;
 - Ensure that weatherization work complies with state technical program standards;
 - Coordinate resources; and
 - Develop and implement innovative leveraging strategies.

TRAINER

- Prerequisites:
 - ◆ Trainers should possess *Safe Work Practices, Auditor, and Inspector* competencies;
 - ◆ Trainers should be knowledgeable of *Installer* competencies;
 - ◆ Completion of adult education training program; and
 - ◆ Certification in subject areas of presented training.
- Possess a working knowledge of:
 - ◆ Principles of building science;
 - ◆ Principles of adult education;
 - ◆ Benefits of cross-training;
 - ◆ Building codes, especially energy and health/safety-related codes;
 - ◆ Allowable activities at the location of training (e.g., knob-and-tube wiring requirements); and
 - ◆ Available resources to aid students in future understanding and application.
- Demonstrate the ability to:
 - ◆ Develop curriculum based on student needs;
 - ◆ Tailor each class to the experience and needs of the students;
 - ◆ Motivate students through inspirational presentations;
 - ◆ Provide hands-on training;
 - ◆ Use technology to enhance the learning experience, especially as related to adult education principles; and
 - ◆ Direct students to other resources to get answers beyond the capacity of the trainer to provide.

Appendix A: Math Pre-Test

You may use a calculator to solve the following questions. Answers may be expressed in decimal or fraction form. (15-minute time limit)

You must score 73% or higher, (answer at least eleven (11) out of fifteen (15) correct). Failure to do so will require additional basic math skills before attending the Initial Inspection course at the OWTC.

1.
$$\begin{array}{r} 8 \frac{1}{2}'' \\ 17 \frac{3}{4}'' \\ + 23 \frac{3}{8}'' \end{array}$$

2.
$$\begin{array}{r} 23 \frac{1}{4}'' \\ - 7 \frac{1}{8}'' \end{array}$$

3.
$$\begin{array}{r} 23.25 \\ \times 12.75 \end{array}$$

4. $350/40 = \underline{\hspace{2cm}}$

5. $3/8 \times 120 = \underline{\hspace{2cm}}$

6. How many inches are in 5 feet? $\underline{\hspace{2cm}}$

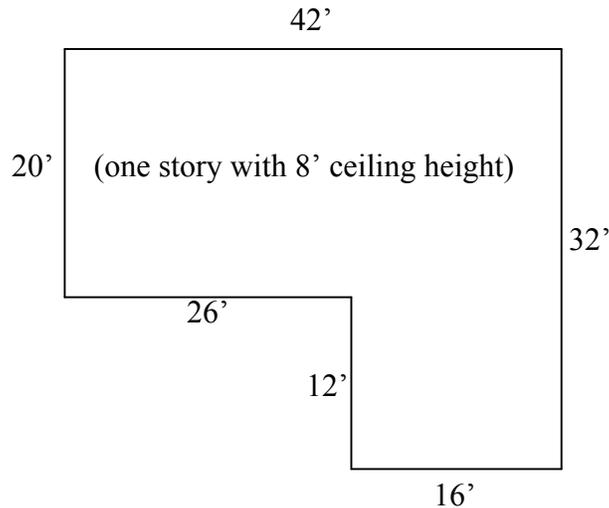
7. One square foot equals how many square inches? $\underline{\hspace{2cm}}$

8. What is the perimeter of the house diagramed below? $\underline{\hspace{2cm}}$ feet.

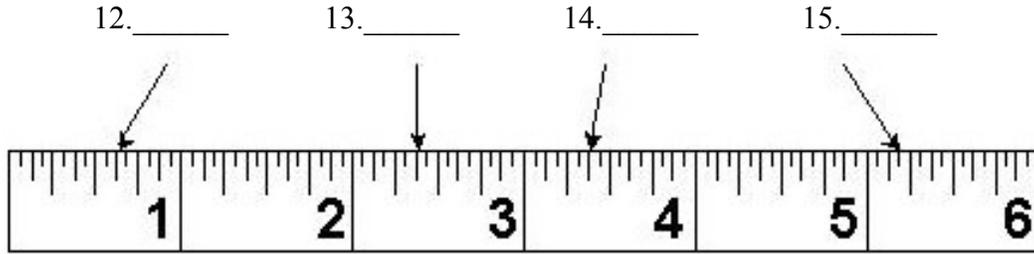
9. What is the area of the house diagramed below? $\underline{\hspace{2cm}}$ square feet.

