

Contents

Air Sealing & Insulation Professional Syllabus	1
Section 1 – Health & Safety	5
Section 2: House as a System	6
Sections 3-5: Fundamentals of Building Science, Pressure Boundaries, Air Sealing	6
Section 6: HVAC	9
Section 7: Preparing for Insulation	11
Section 8: Ventilation Systems	11
Sections 9-13: Baseload, Insulation Basics, Dense-pack, Knee-walls, Attic Doors	12
Jobsite Quick Reference Sheet	14
Table 6.1: R-values Per Inch For Common Insulating Materials	15
Excerpts from NM EnergySmart Technical Standards:	16
1200 Scope.....	16
1600 Deferral of Weatherization.....	16
4100 Health and Safety Requirements	18
4300 Client Health and Safety	19
4400 Agency Health and Safety.....	20
41400 Energy Related Mold and Moisture	22
41414 Dryer Vents.....	22
41600 Combustion Safety Testing.....	22
41700 Carbon Monoxide Alarms.....	23
41800 Smoke Alarms	24
41200 Lead Safe Weatherization (LSW).....	24
41500 Ventilation Systems for Acceptable Indoor Air Quality.....	25
5000 Air Sealing Guidelines	30
5100 Gross Air Sealing	30
5200 Blower Door Guided Air Sealing	31
5210 Air Sealing and Damming Around Chimneys and Vents	32
5300 Room-to-Room Duct-Induced Pressures	32
6250 Attic Access	32
6260 Attic Access Insulation	33
6270 Insulation Shielding and Blocking.....	33



Air Sealing & Insulation Professional Syllabus



Instructor:

Instructor's Contact Information:

Phone:

Email:

Course Information:

Course Description

The successful weatherization of an existing home requires extensive planning, knowledge of building science and codes, and well-executed installations. This course is focused on developing the skills and knowledge of current and potential Weatherization Installers. This class offers three days of review, theory, and hands-on lab exercises to reinforce and extend the knowledge of building science and tools and techniques for insulating, air-sealing buildings, reducing base load, and drywall repair.

By attending this course, the Student will gain a deeper understanding about weatherization material properties for insulating and air-sealing. With a focus on performance, each student participating in lab/field activities is responsible for the appropriate use of insulation blowing machines, air-sealing props, installing base load measures, and drywall repair.

Course Objectives

By the end of this course, students will be able to:

1. Identify typical construction details that lead to gaps in pressure and thermal boundaries and know how to treat them.
2. List the various tools and materials used in air-sealing and attic preparation.
3. Select appropriate tools and materials to air-seal building simulation props. Props are pressure tested to check air tightness.
4. Outline the process for insulating attics with loose-fill insulation on both horizontal and vertical surfaces.
5. Set-up and demonstrate the use of an insulation blowing machine.
6. Dense-pack a test wall & blow loose fill insulation in a simulated attic
7. Discuss safety concerns related to wiring.
8. Demonstrate comparing material use to coverage required.

Prerequisites

N/A

Required Text

NME\$A Air Sealing & Insulation Professional Handbook

Expectations

1. Exhibit professional conduct, including complying with OSHA safety standards.
2. Attend all classroom, lab, and field sessions.
3. Complete and submit all required assignments/exercises according to course deadlines.
4. Participate in classroom discussions.
5. Complete/participate in all field and laboratory projects.
6. Use individual knowledge and skills to assist with group activities.
7. Demonstrate ability to properly perform specific specialized diagnostic tests.

Assignments

- Primary assessments will be conducted by observation throughout classroom, laboratory, and field sessions. This includes productive participation in question and answer sessions, and discussions during each lesson.
- Final evaluation consists of skill demonstrations and completion of Course Handbook exercises.

NME\$A and SFCC Policies/Procedures

[see SFCC Student Handbook and JACK for SFCC and NME\$A policies: www.sfcc.edu]

Attendance: Students are required to attend each class in order to pass each course offering for certification. Notify your instructor within 24 hours of any unforeseen absence. Courses are not run on a regular basis and therefore, make-up scheduling may not be possible.

Academic Honesty: Students may not gain, or attempt to gain, academic advantage by misrepresenting their work or by interfering with the completion, submission, or evaluation of work. *[see SFCC policies on plagiarism in Student Handbook]*

Electronic Devices: All electronic devices must be set to off at the beginning of each class session. Student cell phone use policy is “emergencies only” during instruction.

Grading:

Students must achieve the following to receive a passing grade/certification

100% completion of all Skill Demonstration Tasks is required

100% completion of the Course Handbook

70% on Quizzes

Students with Disabilities: If you have a disability for which you would be requesting accommodations by SFCC or the NME\$A program, please contact your instructor upon enrollment.

Resources

Weatherization Assistance Program Technical Assistance: www.waptac.org

Weatherization TV: www.wxtvonline.org

SFCC Online Course Materials: <https://sfcc.instructure.com>

Schedule

(Each day after class: 15-30 minutes for one-on-one sessions as needed)

Day 1:

Introductions, course expectations	8:00-8:30am
Review: Health & Safety, Building Math, House as a System, Building Science, Common Pressure Boundary Problems	8:30-9:00am
<break>	9:00-9:10am
Review: Health & Safety, Building Math, House as a System, Building Science, Common Pressure Boundary Problems (<i>con't</i>)	9:10-10:10am
<break>	10:10-10:20am
Insulation and air-sealing tools and materials	10:20-11:20am
<break>	11:20-11:30am
Review air-sealing props and desired outcomes	11:30-12:00pm
<LUNCH> Early Return - instructor available for questions	12:00-1:00pm
Air-seal props; pressure testing	1:00-2:00pm
<break>	2:00-2:10pm
Air-seal props; pressure testing (<i>con't</i>)	2:10-3:10pm
<break>	3:10-3:20pm
Air-seal props; pressure testing (<i>con't</i>)	3:20-4:20pm
Clean-up lab; store completed props	4:20-5:00pm

Day 2:

Day 1 Review	8:00-8:20am
HVAC problems, preparing for insulation, venting systems	8:20-9:20am
<break>	9:20-9:30am
HVAC problems, preparing for insulation, venting systems (<i>con't</i>)	9:30-10:00am
Continue air-sealing props	10:00-10:30am
<break>	10:30-10:40am
Insulation blowing machine; safety, operations & maintenance	10:40-11:40am
<LUNCH> Early Return - instructor available for questions	11:40-12:40pm
Insulation blowing machine: loose-fill prop	12:40-1:40pm
<break>	1:40-1:50pm
Insulation blowing machine: loose-fill prop (<i>con't</i>)	1:50-2:50pm
<break>	2:50-3:00pm
Mobile home construction & site visit	3:00-4:00pm
<break>	4:00-4:10pm
Mobile home construction & site visit (<i>con't</i>); complete course handbook exercises	4:10-5:00pm

Day 3:

Review Day 2	8:00-8:20am
Baseload measures (CFL's, low-flow devices, water heater blanket installs, DHW pipe-wrap)	8:20-9:20am
<break>	9:20-9:30am
Baseload measures (<i>con't</i>)	9:30-9:50am
Insulation basics	9:50-10:30am
<break>	10:30-10:40am
Insulation blowing machine: hole drilling; dense-pack props	10:40-11:40am
<LUNCH> Early Return - instructor available for questions	11:40-12:40pm
Insulation blowing machine: hole drilling; dense-pack props (<i>con't</i>)	12:40-1:40pm
<break>	1:40-1:50pm
Insulation blowing machine: hole drilling; dense-pack props (<i>con't</i>)	1:50-2:50pm
<break>	2:50-3:00pm
Drywall repair	3:00-4:00pm
<break>	4:00-4:10pm
Drywall repair & lab clean-up	4:10-4:30pm
Complete Course Handbook / Class Evaluation	4:50-5:00pm

Day 1 Exercises

Section 1 – Health & Safety

1) What are some examples of “PPE” that installers should always have in their trucks?

