

NEBRASKA WEATHERIZATION ASSISTANCE PROGRAM

TECHNICAL STANDARDS



Last Updated
June 25th, 2026

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Chapter 1.0 General Information

1.01 Program Purpose and Scope

The Nebraska Weatherization Program is committed to delivering safe, high-quality, and cost-effective energy efficiency services to eligible households. Through a comprehensive whole-house approach, the program reduces energy burden, improves comfort, and protects the health and safety of occupants. All services are provided in accordance with state and federal guidelines and are performed with a focus on quality workmanship, accountability, and measurable energy savings.

Refer to Nebraska Weatherization Policies and Procedures Manual for more details on program policies, including Occupational Safety and Health Administration (OSHA), crew safety, and State Historic Preservation Office (SHPO) requirements.

1.02 Applicable Standards and References

This standard is designed to be aligned with the DOE approved Standard Work Specifications (SWS). There are links inserted with appropriate standards that if clicked will open up that standard in your browser. Incorporated into this standard is NEAT MHEA WAweb Version 10/11, Building Performance Institute's (BPI) most current relevant standards like the [BPI 1200](#), [BPI 1100](#) and ASHRAE 62.2 2016 among others. Also included is [2018 International Residential Code](#) (IRC), [2018 International Energy Conservation Code](#) (IECC), [National Fire Protection Association](#) (NFPA) including NFPA 54, 31,120 among others. This standard is a living document and a work in progress. This standard will change as the SWS or any other standard changes. If a discrepancy exists, please refer to the most current approved Nebraska Weatherization Program State Plan, or Health and Safety Plan which are updated every Program Year.

1.03 Roles and Responsibilities

The Nebraska Weatherization Assistance Program (NeWAP), administered in accordance with the requirements of the U.S. Department of Energy, defines clear roles and responsibilities to ensure uniform program delivery, regulatory compliance, and high-quality outcomes.

The State agency provides overall program administration, including policy development, training, monitoring, and quality assurance.

Subgrantees are responsible for day-to-day program implementation, including eligibility determination, energy auditing, scope development, and project management.

Contractors and installation crews shall complete all work in accordance with approved work orders, applicable codes, and Standard Work Specifications (SWS), while adhering to all health and safety requirements.

Quality Control Inspectors (QCI) shall conduct final inspections to verify compliance prior to reimbursement. All entities involved in the program are responsible for accurate documentation, proper use of funds, and ensuring that all work performed protects occupant health and safety and achieves cost-effective energy savings.

1.04 Subgrantee and Contractor Requirements

- Sub-grantee and contractor staff must always behave in a professional manner, as they function as weatherization representatives.
- Sub-grantee and contractor staff must use all required Protective Personal Equipment (PPE) and comply with Federal, State or Agency Having Jurisdiction (AHJ) Codes or Program Policies; including but not limited to OSHA and Lead Safe Weatherization.

Prohibited Activities

- Drinking, illegal drugs, or the inappropriate use of prescription drugs while on the job or in interactions with the client
- Harassment, including but not limited to, sexual harassment
- Engaging in any discussion of work, or the performance of work, with the client either at no-cost or at-cost of the client outside of the scope of weatherization work with the client
- Violence against self, other staff, or the client
- Presence of weapon or firearms at the job site (weapon/firearm may be locked in vehicle); and
- All other illegal activities not specified above

1.05 Required Tests and Documentation

The Nebraska Weatherization Program requires agencies to conduct certain diagnostic tests and document results in the client file.

Some of this information must also be recorded on the appropriate data collection form, diagnostic forms or NeWAP database. The following is a list of the required tests and documentation:

- Inspection of the ambient air for carbon monoxide (CO) and combustible gas prior to undertaking inspections of fuel distribution systems and combustion appliances. See [Section 2.0601](#)
- Testing for gas leakage of accessible natural gas and propane piping systems. See [Section 2.0201](#)
- Inspection of oil-fired appliance fuel supply system (tank, supply line, burner) for leaks.

- Inspection of combustion venting systems for damage, leaks, disconnections, inadequate slope, and other safety hazards. See [Section 2.0203](#)
- Verification that sufficient combustion air is available. See [Section 2.0202](#)
- Steady State Efficiency Test See [Section 2.0203.02](#)
- Record baseline pressure readings of the combustion appliance zone (CAZ) with reference to (WRT) outside. Then set the house up in worst case – reference BPI standards. See [Section 2.0602](#)
- Temperatures on the supply and return plenums to obtain the temperature rise results. Record results for both pre- and post-weatherization. See [Section 2.0604](#)
- CO Testing of all Combustion Appliances regardless of venting type.
- Pre and Post Spillage testing and CO measurement of all atmospherically vented combustion appliances (including fan-assisted combustion appliances venting into atmospheric chimneys or flues) with the combustion appliance zone (CAZ) in a depressurized state. See [Section 2.0603](#)
- CO measurement of all direct vent and power-vented appliances (without atmospheric chimneys or flues) if the outlet of the exhaust is safely accessible. See [Section 2.0603](#)
- Testing of gas ovens and unvented appliances for CO. See [Section 2.0603.03](#)
- Inspection of Solid fuel burning appliances for safe operation. See [Section 2.0608](#)
- Pre- and post-weatherization Pressure Pan test reading. See [Section 2.0606](#)
- Pre- and post-weatherization garage leakage test readings for homes with attached or tuck-under garages. See [Section 2.0703](#)
- Pre- and post-weatherization blower door readings. See [Section 2.0701](#)
- Appliance (refrigerator/freezer) meter readings. See [Section 6.0101](#)
- If pre-and post-weatherization attic by-pass leakage is tested, it needs to be reported on WX19/20. See [Section 2.0703](#)
- Target and Pre and Post RED Calc calculation results. See [Section 4.04](#)
- Pre and Post Weatherization Spot and Whole house fan ratings See [Section 2.1001](#)
- Heat Loss Calculation Worksheet and full Manual calculation. Worksheets not needed if agency does Manual J calculations. Calculated loads based on post-retrofit dwelling characteristics.

Other Recommended tests include:

- Draft pressure results for both the heating system and water heater under the worst-case scenario. See [Section 2.0603.02](#)
- Room-to-room pressures. See [Section 2.0704](#)
- Static pressure testing on all furnaces. See [Section 2.0604](#)

1.06 Work Order Requirements

- Agency auditors are to create their work order from the NEAT/MHEA Audit Recommended Measures material list. Subgrantee's can develop their work

order using the WAweb Energy Audit Tool or create their own. The work order is to include:

- Insulation R-values,
 - U-values,
 - Efficiencies of mechanical equipment,
 - Infiltration and duct sealing targets,
 - All Energy Conservation Measures (ECM),
 - Repairs,
 - Health and Safety Measures
 - General Heat Waste Measures that are going to be installed on the dwelling
 - Funding Category for each measure installed (ECM, IRM, GHW etc.)
 - Funding Source for each measure installed (DOE, LIHEAP, State Funds, etc)
- The work order must clearly explain where measures are to be installed.
 - Heating unit and water heater work bid prices must be re-entered into the NEAT/MHEA Audit and the NEAT/MHEA Audit run again in order to determine which additional measures are cost-effective for the home. Once the NEAT/MHEA Audit has been re-run, the mechanical and general weatherization insulation work may be awarded.
 - Best practice is for all heating unit and water heater work to be completed prior to general weatherization work. When completing general weatherization work first, an explanation regarding the need to do so must be in the file.

1.07 Cost Limits

The Nebraska Weatherization Program has a limit on the total amount of program funds spent on a home as well as limits on how much can be spent on various measures.

These limits are listed in the most current NeWAP State Plan, Health and Safety Plan, NeWAP Technical Standards and NeWap Policies and Procedures. Agencies must obtain prior approval from Department of Water, Energy, and Environment (DWEE) Weatherization Program to exceed established expenditure limits.

1.08 Fuel Switching

Situations may arise when an agency should consider changing fuel for the heating system or water heater that uses a different fuel source.

Due to the complaints the agency and program may receive from a fuel vendor who has lost business due to fuel switching, a lot of consideration must be given to this decision.

The reasons for considering fuel switching are:

- As an Energy Conservation Measure (ECM) on owner occupied units, when a site-specific NEAT/MHEA Version 10 audit demonstrates the cost effectiveness of

the fuel-switch over the life of the measure as indicated by the Savings to Investment Ratio (SIR) of 1.0 or greater.

- When it is necessary for health and safety reasons, usually when a gas water heater is back-drafting or has spillage and the only solution is to install an electric water heater. This may only be done if all other options, such as moving the existing water heater or installing a power-vented water heater, have been considered and will not work. These situations must be reviewed and approved by the Nebraska Weatherization Assistance Program.
- If a heat pump or other combined heating-and-cooling system is to replace a heating-only system (no existing cooling system), no savings will be attributed to the non-existent cooling system, but the operating costs of the new system throughout the year must be accounted for and included in the audit and Savings to Investment Ratio (SIR) calculation.

When determining whether it is cost-effective to switch fuels, actual costs associated with the installation of a new system using a different type of fuel must be considered and included in the WAweb (NEAT/MHEA Audit) to prove cost effectiveness. For example:

- If a heat pump or other combined heating-and-cooling system is to replace a heating-only system (no existing cooling system), no savings will be attributed to the non-existent cooling system, but the operating costs of the new system throughout the year must be accounted for and included in the audit and Savings to Investment Ratio (SIR) calculation.
- If ductwork would have to be added for a new furnace, the cost of adding the ductwork needs to be included in the cost-effectiveness determination.
- If applicable, the cost of hooking up the house to a natural gas pipeline needs to be considered.
- Program funds cannot be used to pay the cost of LP tanks or running gas lines to the house.
- These costs must be covered by the client or another source of funds.
- The cost analysis must include estimates of both installation and operation costs.

Cost-effectiveness of fuel switching must be shown by one of the following methods:

Heating Systems:

- The NEAT audit will calculate savings for switching fossil fuel to fossil fuel. Therefore, any switching from oil to gas or LP to natural gas, etc., requires a copy of the NEAT audit heating system input and all recommended measures be submitted with the Fuel Switching Request Form.
- The NEAT audit will calculate savings for switching fossil fuel to electric or vice versa. Agencies must use the current fuel costs from the NEAT audit in the calculation to determine cost effectiveness. If a utility company offers a special rate for using their fuel (lower electric rate for all electric houses), the agency may use the lower rate only if it is documented by the utility and submitted with the request for approval. A copy of the clients' fuel usage documentation must also accompany the request to demonstrate that accurate BTU calculations were made.

- The MHEA audit will calculate switching all fuel types. Therefore, agencies must submit a copy of the MHEA audit heating system input and all recommended measures with the Fuel Switching Request Form.

Water Heaters:

- Both the NEAT and MHEA audits will calculate fuel switching savings for water heaters. Therefore, agencies must submit a copy of the NEAT/MHEA audit input and all recommended measures with the Fuel Switching Request Form.

State Approval

The agency must receive approval from Nebraska Weatherization Assistance Program before making any fuel switch regarding heating systems and water heaters.

- This is done using:
 - The Fuel Switching Request Form,
 - The NEAT/MHEA Audit, whichever is applicable (must be rerun with bid/actual costs),
 - AND the client fuel usage documentation, as appropriate.
 - Forms are available on the State of Nebraska Weatherization website [Publications, Grants & Forms | DWEE NE](#)
 - Once the fuel switch is approved by Nebraska Weatherization Assistance Program, copies of the forms are to be maintained in the client house file.

Client Approval

The agency must obtain client's written approval before installing an appliance that uses a different fuel. This signature line is on the Fuel Switching Request Form. This prevents the fuel vendor, who had supplied the fuel that is being replaced, from complaining the program is "taking his/her business away." If a vendor complains, the client request is documented.

If a client requests the replacement appliance using a different fuel, the fuel switch may only be done if it is cost-effective as demonstrated by either the NEAT or MHEA Audit or for a Health and safety reason.

1.09 Material

- Materials used for energy efficiency measures must meet or exceed the specifications described in 10 CFR 440, Appendix A, "Standards for Weatherization Materials". [CFR-2024-title10-vol3-part440-appA.pdf](#)
- Materials used for health and safety purposes and repairs are not required to meet or exceed the specifications described in 10 CFR, 440, Appendix A.
- All materials shall be installed according to the International Residential Code, local building codes, manufacturer specifications and/or these standards. If local codes or ordinances are more stringent than the Standards, the local codes or ordinances shall apply. If the Standards are more stringent than local codes or ordinances, the Standards shall apply.
- Materials selected for work on manufactured homes will comply with manufactured housing rules and HUD regulations.

- SDS sheets (electronic or hard copy) will be provided onsite and available during all work.

When replacing materials/equipment, the old items must be removed from the premises.

1.10 Quality of Work

The quality of all materials and work performed for weatherization must be guaranteed to be free from defects in workmanship for a period of one (1) year after the date of completion.

All work must be neat in appearance.

An agency's continued inability and/or refusal to comply with these Standards are grounds for the Nebraska Weatherization Assistance Program to suspend, terminate, or otherwise apply special conditions to the agency's contract to [provide weatherization services](#).

1.11 Deferral Policy and Procedures

The decision to defer work in a dwelling is difficult but necessary in some cases. Subgrantees are expected to pursue reasonable options on behalf of clients and to use good judgment in dealing with difficult situations. Deferral conditions may be found throughout this standard with the corresponding issue if applicable. Reasons for deferral are but not limited to:

- **When a client or occupant(s):**
 - Refusing to allow the installation of top energy efficiency measures or important health and safety measures.
 - Refusing access to parts of the house that prevent the evaluation of the house from being performed or prevents required measures from being installed.
 - Refusing to change behavior that can cause health and safety problems
 - Moves or dies while weatherization services are being provided. (Weatherization services may be completed if the majority of work is done prior to the client moving/dying.)
 - Is threatening or physically or verbally abusive.
 - Has known health conditions which prohibit the installation of insulation or other materials.
 - Is involved in illegal activities.
- **When a Dwelling:**
 - Has a cumulative SIR of < 1.0 – smoke and CO alarms may be installed in this case
 - Is posted as being "For Sale" or is known to be for sale (except homes currently in a housing rehabilitation program).
 - Is scheduled for demolition.