10. What is the volume of the house diagramed below? $\underline{\hspace{2cm}}$ cubic feet.

11. What is 75% of 2400? $\underline{\hspace{2cm}}$.



12-15. Write in the measurement indicated by the arrow pointing at the tape measure.



Appendix B: Computer Skills Pre-Test

Basic Computer Skills Survey

1. Have you used a computer before? Yes No
2. Do you own a computer? Yes No
3. How well can you type? Good OK Not Good
4. What software programs have you used?
 - a. Microsoft Word or other word processor? Yes No
 - b. Excel or other spreadsheet program? Yes No
 - c. Outlook or other email program? Yes No
 - d. Internet Explorer or other Internet browser? Yes No
 - e. NEAT, MHEA, or other energy audit software? Yes No

Windows Basics Test

Perform the following tasks on the computer.

1. Open three different software programs, resize and position the windows so you can see all three applications on the screen at once.
2. Minimize all three programs and create a new folder on the desktop.
3. Create a word-processing file and save it on the desktop
4. Move this new file into the new folder using drag and drop.
5. Open the folder and confirm you successfully moved the file.
6. Using the Windows Help menus locate instructions for cut and paste and drag and drop. Point to what tutorials come with windows for learning file management. (copy, delete, move, rename, view properties)

File Management Basics Test

Nearly everything you'll do with computers revolves around creating content in the form of different types of files using different software programs. You'll need to be comfortable with creating, saving, opening, and editing files. Then you'll need to understand storing, organizing, renaming, moving, copying, deleting and backing up your important files. Plan on learning by doing. Mistakes are considered positive learning experiences and are an essential part of using and learning computers. Trouble-shooting gets easier with practice.

Begin by drafting a personal list of the computer skills you have and the skills you want to learn. Then complete the following tests.

1. Create a new folder on the desktop named “Test Folder #1” and save a simple word processing document to this folder.
2. Create a folder named “Test Folder #2” within “Test Folder #1” and move the word processing file into this new folder.
3. Put a copy of this file into the first folder you created.
4. Rename this file.
5. Create another new folder on the desktop named “Test Folder #3” and move Test Folder #2 into this folder.
6. Delete all these folders and files.

Copy and Paste Basics Test

Perform the following tasks on the computer.

1. Highlight a section of text in a document and copy it to another location.
2. Highlight a section of text in a document and move it to a new location.
3. Highlight an image in a document and copy it to another location. Then, move the image to new location.

Spreadsheet Basics Test

Circle the letter of the best answer.

1. Spreadsheets:
 - a. Are large amounts of information
 - b. Organize text and numbers into columns and rows
 - c. Are usually graphics
2. Columns are:
 - a. Labeled with numbers
 - b. Not labeled
 - c. Labeled with letters
3. Rows are:
 - a. Labeled with numbers
 - b. Not labeled
 - c. Labeled with letters

4. What are the intersection of a column and a row?
 - a. Formulas
 - b. Entries
 - c. Cells

5. The column and row label combined at the point of intersection is known as the:
 - a. Active cell
 - b. Cell name
 - c. Formula

6. What are the sets of instructions that produce a value for a cell?
 - a. Addresses
 - b. Spreadsheets
 - c. Formulas

7. What character should start any formula?
 - a. Plus sign (+)
 - b. Any operator (+,-,*,/)
 - c. Equals sign (=)

8. Which formula will produce the total cost of all weatherization measures?

	A	B	C	D	E	F
1	Measure	Hours	Rate	Labor	Materials	Total
2	Air sealing	4	\$30	\$120	\$200	\$320
3	Attic insulation	3	\$30	\$90	\$324	\$414
4	Sidewall insulation	8	\$30	\$240	\$312	\$552
5	Water heater wrap	0.5	\$30	\$15	\$14	\$29

- a. =SUM(F2:F5)
- b. =F2+F3+F4+F5
- c. =SUM(B5:F5)
- d. Both a and b

Appendix C: Glossary

Air Barrier – The air barrier of a dwelling, also known as the pressure boundary, is the building shell surface that limits airflow between inside and outside. For maximum energy efficiency and comfort, the air barrier and thermal barrier should be continuous and in contact with each other.