2) Why should you have a respirator fit test?

3) What is a MSDS?

4) Why should we be aware of asbestos?

Section 2: House as a System

- 4) We often say that the “House is a system”. What does this mean?

Sections 3-5: Fundamentals of Building Science, Pressure Boundaries, Air Sealing

- 5) The building envelope or shell is made up of a _____ boundary and a _____ boundary.

- 6) What conditions must be present to cause condensation?

- 7) For air to move, there must be a _____ and a _____.

- 8) CFM stands for _____.

- 9) For every CFM that _____ the home, a CFM _____ enter!

- 10) Which way does air move at the neutral pressure plane?

11) What happens to the neutral pressure plane when you air-seal the top of a building?
(circle your answer)

- a. It moves UP
- b. It moves DOWN
- c. NOTHING

12) Which of the following is the CONTROLLED movement of air into our homes
(circle your answer)

Infiltration

Ventilation

Exfiltration

13) What happens when the air temperature reaches the Dew Point?

14) What can you do to help control moisture in a crawlspace?

15) List some examples of thermal by-passes.

16) What are some clues that you might have thermal by-passes in a building?

17) What are some tools and materials that you can use to fix thermal by-passes?

18) Match the house problem on the left with to the appropriate weatherization materials solution on the right. (You may use more than one letter for each problem.)

Band Joist bypass	_____	A. High-temp caulk
Hole around furnace flue pipe	_____	B. Silicone caulk
Top of a ballooned frame wall	_____	C. 5/8" sheet rock
Leaky rim joist	_____	D. 1/2" sheet rock
Hole surrounding vent-stack	_____	E. dense-pack cellulose
Uninsulated exterior walls	_____	F. dense-pack fiberglass
Non-IC rated recessed attic can	_____	G. Great Stuff Foam
Uninsulated and leaky attic hatch	_____	H. 3/4" foam weatherstripping
Top plate drilled for electrical cable	_____	I. Loose-fill fiberglass
Interior Wall 'connected' to the attic	_____	J. 26 ga sheet metal
Uninsulated attic floor	_____	K. Fiberglass batt
		L. Foam board
		M. Fire Block Sealant

Day 2 Exercises

Section 6: HVAC

- 1) Why should we care about duct leakage?

- 2) What are some common problems caused leaky supply ducts?

- 3) List some common problems with poorly installed flex duct.

- 4) A 180 degree turn in flex duct is equal to about _____ feet of 'extra' ductwork and results in _____ drop.

- 5) What can happen when uninsulated ducts run through unconditioned spaces during the winter?

- 6) Why do we use pressure pans?

7) When is it approved to use duct tape on ductwork?

8) In a warm air furnace, where would you find the highest pressures?

9) Enter any missing steps in the flex-duct installation process shown below.

Step 1: Apply mesh tape

Step 2: Add mastic

Step 3: Slip on the inside of the duct insulation

Step 4: Slip on the external insulation sleeve

Step 5: Apply mastic and a zip tie

10) What are some problems with panned returns?

Section 7: Preparing for Insulation

11)What problems do we often see with bathroom fans?

12)What are some causes of ice dams?

13)What should you do in an attic before you insulate.

Section 8: Ventilation Systems

(Circle **True** or **False** for the following questions.)

14)**True** or **False**: Make-up air should be provided for kitchen fans exhausting more than 200 CFM.

15)**True** or **False**: Ventilation must always run continuously.

Day 3 Exercises

Sections 9-13: Baseload, Insulation Basics, Dense-pack, Knee-walls, Attic Doors

1) In the list below, circle the letter of every baseload measure?

- a. Compact fluorescent lights
- b. Insulating water heaters
- c. Blowing attic insulation
- d. Wrapping hot water pipes
- e. Low flow shower heads/aerators

2) **True** or **False**, baseload does not include heating and cooling. _____

3) What should you do when insulating a natural gas hot water tank?

4) You have two air-sealed attics in Santa Fe, NM. One is insulated to an R-19 with blown cellulose. The other is insulated to an R-30 with blown fiberglass. What attic will lose more heat over the winter season? (Circle one):

R-19 Attic

R-30 Attic

5) You have a home with the following:

- 1,200 ft² attic
- *Existing* R-value: 8
- *Desired* R-value: 38

How many inches of cellulose would you have to blow into this attic? _____

6) Dense-pack cellulose insulation should have a density of: _____

- a. 2.5 lbs/ft³
- b. 3.5 lbs/ft³
- c. 7.5 lbs/ft³
- d. Depends upon the thickness of the wall

7) Dense-pack fiberglass insulation should have a density of: _____

- a. 2.5 lbs/ft³
- b. 3.5 lbs/ft³
- c. 2.2 lbs/ft³
- d. You shouldn't dense-pack fiberglass

8) An average 25 lb. cellulose bag will dense-pack _____ cubic feet:

- a. 2.5
- b. 7.1
- c. 5.1
- d. Depends upon the type of blowing machine you're using

9) When should you follow Lead Safe practices?

10) What are some problems with attic knee walls?

11) What are the size limitations when installing an interior attic access in the ceiling?

Maximum size: _____ Minimum size: _____

12) What are the New Mexico Standards for weatherizing an interior attic access?

13) **True or False:** In pre-1978 homes, installation of an attic access does not require the use of lead-safe work practices.

14) Why is it a best practice to use a **Dense-Pack Test Box**?

Health and Safety

Jobsite Quick Reference Sheet

Carbon Monoxide (CO) Ambient

- 9ppm – “Evaluate” – Work may continue. Source must be found and fixed.
- 35ppm – “Evacuate” – WORK MUST STOP. Move all crew and clients to safety.
- Ventilate area. Once level is below 35ppm, identify source. Problem must be fixed before work can resume.

Lead-Based Paint (pre-1978)

- Required Training – EPA Lead Paint Renovator & DOE LeadSafe Weatherization
- Use containment to minimize the spread of paint dust.
- Use controls to limit the production of paint dust.

Friable Asbestos

- Required Training -EPA AHERA
- DO NOT DISTURB.
- Do not use tools that may create asbestos dust.

Mold and Other Biological Hazards

- Refer to New Mexico Weatherization Assistance Program Technical Standards -Section 4000

Table 6.1: R-values Per Inch For Common Insulating Materials

R-Values Per Inch For Common Insulating Materials	
Insulating Material	Avg. R-Value Per Inch
Mineral wool	3.2
Fiberglass batt	3.2
Vermiculite	2.1
Perlite	2.7
Cellulose*, open-blow in attic	3.7
Cellulose*, dense-packed	3.4
Fiberglass (loose fill)	2.2
Rock Wool (loose fill)	2.2
Expanded polystyrene board (cut-cell surface)	4.0
Extruded polystyrene board (smooth cell surface)	5.0
Polyisocyanurate board, foil faced	6.0
Two-component polyurethane foam	6.0
* For the New Mexico weatherization program, cellulose insulation must be the borate-only grade.	