- Poses a health or safety hazard to crew workers or contractors, for example, rats, bats, roaches, reptiles, insects, animals, or other vermin inappropriately or not properly contained on the premises.
- One or more health and safety hazards exist that must be corrected by the client (or landlord) before weatherization services may begin. Examples include, but are not limited to:
 - Severe mold or moisture problems (such as pooling in the crawlspace or standing water in the basement) so severe they cannot be resolved within program limits when included in the cost of an ECM (energy conservation measure).
 - The presence of animal feces or raw sewage that prevents weatherization measures from being installed.
- Unsafe secondary units, including space heaters, must be repaired, or removed and disposed of, or deferral is required. Secondary unvented space heaters are considered unsafe if they:
 - are not listed and labeled as meeting ANSI Z21.11.2;
 - have an input rating of more than 40,000 BTU/hour;
 - are in a bedroom and have an input rating of more than 10,000 BTU/hour;
 - are in a bathroom and have an input rating of more than 6,000 BTU/hour;
 - are operating in an unsafe manner (e.g., high carbon monoxide (CO) readings, too close to combustible materials, lack sufficient combustion air volume);
 - are not permitted by the Authority Having Jurisdiction (AHJ);
 - are **not** in a manufactured home;
 - have an ambient CO in the CAZ of the unvented space heater that exceeds 9 PPM or;
 - are tested and have undiluted gas of the main burn that exceeds 200 PPM free air.
- The presence of disconnected water waste pipes or hazardous electrical wiring that prevents weatherization measures from being installed.
- The presence of asbestos, including vermiculite that contains asbestos, that prevents weatherization measures from being installed.
- When health and safety hazards, including unsafe combustion appliances, could pose a health or safety threat to clients but the weatherization program cannot mitigate the hazards due to expenditure limits or program rule/policy limits.
- It is undergoing remodeling or has unfinished areas, which directly affect the weatherization process. Weatherization work may be done when the remodeling is completed.
- It is so full of clutter a weatherization evaluation or weatherization services cannot be done.
- Is beyond the scope of the program due to major structural deficiencies or is in such a state of disrepair that failure is imminent and the conditions cannot be resolved in a cost-effective manner.

- **When a manufactured home:**
 - Includes a heating system other than a heating system designed for manufactured homes, however, a sealed combustion high efficiency furnace with modifications per manufacturer's instructions and installed properly to include outside air for combustion is allowed to remain.
 - It has a solid-fuel burning appliance drawing combustion air from inside.
 - It has an installation deficiency that may affect worker safety.

1.12 Worker Safety

Weatherization staff are vitally important, and staff must not be required to work in unsafe and/or unhealthy unsanitary conditions.

- Sub-grantee crews and contractors must comply with Occupational Safety and Health Administration (OSHA) standards and Safety Data Sheets (SDS) and take precautions to ensure the health & safety of themselves and other workers, including the use of personal protection equipment
- Costs incurred by subgrantees to comply with OSHA requirements may be charged to the Health & Safety budget category.
- OSHA standards including, but not limited to:
 - respirator protection,
 - techniques for safely lifting heavy objects,
 - Electrical equipment safety,
 - ladder safety, and
 - general worker protection.
- SDS documentation for all materials installed through the Nebraska Weatherization Assistance Program must be maintained on site during the weatherization of the home and on file by each program
- Personal protective equipment must be worn when appropriate.
- Worker Health & Safety concerns must be continually addressed, implemented and enforced within the NeWAP.
- First aid supplies must be available in the office and at the job site.
- Costs related to Grantee Health & Safety training must be charged to Training & Technical Assistance.
- The NeWAP allows \$200.00 towards minor repairs to stairs or handrails that create a safety issue for workers.

1.13 Low-Rise Multifamily, Region 3 Priority List

The Nebraska Weatherization Assistance Program (NeWAP) utilizes the **DOE Low-Rise Multifamily, Region 3 Priority List** for eligible multifamily buildings. In accordance with Weatherization Program Notice 22-8, the Priority List may be used as an alternative to a site-specific energy audit when the building meets the eligibility requirements established by DOE and the Nebraska Weatherization Assistance Program State Plan. All installation costs must be procured in compliance with 2 CFR 200 and Grantee's procurement policies.

The Priority List may only be used in multifamily buildings that meet all the following criteria:

- The structure is a **wood-framed, low-rise multifamily building containing five (5) or more dwelling units.**
- The building is **no more than three (3) stories above grade.**
- **Incidental Repair Measure (IRM) costs funded with DOE Weatherization Assistance Program funds do not exceed ten percent (10%) of the total Energy Conservation Measure (ECM) package cost,** as defined in the Nebraska Weatherization Assistance Program State Plan.

If a building does not meet the criteria required for use of the Priority List, the Subgrantee must perform a **site-specific energy audit using an approved audit tool.**

Program Requirements

Subgrantees implementing weatherization measures using the Low-Rise Multifamily Priority List must comply with the following requirements.

Health and Safety

All required Health and Safety (H&S) measures shall be implemented in accordance with the Nebraska Weatherization Assistance Program DOE-approved Health and Safety Plan and applicable DOE guidance, including Weatherization Program Notice 22-7.

Health and Safety measures must be completed prior to or in conjunction with the installation of weatherization measures when necessary to ensure the safety of occupants and weatherization personnel.

Measure Installation

Energy Conservation Measures identified in the Priority List shall be installed unless:

- Area is inaccessible and work is physically impossible to complete, or
- Installation would create a health or safety hazard.
- Any measure that is skipped must be documented in the project file, including the reason the measure could not be installed.
- All measures must be implemented in accordance with the DOE Standard Work Specifications (SWS) and the Nebraska Weatherization Assistance Program field standards.

Definition of Accessibility

A building component or area shall be considered *accessible* if it can be reached and worked on safely without causing undue damage to the structure or posing a health or safety risk to workers or occupants.

Allowable Alterations to Improve Accessibility

Reasonable efforts shall be made to make inaccessible areas accessible when cost-effective and practical. Allowable alterations may include, but are not limited to:

- Installation of attic access hatches or doors
- Creation of access openings in knee walls
- Temporary removal and replacement of floorboards or other finish materials
- Minor modifications necessary to gain safe access to enclosed cavities

Alterations to improve accessibility shall be performed when:

- The cost of the alteration is justified by the expected energy savings,
- The work can be completed within reasonable labor time, and
- The alteration does not create additional health, safety, or structural concerns.

Each Subgrantee shall establish and maintain specific guidance defining acceptable cost thresholds, labor limits, and scope of work for accessibility modifications.

Documentation Requirements

If an ECM is not installed due to inaccessibility, the project file must include:

- A description of the area and why it is not accessible
- Documentation of why allowable alterations were not performed (e.g., cost, safety, structural limitations)
- Supporting photos where applicable

All determinations regarding accessibility and skipped measures must be clearly documented and justified in the client file.

Mandatory and Optional Measures

Measures identified in the Priority List may be categorized as mandatory or optional measure.

- Mandatory measures must be installed whenever feasible unless installation is physically impossible or would create a health or safety hazard.
- Optional measures may be installed when appropriate within eligible dwelling units.
- In accordance with Weatherization Program Notice 22-8, optional measures may not be installed in common areas using DOE Weatherization Assistance Program funds.

Common Area Measures

Mandatory Energy Conservation Measures may be installed in common areas that are physically connected to the eligible building, regardless of who pays the utility costs associated with those spaces.

Common areas may include spaces such as:

- hallways
- stairwells
- shared laundry rooms
- lobbies
- mechanical rooms
- other tenant common spaces physically connected to the building

Common areas that are not physically connected to the eligible building, even if used exclusively by tenants of the building, are not eligible to receive services funded by the Weatherization Assistance Program.

Average Cost Per Unit (ACPU)

The Average Cost Per Unit (ACPU) expenditure for labor, weatherization materials, and related costs funded through the Weatherization Assistance Program must not exceed the limits established in the Nebraska Weatherization Assistance Program DOE-approved State Plan.

Procurement Requirements

All labor, materials, and installation services must be procured in accordance with Federal procurement regulations contained in 2 CFR 200 and the Grantee's procurement policies.

Documentation

Subgrantees must maintain documentation in the project file demonstrating:

- Building eligibility for use of the Priority List
- Compliance with ACPU and IRM limits
- Completion of required Health and Safety measures
- Measures installed and justification for any measures that were skipped
- Documentation must be maintained in accordance with program recordkeeping requirements

NeWAP Low-Rise Multifamily Region 3 Priority List

1. **Mandatory: Install all applicable Health and Safety (H&S) measures** per the Grantee's DOE-approved H&S Plan.
2. **Mandatory: Light Emitting Diode (LED)** lighting replacement of all existing screw-based incandescent, halogen, or compact fluorescent lighting used for a minimum of one hour per day. [Lighting Replacement SWS](#)
3. **Mandatory: Air Sealing** – seal the primary pressure boundary surfaces at the following locations: attic top-plates; attic ceiling; exterior wall, and floor penetrations, and holes; sill box to floor intersection if on unconditioned crawlspace or basement, or entire sill box area if conditioned foundation. [Air sealing SWS](#)

4. **Mandatory: Duct Sealing** – seal all accessible ducts located outside the thermal boundary. [Duct sealing SWS](#)
5. **Mandatory: Duct Insulation** – insulate all accessible uninsulated ducts located outside the thermal boundary to R-8 or R12 if exposed to the exterior. [General Duct insulation SWS](#)
6. **Mandatory: Ceiling insulation** – insulate all accessible attics to R-60 or to capacity if less. Attic Floors - [Unconditioned Attics SWS](#)
7. **Mandatory: Wall Insulation**
 - a. **Mandatory** – where the total gross area of any uninsulated exterior wall is >10%, insulate the missing areas to capacity with dense pack insulation.
 - b. **Optional** – Insulate any partially insulated exterior wall cavities (e.g., 3.5" cavity with 2" of existing batt) using dense-pack insulation. [Dense Pack Insulation SWS](#)
8. **Mandatory: Foundation Insulation – (skip measure if foundation is slab)**
 - a. **Conditioned and Unvented Foundations**
 - i. **Mandatory:** Insulate accessible rim/band joist (sill box) to R-30 or to capacity, if less. [Rim/Band Joist SWS](#)
 - b. **Unconditioned or Vented Foundations**
 - i. **Mandatory:** Insulate all floors over unconditioned foundations to R-30 or to full joist capacity, if less. Must include complete ground moisture barrier over any exposed dirt. [Floors SWS](#) [Ground Vapor Retarders SWS](#)
9. **Optional: \$250 per dwelling unit DOE WAP funds cap**
 - a. **Showerhead** ≥2.5 GPM [Low Flow Devices SWS](#)
 - b. **Domestic Water Heater (DWH) tank insulation (R-10)** – [Tank Insulation SWS](#)
 - c. **DWH pipe insulation** (6' of both hot and cold-water lines nearest the DWH, and any accessible hot water lines beyond that to R-3) – [Pipe Insulation SWS](#)
10. **Optional: LED lighting replacement of fluorescent tube lighting** - [Lighting Replacement SWS](#)

1.14 Heating/Cooling Repair and Replacement (HCRRA)

Heating/Cooling Repair or Replacement Assistance (LIHEAP-HCRRA) is an option available to NeWAP Subgrantees to complete repair or replacement work for clients, in owner occupied homes. LIHEAP-HCRRA assistance is available to clients that are not eligible for the Weatherization Assistance Program due to previous weatherization or in cases where the homeowner elects not to proceed with full weatherization services in the home. The program covers a maximum cost of \$6,000.00 per residence to repair/ replace heating and/or cooling systems. However, approval to exceed this limitation can be reviewed on a case-by-case basis by the DWEE prior to any work being implemented. Costs that exceed the maximum coverage cost, not approved in writing by DWEE, and accessories (e.g., humidifiers, wireless thermostat) that are not eligible for installation or exceed program limits must be invoiced to a third-party entity or individual responsible for the installation costs.

LIHEAP-HCRRA allows a maximum of \$500.00 in costs to correct deficiencies in eligible heating or cooling systems. If the cost to repair heating or cooling the system exceeds \$500.00 the unit must be replaced. However, approval to exceed this limitation can be reviewed on a case-by-case basis by the DWEE prior to any work being implemented.

Detailed information concerning the work standards and requirements are outlined in the Nebraska Weatherization Technical Work Standards document.

Eligibility Requirements and Verification of Need

Homes eligible for LIHEAP-HCRRA assistance **must**:

- be owner occupied units,
- meet NeWAP income eligibility requirements or (for heating systems only) have received energy assistance payments paid under the Low Income HomeEnergy Assistance Program of 1981 during the same program year that the LIHEAP- HCRRA application for assistance is received,
- have a heating system that requires repair or replacement needs verifiable through one of the following:
 - redtag confirmation,
 - written documentation provided by a qualified heating technician, or
 - on-site sub-grantee inspection.
- have cooling system that requires repair or replacement needs verifiable through one of the following:
 - redtag confirmation,
 - written documentation provided by a qualified heating/cooling technician, or
 - on-site sub-grantee inspection.
- **And** have documentation that the home's permanent resident(s) include:
 - A child under six years of age, who receives ADC,
 - A person 70 years of age or older, or
 - Has a severe illness or condition which is aggravated by extreme heat as verified using a FORM WX30 signed by a healthcare provider as indicated on the Form.
- not have received LIHEAP-HCRRA assistance within 5 years.

LIHEAP-HCRRA *Eligibility and Verification of Emergency Need* documentation is required to be kept in the client file for future state and federal monitoring.

Subgrantee HCRRA Quality Control Inspections

Subgrantees must complete a final Quality Control Inspection (QCI) on LIHEAP-HCRRA work before reporting it to the DWEE as completed and requesting reimbursement. The QCI must be completed by a Building Performance Institute, Inc. (BPI) Certified Quality Control Inspector certifying that the work has been completed in accordance with the NeWAP Technical Standards. The Inspections also include (but not be limited to) client file review and final diagnostic testing. A copy of the Subgrantee *QCI Documentation* is required to be kept in the client file for future state and federal monitoring.