ASHRAE – American Society of Heating, Refrigeration, and Air Conditioning Engineers

ASHRAE 62 – ASHRAE 62 is a group of ASHRAE standards for minimum building ventilation requirements. ASHRAE 62.1-2004, entitled Ventilation for Acceptable Indoor Air Quality, cover general topics and requirements for commercial and high-rise residential buildings. ASHRAE 62.2-2004, Ventilation for Acceptable Indoor Air Quality in Low-Rise Residential Buildings, has a self-explanatory title.

Attic Ventilation – Building codes require attic openings to outside to induce airflow that cools the attic in summer and exhausts moisture. There is a growing consensus that unvented attics have energy benefits and that in hot, humid climates attic ventilation brings in more moisture from outside than it purges.

Auditor – An auditor is a weatherization worker that assesses an eligible dwelling for potential weatherization services. Auditors visually inspect the building shell and mechanical systems; conduct diagnostic, health, and safety tests; record the location, condition, and dimensions of walls, ceilings, floors, windows, doors, and mechanical systems; enter data into computerized energy audit or use a priority list to select cost-effective measures; and prepare clear and accurate work orders to ensure the most appropriate measures are installed properly.

Balloon-Framed Walls – Balloon-framed walls are built without top or bottom plates. This type of framing often provides an air channel from the basement or crawlspace to the attic that allows outside air to flow through the walls resulting in excessive heat loss/gain.

Band Joist – Band joists are the floor joists that run around the perimeter of the house. There are two types of band joists - header joists that run perpendicular to the floor joists and rim joists that run parallel. A typical weatherization measure involves insulating the header joist spaces between floor joists and along the rim joists.

Base Load – Base loads are energy loads from appliances that are on most of the time and do not vary with changing climate. Base loads include refrigerators, water heaters, and lights. Base loads are often thought to be primarily electric loads, but can be fueled by other energy sources.

Batt Insulation – Batts are insulation manufactured in rolls precut to standard widths to fit snugly between framing (joists, rafters, or studs) on 16-inch or 24-inch centers in ceilings, floor, and walls. While often made with a “Kraft” paper facing designed to

retard vapor transmission, batt insulation is also available without the paper facing (unfaced batts).

Blower Door – A blower door is a device for testing the airtightness of a building. A blower door consists of a calibrated fan for measuring an air flow rate and a pressure sensing device to measure the pressure created by the fan flow. The combination of pressure and flow can be used to estimate the airtightness.

Building Performance Institute (BPI) – BPI is an organization that supports the development of a professional building performance industry through individual and organizational credentialing and a quality assurance program. BPI offers certification of individuals in evaluation, mechanical, envelope, mobile home, and multi-family designations, as well as accreditation of organizations committed to using a quality management system.

Building Science – Building science is the collection of scientific knowledge that focuses on the analysis and control of the physical phenomena affecting buildings. This includes the detailed analysis of building materials and building envelope systems.

Building Tightness Limit – Also known as the minimum ventilation rate, the building tightness limit is the least amount of fresh air that must be drawn through a house (by either natural or mechanical means) to ensure acceptable indoor air quality.

Bypass – A bypass is a hole between conditioned and unconditioned space that allows air leakage through the pressure boundary, or air barrier, of a dwelling.

CAZ – A combustion appliance zone, or CAZ, is any zone containing a combustion appliance.

CO – Carbon monoxide

Combustion Air – Complete combustion of fossil fuels such as natural gas, propane, and fuel oil requires an adequate supply of air. Inadequate combustion air causes incomplete combustion, which generates carbon monoxide.

Combustion Appliance – A combustion appliance is a furnace, boiler, space heater, wood stove, water heater, cook stove, or other device that burns wood or fossil fuel such as natural gas, propane, or fuel oil.

Compact Fluorescent Lamp – A compact fluorescent lamp (CFL) is a type of fluorescent lamp that screws into a regular light bulb socket or plugs into a small lighting fixture. In comparison to incandescent light bulbs, CFLs have a longer rated life and use less electricity.