Excerpts from NM Energy\$mart Technical Standards:

1200 Scope

1. The goal for the New Mexico Energy\$mart Program (hereinafter referred to as NM Energy\$mart) is:

"To reduce costs for low-income New Mexican families, particularly for the elderly, people with disabilities, and children, by improving the energy efficiency of their homes and ensuring their health and safety."
2. The New Mexico Energy\$mart Technical Standards are referred to throughout this document as the "Standards."
3. The Standards shall apply to all local administering agencies (subgrantees) providing weatherization program services.
4. The Standards provide minimum guidelines for the installations of energy conservation measures and repairs. Materials and measures that are allowed or not allowed will be specifically designated.
5. These Standards are not intended to abridge safety, health, environmental, local codes, or other ordinances. Such requirements, if more stringent than these, shall apply; if these Standards are more stringent, the Standards shall apply.
6. All questions concerning the content or implementation of the Standards should be directed to the New Mexico Mortgage Finance Authority (MFA).

1600 Deferral of Weatherization

There are some situations in which an agency or contractor should not, or may choose not to, weatherize an otherwise eligible unit. In order to deal with these cases, the MFA implements the deferral policy for all agencies administering the Energy\$mart Program. This policy allows weatherization staff to postpone services when certain conditions or circumstances exist. However, an agency should define its intentions at the time a condition occurs. At a minimum, the agency/contractor deferral/postponement policy must contain these elements:

1. *Postponement of Weatherization Services:* An agency or contractor may postpone weatherization services under the following conditions:
 - a. A dwelling unit is vacant.
 - b. A dwelling unit is for sale.
 - c. A dwelling unit is scheduled for demolition.
 - d. ***A dwelling proves to be dilapidated or structurally unsound and unsafe. Dilapidated units are classified as those which do not provide decent, safe, and sanitary shelter in their present state and have defects so serious and numerous that the repairs required to reinstate the structure to standard condition would not be economically feasible.***
 - e. ***A dwelling unit is deemed by the auditor to pose a threat to the health or safety of the crew or contractor.***
 - f. A mobile home is improperly installed (for example, within adequate supports).
 - g. A dwelling unit is uninhabitable (for example, a burned-out apartment).
 - h. ***A building is affected by mold and mildew and the area affected is too large for the weatherization crew or contractor to remediate.***

- i. ***The client is uncooperative with the weatherization agency or its contracted agent, either in demanding that certain work be done, refusing higher priority work which is needed, being abusive to the work crew or contractor, or by being unreasonable in allowing access to the unit. Every attempt should be made to explain the program and the benefits of the work. If this fails, work should be suspended and the MFA should be consulted. In such cases, documentation is required.***
- j. Obvious discrepancies are found between the in the information supplied by the client on the application and observed conditions at the time of weatherization. The agency or contractor must resolve these discrepancies before weatherization work can continue.
- k. If, at any time prior to the beginning of work (work officially begins when the audit is performed), the agency or contractor determines that the client is no longer eligible, or personnel believe that circumstances may have changed, the unit shall not be weatherized until updated information can be obtained from the client.
- l. ***There are rats, bats, roaches, reptiles, insects, or other animals or varmints that are inadequately or not properly contained on the premises.***
- m. ***There are health or safety hazards that must be corrected before weatherization services may begin including, but not limited to:***
 - i. *The presence of animal feces and/or other excrement,*
 - ii. *Disconnected waste water pipes,*
 - iii. *Hazardous electrical wiring,*
 - iv. *The presence of unsafe levels of mold or mildew, or*
 - v. *Unvented combustion appliances or actionable levels of ambient carbon monoxide.*
- n. There are illegal drugs or illegal activities occurring on the premises.
- o. ***The client or owner is physically or verbally abusive to any personnel.***
- p. The dwelling unit or parts thereof are being remodeled and weatherization work is not coordinated with a housing rehabilitation program.
- q. The eligible household moves from the dwelling unit where weatherization activities and services are in progress. In such a case, the agency or contractor must determine whether to complete the work, and the circumstances must be documented in the client file.
- r. One or more occupants in a dwelling have been diagnosed with a contagious and life-threatening disease.
- s. ***When a person's health may be at risk and/or the work activities could constitute a health and safety hazard, the occupant at risk will be required to take appropriate action based on the severity of the risk. Failure or the inability to take appropriate actions must result in deferral of the weatherization work.***
- t. In unusual situations not covered above or where other problems of a unique nature exist, MFA should be consulted.

2. Procedure

- a. If an agency or contractor cannot, or chooses not, to weatherize a dwelling unit, it must notify the client or owner/authorized agent by use of the Deferral of Services Form or some other appropriate agency form or process which might include:
 - i. The nature and extent of the problem(s) and how the problem(s) relate(s) to the determination not to weatherize the unit;
 - ii. Any corrective action required before weatherization services can be initiated;
 - iii. A time limit for correcting problems so that weatherization services may be rescheduled;
 - iv. The name of the person or entity responsible for correcting the problem(s); and
 - v. The right of appeal.
- b. All documentation justifying the decision to postpone services must be kept in the client file.

4100 Health and Safety Requirements

While the primary purpose of the NM EnergySmart Program is to reduce the energy use in low-income dwellings, it is necessary on occasion to make related repairs and to mitigate health and safety concerns which may not result in a decrease in energy use or in monetary savings. Therefore, as part of the NM EnergySmart Program, the following health and safety standards have been developed with the objective of providing general guidance to agencies and subcontractors doing work within the program. All persons providing services under this program shall be governed by these requirements.

In those instances where the existing conditions are perceived to **pose a threat to the crew or contractor's health and safety**, the NM EnergySmart Program allows technical waivers for any audit or inspection process, installation, or any portion of the weatherization activity.

Under these Standards, health and safety assessments of the following must be performed:

1. Hazardous conditions and materials assessment, including, but not limited to:
 - a. Friable asbestos
 - b. Unsafe levels of combustion byproducts, including carbon monoxide.**
 - c. Human or animal waste within the occupied dwelling.**
 - d. Unsafe and excessive levels of chipping and peeling lead paint in pre-1978 homes. This is of particular concern on interior surfaces and components.**
 - e. Mold or mildew.**
 - f. In homes where radon may be present:
 - i. Provide the client with EPA's consumer guide to radon.
 - ii. Whenever conditions permit, exposed dirt must be covered with a vapor permeable ground cover.
 - iii. In dwellings where radon may be present, precautions should be taken to reduce the likeliness of making radon concentrations higher.
 - iv. Radon mitigation is not required by DOE.
 - v. Radon testing is not an allowable DOE expense.
2. Air quality assessment, including:
 - a. Interviewing client(s) regarding health conditions of occupants with the intent of determining if air quality is unacceptable.
 - b. Determination of ventilation needs for ensuring acceptable indoor air quality. Mechanical ventilation requirements shall be based on *Ventilation and Acceptable*

3. Combustion systems assessment, including:
 - a. Combustion safety testing, including worst-case depressurization spillage, draft, and carbon monoxide testing in appropriate dwellings before and after weatherization work. Additionally, it is required that worst-case depressurization testing be done while the work is being done, just before the crew or contractor leaves the job site for the day.
 - b. Fuel storage and fuel distribution hazards, including oil tank or propane storage problems and oil, propane, and natural gas distribution line leaks.
 - c. Hazardous combustion appliance conditions.
4. ***Assessment of crew, contractor and client safety concerns.***
 - a. ***All materials stored on the job site for weatherization work must be stacked, organized, and properly marked so that it does not pose a hazard to clients, neighbors or weatherization personnel.***
 - b. ***All weatherization work must be performed in a manner that does not create a known hazard to clients, neighbors, or weatherization personnel.***
 - c. ***For pre-1978 homes where lead testing has been completed and lead is found to be present, all weatherization work must be performed by weatherization personnel certified lead-safe work practices.***
5. Reclaim any refrigerants using procedures of the Clean Air Act 1990, section 608, as amended by 40 CFR82, May 14, 1993.