State Monitor HCRRA Quality Control Inspections

Department of Water, Energy and Environment (DWEE) Certified Quality Control

Inspectors/Technical Monitors will conduct Quality Control Inspection monitoring on homes where LIHEAP-HCRRRA work is completed. State Monitor QCIs will be completed on Subgrantee units submitted for reimbursement to DWEE. The Inspections also include (but not be limited to) client file review and final diagnostic testing. Statewide State Monitor Quality Control Inspections are completed on (10) percent of all units submitted for reimbursement. State QCI reports are sent to Subgrantees outlining all monitoring activities completed as well as recommendations, findings, and any questioned costs. Subgrantees have 30 days to respond and provide documentation that required actions were completed.

If it is determined that a serious problem and/or deficiency exists that is an immediate threat to the health and safety of a weatherization client, DWEE will issue an Immediate Action Directive to the Subgrantee who must take action to immediately rectify the issue.

Health and Safety Problems Occurring After HCRRRA Work

Program LIHEAP Health & Safety funds may be used to address problems that become evident after LIHEAP HCRRRA work is completed and is documented during the QCI and that can be directly attributed to the LIHEAP HCRRRA work completed in the home.

Additionally, LIHEAP-HCRRRA funds may be used to install a Carbon Monoxide or Propane Detector following the repair/ replacement of fuel gas heating systems.

Chapter 2.0 HEALTH AND SAFETY

2.01 Health and Safety Assessment

Health and safety problems found during the health and safety assessment will result in the agency taking one of the following actions:

- If the problem will not prevent the dwelling from being weatherized and installing weatherization measures won't exacerbate the problem, the agency can proceed with weatherizing the dwelling but will notify the client of the problem.
- If the problem must be remedied before weatherization measures can be installed, the agency must determine if the program can remedy the problem or if the client or landlord will have to correct the problem. If the program can remedy the problem, weatherization can proceed once the agency has corrected the problem.
- In those cases where the client or landlord is responsible for correcting the problem, the agency must ensure the client understands either he/she or the landlord is responsible for correcting the problem before weatherization can begin. The agency must notify the client of the problem regardless of who is responsible for correcting it.

Health and safety testing must also be repeated after weatherization to ensure the activities did not create a health and safety problem in the home. Program funds may be used to conduct the assessment and testing, and to abate certain health and safety problems.

It is very important the agency document any health and safety problems and any problems or conditions which could result in health and safety problems. Documentation must include photos. Good documentation can protect the agency from claims made by clients that the work done by or on behalf of the agency caused a health and safety problem.

2.02 Combustion Appliance Testing and Repair/Replacement

2.0201 Fuel Lines

[SWS 5.0504.1](#)a through 1i, [5.0504.2](#)a-f

Documentation

Test Results documented on WX9 Form, including photos in client file if applicable

When Required

All homes with gas fired appliances

Procedures

Auditors and QCI must have a combustion gas analyzer variable tick rate or changing tone based on gas concentration levels. Note: The tick rate provides the indication of

concentration but only accounts for relative concentration changes, not necessarily identifying hazardous concentration thresholds.

- Check all gas piping on all combustion appliances, including gas cooking stoves and dryers, for leaks.
- Check all exposed exterior gas lines for leaks.
- No weatherization can be done until leaks detected by any means are repaired by the program. See below regarding an exception for gas leaks on the utility side.
- Leaks on the utility side can only be repaired by the utility or their contractor. Weatherization funds cannot be used to fix a leak on the utility side.
- When a gas leak is on the utility side and located **inside** the home:
 - Verify the leak with a soapy or bubbling solution to eliminate false positives. Maintain a photo of the verified leak in the file, notify the utility of the leak, and document the date and time the utility was notified.
 - If unable to verify with soapy or bubbling solution but there is evidence of a leak, make a notation in the file, notify the utility of the leak, and document the date and time the utility was notified.
 - Weatherization work cannot continue until the leak is repaired by the utility.
- When a gas leak is on the utility side and is located **outside** the home:
 - Verify the leak with a soapy or bubbling solution to eliminate false positives. Maintain a photo of the verified leak in the file, notify the utility of the leak, and document the date and time the utility was notified.
 - If unable to verify with soapy or bubbling solution but there is evidence of a leak, make a notation in the file, notify the utility of the leak, and document the date and time the utility was notified.
 - Weatherization work may continue.
 - The home may be closed complete after all other work has passed final inspection by a QCI.
- If a natural gas leak is found after the meter, program funds may be used to repair the leak.
- If a propane leak is found outside the house, it is the responsibility of the client/landlord or the propane company to repair the leak. The client must be notified of the leak. Defer work until the leak is repaired.
- Use a combustible gas leak detector to check all gas lines, including flexible brass and flexible copper, for leaks.
- Gas line connections must be tested by moving the probe around the connections at a rate of 1" per second.
- Gas leaks must be verified by soapy or bubbling solution or any means possible to eliminate false positives.
- In that case the gas line must be replaced, all gas piping must be installed according to the NFPA54/ANSI/AGA Z223.1.

2.0202 Combustion Air Requirements

[SWS 5.0502.1](#)a-1b

Combustion appliances require oxygen or combustion air to operate, and some appliances draw combustion air from inside the home or *building envelope*. Completing an assessment on each combustion appliance in a home ensures that a combustion air problem does not interfere with combustion, create carbon monoxide or contribute to spillage or back drafting. Combustion appliance zones are classified as either un-confined spaces or confined spaces.

- Un-confined spaces are open or connected to enough building volume to provide adequate combustion air.
- Confined spaces are Combustion Appliance Zones with a closed door and sheeted walls and ceiling that creates an air barrier between the appliance and other indoor spaces. A confined space is defined as a room containing less than 50 cubic feet of volume for every 1000 Btu per hour of appliance input.
- NeWAP subgrantees must verify and document in each client file that each *Combustion Appliance Zone* in a weatherized home has adequate combustion air supply.
- When additional combustion air is required, the following options must:
 - Provide combustion air from adjacent indoor spaces by installing a combustion air vent or grille or under-cutting interior doors. The following is an example of sizing grilles to supply combustion air to a confined space from an adjacent indoor area:
 - The furnace has an input rating of 100,000 Btu/hour.
 - The water heater has an input rating of 40,000 Btu/hour.
 - Therefore, there should be 280 in² of net free area of vent between the mechanical room and other rooms in the home. $([100,000 + 40,000] \div 1,000 = 140 \times 2 \text{ in}^2 = 280 \text{ in}^2)$.
 - Provide outdoor combustion air into the *Combustion Appliance Zone* (CAZ), or analyze the cost effectiveness of installing direct-vent appliances that utilize outdoor combustion air.

Manufactured housing specific work standards:

- The combustion air sleeves and air conditioner condensates to the underbelly must not be covered.
- The costs associated with installing the make-up fresh air must be charged to Health & Safety.
- Verify that any gas-fired water heater installed in a manufactured home is specifically listed and labeled for manufactured home use.
- Confirm that the unit is installed in an approved location and that the installation complies with all combustion air supply requirements, including proper enclosure (if applicable), venting, and combustion air provisions in accordance with applicable codes, manufacturer specifications, and DOE Standard Work Specifications (SWS).

2.0203 Furnaces and Boilers

SWS 5.01 SWS 5.02 SWS 5.03

2.0203.01 Heating Plant Safety

Prior to weatherizing the *building envelope*, all eligible heating units must be inspected by a

Qualified Heating Technician, utility company or *Trained Weatherization Staff*. Testing of a new unit if replaced is required after the installation.

Combustion safety and efficiency testing is required on all combustion appliances present in the home. Spillage testing is required under worst case conditions. Draft testing is optional but recommended.

The home must be deferred if the owner or client refuses a *safety inspection* of the *heating system* or until any *heating system* deficiency has been repaired and/or the *heating plant* replaced.

The State of Nebraska's annual heating degree day normal, over the forty- seven year period from 1970-2017 is 6322, with January average °F high and low temperatures of 35 to 12.

Clients in units that contain *heating plants* that are *inoperable* or red-tagged are in danger of frost bite, hypothermia and other life-threatening issues. Therefore, units that contain heating units that are inoperable or red-tagged at the time of the initial inspection must not be weatherized until the *heating plant* has been repaired or replaced.

All primary heat source, unvented fuel-fired heating units, which cannot be vented must be removed or replaced with properly vented units. No weatherization work can be completed until the problem is corrected.

Eligible heating plants that cannot be repaired must be replaced.

The replacement *heating plant* must be properly vented. If the new *heating plant* will not be vented through the masonry chimney, but the water heater will still be vented through that chimney, a properly sized flue liner must be installed. As an alternative, a power vent may be installed on the water heater.

If a dwelling is heated by *unvented combustion space heaters* and an inoperable conventional *heating system* is present, the conventional *heating system* must be repaired or replaced to eliminate the need for unvented space heaters.

If a dwelling utilizes *unvented combustion space heaters* as the primary *heat source*, the *unvented combustion space heaters* must be replaced with a vented combustion *heating system*. If this issue cannot be resolved, the dwelling must be deferred.

Best practice is for all heating unit and water heater work to be completed prior to general weatherization work. When completing general weatherization work first, an explanation regarding the need to do so must be in the file.

2.0203.01a Secondary Heating System

Secondary systems or units are employed only in extreme weather or as backup to the primary system and do not provide heat to the entire dwelling. Replacement of a secondary heating system is not allowed.

Unsafe secondary units, including space heaters, must be repaired, or removed and disposed of, or deferral is required. Secondary unvented space heaters are considered unsafe if they:

- are not listed and labeled as meeting ANSI Z21.11.2;
- have an input rating of more than 40,000 BTU/hour;
- are in a bedroom and have an input rating of more than 10,000 BTU/hour;
- are in a bathroom and have an input rating of more than 6,000 BTU/hour;
- are operating in an unsafe manner (e.g., high carbon monoxide (CO) readings, too close to combustible materials, lack sufficient combustion air volume);
- are not permitted by the Authority Having Jurisdiction (AHJ);
- are not in a manufactured home;
- have an ambient CO in the CAZ of the unvented space heater that exceeds 9 PPM or;
- are tested and have undiluted gas of the main burn that exceeds 200 PPM free air.

All CO readings must be documented on the **WX9** form.

Solid Fueled space heaters – secondary heating

- Inspect solid fuel space heaters for proper venting and clearance.
- If unsafe, the unit must be removed or work must be deferred.

2.0203.01b Manufactured Homes

Manufactured homes with solid fuel combustion heating systems that are not listed for manufactured home use, improperly installed, or that do not meet sealed combustion requirements shall be evaluated for correction or deferral.

If the issue can be corrected through repair or replacement in a manner that brings the system into compliance with applicable codes, manufacturer specifications, and DOE Standard Work Specifications (SWS), the correction must be completed prior to the start of weatherization work.

If the condition cannot be corrected through allowable repairs or replacement within program guidelines (e.g., cost, feasibility, or safety constraints), the dwelling unit must be deferred in accordance with the Grantee's deferral policy.

All combustion heating systems in manufactured homes are required to be sealed combustion. Systems that draw combustion air from inside the dwelling are not permitted unless they are repaired or replaced to meet sealed combustion requirements prior to weatherization.

All determinations, including whether correction or deferral is required, must be fully documented in the client file.

Manufactured homes that have non-manufactured home or incorrectly installed solid fuel combustion heating systems must be deferred. All units should be sealed combustion. If combustion air is from inside, repair or replacement of the heating system must be completed before beginning weatherization work.

However, a sealed combustion high efficiency furnace with modifications per manufacturer's instructions and installed properly to include outside air for combustion is allowed to remain.

2.0203.02 Heating Plant Efficiency Testing

Furnaces may be replaced for efficiency reasons if, after running the steady state efficiency test, the NEAT Audit lists the measure with an individual SIR of 1.0 or greater.

Combustion Analysis

Steady State Efficiency testing is required for all gas fired furnaces. Testing should be completed with heating unit operating in winter operating conditions. After the unit has reached steady state or has been operating for 5 minutes, measure and record the steady state efficiency.

Combustion analysis for determination of steady-state efficiency shall be performed at the draft diverter or at an existing test port where accessible. **Drilling of double-wall or B-vent flue systems is prohibited.** Steady-state efficiency shall only be reported when it is directly measured in the field using combustion analysis. Where no safe and accessible test location exists, combustion testing shall not be performed. In these cases, the system efficiency shall be documented using the manufacturer-rated Annual Fuel Utilization Efficiency (AFUE) or nameplate efficiency, as applicable.

All testing locations, methods, and the basis for reported efficiency values (measured steady-state vs. manufacturer-rated AFUE) shall be clearly documented in the client file.

Test Hole

Using a Unibit so particles do not fall into the furnace blower drill a hole no bigger than needed, usually around ¼ inch. When testing is complete cover hole with metallic tape encompassing the complete pipe or with a plastic plug. Use manufacturers installed test ports when available.

Atmospheric Draft Furnace (60%)

Insert the probe into the heat exchanger before the draft diverter. Each chamber must be tested separately.

Induced Draft Furnace (80%)

Drill hole in flue 18-24 inches above furnace or first elbow. Insert the sampling probe of a combustion analyzer in the flue to attain your reading.

Sealed Draft Furnace (90%)

Test using combustion analyzer at PVC termination if possible. If testing at termination is not possible, and local codes allow, the PVC exhaust may be drilled 18-24 inches above inducer motor blower.

2.0203.03 Heating Plant Clean and Tune

Based on heating plant conditions, the Energy Auditor may determine if a clean & tune is necessary. All repairs, maintenance, or service activities described in this section shall comply with applicable program requirements and allowable funding categories under the U.S. Department of Energy.