Competency – Competency means the possession of a minimum level of knowledge and proficiency required to collect appropriate information, make informed decisions, and

physically takes the needed actions to deliver the high-quality weatherization service in question.

Consumer/Client Education – Consumer or client education includes discussion, instruction, brochures, and pamphlets that explain the weatherization process, the measures installed in the client’s house, how to use certain measures (such as programmable thermostats), and low-cost/no-cost ways to save energy and reduce energy costs.

Crew Chief – A crew chief is a weatherization worker that supervises a crew of installers and directs their efforts to weatherize eligible dwellings.

Critical Junction Point – Critical junction points are areas in building construction that typically exhibit air leaks or are inadequately insulated. Critical junction points include the intersection of ceilings and walls, cantilevers, and finished-attic kneewalls.

Cross Training – Training every member of a crew to be able to do every job is known as cross training. While certain crew members may specialize in specific tasks, a cross-trained crew understands how their specialty impacts all others and can adjust to staff turnover.

Delta Q – Delta Q is a testing protocol to measure duct leaks to the outside under actual operating conditions.

Demonstrated Ability – A demonstrated ability is the physical performance of a test, procedure, or technique on an actual house, a prop, or in a training lab in the presence of someone qualified to assess the particular competency.

Dense-Packed Insulation – Loose-fill insulation (cellulose or fiberglass) is blown into closed building cavities (usually walls, but also floor and roof/ceiling cavities) to a density of 3½ or 2 ½ pounds per cubic foot¹, respectively, to air seal as well as insulate.

DOE – U.S. Department of Energy

Dropped Soffit – A dropped soffit (or simply drop soffit) is built from framing and drywall over kitchen cabinets to give a more finished appearance than just hanging wall cabinets with a foot or so gap between the top of the cabinet and the ceiling. From the attic, a dropped soffit looks like a big hole in the floor and often causes breaks in the attic thermal and air barriers.

Duct Blaster – A Duct Blaster is a calibrated airflow measurement system designed to test and document the air tightness of forced-air duct systems. Duct Blaster is the trade name of the device manufactured by the Energy Conservatory of Minneapolis,

¹ Guidelines are based on infiltration reduction lab and field results and subject to change as more data becomes available.

Minnesota. Other competing companies such as Infiltec and Retrotec manufacture similar systems.

EPA – U.S. Environmental Protection Agency

HVAC – Heating, ventilation, and air conditioning

HVAC Installer/Contractor – A HVAC installer/contractor is a crew member or contractor trained and licensed to repair and replace furnaces, boilers, air conditioners, and related equipment.

Hydronic Distribution Pipes – Hydronic distribution pipes deliver hot water or steam from a water heater or boiler to baseboard convectors or radiators located throughout a house.

Inspector – An inspector verifies the proper selection, installation, and effectiveness of weatherization measures installed in eligible dwellings through review of documentation, visual inspection, and performance of diagnostic, health, and safety testing.

Installer – An installer is a crew member or contractor that installs weatherization measures in eligible dwellings.

Knob-and-Tube Wiring – Older homes may have “knob-and-tube” electrical wiring, where two separate wires run through ceramic posts (knobs) attached to the top of ceiling joists or through ceramic tubes inserted into holes drilled in the wall or roof framing. Since this type of wiring was designed to dissipate heat to the attic air, insulating over knob-and-tube wiring can cause dangerous overheating.

Lead-Safe Work Practices – Lead-safe work practices are the use of specific precautions in the conduct of weatherization activities designed to avoid contaminating homes with lead-based paint dust and debris, and to avoid exposing the clients, weatherization workers, and their families to this hazard.

Mastic – Mastic is a material used to seal duct leaks. It is the consistency of drywall joint compound when applied, but dries to a hard, durable finish. To seal duct leaks larger than ¼ inch, mastic is applied over a specially made fiberglass mesh tape.

Material Safety Data Sheet (MSDS) – A material safety data sheet or MSDS describes the properties of a particular substance (e.g., caulk, mastic, sealant). An important component of workplace safety, it is intended to provide workers and emergency personnel with procedures for handling or working with that substance in a safe manner.

Mechanical Ventilation – Mechanical ventilation is the controlled exhaust of indoor air, intake of fresh outdoor air, or a combination of both through the use of fans, controls, passive air intakes, and sometimes ducts, registers, and air-to-air heat exchangers.