4300 Client Health and Safety

1. Weatherization services must be provided in a manner that minimizes risk to clients.
2. Health and safety issues should be addressed as part of the client education process, both verbally and by distributing educational pamphlets (when available) during the audit "walk-through." This can be particularly effective as the auditor notices and discusses potential hazards.
3. ***Dwellings with unvented (vent-free) combustion appliances used as a primary heat source, with the exception of gas ranges, may not be weatherized until such appliances are properly vented to the outdoors (according to the appropriate code) or removed.***
4. *Building owners and clients must be notified of any health or safety problems that require terminating the weatherization work. Documentation of this notification must be included in the client file.*
5. It is preferred that agencies minimize or restrict the use of materials that may be hazardous to the client; however, if the agency must use hazardous chemicals, it must be discussed with the client prior their use.
6. Special precautions must be taken if the occupant of the home has respiratory ailments, allergies, is pregnant, or has unique health concerns.
7. *Agencies should try to protect all clients from respirable particles, such as paint or insulation dust, during the weatherization process.*
8. *The installation of hazardous materials must be done in well-ventilated areas.*
9. ***Weatherization personnel shall not smoke cigarettes, cigars, or pipes in a client's home or outdoors within 25 feet of the client's home.***
10. If strong smelling chemicals, such as formaldehyde, are detected in the client's home, agencies should not perform any weatherization measures that would reduce the

natural air leakage of the dwelling, unless mechanical ventilation is present or installed.

11. At a minimum, auditors and weatherization personnel should inform property owners of safety problems, code problems, and other health and safety issues. These items might include:
 - a. Hazardous levels of carbon monoxide.
 - b. Raw sewage leaking from waste plumbing pipes.
 - c. Mold and moisture.
 - d. Friable asbestos.
 - e. Radon gas.
 - f. For lead safe weatherization requirements, please see Section 41200 on page 26 of the NM EnergySmart Standards.

4400 Agency Health and Safety

1. When in doubt, agencies should seek consultation services from an OSHA subsidized professional safety consultant (See: OSHA Publication # 3047, Consultation Service for the Employer) for identifying hazards and developing a worker health and safety program.
2. Agencies must have an approved Health and Safety Policy in place to protect worker health and safety.
3. The Health and Safety Policy should specify:
 - a. That Material Safety Data Sheets (MSDS) must be on the job site and available to medical personnel.
 - b. Where employees should go for treatment.
 - c. A written procedure for reporting medical emergencies.
 - d. A written procedure for reporting non-emergency accidents.
 - e. How to provide prompt medical attention for serious injuries.
 - f. How to provide prompt transportation or contact an ambulance in the case of a serious emergency.
 - g. That telephone numbers of physicians, hospitals, or ambulances should be conspicuously posted.
 - h. That a first aid program should be in place. It should include the following:
 - i. First aid training provided to at least one member of each crew/contractor.
 - ii. CPR training provided to at least one member of each crew/contractor.
 - iii. One complete first aid kit per vehicle.
 - iv. One eye-wash station with at least one refill per vehicle.
4. Agencies must establish a Personal Protective Equipment Program. This program should include the following:
 - a. Respiratory Protection Procedures that provide employees with the following:
 - i. The proper personal respiratory protection equipment.
 - ii. Respirator fit testing, by a trained person.
 - iii. Training to employees on respirator use.
 - iv. Medical examination of pulmonary capacity with a frequency recommended by appropriate OSHA standards.
 - b. Eye protection should be made available when appropriate.
 - c. Gloves and protective coveralls should be made available when needed to protect worker health or safety.
5. Agencies should have in place a Tool Safety Program designed to protect employees from work place hazards. This program should ensure the following:
 - a. Tools are safe and adequate for the job.

- b. Ground-fault protection is provided for power tools.
 - c. Employees are trained in the safe and proper operation of tools and equipment used in their work.
 - d. Safety guards are in place on all tools that come equipped with such devices.
 - e. Ladders and scaffolding are adequate for use, have the proper weight rating, and are constructed of non-conductive material.
 - f. That hearing/ear protection is provided to individuals working around high decibel equipment or in high dust environments.
6. It is preferred that the agencies have a Fire Protection Program. This program should include the following:
- a. Fire extinguishers are provided and are:
 - i. Located in the agency offices and warehouse.
 - ii. Located in each vehicle.
 - iii. Inspected regularly.
 - b. Training on fire extinguisher use.
 - c. Fire emergency procedures.
7. It is preferred that agencies have a Job Hazards Identification Program. This program should include the following:
- a. Investigation of job-specific safety hazards.
 - b. Hazard Communication Procedures that include the following:
 - i. Written policies for dealing with job hazards.
 - ii. All hazardous materials containers labeled with:
 - 1. Hazardous chemical contents.
 - 2. Hazard warning appropriate for employee protection.
 - 3. Legible and prominent labels on all containers.
 - iii. Means of communication for non-routine tasks and unlabeled chemicals.
 - iv. A means for the exchange of information between agencies and sub-contractors regarding hazardous materials.
 - c. A catalog of Material Safety Data Sheets (MSDS) for all hazardous material that is made available to all employees, kept on file at the agency offices, and on all jobs sites. The MSDS catalog should contain the following for each hazardous substance:
 - i. Its chemical and common name.
 - ii. Its physical and chemical characteristics.
 - iii. Known acute, chronic and related health effects.
 - iv. Precautionary measures.
 - v. Exposure limits.
 - vi. Identification of carcinogens.
 - vii. First aid procedures.
 - d. Implementation of a Hazardous Material Communication Policy. Such implementation should include the following:
 - i. Information on where hazardous materials are located and where they are used.
 - ii. Employee information and training on hazardous materials.
 - iii. Training conducted at the time of initial assignment or whenever a new hazard is introduced to the work environment.
 - iv. How to read and interpret labels and MSDS.
 - v. How to obtain and use information on the hazards of a chemical and how to implement protective measures.
 - e. A Hazardous Chemicals List that is made available to employees.
 - f. Written hazard evaluation procedures for agencies.
 - g. Written materials on workplace hazards for agencies.

41400 Energy Related Mold and Moisture

Moisture, mold, and mildew can seriously affect the health and safety of the client and crew. Steps must be taken to alleviate moisture problems. The New Mexico Weatherization Program shall ensure that regular weatherization work is performed in a manner that does not contribute to the increase of any mold problems and when the work is performed properly, can alleviate many mold conditions.

41414 Dryer Vents

1. **Electric and gas dryers must always be vented to the outdoors.**
 - a. **Dryer vent pipe should not be installed with sheet metal screws or other intrusive fasteners that will collect lint (according to NFPA 54).**
2. **Extend mobile home dryer vents through the skirting to the outdoors.**
3. Dryer vent ductwork should be smooth-surfaced. No more than two 90° elbows may be used in the vent system, and the ductwork should not exceed 15 feet. If three 90° elbows are required, the total length of the vent may not exceed 10 feet. Alternately, the duct diameter can be upsized 1 or 2 inches.

41600 Combustion Safety Testing

With the integration of blower door technology and dense pack sidewall insulation, houses are being sealed tighter than ever before. In accordance with the "house-as-a-system" approach to weatherization, we recognize that there can be existing indoor air quality conditions that may be intensified by air sealing techniques.