Work performed using DOE funds shall be limited to activities that qualify as either an Energy Conservation Measure (ECM), justified through the energy audit and meeting Savings-to-Investment Ratio (SIR) requirements, or as an allowable Health and Safety (H&S) measure, as defined in the Nebraska DOE-approved Health and Safety Plan. Routine maintenance, general service work, or repairs that do not meet the requirements of an allowable DOE funding category shall not be completed using DOE funds and may only be performed using approved non-DOE funding sources, where available. The funding source and justification for all work performed shall be clearly identified in the work scope and documented in the client file.

2.0203.03a Combustion Furnaces [SWS 5.0109.4](#)

Must be completed by a Qualified Heating Technician and must include the following:

- Lubricating all moving parts
- Calibrating and adjusting the thermostat
- Cleaning or replacing the furnace filter
- Adjusting the conditioned air flow, high limit control, fan control and temperature rise
- Cleaning and adjusting the burners and removing and cleaning the blower
- Cleaning and vacuuming the return air and furnace cabinet, filter rack, exhaust port and draft hood
- Cleaning the heat exchanger
- Adjusting the belt tension or replace the belt
- Sealing the thermostat wire penetration
- Testing the furnace for CO and adjusting or repairing the furnace as needed
- If accessible, inspecting and cleaning the central air conditioner coils.

Information verifying completed work to be included on the NeWAP Mechanical System Inspection/Clean & Tune **Form WX17** and included in the client file.

2.0203.03b Air Handlers [SWS 5.0109.2](#)

Must be completed by a Qualified Heating Technician and must include the following:

- Lubricating all moving parts
- Calibrating and adjusting the thermostat

- Cleaning or replacing the furnace filter
- Adjusting the conditioned air flow, high limit control, fan control and temperature rise
- Removing and cleaning the blower
- Cleaning and vacuuming the return air and furnace cabinet, filter rack and electric elements
- Adjusting the belt tension or replacing the belt
- Sealing the thermostat wire penetration
- Testing the heating elements and sequencers
- Inspecting the interior and exterior wiring inside the cabinet on electric units
- If accessible, inspecting and cleaning the central air conditioner coils.

Information verifying completed work to be included on the NeWAP Mechanical System Inspection/Clean & Tune **Form WX17** and included in the client file.

2.0203.03c Fuel Fired Boilers [SWS 5.02.4.1](#)

Must be completed by a Qualified Heating Technician and must include the following:

- Verify function and safety of system elements
- Perform combustion testing that includes the following: Carbon monoxide, combustion efficiency, gas pressure testing, temperature rise, stack temperature
- Adjust combustion as needed to meet [BPI](#) 1200 standards for carbon monoxide
- Clean the following elements: heat exchangers, burners
- Remove combustible/flammable materials from area
- Repair or replace additional elements as needed
- Purge, verify system pressure, and flush or skim steam boiler

2.0203.04 Heating Plant Installation

[SWS 5.0108](#) [SWS 5.0504.1](#) [SWS 5.0504.2](#) [SWS 5.0106.1](#) [SWS 3.0101.1c](#)

All heating plant work shall be performed by a qualified, furnace technician, or trained agency personnel.

- Energy Auditor must perform either an estimated Manual J calculation (Residential Heat Loss Calculation form) or full Manual J calculations to be included with the invitation to bid. All calculations (Residential Heat Loss Calculation and full Manual J calculations) must be included in the client house file.
- Room by room load calculations will be performed when installing a new duct system or in retro-commissioning projects.
- When a new heating system is required, a new thermostat must be installed if mercury style thermostat exists.

Equipment Selection

- Efficiency ratings for all replacement equipment must be listed in the most current edition of the Air Conditioning, Heating, and Refrigeration Institute (AHRI) Directory of Certified Product Performance.

- Select heating equipment of the lowest capacity required to meet the design heating load and provide the air volume required by any air conditioning equipment installed
- Select system that is ENERGY STAR® certified or equivalent
 - 95% or more for furnaces
 - 90% for Boilers.
 - 80% for console or wall heaters) may be installed in homes using Non-DOE Funds in some cases. Contact DWEE when this is the case.
- Heat exchangers in all replacement heating plants must have a minimum 10-year manufacturer's warranty and a minimum 1-year warranty for materials, workmanship, and serviceability.
- The replacement heating plant must be competitively bid and properly sized using the post- weatherization characteristics of the home.
- A service label must be placed on or near the heating plant containing the name, business address and phone number of the company or agency performing the work, any repairs that were completed and the date the work was performed.

Unit Location and Installation

- Locate unit in a dry location and within conditioned space (when feasible) that provides adequate service access according to manufacturer specifications and applicable code
- Install unit according to manufacturer specifications and applicable building code (e.g., IRC, IMC, IBC) and ANSI/ACCA Standard 5 (HVAC Quality Installation Standard)

Fuel Delivery

- Select approved pipe type in accordance with applicable code (e.g., NFPA 54/ANSI/ACCA Z223.1, NFPA 31, IMC) and capable of supporting the total connected load of all appliances.
- Locate/route gas piping/train to create the least pressure drop possible and all fuel piping so as to not create a trip hazard and not be damaged by water
- Support fuel piping in compliance with applicable code
- All piping installations must contain at a minimum:
 - a manual fuel shut off valve, union joint, and a sediment trap for each appliance
- If installed, vent all gas pressure regulators requiring venting to outside the building with code-approved rigid pipe. Terminate pipe in a safe location without any thread, coupling, fitting etc. that would allow a plug to be easily fitted
- Seal all gas piping in accordance with manufacturer specifications
- Install a secondary liquid propane safety detector system (e.g., valve, exhaust fan, alarm light) for propane piping installed below grade
- If a gas pressure booster is necessary, confirm compatibility with the gas-fired equipment and check low and high gas pressure switches for proper operation
- If a fuel pump is required on oil systems, design it in accordance with manufacturer specifications based on fuel type, distance from tank and equipment size. Install a serviceable strainer in the pump supply side. Pump must be interlocked with appliance to cut off when appliance is not functioning.

- Use connectors and filter fittings for oil systems that are approved by applicable code (e.g. NFPA 31, IMC)

Support

- Ensure unit is level, stable, secured to ductwork, properly braced to prevent movement (seismic bracing), and elevated as required by applicable building code
- For Horizontal Flow Systems in an Attic, support equipment on a fireproof platform that is elevated above the insulation level or suspend with threaded rod in accordance with local codes and manufacturer specifications. Install vibration pads/isolators according to manufacturer specifications
- For Horizontal Flow Systems in a Subspace, support equipment on a non-wicking, fireproof material or suspend with threaded rod in accordance with local codes and manufacturer specifications. Install vibration pads/isolators according to manufacturer specifications.
- For Up flow Systems on a Platform, support equipment on a durable, fireproof platform capable of supporting the weight of the equipment. Install vibration pads/isolators according to manufacturer specifications
- For Downflow Systems, support equipment on ductwork capable of supporting the weight of the equipment.

Connections, Intakes and Terminations

- Install equipment connections (e.g., electrical service, condensate drains, ductwork, fuel, venting, refrigerant lines) to allow for necessary service and repair access to all portions of the equipment
- Locate all intakes/terminations in compliance with manufacturer specifications and applicable building code

Electrical Wiring

- Install electrical wiring according to NFPA 70, and provide an electrical disconnect within site of the unit.
- Install all high voltage wiring inside of protective conduit and approved junction boxes, no wiring connections (high or low voltage) will occur outside of appropriate junction box
- Install combustion venting in compliance with manufacturer specifications and applicable building code (e.g., IRC, IMC, IBC)

Condensate Drainage

- The condensate line must be drained to a code approved drain.
- Install a float switch interlocked to the cooling system power under all units that exist in or above conditioned space
- Pipe condensate to a properly sized sanitary drain or the outdoors and provide with traps as specified by the manufacturer and applicable building code

- When there is potential for condensation or freezing of the drain line, insulate condensate drain lines to a minimum of R-4 with insulation that contains a Class II or greater vapor retarder

Air Handler Sealing (See Job Aid 19-1) [Job Aid 19-1: Seal Ducts With Mastic](#)

- Seal air handler and adjoining ductwork:
- Select only UL 181 approved materials that are compatible with their intended surfaces, allow for differential expansion and contraction between dissimilar materials, and meet the requirements of the applicable fire safety code (e.g., thermal or ignition barriers)
- Select low volatile organic compound (VOC) sealants for use inside the pressure boundary that meet independent testing and verification protocols
- Clear surrounding insulation to expose joints being sealed, salvage for reuse if possible
- If duct must be cut open to gain access, position the hole to make repair with appropriate materials feasible
- Remove loose debris using a vacuum
- Remove any substance that will prevent sealant adhesion (tape, oil, etc.) using appropriate solvent
- Securely fasten all duct connections using appropriate mechanical fasteners according to [Chart 1 below](#)
- Seal all accessible seams, cracks, joints, holes, and penetrations of duct system
- Select method according to physical leak size:
- Mastic alone is acceptable for holes less than 1/8" in size that are more than 10' from air handler if static operating pressure is less than 1" of Water Column
- Seal leaks less than 1/4" using fiberglass mesh and mastic
- Seal leaks between 1/4" and 3/4" using a two stage process:
 - Install temporary tape as a backing material, then seal with fiberglass mesh and mastic that extends at least 1" past the temporary tape on all sides
- Repair leaks larger than 3/4" using a rigid duct patch. Mechanically fasten patch before applying mastic. Install fiberglass mesh and mastic over the seam, overlapping repair joint by at least 1" on all sides
- Seal gaps between boot and surface connections using fiberglass mesh tape and mastic or appropriate flexible caulking. Ensure sealant is dry before reinstalling the register. Ensure the register can be removed and reinstalled by the dwelling occupant.
- Seal any joints, cracks, and holes that are not gasketed or weather-stripped and are not needed for proper function or service of the unit using removable sealant (e.g., foil tape, gaskets, etc.)
- Seal the filter slot with a durable, client removable filter slot cover (e.g., magnetic strip)
- If air handler is installed in a building cavity (i.e., closet), seal the cavity to eliminate any return air leaks from adjoining chases ([See Chapter 3 in this article for isolating a Appliance Zone](#)) [Measure Guideline: Combustion Safety for Natural Draft Appliances Through Appliance Zone Isolation](#)

Occupant Safety and Documentation

- Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information

Chart 1 Duct Fastening

Metal to Metal	3 equally-spaced galvanized or stainless steel mechanical fasteners
Flex to Metal	UL-Listed approved tie bands using a tie band tensioning tool
Flex to Flex	Rigid metal coupling of the same size at the flex duct between the two sections. Fasten both joints with UL-listed approved tie bands using a tie band tensioning tool
Duct Board to Duct Board	Cut duct board edges to create an overlapping joint on all contact surfaces. Fasten joints with outward clinching (stitch) staples every 2 inches. Cover joint with UL 181 rated mastic embedded fiber tape and additional mastic that laps at least 1" past the edges of the tape on all sides.
Duct Board to Flexible Duct	Install a metal take-off collar on the duct board specifically designed for the thickness of the duct board. Bend all finger tabs down securely so collar shank is firmly seated against the exterior surface. Attach flexible duct to collar with UL listed tie bands using a tie band tensioning tool.
Duct Board to Metal	Fasten duct board to metal duct using metal channel and mechanical fasteners spaced evenly on all sides. Cover connection joint with UL-listed mastic embedded fiber tape and additional mastic that laps at least 1" past the edges of the tape on all sides.
Duct Board Plenum to Air Handler Cabinet	Fasten using metal channel fastened with screws space a maximum of 6" with the duct board sandwiched between the channel flanges. In up flow air handler connections, install a flexible connection between supply plenum and unit that does not reduce the inside dimensions of the duct.

Duct Boot to Subfloor	Minimum of 1 stainless steel or galvanized fastener per side
Duct Boot to Gypsum	If accessible, fasten a boot hanger to adjacent framing with mechanical fasteners, then connect boot to hanger with mechanical fasteners.
Metal Plenum to Air Handler Cabinet	Install a flexible connection between plenum and unit that does not reduce the inside dimensions of the duct. Fasten plenum on all sides with mechanical fasteners no more than every 6 inches.

2.0203.05 Thermostats [SWS 5.0201.1](#) [SWS 5.0101.1](#)

- Mercury thermostats may be replaced with Non DOE funds with digital programmable/setback thermostats and if being replaced must be disposed of properly.
- New thermostats must be calibrated and adjusted and any operable accessories that were installed on the existing heating system must be removed and reinstalled on the new heating system, if possible.
- If a new thermostat is installed, the wire hole in the wall behind the thermostat must be sealed.
- Document the location of the thermostat. Ensure it is not on an outside wall or near an outside door or over a heat supply/return duct.
- At Energy Auditor's discretion, a programmable/smart thermostat may be installed if the NEAT/MHEA Audit calls for it. The energy auditor must activate the measure in the NEAT/MHEA Audit set up to determine cost effectiveness. The Energy Auditor must first determine if the client is capable of re-setting the thermostat.
- The client will be taught how to use the thermostat and written manufacturer's instructions are to be left with the client.

2.0203.06 Heating Plant Distribution System

[SWS 5.0104.1](#) [SWS 5.0105](#) [SWS 5.0106](#) [SWS 5.0107](#)

Forced Air System for Energy Auditor

- Note the location of the registers in each room.
- Note any blocked or covered registers and unblock them and explain to client why this is important.
- Note the location of any registers outside the heated area or in other inappropriate locations. Consult with the client about appropriate corrective measures.
- Note any supply/return registers in the garage. These must be removed and sealed.

Note the presence of an suspected Asbestos on the ductwork. See [Section 2.15](#) on Asbestos in this document.