Minimum Ventilation Rate – Also known as the building tightness limit, the minimum ventilation rate is the least amount of fresh air that must be drawn through a house (by either natural or mechanical means) to ensure acceptable indoor air quality.

Monitor (Administrative) – An administrative monitor is someone employed or contracted by a state to review the administrative and programmatic activities of local weatherization agencies (subgrantees) to ensure compliance with applicable laws and programmatic and financial regulations.

Monitor (Technical) – A technical monitor is someone employed or contracted by a state to review the technical and field activities of local weatherization agencies (subgrantees) to ensure compliance with the enacting federal legislation, federal program regulations, and state technical program standards.

NASCSP – National Association for State Community Services Programs is a national association charged with advocating and enhancing the leadership role of states in preventing and reducing poverty. NASCSP's members are state administrators of the U.S. Department of Health and Human Services' Community Services Block Grant (CSBG) and the U.S. Department of Energy's Weatherization Assistance Program. NASCSP keeps its members, the federal government, and other interested parties informed about issues related to CSBG and the Weatherization Program through its publications and training.

OSHA – The Occupational Safety and Health Administration's mission is to assure the safety and health of America's workers by setting and enforcing standards; providing training, outreach, and education; establishing partnerships; and encouraging continual improvement in workplace safety and health.

Personal Protective Equipment – Equipment such as respirators, safety goggles, disposable coveralls, and hard hats worn by weatherization workers to protect them from jobsite hazards.

Plenum – A plenum is the initial duct on the supply and return side of an air handler.

Pressure Pan – A pressure pan resembles a cake pan and is used to locate duct leakage with a digital manometer while a blower door is running.

Priority List – A priority list is a list of weatherization measures appropriate for typical housing stock ordered by descending cost effectiveness. DOE-approved energy audit software is used to verify the cost effectiveness of the measures and account for the interaction between measures.

R-Value – R-value is a measure of resistance to heat flow. Insulation with an R-value of R-38 resists heat loss better than R-19 insulation.

Room Pressure Imbalances – Pressure imbalances happen when the conditioned air supplied to a room does not equal the airflow returned to the furnace or air conditioner. In dwellings with forced-air distribution and a central return system, closing bedroom doors can cause the bedrooms to experience a positive pressure and rooms that are open to the return grille see a negative pressure. Atmospherically vented combustion appliances can backdraft if they are located in a zone with negative pressure.

Steam Trap – Steam traps are automatic valves used in steam heating systems to remove condensed steam (hot water) from the steam pipes and return it to the boiler.

Temperature-Rise Test – A temperature-rise test is conducted on a furnace by measuring the temperature of air entering the furnace and of the air exiting the furnace. The difference between these two temperatures is known as the temperature rise and is compared to the normal range indicated on the nameplate to verify proper operation of the furnace.

Thermal Barrier – The thermal barrier of a dwelling is the building shell surface that limits heat flow. For maximum energy efficiency and comfort, the air barrier and thermal barrier should be continuous and in contact with each other.

Unvented Combustion Appliance – An unvented combustion appliance vents combustion gases to the living space instead of outside as does a vented appliance.

Weatherization *Plus* – The U.S. Department of Energy’s effort to plan the continued evolution of the Weatherization Program for the next five years through activities designed to expand resources (leveraging and partnerships), share relevant information with the weatherization network, and increase the consistent delivery of high-quality weatherization services nationwide.

Work Order – A work order describes what weatherization measures are to be installed in an eligible dwelling and includes a list of the type and quantity of materials that are required to complete the job.

Working Knowledge – Working knowledge of means to:

- Knowing how a particular topic impacts the weatherization process;
- Having the relevant information committed to memory or being able to locate it in readily available sources; and
- Using the knowledge to make informed decisions and guide weatherization work.

Worst-Case Draft Test – A worst-case draft test is procedure used to verify the ability of a combustion appliance to safely exhaust combustion gases outside even when exhaust fans, pressure imbalances, and the stack effect are fighting its ability to properly draft.

Zone Pressure Diagnostics – Test procedures used with the blower door to locate air leakage are known as zone pressure diagnostics.