1. Therefore, the following health and safety measures must be performed on all combustion appliances of weatherized homes.
 - a. **Measurement of ambient carbon monoxide concentrations should be done. If any ambient level of CO above 9 ppm is found, the source must be identified and the problem corrected.**
 - i. The energy auditor should enter the dwelling with their CO measurement instrument running so that they can check the ambient CO concentration throughout the dwelling.
 - ii. An ambient air test for CO should be taken on coal, wood, unvented heaters and gas cook stoves.
 - b. A CO test of undiluted flue gases must be done on all vented combustion appliances. If a CO level above 100 ppm as-measured is found in the undiluted flue gas sample, corrective action must be taken to reduce the CO to acceptable levels. If readings are detected above the minimum levels, no weatherization work is to be done until the problem is corrected.
 - c. **A gas leak detection test must be taken on all natural and LP gas appliances and supply lines. All gas leaks must be repaired before any work is done. Oil supply lines and components must also be checked for leaks.**
 - d. **Spillage and draft tests on all Category I natural gas, LP gas and oil appliances must be performed under worst-case depressurization conditions to ensure an adequate venting.**
 - e. An inspection of the vent system must be completed to ensure that the proper size and type of pipe is used, the condition of the vent pipe is satisfactory, the clearance meets applicable codes, and the vent system is unobstructed.
 - f. Identify the combustion air source and make sure it is unobstructed and sufficient, as defined by NFPA code.
2. A detailed description of these tests can be found in Section 13800 on page 120.

3. The local agency is responsible for any potential health and safety problems that will be compounded if prescribed conservation measures are installed. For example, if a furnace is emitting unacceptable levels of CO, it is likely that tightening the home would increase the problem. Therefore, **this problem must be fixed before any air sealing is completed.**

41700 Carbon Monoxide Alarms

1. At least one CO alarm must be installed in each weatherized dwelling. Follow the manufacturer's recommendations for locating and installing the alarm. Typically, alarms are installed where the clients spend most time, such as near bedrooms. If an entire multi-family building is to receive weatherization services, a CO alarm should be installed in each unit of the complex.
 - a. Combustion appliances are defined as any piece of equipment (such as a water heater, cook stove, or heating system) that burns a fuel such as wood, kerosene, oil, natural gas, or propane.
 - b. Unvented space heaters are expressly prohibited in weatherized homes unless they are a secondary heat source.
2. All installed CO alarms must:
 - a. Be listed as UL 2034 compliant.
 - b. Have an electrochemical sensor with a 5-year warranty.
 - c. Be a plug-in type with a battery backup or battery operated units with a 5-year warranty.
 - d. Have a sensor life monitor that alarms after 5 years or at the expiration of the useful sensor life.
 - e. Have a digital LCD display.
 - f. Sample ambient air at least every 2 minutes.
 - g. Have an alarm of 85 decibels at 10 feet.
 - h. Be capable of displaying: the current CO level detected from 1 ppm to 500 ppm CO, the peak level detected, the total time peak level was recorded.
3. Customer education is a vital part of protecting households from the dangers of CO. Ensure that client education regarding the potential hazards of combustion appliances is delivered.
4. The cost of the CO alarm or combination CO and smoke alarm is a health and safety material cost.

41800 Smoke Alarms

If smoke alarms are inoperable or non-existent, at least one alarm must be installed in each weatherized dwelling. If existing hard-wired smoke alarms are inoperable or broken, they must be replaced with comparable units.

41200 **Lead Safe Weatherization (LSW)**

Each agency must give notification to the occupants of homes to be weatherized regarding the potential hazards of lead paint and lead paint dust if the home was built prior to 1978. EPA's publication "Renovate Right: Important Lead Hazard Information for Families, Child Care Providers and Schools" must be given to an adult occupant of the affected home. For occupied homes, the weatherization staff, crew, or contractor must have an adult tenant or homeowner sign an acknowledgement after receiving the pamphlet. The pamphlet can also be sent by certified mail with receipt to be placed in the customer file.

Lead-Safe Weatherization (LSW) includes weatherization worker protection, general LSW work practice standards, and lead dust containment standards. Please refer to the latest weatherization program standard for details.

1. Level 1 Containment.
 - a. Level 1 containment is required in pre-1978 homes when less than 6 ft² of interior painted surface per room or 20 ft² of exterior painted surface will be disturbed.
 - b. Level 1 containment consists of methods that prevent dust generation and contains all debris generated during the work process. The containment establishes the work area which must be kept secure.
 - c. Measures that may fall within this guideline include:
 - i. Installing or replacing a thermostat.
 - ii. Drilling and patching test holes.
 - iii. Replacing HEPA filters and cleaning HEPA vacuums.
 - iv. Changing furnace filter.
 - v. Removing caulk or window putty (interior).
 - vi. Removing caulk or window putty (exterior).
 - vii. Removing weatherstripping.
2. Level 2 Containment.
 - a. Level 2 containment is required when Weatherization activities will disturb more than 6 ft² of interior surface per room or 20 ft² of exterior surfaces in homes built prior to 1978. Level 2 containment consists of methods that define a work area that will not allow any dust or debris from work area to spread. Level 2 containment requires the covering of all horizontal surfaces, constructing barrier walls, sealing doorways, covering HVAC registers with approved materials, and closing windows to prevent the spread of dust and debris.
 - b. Measures requiring level 2 containment may include:
 - i. Drilling holes in interior walls.
 - ii. Drilling holes in exterior walls, removing painted siding.
 - iii. Cutting attic access into ceiling or knee walls.
 - iv. Planing a door in place.
 - v. Replacing door jambs and thresholds.
 - vi. Replacing windows or doors.
 - vii. Furnace replacements.
 - c. Additionally, Level 2 containment must ALWAYS be used where any of the following is conducted (even if the activities will disturb less than the hazard levels within the Level 1 category):

- i. Window replacement.
 - ii. Demolition of painted surface areas.
 - iii. Using any of the following: Open-flame burning or torching; machines to remove paint through high-speed operation without HEPA exhaust control; or operating a heat gun at temperatures at or above 1100 F°. Note that the use of a drill, reciprocating saw, or other power tool is considered a “machine” for removing paint. As examples: Cutting an attic hatch inside the dwelling or interior drilling of holes for the installation of insulation require level two containment.
- 3. There must be adequate documentation in the client file to demonstrate that lead safe weatherization measures were performed when necessary. Documentation should include photos of the site and containment set up, as well as a listing of materials used and measures taken. Post work inspector must also certify that LSW procedures were used and properly implemented.
- 4. New Mexico Weatherization will adhere to EPA lead safe rules as written in the “Lead; Renovation, Repair, and Painting Program” Final Rule (LRRPP Final Rule), as directed by DOE.
- 5. Weatherization of HUD program housing stock, including HUD Section 8, is infrequent in New Mexico. These units will only be weatherized if HUD will provide certification that abatement or control of any lead paint hazard has been addressed, and will agree that the local agency will not be liable for any lead hazards, provided the safe work practices generally outlined above are employed.

In cases where the agency cannot safely weatherize a home due to lead paint hazards, the agency may defer the work. Such deferral will be considered by the state on a case-by-case basis. Agencies may not weatherize dwellings where there are cases of documented or suspected lead poisoning. Additionally, they shall not weatherize homes where there is an extraordinary lead paint hazard with no means to abate the hazard, including insufficient funds or insufficient training to properly address the hazard.

41500 Ventilation Systems for Acceptable Indoor Air Quality

An ideal ventilation strategy provides spot exhaust ventilation where the moisture and other pollutants are created, and also provides dilution ventilation to the entire home to provide fresh air for the occupants.

ASHRAE 62.2-2010, *Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings*, shall be used for the installation of ventilation systems, both local ventilation and whole-building ventilation.

Existing operable fans that will remain in place and serve as part of the ventilation system shall be measured for CFM airflow. This airflow shall be recorded.

1. Bathroom ventilation
 - a. Must have on-demand fans that exhaust at least 50 CFM and are controlled by an on/off switch or a time-delay-shutoff switch; or
 - b. Must have continuously operating 20 CFM fan. A continuously operating bathroom fan or a programmed intermittently operating fan may serve as the whole-building ventilation.
 - c. If a bathroom does not have this amount of ventilation stated in 1.a. or 1.b. above, it must be provided or Appendix A of ASHRAE 62.2-2010 must be used for sizing whole-building ventilation.
 - d. Installed fans must have a back-draft damper at the fan, at the duct termination, or at both locations.