Ductwork Inspection

- Inspect for supply and return duct leakage location. See [Section 2.0606](#) & [Section 2.0607](#)
- Return air cannot come from unconditioned and unintentionally conditioned basement and crawl spaces.
- Seal return air plenum.
- Inspect ductwork support system. Note any areas needing additional support.
- Inspect for adequate supply and return ductwork.
- Note sections of the ductwork that are missing or disconnected, severely corroded, rusted through or punctured or other problems in the panned floor joist returns.
- Note any damage to the supply or return duct restricting airflow and repair as needed.
- Note the presence of ducts passing through unconditioned foundation spaces (see Foundation Types below).
- Note the existence of any duct insulation. Determine if any insulation is needed and record measurements and the amount needed.
- Note the size of the furnace filter and whether it is dirty. Show the client how to change the filter and educate the client on the importance of changing filter monthly.
- Note closeable rooms containing supply registers and no return.
- Note whether the central return is located in a room with a closeable door.
- Note the client's door closing habits.
- Discuss with the client the importance of having an uninterrupted airflow from the supply register to the return register. See [Section 2.07](#)
- New ductwork will be designed in accordance with ANSI/ACCA Manual D and manufacturer specifications. Termination design will be performed in accordance with ANSI/ACCA Manual T and manufacturer specifications.

Foundation Types

The choices are Conditioned, Non-Conditioned, Vented Non-Conditioned, Unintentionally Conditioned, Uninsulated Slab, Insulated Slab, and Exposed Floor. The first four choices are used to describe basements, crawlspaces, and any other type of enclosed foundation space.

Conditioned means that the space is purposefully heated (or more rarely cooled) by a heating or cooling system to maintain a temperature at or near the rest of the dwelling.

Unintentionally Heated means that there is a heat source in the space that adds heat unintentionally to the space so that the temperature of the space is maintained above the outside temperature or ground temperature.

Non-Conditioned means that there are no sources of heat in the space other than conduction through walls, floors, and perhaps insulated ductwork.

Vented Non-Conditioned means that there are no sources of heat in the space other than conduction through walls, floors and perhaps uninsulated ductwork, and the space is vented directly to the outdoors.

NEAT assumes that all Conditioned, Unintentionally Conditioned, Non-Conditioned, and Vented Non-Conditioned foundations (i.e., basements and crawl spaces) are enclosed by walls with thermal characteristics of concrete block walls.

For modeling purposes, spaces designated as Unintentionally Conditioned are treated by NEAT as unconditioned spaces.

If a foundation space is determined to be within the building pressure boundary, it must be modeled as Conditioned in NEAT to ensure the software properly evaluates the space for applicable measures, including foundation wall insulation and sill/rim joist insulation.

Auditors must use field verification (e.g., pressure diagnostics, visual inspection of the air barrier) to determine whether a foundation space is inside or outside the pressure boundary prior to assigning the appropriate NEAT classification.

All modeling assumptions and justifications must be documented in the client file.

Walls built with other cementitious materials, including solid concrete walls, likely have similar thermal characteristics to block walls.

Duct Repair/Replacement/Installation

- See [Chart 1](#) above for new ductwork installation and standards.
- See section above in Air Handler Sealing and section Duct Leakage Sealing [Section 2.0607](#) for sealing of existing ductwork.
- Any Ductwork exposed to the exterior must be insulated to a minimum of R12 and painted with a UV paint.
- All patches and sealing completed with mastic meeting UL 181.

Boilers SWS [5.0203.1b](#)

- Locate all water lines.
- Inspect for leakage.
- Repair leaks within allowable expenditure limits.
- Check for the presence of insulation on the heated distribution pipes.
- Consult with the client about the usage patterns of the area to determine if the water lines should be insulated.
- All distribution pipes in unconditioned areas are to be insulated to R-5 or greater.
- Inspect heat transfer fins and radiator, noting their condition and the presence of leaks and/or dirt.
- Inspect all bleeder valves for signs of leakage.

- Check for presence of zone valves. Inspect all zone valves for leaks and corrosion. If it is heating season, test the zone valves to see if they work.
- Note the presence and condition of any suspected asbestos on the pipes. Follow Asbestos guidelines in [Section 2.15](#).

Manufactured Homes

- Pre- and post-weatherization pressure pan testing and operating pressures must be completed in all manufactured homes to determine duct leakage to the outside.
- Operating pressures are measured by:
 - Turn on air handler.
 - At each register, insert pressure probe into center of duct.
 - Record each reading.
 - Add all readings together and divide by the number of registers.
 - Record as before duct sealing duct operating pressure in MHEA.
 - The after-duct sealing duct operating pressure will be recorded as 2 Pascal more than the pre-weatherization number.
- The pressure pan readings must be documented in the file and the Client Home Energy Audit Form.
- Inspect duct system to determine location of ducts and registers.
- Visually check all boots and repair and seal with mastic, if necessary.
- Visually check any crossover ducts and repair and seal with mastic, if necessary.
- Make sure these ducts are supported properly.
- Visually check furnace-plenum joint and repair and seal with mastic, if necessary.
- All ducts should be sealed immediately after the final registers.

2.0204 Gas Range/Oven Testing [SWS 6.0201.2](#)

Testing of gas ovens is required to identify combustion-related health and safety concerns and to inform occupants of potential risks. Not all identified conditions will be corrected using program funds. The Weatherization Program is not intended to provide full repair or replacement of cooking appliances except in cases where severe and immediate health and safety hazard exists and allowable funding is available.

Documentation

Testing results must be documented on WX9 and/or WX19/20

When Required

- Pre-weatherization testing of gas ovens shall be completed during the initial audit. Post-weatherization testing shall be completed when weatherization work, ventilation changes, or other conditions may affect combustion appliance performance.

Procedure

- Test for gas leaks of accessible gas lines and follow instructions in [Section 2.0201 Fuel Lines](#)
- Check inside oven for any stored items

- Turn Oven burner to at least 400 degrees and Range burners one by one to high.
- Monitor Ambient CO levels at all times during the test. Follow Action levels in Tables D.1.B and 7.3.3.3 below as applicable.

Range Top

- Inspect each burner for proper ignition, flame carryover and flame color
- Flames should be evenly distributed and predominantly blue in color.
- If deficiencies are observed recommend to client that service should be completed including:
 - Clean burner ports
 - Remove dirt, grease and soot buildup
 - Adjusting burner air shutters
 - Cleaning or replacing burner orifices
- Routine maintenance and service of range top burners shall be the responsibility of the client and will not be completed using NeWAP funds unless a severe health and safety hazard exists and allowable funding is available.

Oven

- After the oven reaches at least 400°F and has operated for approximately 7–12 minutes, or until steady-state conditions are achieved, test for CO. The auditor may complete other audit tasks while the oven is preheating.
- Using a combustion analyzer, locate the oven exhaust port or exhaust stream, typically located at the rear of the cooktop or oven vent opening, test and record CO reading.
- CO readings of 225 ppm *as measured* or less require no action.
- CO readings greater than 225 ppm *as measured* shall be documented, and the client shall be notified of the elevated CO and associated risks.
- When elevated CO levels are accompanied by severe combustion deficiencies, repeated failed testing, or conditions indicating that minor maintenance is unlikely to correct the issue, the appliance may be considered for replacement using allowable non-DOE funds (LIHEAP Health and Safety and State funds), when eligible.

Client Education

- Educate clients to follow these safety practices when using their gas range:
- Never use a range burner or gas oven as a space heater
- Open a window and turn on the kitchen fan exhaust fan when using the range or oven.
- Never install aluminum foil around a range burner or oven burner because the foil could interfere with the flame.

2.0205 Water Heaters

2.0205.01 Water Heater Safety

The costs associated with water heater repair and/or replacements are eligible for reimbursement through the NeWAP. Water Heating Measures that are indicated as cost-effective in the Energy Audit must be implemented.

The safety inspection of water heating systems must include all of the following:

- Conduct a fuel leakage test of the appliance piping and control system downstream of the shutoff valve in the supply line to the appliance.
- Visually inspect the venting system for proper size and horizontal pitch and determine that there is not blockage, vent size reduction or restriction, leakage, corrosion or other deficiencies that could cause an unsafe condition.
- Inspect burners and crossovers for blockage and corrosion.
- Determine that the pilot is burning properly and that main burner ignition is satisfactory.
- Test the pilot safety device to determine that it is operating properly.
- Visually determine that main burner gas is burning properly.
- Test for spillage at the draft hood relief opening.
- Testing of CO levels
- Verify that the water heater has a pilot access door, pressure relief valve with drip leg and draft hood.
- Inspect for evidence of water or combustion product leaks.
- Inspect for exposed wiring.

2.0205.02 Thermal Loss Reduction SWS [7.0301.2](#)

- Water Heater Tank and Pipe Insulation and Distribution System improvements help to reduce heat loss.
- These types of improvements can also help to reduce the amount of time that people wait for hot water after they turn on the faucet or shower.
- Water heater tank insulation must be a minimum R-10 blanket secured with tape and bound with a minimum of 2 wires, cords, plastic or nylon bands on the tank.
- Insulation must not be installed on water heaters if doing so voids the warranty of the unit. Insulation must not cover the pressure relief valve, end of the drip leg, draft hood, burner air inlet, pilot light access door, thermostat control, drain valve or the top of the water heater on natural gas or propane water heaters.
- Insulation must not cover the pressure relief valve, the drip leg, high limit switch, and plumbing pipes or drain valve on electric water heaters.
- Electric water heaters must have the top insulated and the thermostat control access panels accessible or marked and labeled.
- Hot and cold water lines must be insulated a minimum of 6 feet (to a maximum of 18 feet, if cost effective) in all directions from the water heater, using properly sized preformed pipe wrap or insulation specifically designed as pipe wrap.
- Accessible pipes must be insulated with 1-inch material having a minimum R-3 pipe insulation specifically manufactured as pipe insulation. [SWS 7.0301.1b](#)
- Each section of preformed pipe wrap must be fastened with a minimum of 3 wires, cords, plastic or nylon bands.
- Joints and elbows must be insulated.

- Duct tape must not be used as a means of fastening pipe wrap.
- Maintain a minimum of 6", or the distance specified by the manufacturer, between combustible pipe insulation and fuel-fired water heater draft hood and/or single wall metal vent materials.
- Water lines that have asbestos pipe wrap must not be insulated or sealed in the area containing the asbestos.

In Manufactured Housing:

All accessible water lines in the water heater compartment must be insulated using properly sized preformed pipe wrap or insulation specifically designed as pipe wrap.

2.0205.03 Maintenance/Inspection/Repair

- Existing unvented gas water heaters must be vented to the exterior.
- Missing or damaged Temperature and Pressure Relief Valves (discharge piping) must be replaced as per local, state and national codes and be plumbed within 6 inches of the floor.
- A maximum of \$250 in material and labor may be spent to correct deficiencies in water heaters. If the material and labor exceeds \$250, in owner occupied homes, the unit must be replaced.
- This maximum limitation does not apply to the addition of power vents to existing operating units where drafting is negatively impacted by air sealing the home thru the weatherization process.
- In renter occupied homes, the owner can be encouraged to repair or replace the water heater if the replacement is required due to Health & Safety concerns. If the Health & Safety replacement is made in accordance with these installation standards the Nebraska Weatherization Assistance Program may contribute a maximum of \$500.
- Weatherization of the building must not proceed until the water heater has been repaired or replaced.

2.0205.04 Water Heater Replacement [10 CFR Part 430 Subpart C Section d](#)

- Unsafe water heaters that cannot be repaired must be replaced. Weatherization of the building must not proceed until the water heater has been repaired or replaced.
- With Nebraska Department of Water, Energy and Environment approval, replacement water heaters may utilize a new fuel source.
- New fuel fired water heaters in framed homes must have a minimum UEF of 0.70.
- New electric water heaters in both framed and manufactured homes must have a minimum UEF of 0.93. [SWS 7.0302.1](#)
- All repairs and replacements must be performed by a Qualified Heating Technician, a Qualified Plumbing Technician or a utility company.
- Provide user's manual, warranty information, installation instructions, and installer contact information to the occupant.

- A service label must be placed on or near the water heater containing the name, business address and phone number of the company or agency performing the work, any repairs that were completed and the date the work was performed.
- Water heater replacements in rental units is allowed if the replacement is determined to be cost effective with a Savings-to-Investment Ratio (SIR) for replacing the unit that meets or exceeds funding source requirements.
- Health & Safety replacements in rental units is not allowed.

2.0205.05 Manufactured Homes

- New fuel fired water heaters in Manufactured Homes must be listed and labeled for use in Manufactured Homes, drafts all its combustion air from outside of the dwelling, and fits in the installation space with required clearances. [SWS 7.0302.2](#)
- New electric water heaters in both framed and manufactured homes must have a minimum UEF of 0.93. [SWS 7.0302.1](#)
- Replacement gas water heaters in manufactured homes must be specifically designed as manufactured home water heaters and the unit's location in the home must meet the installation of the unit to appropriately provide combustion air to the unit. [SWS 7.0302.2](#)
- New fuel fired water heaters in manufactured homes must have a minimum UEF of .59.

In the event a On Demand Water Heater or Heat Pump Water Heater is being considered please contact DWEE for approval and consideration.

2.03 Combustion Appliance and Dryer Venting

Combustion Appliance and dryer venting systems will be inspected for damage, leaks, disconnections, inadequate slope, and other safety hazards. Any hazards identified will be corrected within program limits.

2.0301 Furnace and Water Heater Venting

- Solid-fuel burning system cannot share the same flue with a gas-fired appliance. The venting system must be separated.
- If the venting system cannot be reconfigured, the house will not be weatherized.
- Inspect all vent systems (including solid-fuel) to ensure they extend from the heating unit to the outside of the dwelling.
- Look for excessive corrosion or rust, cracks, holes and unsealed or disconnected sections.
- Inspect the vent/chimney connections to determine whether they are securely fastened.
- Existing problems must be corrected.
- All new heating systems and/or water heaters must be vented in accordance with the manufacturers' specifications, the IRC, or NFPA 31, 54, 58 and 211 whichever is stricter.

- Any horizontal run in the vent connector must have a rise of at least ¼” per foot. If the existing connector does not, it should be repaired if possible.
 - Exception: If the appliance drafts properly under worst-case setup, this requirement is waived.
- When a common flue is used for more than one appliance, a ‘Y’ connector is the preferred connection. Be sure that vent connections are not directly across from each other, when an induced appliance is used.
- When checking vent sizing for proper venting, refer to local codes or the most recent IRC adopted by governing jurisdiction, NFPA codes, or the State of Nebraska, whichever is stricter.
- If a sealed combustion, two pipe furnace exists or is being installed, test the atmospheric draft water heater draft under worst-case conditions.
- Line the chimney according to code, if proper draft is not achieved.
 - If water heater does not have spillage, the chimney does not need to be lined.
 - If, at the time of inspection, the water heater spills, consider lining chimney before replacing water heater by using CAZ pressure and target blower door.
- Chimney vents will have an airspace clearance to combustibles in accordance with most current IRC adopted by governing jurisdiction or the State of Iowa, whichever is stricter.
- If present, thermal flue dampers must be removed.
- Determine whether all chimneys, including brick, blocks and mortar are in good condition and unobstructed.
- Necessary minor chimney repair must be made for air sealing, for example, seal between brick and metal liner in the attic.
- If a space heater is vented using a masonry chimney, it must be lined.
- All disconnected non-functioning chimneys in the attic must be sealed.
- Determine whether chimney liners are in good condition and unobstructed.
- Necessary repairs or replacement of liners must be completed.
- Inspect the exterior of chimneys for proper termination height according to most current NFPA 54 Chapter 12 adopted by authority having jurisdiction or adopted by the State of Nebraska (whichever is stricter) or according to manufacturer’s specifications.
- Install new chimney caps on all chimneys, if one does not exist

2.0302 Dryer Venting [SWS 6.0202.1](#) [Installation Standard 6.1, 6.2, 6.3](#)

Venting dryers indoors, into an attic or other areas of a home can lead to mold growth, respiratory or more serious health conditions.

NeWAP Subgrantees must vent existing unvented or improperly vented clothes dryers to the exterior of the home using the following installation standards:

- Dryer vent pipe shall not be installed with sheet metal screws, rivets or other intrusive fasteners that will collect lint.
- Acceptable fasteners include clamps, straps and duct mastic with mesh tape.

- Dryer vent pipe must be metal and the termination cap must be dampered and attached with rust proof fasteners.
- Dryer vent ductwork must be smooth surfaced and whenever possible, not exceed 14 feet in length.
- No more than two 90-degree elbows may be used in the vent system.
- Relocation of dryers may need to be considered to meet this vent pipe length limitation.
- Flexible metal (not flexible fabric duct) vent pipe may be used if it does not exceed 8 feet in length.
- The dryer vent pipe must not be installed with sheet metal\ screws, rivets or other intrusive fasteners that will collect lint.
- Dryer vent terminations must not have a pest screen.

2.04 Section Reserved

2.05 Section Reserved

2.06 Combustion Appliance Diagnostics

2.0601 Carbon Monoxide Testing (Ambient CO Test)

The purpose of carbon monoxide testing is to verify that combustion appliances within the dwelling are not producing hazardous levels of carbon monoxide. Testing shall be performed during the energy audit and again at the time of the final inspection.

Documentation

The Pre and Post Carbon Monoxide Testing results should be documented on the WX 19/20 and WX1.

When Required

Pre and Post Carbon Monoxide Testing is required when entering the home and all combustion appliances used by the home.

Procedure

Before entering the home, zero the combustion analyzer, gas detector, personal CO and turn on outside.

Ambient CO will be monitored at all times during the Energy Audit. Action Levels are in Table 7.3.3.3 below:

BPI 1200 Table 7.3.3.3

70 ppm or greater	36 ppm-69 ppm	9 ppm-35 ppm
If the CO instrument indicates an ambient CO level of 70 ppm or greater, the auditor shall immediately terminate the inspection and notify the homeowner/occupant of the need for all building occupants to evacuate the building. The auditor shall immediately leave the building and the appropriate emergency services shall be notified from outside the home.	If the CO instrument indicates an ambient CO reading in the range of 36 ppm-69 ppm, the auditor shall advise the homeowner/occupant that elevated levels of ambient CO have been detected. Windows and doors shall be opened. The auditor shall recommend that all possible sources of CO be turned off immediately. Where it appears that the source of CO is a permanently installed appliance, the auditor shall recommend that the appliance be turned off and the homeowner/occupant shall be advised to contact a qualified professional.	If the CO instrument indicates an ambient CO reading in the range of 9 ppm-35 ppm, the auditor shall advise the homeowner/occupant that CO has been detected and recommend that all possible sources of CO be checked and windows and doors opened. Where it appears that the source of CO is a permanently installed appliance, the homeowner/occupant shall be advised to contact a qualified professional.

2.0602 Worst Case Setup

[SWS 5.0501.1](#)

Documentation

Test Results documented on WX9 Form including photos in client file if applicable

When Required

Homes must be configured in the worst-case setup when conducting spillage/pressure tests and carbon monoxide tests are required/needed.

Procedure

The configuration of the house must be determined on a house-to-house basis.

- This configuration will include interior doors open or closed and the exhaust devices to be activated.
- In every case, the combustion test should be done with the house in its worst-case situation.

Consideration must be given to the following:

- The type and location of the heating system.
- The location and strength of all the exhausting equipment (bath fans, dryer, kitchen exhaust devices, etc.).
- The location of wood stoves, fireplaces, and water heater.
- The location of the forced air system returns, or supply leaks to the outside

Set home up for CAZ Testing

Place the home in winter mode with all the windows and exterior doors closed. If the blower door is set up, make sure the cover is on the fan.

- Fireplace or wood stove dampers must be closed when testing primary heating system.
- Deactivate all combustion appliances and exhaust fans.
- Check furnace filter, clean or remove.
- Close all interior doors unless there is a exhaust fan or return air ducts inside
- Close any existing door to the combustion appliance zone (CAZ).
- While standing in the combustion appliance zone using a digital pressure gauge run a hose to the exterior (outside) of the house to the “A” side **reference** tap on the digital gauge. This measures the CAZ with reference to (WRT) the outside. This is called the baseline measurement. **Record** this reading.
 - Baseline is the natural pressure difference for the interior and exterior of the home caused by natural elements such as temperature, wind, and stack effect. Leave the pressure gauge and hose in this set-up for more testing.
 - If you cannot personally fit in a CAZ area, you can stand outside with CAZ door closed with all previous steps completed and also run another hose from the “A” side **Input** tap and under the CAZ door and into the CAZ area.

Exhaust Fans

- Turn on the following exhaust equipment: clothes dryers (check and clean the dryer filter and look for blockage at the external vent damper prior to operation), range hoods, whole house vacuums and other exhaust fans. If there are speed controls, operate the exhaust equipment at the highest speed setting. Do not operate a whole house cooling exhaust fan.
- Measure and record the pressure in the CAZ WRT outside.

Air Handler

- Turn on any central forced air system blowers (fan only) and **measure and record the pressure in the CAZ WRT outside.**
 - If the pressure in the CAZ becomes more negative WRT outside after the blower is turned on, leave the blower ON during combustion appliance safety inspection.
 - If the pressure in the CAZ becomes more positive WRT outside after the blower is turned on, leave the central forced air system blowers OFF during the combustion appliance safety inspection.

CAZ Door(s)

- Open interior door(s) directly leading to the CAZ. **Measure and record the pressure in the CAZ WRT outside.**
 - If the pressure in the CAZ becomes more negative WRT outside after the door(s) are opened, leave the door(s) open during the combustion appliance safety inspection.

You have now found your Worst-Case setup.

2.0603 Spillage and CO Testing

The purpose of the Spillage and CO test is to ensure the proper venting of all combustion devices in the home to reduce the chances of the appliances spilling combustion gases into the home. All spillage tests must be taken under “Worst-Case Scenario” and under natural conditions if spillage tests fail under worst case scenario.

Spillage Testing procedures described in this section apply to Category I combustion appliances only

2.0603.01 Furnace and Water Heater

Spillage testing can be completed using a smoke device, mirror, glass and visual touch and feel. As a guideline to help determine possible spillage after weatherization a draft test is recommended. See [Section 2.0603.02](#). Low draft numbers would indicate possible spillage post weatherization.

CO assessment can be completed using the same location and hole as the Steady State Efficiency test. Instructions on how and where to drill those holes can be found in [Section 2.0203.02](#).

Documentation

Test Results for pre and post Weatherization Tests documented on WX9 Form including photos in client file if applicable. Daily Safety Test out results are documented on the WX10 Form.

When Required

NeWAP subgrantees must complete Spillage and CO testing on all areas within a home that contain one or more *atmospherically vented combustion appliances* pre and post weatherization. Daily Safety Test Out testing is also required when working on a home. Follow instructions on WX10 for Daily Safety Test out.

Procedures

- Put house in worst case setup.
- Spillage Assessment and CO Measurements in **Cold Vent** (except **water heaters** which are always measured in the Warm Vent).
 - Spillage shall be assessed at 5 minutes of main burner operation (see Table D.1.A below for action levels in case of spillage).
 - CO measurements of undiluted flue gas shall be taken at 5 minutes of main burner operation.
- Spillage Assessment and CO Measurements in **Water Heater** and/or **Warm Vent**.
 - Spillage will be assessed at 2 minutes of main burner operation
 - CO measurements of undiluted flue gas shall be taken at 5 minutes of main burner operation.
- Spillage and CO measurements will be compared to Table 1 7.95 for CO Thresholds and Table D.1.B for Action Levels. Tables are below

Multiple Combustion Appliances Sharing Chimney (Warm Vent)

- When a chimney and/or venting system is shared by multiple combustion appliances, the following procedures to test for spillage and CO levels must be used.
- Combustion appliances shall be tested in order from lowest BTU/h input rating to highest BTU/h input rating.
- The appliance with the lowest BTU/hour input rating shall be assessed for spillage and CO measurement in undiluted flue as described above in Cold or Warm Vent.
- Upon completion of spillage testing and CO measurement of the first appliance, place the next largest BTU/h combustion appliance in operation with the first appliance still firing. Do not wait for the chimney to cool.
- Retest the first appliance for spillage when the second appliance has reached 2 minutes of main burner operation. Test the second appliance for spillage immediately thereafter.
- Measure CO level in the undiluted flue gas of the second appliance at 5 minutes of main burner operation. Continue this process for each additional commonly vented combustion appliance in order of BTU/h input rating until all are running simultaneously.
- See Table 6 for action levels in case of spillage. See Table 8 for CO action levels.
- If spillage during under worst case, turn off appliance, let vent cool and retest under natural condition. If spillage fails under natural condition, the appliance(s) must be repaired or replaced.

Pre-weatherization

- If the water heater has spillage the energy auditor must install CO alarms. If after weatherization is completed, the water heater is spilling, the water heater must be repaired or replaced.

Spillage Solutions under Worst Case Conditions

- Check for blockage in the vent system and, if found, correct the problem.
- Check vent system for leaks, including missing or loose cleanout doors or open or cracked mortar joints. Seal vent system as appropriate. Lining a chimney may solve this problem.
- Properly seal return duct leakage in the CAZ.
- Increase the CAZ air volume by connecting the CAZ to other areas within the conditioned volume of the dwelling (see NFPA 54, NFPA 31).
- Increase the CAZ air volume by connecting the CAZ to the outdoors (see NFPA 54, NFPA 31, or NFPA 211).
- Install fan to supply air to pressurize the CAZ. It is best to link the controls of such a make-up air fan to the operation of the combustion appliance(s) in the CAZ.

2.0603.02 Draft Test

COMBUSTION APPLIANCE ZONE AND WORST CASE DRAFT TESTING

with DG-700 Digital Manometer

You are in CAZ

House Should be in Winter Mode with Blower Door Fan Covered
Setup Hoses to Measure:
CAZ with reference to Outside on Channel A and
Vent with reference to CAZ on Channel B (based on your location)

1. Connect Hoses to Manometer
2. Turn Manometer on.
3. Press BASELINE Button 1 time.
4. Press START Button 1 time.
5. Wait until number is steady, then press ENTER Button 1 time.
6. Follow BPI Procedure to Determine Worst Case Depressurization for each CAZ
7. Recreate Worst Case Depressurization and Perform Worst Case Draft Test on each Appliance starting with the smallest BTU.

0. You may press the TIME AVG Button until it says LONG. Record reading when it becomes steady. Press START Button once to restart TIME AVG as necessary.

You are NOT in CAZ

BPI STANDARDS

Minimum Acceptable Draft with Static Probe

Outdoor Temp (deg F)	Minimum Draft (pascals)
100	-0.50
90	-0.50
80	-0.75
70	-1.00
60	-1.25
50	-1.50
40	-1.75
30	-2.00
20	-2.25
10	-2.50
0	-2.50

Maximum Spillage Period = 60 seconds

Anthony Cox NRCERT 2006, Manometer Graphics Compliments of Rees Byars South Carolina Weatherization Program

2.0603.03 Gas Range/Oven Testing and Replacement Policy

SWS 6.0201.2

Testing of gas ovens is required to identify combustion-related health and safety concerns and to inform occupants of potential risks. Not all identified conditions will be corrected using program funds. The Weatherization Program is not intended to provide full repair or replacement of cooking appliances except in cases where severe and immediate health and safety hazard exists and allowable funding is available.

Documentation

Testing results must be documented on WX9 and/or WX19/20

When Required

- Pre-weatherization testing of gas ovens shall be completed during the initial audit. Post-weatherization testing shall be completed when weatherization work, ventilation changes, or other conditions may affect combustion appliance performance.

Procedure

- Test for gas leaks of accessible gas lines and follow instructions in [Section 2.0201 Fuel Lines](#)
- Check inside oven for any stored items
- Turn Oven burner to at least 400 degrees and Range burners one by one to high.
- Always Monitor Ambient CO levels. Follow Action levels in [Tables D.1.B](#) below and [7.3.3.3](#) in section 2.0601 above as applicable.

Range Top

- Inspect each burner for proper ignition, flame carryover and flame color
- Flames should be evenly distributed and predominantly blue in color.
- If deficiencies are observed recommend to client that service should be completed including:
 - Clean burner ports
 - Remove dirt, grease and soot buildup
 - Adjusting burner air shutters
 - Cleaning or replacing burner orifices
- Routine maintenance and service of range top burners shall be the responsibility of the client and will not be completed using NeWAP funds unless a severe health and safety hazard exists and allowable funding is available.