2. Kitchens ventilation
 - a. Must have on-demand fans that exhaust at least 100 CFM and are controlled by an on/off switch. A vented range hood is required if the fan airflow is less than 5 kitchen ACH; or
 - b. Must have continuously operating fan that exhaust at least 5 ACH based on kitchen volume. A continuously operating bathroom fan or a programmed intermittently operating fan may serve as the whole-building ventilation.
 - c. If a kitchen does not have this amount of ventilation stated in 2.a. or 2.b. above, it must be provided or Appendix A of ASHRAE 62.2-2010 must be used for sizing whole-building ventilation.
 - d. Installed fans must have a back-draft damper at the fan, at the duct termination, or at both locations.
 - e. Make-up air should be provided for kitchen fans exhausting more than 200 CFM.
3. Whole-building ventilation operating continuously shall be no less than 7.5 CFM per person + 1 CFM per 100 ft² of conditioned floor area. If the number of people living in the dwelling is not known, or if the number of bedrooms plus 1 is greater than the number of people, the number of bedrooms plus 1 shall be used to determine the occupant number.
 - a. This ventilation may operate intermittently, but
 - i. The CFM airflow must be increased accordingly while the fan is operating. For example, a flow rate of 25 CFM for continuous operation would be increased to 50 CFM for 30 minutes-on-30-minutes-off operation.
 - ii. The fan must operate at least once every 4 hours.
 - iii. The fan must be controlled automatically.
 - iv. The fan control must be appropriately labeled.
 - b. If the bathroom and/or kitchen fans do not satisfy the requirement of 50 CFM and 100 CFM airflow rates, respectively, Appendix A (Alternative Compliance Supplement) must be used when sizing the minimum whole-building airflow rate.
 - c. The whole-building ventilation may be a single exhaust fan, multiple exhaust fans controlled appropriately, or a balanced systems, such as a heat recovery ventilator. It may also be part of the furnace/central air-conditioning air handling system.
 - i. Local bathroom and/or kitchen exhaust fans are permitted to be part of the whole-building ventilation system.
 - ii. The system must be designed to operate during all occupiable hours. A readily available override control must be provided to the occupant.
 - d. Whole-building minimum ventilation requirements shall be determined with ZipTest Pro³ software for the TI-89 calculator, version 1.2 or later; ResVent 62.2 for the iPhone, version 1.1 or later; or by another method acceptable to New Mexico MFA.
 - i. The infiltration credit shall be calculated as part of the procedure and be based on ASHRAE 119 and 136, and
 - ii. The alternative compliance supplement (Appendix A of ASHRAE 62.2-2010) shall be included when bathrooms or kitchens do not meet the local ventilation requirements.
 - e. Whole-building ventilation discretionary threshold.
 - i. If the whole-building minimum ventilation requirement is 15 CFM or less, the energy auditor may decide to install a whole-building ventilation system or not. The reasons for not installing a ventilation system when the minimum CFM requirement is between 1 and 15 shall be documented in the client file. This decision shall be based on:
 1. The moisture assessment of the dwelling,
 2. The indoor air quality assessment of the dwelling,

3. The health of the occupants, and
4. Other factors deemed significant by the energy auditor.
- ii. If the whole building minimum ventilation requirement is greater than 15 CFM, a system supplying the design ventilation airflow must be installed unless a written waiver is granted by NM Finance Authority.
- f. Installed fans must have a back-draft damper at the fan, at the duct termination, or at both locations.
4. Fan sound ratings
 - a. Fan sound ratings shall be equal to or less than the ratings in Table 4-1.

Table 4-1

Maximum Fan Sound Ratings		
New Replacement Fans	Existing Retained Fans	Maximum Sound Rating
Local bath, on-demand		3.0 sones or 50 dBA*
	Local bath, on-demand	N/A
Local bath, continuous		1.0 sone or 30 dBA*
	Local bath, continuous	N/A
Local kitchen, on-demand		3.0 sones or 50 dBA*
	Local kitchen, on-demand	N/A
Local kitchen, continuous		1.0 sone or 30 dBA*
	Local kitchen, continuous	N/A
Whole-building		1.0 sone or 30 dBA*
	Whole-building	1.0 sone or 30 dBA*
* A-weighted decibels measured at 5 feet from fan grille. Source: ASHRAE 62.2-2010.		

5. Ductwork
 - a. Ducts outside of the thermal envelope shall be insulated to a minimum of R-6¹.
 - b. Rigid ductwork with a smooth interior surface is recommended over flexible ductwork.
 - c. Duct support
 - i. Rigid ducts will be supported at intervals of 4 feet or less. Supports shall have a width of at least 1 ½ inches.
 - ii. Flexible ducts will be supported at intervals of 2 feet or less. The maximum amount of support between supports shall be ½ inch per foot of horizontal run, or less. Supports shall have a width of at least 1 ½ inches.

¹Based on 2009 New Mexico Energy Conservation Code, Section 14.7.6.14.

- d. Duct diameter will be equal to or greater than the exhaust fan outlet.
- e. Duct runs shall be as short as possible and shall have not more than one elbow of a maximum of 90 degrees.
- f. Kitchen fan ductwork shall be rigid, smooth metal of at least 30 gauge wall thickness.
- g. Rigid ducts
 - i. Metal-to-metal or metal-to-PVC connections shall be fastened with a minimum of at least three equally spaced screws.
 - ii. PVC-to-PVC joints shall be joined with approved PVC cement.
 - iii. In addition to mechanical fasteners, seal duct connections with UL 181B or 181-M listed material. *Exception: PVC connections.*
 - iv. Rigid ductwork shall be sized according to Table 4-2.
- h. Flexible ducts
 - i. Shall not be bent around framing members of other objects.
 - ii. Extend flex duct to its full length so that the excess length is no more than 5 percent.
 - iii. When flex duct is run through confined spaces, do not reduce the diameter of the flex duct in order to fit it within the space.
 - iv. Repair tears in flex duct vapor barrier using a recommended material.
 - v. Attach sections of flex duct according to the manufacturer's recommendations.
 - vi. Flex-to-metal or flex-to-PVC joints shall be fastened with tie bands using a tie band tensioning tool.
 - vii. Flexible ductwork shall be sized according to Table 4-2.

Table 4-2

Prescriptive Duct Sizing*								
Duct Type	Flex Duct				Smooth, Rigid Duct			
Fan Rating, CFM⁺	50	80	100	125	50	80	100	125
Duct Diameter, inches	Maximum Length, feet							
3	X	X	X	X	5	X	X	X
4	70	3	X	X	105	35	5	X
5	NL	70	35	20	NL	135	85	55
* This table assumes no elbows. Deduct 15 feet of allowable duct length for each elbow. + Fan rating @ 0.25 inches of water column. NL = no limit on duct length of this size. X = not allowed, any length of duct of this size with assumed turns and fitting will exceed the rated pressure drop. Source: ASHRAE 62.2-2010, Table 5.3, page 6.								

- i. Duct terminations, exhaust
 - i. The termination collar shall be at least the same equivalent size as the exhaust fan outlet.
 - ii. Termination fasteners shall not inhibit damper operation.
 - iii. Exterior termination will be flashed or weather sealed.
 - iv. Galvanized hardware cloth with no less than ¼ inch and not greater than ½-inch hole size will be used to exclude pests.