Oven

- After the oven reaches at least 400°F and has operated for approximately 7–12 minutes, or until steady-state conditions are achieved, test for CO. The auditor may complete other audit tasks while the oven is preheating.
- Using a combustion analyzer, locate the oven exhaust port or exhaust stream, typically located at the rear of the cooktop or oven vent opening, test and record CO reading.
- CO readings of 225 ppm *as measured* or less require no action.
- CO readings greater than 225 ppm *as measured* shall be documented, and the client shall be notified of the elevated CO and associated risks.

- When elevated CO levels are accompanied by severe combustion deficiencies, repeated failed testing, or conditions indicating that minor maintenance is unlikely to correct the issue, the appliance may be considered for replacement using allowable non-DOE funds (LIHEAP Health and Safety and State funds), when eligible.

Client Education

- Educate clients to follow these safety practices when using their gas range:
- Never use a range burner or gas oven as a space heater
- Open a window and turn on the kitchen fan exhaust fan when using the range or oven.
- Never install aluminum foil around a range burner or oven burner because the foil could interfere with the flame.

Table 1

CO Thresholds for Fossil-Fuel Fired Combustion Appliances	
Appliance	Threshold Limit
Central Furnace (all categories)	400 ppm air free ⁴
Boiler	400 ppm air free
Floor Furnace	400 ppm air free
Gravity Furnace	400 ppm air free
Wall Furnace (BIV)	200 ppm air free
Wall Furnace (Direct Vent)	400 ppm air free
Vented Room Heater	200 ppm air free
Unvented Room Heater	200 ppm air free
Water Heater	200 ppm air free
Oven/Broiler	225 ppm as measured
Clothes Dryer	400 ppm air free
Refrigerator	25 ppm as measured
Gas Log (gas fireplace)	25 ppm as measured in vent
Gas Log (installed in wood burning)	400 ppm air free in firebox

TABLE D.1.A ACTION LEVELS FOR SPILLAGE IN COMBUSTION APPLIANCES

The following actions shall be taken when spillage occurs under the specific circumstances detailed below.

Test Result	Action Required
Greatest CAZ depressurization occurs with the air handler on*	Conduct further analysis of the distribution system to determine if leaky ducts or other HVAC-induced imbalances are the cause of the spillage. If so, recommend distribution system repairs that will reduce or eliminate the CAZ depressurization.
Greatest CAZ depressurization occurs with door to CAZ closed, but is alleviated when door to CAZ is open*	Recommend measures to improve air transfer between the CAZ and the core of the house

The cause of spillage has been traced to excessive exhaust** independent of CAZ door position, air handler, or a problem with the flue†	Verify that sufficient combustion air is available per <i>ANSI Z223.1/NFPA 54</i> for gas-fired appliances and <i>NFPA 31</i> for oil-fired appliances or recommend verification by a qualified professional and/or Recommend further evaluation/service by a qualified professional to address the venting/combustion air issues
*In the case where both spillage and excessive CO are present, in addition to the specific recommendations above, recommend that the appliance be shut down until it can be serviced by a qualified professional. ** Refers to exhaust caused by mechanical ventilation and/or other means of exfiltration. †When a recommendation to replace atmospherically vented combustion equipment inside the pressure boundary is made, and when cost-effective, recommend replacement with direct-vented, or power-vented equipment (or non-combustion equipment, such as a heat pump), which is ENERGY STAR®-labeled.	
TABLE D.1 B. ACTION LEVELS FOR CO IN COMBUSTION APPLIANCES	
Unacceptable CO level	Advise the homeowner/occupant that the appliance should be serviced immediately by a qualified professional Note: If ambient CO levels do not exceed 70 ppm, testing of other appliances and other audit procedures may continue at the discretion of the auditor
Acceptable CO level	No action required

2.0604 Temp Rise and Static Pressure

The measurement of temperature rise, and total external static pressure is performed to evaluate furnace performance and identify potential operational issues. Temperature rise represents the difference between the air temperature entering the return duct and the air leaving the supply duct. Total external static pressure reflects the resistance to airflow within the system by comparing internal air pressure within the appliance to the surrounding ambient air. As static pressure increases, airflow through the system decreases, demonstrating an inverse relationship between pressure and airflow.

Temp Rise

Documentation

Temp Rise results will be documented on the WX9 form. Static Pressure testing can be recorded on the HVAC section of the WX19/20 and WX1 forms

When Required

Temp Rise testing is required on all force air heating systems.

Procedure

- Home set up in winter mode with all registers open and exterior doors and windows closed.
- Drill holes in the supply and return duct system within a foot or two of plenum for supply and before the furnace filter in return.
- If filter is dirty it should be removed before testing
- Once furnace has ran for 5 minutes or steady state is achieved, place calibrated thermometer(s) in holes in the supply and return trunklines and record temperature.
- Subtract Supply temp from Return temp and located the manufacturers temp rise allowance located on the data plate usually outside the unit or just inside the door and compare results.
- If results are outside the manufacturers range, suggest service by a HVAC technician and document results.

Static Pressure

Procedure

- Setup for Static Pressure testing is the same as Temp Rise and you can use same holes.
- Use a digital monometer, 2 L shaped static pressure tubes and 2 pressure hose.
- Connect pressure hose from return tube to “A” Input port on digital monometer and connect pressure hose from supply tube to “A” Reference port on digital monometer.
- With Furnace blower running, insert L shaped probes in the supply and return with the tube end facing into the air stream. The total of these readings in Pa should be equal to or less than 125 Pa. (125 Pa = .5 IWC)
- If static pressure is higher than manufactures recommendations, check the return and supply individually. The side with the higher static pressure will have more restrictions to be alleviated if service is required. If either side is higher the 75 Pa individually, service may be needed.
 - Filter may be dirty or wrong MERV rating
 - A-coil may be clogged or dirty
 - Obstruction in duct system

2.0605 Clocking the Meter

Clocking the gas meter is used to verify the gas being consumed matches the input of the appliance or to measure the input of a specific appliance.

Documentation

Results can be recorded on the WX19/20 and the WX1.

When Required

Clocking the Meter is a optional test used when a required test shows a issue and Auditor or inspector needs more information to find a issue.

Procedure

- Turn off all gas combustion appliances such as water heaters, dryers, cook stoves, and space heaters that are connected to the meter you are timing, except for the appliance you wish to test.
- Fire the unit being tested, and watch the dials of the gas meter.
- Monitor the dials on the gas meter, timing how long it takes to burn a cubic foot of gas.
- Use the length of time it took to burn a cubic foot of gas (in seconds) in the following formula to calculate BTUs/hour: $(3,600 \times 1,000)/\text{number of seconds}$
- In this formula 3,600 represents the number of seconds in an hour, and 1,000 is the number of Btu in one cubic foot of natural gas.
- Compare the BTUs/hour value you calculate at the meter with the input BTUs/hour labeled on the appliance.
- If the measured input is within 5% or higher or lower than input on the name plate, the gas pressure can be adjusted by a *Qualified Heating Technician*.
- If the measured input is still out of range, the tech should recommend the system be inspected by the gas supplier.

2.0606 Pressure Pan Testing

Pressure pan testing is used to identify duct leaks or disconnections that are connected to the outside of the building. This test does not quantify total duct leakage but instead indicates the presence of leakage to the outside by measuring pressure at individual registers.

Documentation

Pressure pan testing results will be documented on the WX19/20 and WX1

When Required

Pressure Pan testing is required when duct systems are outside the thermal envelope and in all mobile homes. But can be completed when a Auditor feels that it is needed.

Procedure

- Set up home in normal winter conditions with all exterior doors and windows closed.
 - If basement is unconditioned, open a window or door between basement and outside. Close any door or hatch between conditioned space and basement during testing
 - If furnace has fresh air intake from the outside, seal the intake during the test.
 - If supply ducts are located in a garage or other unconditioned space seal these registers so they do not show up as duct leakage.
- Ensure Furnace and air handler are off.
- Remove furnace filter.
- Ensure all furnace grills, registers and dampers are fully open in the conditioned space. Make sure to mark dampers so they can be returned to original position.
- Set up blower door using the procedure in [Section 2.0701](#)

- Depressurize the home to -50 Pa
 - If pressurizing the home must be done, results will still be interpreted the same, you will be pushing air through leaks instead of pulling air in leaks.
- Connect hose between pressure pan and Input tap on monometer. Leave Reference tap open.
- With the blower door running, place the pressure pan completely over each grille or register one by one to form a tight seal. Leave all other grilles and registers open when making a test. Record each reading, which should give a positive pressure reading.
- If pressure pan is too big or register is in a hard-to-reach place, tape over register and stick a probe through the tape to obtain reading instead of pressure pan. Results will be the same.

There are 3 pre-qualifying criteria for determining the need to measure and repair duct system leakage for energy use reduction in Site built homes. All pressure pan measurements listed below are to be taken with the house depressurized by 50 Pascals with respect to outside. It is assumed that a pressure pan reading will be taken at every register and grille in the house, and that all unconditioned spaces containing ducts are well connected to the outside.

- **Criteria #1 (Tight Duct Systems):** This is the NeWAP target for Site Built homes. All pressure pan readings are less than 1.5 Pascals, and not more than 2 readings can be greater than 1.0 Pascals. Duct systems in **Criteria #1** houses are considered tight for typical existing systems. **Criteria #1** houses should require no direct measurement of duct leakage, and repairs for duct leakage are not recommended unless they are very easy to make, or repair is needed to correct a health, safety, durability or comfort problem.
- **Criteria #2 (Leaky Duct Systems):** 3 or more pressure pan readings are greater than 2.0 Pascals. Duct systems found in houses meeting **Criteria #2** are considered leaky and repair is suggested for energy use reduction. Measurement and quantification of duct leakage is not needed because the pressure pan readings have told us that the duct system is leaky enough to warrant immediate repair work.
Each pressure pan reading above 1.5 Pascals should be identified and the associated duct run repaired, starting with the highest pressure pan reading and working to the lowest. It is often useful to perform mid-repair pressure pan testing to reduce the amount of time required to repair the system. Often large leaks telegraph their presence to other portions of the duct system, and once the large leaks are repaired, many other pressure pan readings drop.
- **Criteria #3 (Gray Area Systems):**
All houses not meeting **Criteria #1** or **#2** above are classified as Gray Area Systems.
Gray Area Systems require direct measurement and quantification of leakage to determine whether or not repairs will be cost effective. Pressure pan readings alone will not provide enough information to determine if duct repair is needed. Direct measurement is defined as measuring duct leakage to the outside in cubic feet per minute (CFM), using either a duct airtightness tester in combination with a Blower Door, or using the modified Blower Door subtraction technique. If duct leakage measurements using these methods are greater than specified program

target leakage, then repair is recommended.

- Site Built home ducts target readings are required to meet Criteria #1.
- Mobile home ducts target readings are 2.0 or less.

If that cannot be achieved this must be noted and reason's why explained in client data.

If unconditioned spaces in which ducts are not well connected to outdoors and/or well connected to the house, then the unconditioned space will be at a pressure difference between the outside and inside house pressure during the blower door test. In this case the pressure pan difference can give a artificially low number.

- With the house at -50 Pascal, measure the pressure difference between the house and the unconditioned space. (For example, the house-to-zone pressure is 10 Pascal and the pressure pan reading is 2.0 Pascal.)
- Multiply the pressure pan reading by the multiplier in Table 12 to get the adjusted reading. (For example, multiply the pressure pan reading of 2.0 Pascal by 5, resulting in a pressure pan reading of 10 Pascal.) Manufactured homes are exempt from this test.
- Repeat the test for each register and grille on ducts located in unconditioned spaces in a systematic fashion.

Table 12 Pressure Pan Multipliers

House/Zone Pressure	Pressure Pan Multiplier
50	1
45	1.1
40	1.25
35	1.42
30	1.66
25	2
20	2.5
15	3.5
10	5
5	10

2.0607 Duct Leakage/Sealing [SWS 5.0106.1](#)

[Installation Standard 4.17, 4.18, 4.19, 4.20](#)

Duct Sealing/Insulating is to be entered into the NEAT/MHEA for consideration when any of the following criteria is met:

- There is leakage in the duct system to the outside the conditioned area according to the criteria above in [Section 2.0606](#).
- There is spillage problems caused by duct leakage, or

- Either the furnace and/or water heater are an atmospheric draft appliance and there is a pressure reading in the CAZ with reference to the outside of **-5 Pascal** or greater (e.g., -6, -7, etc.) after subtracting the baseline with reference to outside, or
- Both the furnace and water heater are induced draft appliances and there is a pressure reading in the CAZ with reference to the outside of **-15 Pascal** or greater (e.g., -16, -17, etc.) after subtracting the baseline with reference to outside, or
- There are large openings or disconnected ducts, or
- There are **return** air registers in the combustion air zone unless the CAZ is a lived-in, heated area.
- All duct sealing will be completed in accordance with SWS Section [5.0106.1](#) in the SWS.
- All duct insulation will be completed in accordance with SWS Section [5.0107.1](#) in the SWS.

2.0608 Solid Fuel Appliance Inspection and Testing

Fireplaces present special hazards that are affected by weatherization. If draft is poor, smoke may downdraft into living space causing poor indoor air quality, which can be appropriately ventilated by the client. However, near the end of a wood fire glowing coals remain, radiating heat; while the draft lowers and allows the top of the chimney to cool, further reducing draft.

The reduced draft also reduces oxygen available to glowing coals causing production of CO without the smoke that encourages appropriate space ventilation. This creates a dangerous situation as the CO enters the living space due to the lowered draft, causing drowsiness, and sometimes more dangerous situations for the occupants.

Visual Inspection

- Fireplaces must be inspected pre- and post-weatherization.
- The inspection shall include, but not be limited to:
- System clearances to combustibles, inside and outside of the home.
- The type and condition of the flooring material where the unit is installed.
- Visual signs of wear or missing or malfunctioning components.
- Evidence of ash deposit build-out.
- Evidence of creosote build-up.
- Signs of structural failure.
- Evidence of blockage, restriction, leakage, corrosion and/or flame roll-out.
- Visual evidence of soot on the walls, mantel or ceiling or hearth.