- v. Terminations shall be at least 3 feet from any property line or any operable opening in houses and at least 10 feet from any mechanical inlet.
 - vi. Metal or other approved material shall be used for the termination fitting for kitchen exhaust.
 - vii. All existing mechanical exhaust ventilation systems should terminate outside the building shell by extending the ventilation duct through the roof or sidewall. Soffit terminations should not be used.
- j. Exhaust grille location
 - i. For local bathroom or kitchen exhaust, the grille shall be installed in the space where contaminants are generated.
 - ii. For whole-building ventilation when other local bathroom and/or kitchen ventilation is present, the grille shall be located central location within the main body of the dwelling.
 - iii. For whole-building ventilation when no local ventilation is present, the grille shall be installed in the central bathroom with the highest moisture generation.
- k. Furnace air handle ductwork used as whole-building ventilation, supply ductwork from the outdoors to the return plenum
 - i. System shall be installed according to the manufacturer's instructions.
 - ii. Supply ducts shall be attached as close to the system as possible while remaining in compliance with manufacturer's specifications.
 - iii. System shall be set up to provide filtration of air before reaching the air handler system. Intake filters shall be accessible for maintenance, shall not produce ozone, and the occupant shall be educated on how and when to change the filter.
 - iv. A motorized damper will be installed between the intake fitting and the return side of the air handler. The damper control will be linked to the programmed operation controlling device. This damper will be accessible for maintenance.
 - v. Intakes for supply air shall be:
 - 1. 6 feet above grade;
 - 2. At least 10 feet from exhaust outlets, plumbing vent outlets, or combustion vent outlets;
 - 3. Above local snow or flood line; and
 - 4. 18 inches above an asphalt-based or flat roof.
 - vi. Airflow CFM shall be measured during commissioning.
- 6. Attached garage exhaust fans
 - a. Any ventilation in garages shall be exhaust only.
 - b. Leakage between the garage and the living area of the dwelling shall be tested for leakage.
- 7. Instructions, labeling, and client education²
 - a. A ventilation system operation guide designed for the occupants (non-professionals) to explain why the system was installed and how to operate and maintain the system.
 - b. This guide shall be reviewed with the occupants.
 - c. Controls shall be labeled as to their function, unless that function is obvious (such as on-demand bathroom exhaust switches).
 - d. Clients shall be asked to sign a document attesting to the fact that they have been informed about the installed ventilation system.
- 8. Commissioning

² Please refer to ASHRAE Guideline 24-2008, Chapter 13, Operations and Maintenance Documentation, for guidance.

- i. Airflows of local bathroom and kitchen fans and whole-building fans shall be measured after installation to ensure that the design CFM airflow has been achieved.

5000 Air Sealing Guidelines

Although no prescriptive list of treatments is applicable to every dwelling type, there are treatments that are typically cost-effective when applied to most dwellings. Air sealing is cost effective in the vast majority of dwellings; the difficulty is determining the amount of air sealing to do. In all cases, air sealing should be continued in a dwelling until it is no longer cost effective. The procedures below are intended to help the crew or contractors find the cost-effective level of air sealing.

It is important to remember that when air sealing, an air barrier or pressure boundary is being created. It is best if this pressure boundary is:

1. Aligned with the thermal boundary (insulation);
2. Airtight and continuous;
3. Durable so that it will last as long as the insulation with which it is aligned.
4. Tested for tightness and thoroughness before insulation is installed.
 - a. As an exception to this, dense-packed wall insulation serves as a good insulator (thermal boundary) and it also serves as an air barrier (actually a retarder). Unless there are holes in a wall large enough to allow loose insulation to escape, air sealing does not need to be done before the installation of the wall insulation.

Air leaks can be found in a number of ways. These include:

1. Use of an infrared camera before and then during the initial blower door test (when the temperature differences between the outdoors and indoors are large enough, the blower door should run for 10 to 15 minutes to allow the surfaces to cool/warm as a result).
2. Observing tracer smoke movement while a blower door is depressurizing/pressuring a dwelling.
3. Almost fully closing an interior door while a blower door is depressurizing/pressuring a dwelling and using your hand to feel for airflow through the small opening of the door.
4. Looking for dirt marks on existing fiberglass insulation. The fiberglass filters out the dirt which is what you see deposited on the fiberglass.
5. Spiders tend to build webs near airflow to catch insects. Where there are webs, there is usually air leakage.
6. Watching spider webs or other objects move in the airflow created by a blower door.
7. Listening for airflow (whistles) during a blower door test.

Air sealing shall begin with gross air sealing and then move to blower door guided air sealing. It is preferred to have a blower door set up so that the effectiveness of air sealing can be measured as the crew or contractor progresses through the process.

5100 Gross Air Sealing

Gross air sealing includes obvious large holes, missing envelope components like window glass or door panels, or doors or windows that are stuck open. Eliminating these air leaks is obviously cost effective. It should always be noted in the client file whether the initial blower door test was done before or after gross air sealing.

1. Seal all large openings in the envelope (e.g., holes in the walls, floors, or ceilings, missing sheetrock, missing or broken glass, missing windows, etc.).
2. Continue with blower door guided air sealing.

5200 Blower Door Guided Air Sealing

As the name suggests, blower door guided air sealing utilizes a blower door during air sealing activities to guide the process. Operate the blower door in depressurization mode while inspecting for leaks. Do not forget to check for leaks in a conditioned basement. If inspecting for leakage in an attic, it is best to pressurize the dwelling with the blower door by reversing the blower door fan. This type of air sealing work is usually cost-effective only up to a point. Once that point is reached, air-sealing work should cease. Stop air sealing when:

1. The cost-effective guideline procedure (WCEG, Weatherization Cost-Effective Guidelines) included in the ZipTest Pro software package instructs the weatherization workers to stop air sealing (this procedure is not required, but is preferred by MFA); or
2. The Air Sealing Target (AST) CFM₅₀ value is reached.

Air leaks are to be sealed from the largest openings first and progressively working to the smaller leaks.

1. **Due to the stack effect, the most critical leaks are often those in the top part and lowest parts of the house. Always check:**
 - a. Chase ways around chimneys.
 - b. Plumbing and wiring penetrations.
 - c. Interior wall cavities.
 - d. Dropped ceilings.
 - e. Junctures between floors.
 - f. Electrical service entry.
 - g. Rim joist leaks.
 - h. Basement wall leaks.
 - i. Knee wall bypasses
2. Ensure all attic sealing is complete. Often the best method for detecting air leaks between the living space and the attic is by reversing the blower door fan to pressurize the house while the attic floor is inspected. **NOTE: Always seal the attic properly before installing attic insulation.**
3. In mobile homes seal the plumbing chase behind washer and dryer, water heater closet, under/behind bath tub, and around the electric panel box.
4. Seal all duct leaks, both supply and return lines if the ducts are located in unconditioned spaces such as attics or crawl spaces.
5. Seal or install dampers in other openings such as dryer vents, kitchen and bathroom exhaust fans, window air conditioners, unused fireplaces and flues, etc.
6. Install dense pack sidewall insulation in all walls separating conditioned living space from exterior or unheated spaces, using the methods described in these Standards. A blower door test should be done to assess the status of the air sealing work.
7. Openings in recessed light fixtures must not be sealed unless the fixture is rated as a "Type IC" (zero clearance) fixture. However, non-Type IC recessed light fixtures may be boxed with a non-combustible enclosure in the attic. The interior sides of the box must be at least three inches away from any part of the recessed fixture. Insulation may be in contact with the exterior sides of this box, but the top of the box enclosure may not be insulated.
 - a. Non-IC type recessed fixtures may be replaced with IC type if it is deemed cost effective.
8. If additional air sealing is needed, move on to these areas that are generally less effective. Such measures can include:
 - a. Tightening windows by weatherstripping or installing window channels. Re-glaze windows if there is noticeable air leakage, or if the window will likely deteriorate without re-glazing.

- b. Sealing doors with weatherstripping, sweeps, and thresholds. Make doors operate properly and replacement of entry locks as necessary.
- c. Caulking on the interior at baseboard, window, and door trim. This should only be done after walls are dense packed with cellulose and the operation of the blower door with tracer smoke indicates these areas are leaking.

5210 Air Sealing and Damming Around Chimneys and Vents

Special requirements are necessary for air sealing around chimneys and vents because of fire hazard. Follow the requirements below for such sealing.

1. Fire stopping around masonry chimneys “shall be of galvanized steel not less than 26 gauge thick or of noncombustible sheet material not more than ½-inch thick.”³ Such material must be used to seal gaps or chases greater than ¼ inch wide around masonry or metal chimneys. Aluminum flashing may not be used for this purpose. This fire-rated material must be sealed to the chimney and the surrounding framing and finish materials with high temperature caulking. Gaps of ¼ inch or less are to be sealed with high temperature caulking only. This treatment is intended to stop the flow of air and water vapor into the attic from these gaps or chases.
2. In addition to stopping the flow of air around a chimney, a block must be installed to keep insulation at least 2 inches from the masonry or metal chimney. This is to be accomplished with a block of a rigid material. If this material is not fire-rated, it must be at least two inches from the masonry or metal chimney.
 - a. If an existing chimney or flue is treated incorrectly, correct it to comply with these standards. If it is not reasonable to bring a chimney up to these standards, document this fact in the client file and include photographs

5300 Room-to-Room Duct-Induced Pressures

Room-to-room pressure(s) should be measured in all rooms with forced air heating return or supply ducts and operable doors with the air handler operating after all weatherization installations have been completed, but before post-weatherization combustion safety testing is performed.

When the dwelling is closed up in blower-door-test condition and the air handler is operating, the pressure difference across a closed interior door must be 3 Pascals or less. If the pressure difference is greater than 3 Pascals, the crew or contractor must lower the pressure to meet this requirement. Keeping these pressure differences below 3 Pascals reduces the dwelling air leakage when the air handler blower is running and interior doors are closed.

6250 Attic Access

1. There must be access to the attic provided for post work inspection and potential future needs of the client.
2. A gable vent on a hinged plywood or OSB door is considered adequate access.
3. An adequately sized gable vent held in place with screws (no nails) is acceptable if building a hinged door is impractical.
4. When it is necessary to install an interior attic access in the ceiling, it must be:
 - a. At least 16 inches by 20 inches and a maximum of 18 inches by 24 inches.

³ NFPA 211 *Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances*, 2006 ed., 7.1.6.3.

- b. Shall be weatherstripped and insulated to the same level as the attic floor, or with at least 4 inches of extruded polystyrene (R-20).
- 5. In pre-1978 homes, installation of an attic access must be performed using lead-safe work practices, and all dust and debris caused by the installation shall be wet-cleaned if lead has been found.
- 6. An attic ceiling access shall have an insulation dam on the attic side, made of rigid materials, that exceeds the height of the insulation to be installed. The dam must be strong enough to hold the weight of a person entering or exiting the attic. The use of fiberglass or other non-rigid material as a dam around the attic access is not allowed, unless limited roof height restricts rigid material. In such a case, thick fiberglass batts are allowable.
 - a. Examples of approved attic access insulation dam materials include:
 - i. Wood board of at least $\frac{3}{4}$ inch thickness.
 - ii. Plywood of at least $\frac{1}{2}$ inch thickness with $\frac{3}{4}$ inch by 2- $\frac{1}{2}$ inch strapping securely fastened to the exterior face of the plywood box, with the edge of the strapping flush with the top edge of the fabricated plywood box.
- 7. If there are no interior accesses, at least one exterior access to each attic space shall be left for inspection purposes. When it is necessary to install an interior access in a knee wall, it must be at least the width of the knee wall stud cavity and 24 inches high, and shall be weatherstripped and insulated to the same R-value as the knee wall. At least one latch shall also be installed to ensure air tightness. If it is unreasonable to provide permanent access to all knee wall areas, the attic and/or knee wall area must be inspected by a certified Post-Work Inspector before the area is sealed off. The insulation in the sealed knee wall area must be adequately documented in the client file with photo documentation.

If the attic access has pull-down stairs, a zipper insulating tent or prefabricated rigid insulation box is allowed.

6260 Attic Access Insulation

Any interior access hatch to the attic shall be weatherstripped and insulated with at least 4 inches of extruded polystyrene (R-20) that is properly secured to the exterior surface of the attic hatch.

6270 *Insulation Shielding and Blocking*

- 1. All electrical fixtures shall be blocked with rigid material to ensure a minimum insulation clearance of 3 inches and a maximum clearance of 6 inches.
 - a. Exceptions to this rule include Type IC (insulation contact) recessed lights, Type IC light/fan combinations and closed junction boxes.
- 2. No insulation, including fire-rated insulation, shall be installed above recessed light fixtures so as to trap heat or prevent free air circulation. However, insulation may be installed over Type IC (insulation contact) light fixtures.
- 3. Blocking must be installed so that it is effective in shielding the heat source from the insulation, and no insulation shall be left within the blocked area.
- 4. Metal blocking must be notched so that it does not contact electrical wiring.
- 5. Fire stopping around masonry chimneys “shall be of galvanized steel not less than 26 gauge thick or of noncombustible sheet material not more than $\frac{1}{2}$ -inch thick.”⁴ Such material must be used to seal gaps or chases greater than $\frac{1}{4}$ inch

⁴ NFPA 211, *Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances*.

wide around masonry or metal chimneys. Aluminum flashing may not be used for this purpose. This fire-rated material must be sealed to the chimney and the surrounding framing and finish materials with high temperature caulking. Gaps of $\frac{1}{4}$ inch or less are to be sealed with high temperature caulking only. This treatment is intended to stop the flow of air and water vapor into the attic from these gaps or chases.

- a. In addition to stopping the flow of air around a chimney, a block must be installed to keep insulation away from the masonry or metal chimney. This is to be done with a block of rigid material. If this material is not fire-rated, it must be at least 2 inches from the masonry or metal chimney.
- b. If an existing chimney or flue is treated incorrectly, correct it to comply with these standards. If it is not reasonable to bring a chimney up to these standards, document this fact in the client file and include photographs.

Name: _____

Date: _____

Air Sealing & Insulation Requirements Checklist:

Directions: Each student must demonstrate each of the following items and have it confirmed by the instructor before the end of class on Day 3. Failure to complete this checklist will result in a “non-pass” for the course. **Remove your checklist and turn it in to the instructor before leaving on Day 3.**

Note: All work on props requires appropriate selection of PPE and materials.

Instructor Sign-off

☐	Complete <i>all</i> Handbook Exercises	_____
☐	Drywall patch / repair	_____
☐	Wall drilling & probe	_____
☐	Roof & Soffit prop	_____
☐	Duct Sealing prop	_____
☐	Window & Door installation prop	_____
☐	Loose-fill insulation prop	_____
☐	Window Pane replacement / cut glass	_____

The following props must be *air-sealed* and pressure tested:

☐	Attic hatch	_____
☐	Non-IC Recessed light	_____
☐	Exhaust fan & new duct	_____
☐	Large Hole	_____
☐	PVC Vent Stack	_____
☐	Large hole with flue pipe	_____
☐	PVC pipe over joists	_____
☐	Balloon frame opening	_____
☐	Dense-pack test box _____ Pounds.	_____

I used: ☐ Fiberglass ☐ Cellulose