System Evaluation

Assessing solid fuel fired appliances involves inspecting the venting/chimney and the overall installation to ensure it adheres to applicable state and local codes.

To accurately inspect/model solid-fuel heating systems, auditors must document both the heating capacity (BTU/hr) and steady-state or seasonal efficiency (%) of the appliance using a few methods:

Record efficiency and capacity directly from the Manufacturer data plate, Installation manual or manufacturer specifications, [AHRI site](#) , [EPA site](#), or manufacturer website listings.

If manufacturer data plate is not available, classify the system into one of the following categories:

- Open fireplace
- Non-certified wood stove (pre-EPA)
- EPA-certified wood stove
- Pellet stove
- Coal stove or furnace
- Wood furnace or boiler (indoor or outdoor)

Estimate Efficiency by Appliance Type

Use the following default efficiency values when manufacturer data is unavailable:

- Open fireplace: **10–20%** (use 15% default)
- Non-certified wood stove (pre-1990): **40–55%** (use 50% default)
- EPA-certified wood stove: **60–75%** (use 65% default)
- Pellet stove: **70–85%** (use 75% default)
- Wood furnace/boiler (non-gasification): **50–65%** (use 60% default)
- Advanced wood boiler (gasification type): **70–85%** (use 75% default)
- Coal stove/furnace: **60–75%** (use 65% default)

Estimate Heating Capacity (BTU/hr)

When capacity is not listed, use one or more of the following methods:

- Manufacturer Lookup (if brand/model partially known)
 - Search manufacturer literature or EPA databases using visible identifiers
- Firebox Size Method (Wood Appliances)
 - Estimate firebox volume (cubic feet)
 - Use general rule of thumb:
 - 20,000–30,000 BTU/hr per cubic foot of firebox volume
- Comparable Unit Method
 - Match appliance size and design to similar units with known ratings

Field Judgment (Last Resort)

- Small stove: 20,000–40,000 BTU/hr
- Medium stove: 40,000–70,000 BTU/hr
- Large stove/furnace: 70,000–120,000+ BTU/hr

Auditors shall select the value that best reflects the observed condition and design of the unit.

State code requires that the flue areas and chimney requirements of masonry fireplaces meet the following requirements:

- Flue area requirements of masonry fireplaces (excluding sealed combustion/direct vented units) must meet the following requirement:
 - Round chimney flues shall have a minimum cross-sectional area of at least 1/12 of the fireplace opening.
 - Square chimney flues shall have a minimum cross-sectional area of at least 1/10 of the fireplace opening.
 - Rectangular chimney flues with an aspect ratio less than 2 to 1 shall have a minimum cross-sectional area of at least 1/10 of the fireplace opening.
 - Rectangular chimney flues with an aspect ratio of 2 to 1 or more shall have a minimum cross-sectional area of at least 1/8 of the fireplace opening.

Solid fuel fired appliances must be evaluated for the impact of their operation on other combustion appliances.

- A blower door must be set to run at 300 *CFM* (set up as for depressurization testing) to mimic the worst- case airflow dynamics likely when a fireplace or stove is in use.
- If spillage occurs in the other combustion appliances under the worst-case depressurization test, spillage testing would then be performed under natural conditions and Carbon Monoxide Detectors will be installed, as per manufacturer's instructions, located adjacent to the fireplace and the back-drafting appliance.

Manufactured Homes

Manufactured homes with solid fuel combustion heating systems that are not listed for manufactured home use, improperly installed, or that do not meet sealed combustion requirements shall be evaluated for correction or deferral. See Section 2.0203.01b for additional information.

2.07 Air Pressure Diagnostics

Air pressure diagnostics are essential for evaluating how air moves throughout a home and how different zones interact with each other and the outdoors. By measuring pressure differences, auditors can identify conditions that lead to poor airflow, duct leakage, and unsafe depressurization, particularly in areas containing combustion appliances. These diagnostics help ensure that weatherization improvements do not create or worsen health and safety issues, such as back drafting or indoor air quality problems, while also supporting overall system performance and efficiency.

2.0701 Blower Door Test

Documentation

Blower Door test results recorded in the client file and on WX19/20 and WX1

When Required

Pre and Post blower door testing is required for pre and post weatherization. When Friable asbestos is present certain precautions need to be taken. See [Section 2.1501](#) for more information.

Procedure

Set up the house for winter conditions with exterior doors, primary windows and storm windows closed. The door to the basement should be either open or closed, according to whether or not the basement is considered to be within the thermal boundary.

- Install blower-door frame, panel, and fan in an exterior doorway with a clear path to outdoors. On windy days, install the blower door on the home's lee-ward side if possible. Pay attention to the blower door's location and any other conditions that may affect test results.
- Follow manufacturer's instructions for fan orientation and digital-manometer setup for either pressurization or depressurization. Depressurization is the most common orientation.
- Connect Channel A of the digital manometer to measure house WRT outdoors. Place the outside hose at least 5 feet away from the fan. Connect Channel B to measure fan WRT zone near fan inlet. Don't place the hose directly in front of the fan intake.
- Ensure that children, pets, and other potential interferences are at a safe distance from the fan.

Using a DG-700

1. Turn on the manometer by pushing the ON/OFF button.
2. Select the MODE: PR/FL@50.
3. Select the correct DEVICE that matches the blower door you're using.
4. With the fan covered, conduct the BASELINE procedure to cancel out the background wind and stack pressures. Let the manometer average the baseline pressure for at least 30 seconds.
5. Remove the cover from the blower-door fan. Complete the next two steps for tighter buildings.
6. Install the flow ring in the blower-door fan which matches the expected flow rate. The fan pressure should be at least 25 Pa while measuring CFM@50.
7. Push CONFIG or Range button until you match the flow ring being used.
8. Turn on the blower-door fan slowly with the controller. Increase fan speed until the building depressurization on the Channel A screen is between -45 and -55 pascals. The reading doesn't need to be exactly -50 pascals.
9. The Channel B screen displays the single-point CFM50 air leakage of the building. If this number is fluctuating a lot, push the TIME AVG button to increase the averaging time period.
10. You can also use the cruise-control function to automatically control the fan speed to create and hold -50 pascals of pressure.

Using a DG-1000

1. Turn on the DG1000.

2. Choose the test mode: “Auto Test” (preferred) or “Manual” mode.
3. Select the Minneapolis Testing Standard.
4. Set target pressure: usually -50 Pascals.
5. Calibrate tubing length if prompted (important for accuracy).
6. If using Auto Test:
 - Let the DG1000 guide you through the automated baseline reading.
 - The DG1000 will then adjust fan speed to reach and maintain -50 Pa.
 - The DG1000 will calculate the airflow in CFM at -50 Pa (CFM50), and optionally ACH50(air changes per hour at 50 Pa).
7. If doing manually:
 - Turn on the fan and adjust speed until Channel A reads -50 Pa.
 - Choose correct flow ring setting.
 - Read airflow on Channel B in CFM (use).

Blower Door Follow Up

- Inspect combustion appliance pilot lights to ensure that blower-door testing didn't extinguish them.
- Reset thermostats of heaters and water heaters that were turned down for testing.
- Remove any temporary plugs that were installed to increase house pressure.
- Document the location where the blower door was installed.
- Document any unusual conditions affecting the blower-door test.

2.0702 Approximate Leakage Area

There are several ways to convert blower-door CFM50 measurements into square inches of total leakage area. A simple and rough way to convert CFM50 into an approximate leakage area (ALA) is to divide CFM50 by 10. The ALA can help you visualize the size of openings in a home or section of a home.

$$\text{ALA (square inches)} = \text{CFM50} \div 10$$

2.0703 Zone Pressure Test

Creating and measuring zonal pressures is one of the most effective ways to evaluate air leakage in multifamily buildings. Testers observe the building's assemblies and architectural features and formulate assumptions and questions to guide their air-leakage testing and air sealing. The testers may decide to isolate various zones and assemblies to determine their individual leakage to outdoors or to adjacent zones. The goal is a testing and air-sealing process that is cost-effective. Zone Pressure testing is completed with the blower door running. The tests may be quantitative or qualitative. Here are some zones and assemblies that you may want to pressure-test:

- Stairwells
- Ventilation and HVAC ducts, duct joints, and duct chases.
- Overhangs and balconies.

- Basements, crawl spaces, and penthouses.
- Floor and ceiling cavities.

Documentation

Test results will be recorded on WX19/20 and WX1

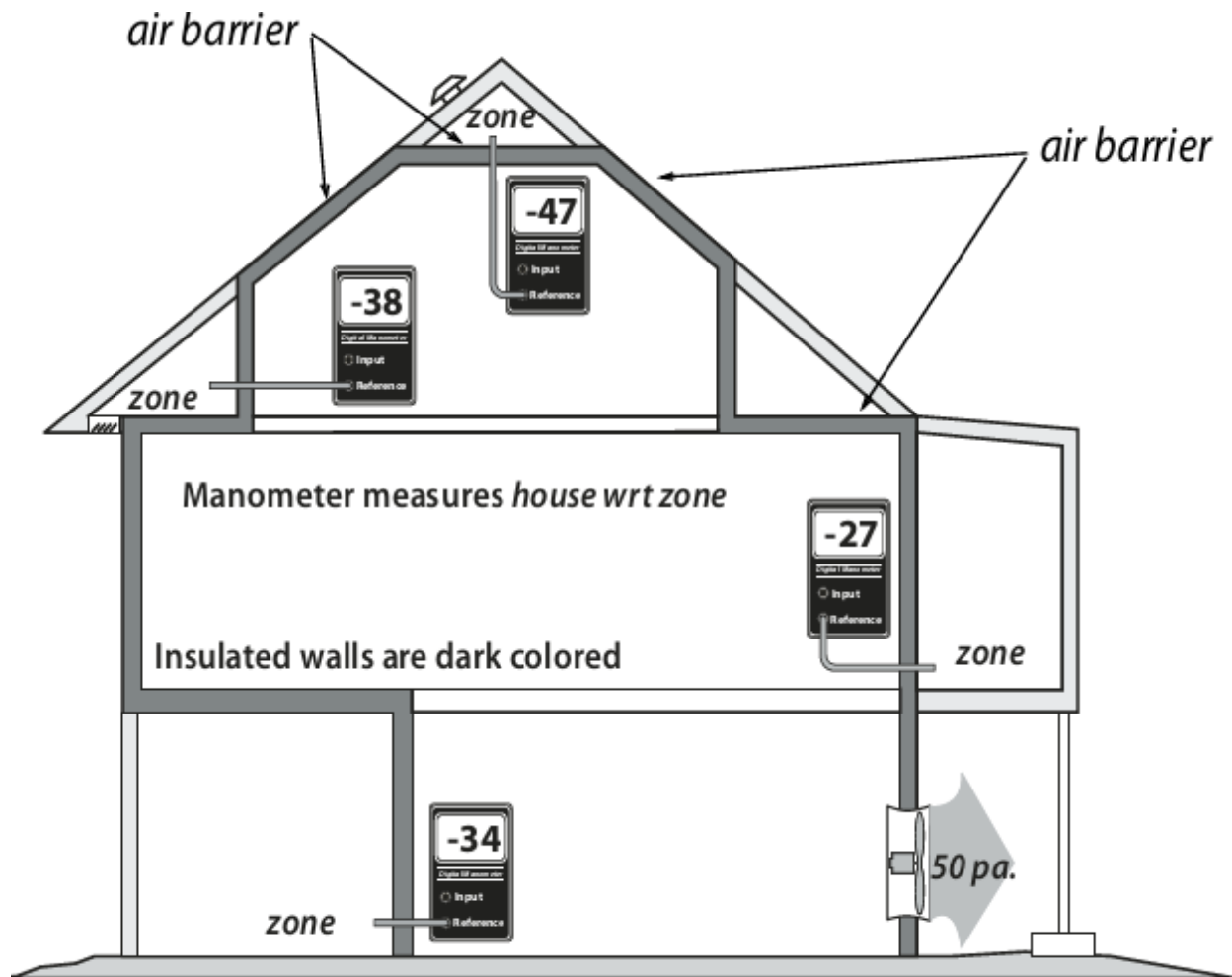
When Required

Zone Pressure Testing is required when the home has an attached garage, testing across the common wall and when crawlspaces are present either outside the Pressure boundary or if found inside it to determine if the crawlspace is connected the home.

Procedure

Depressurize house to –50 pascals with a blower door.

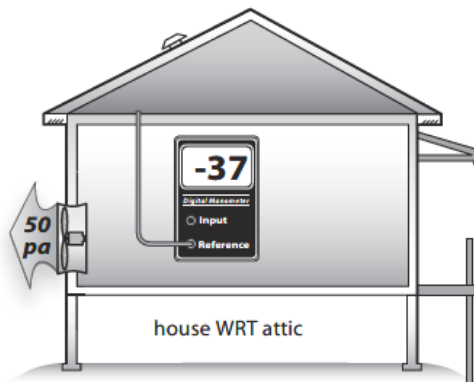
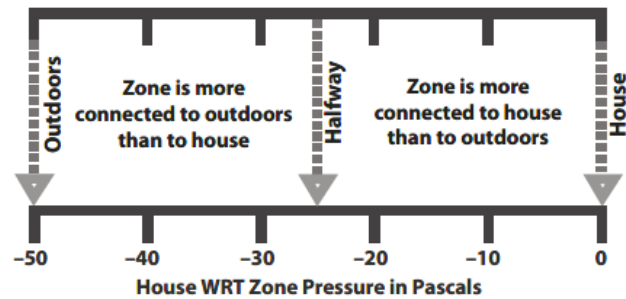
- Find an existing hole, or drill a hole through the floor, wall, or ceiling between the conditioned space and the intermediate zone.
- Connect the reference port of a digital manometer to a hose reaching into the zone.
- Leave the input port of the digital manometer open to the indoors.
- Read the negative pressure given by the manometer. This reading is the house-to-zone pressure, which will be –50 pascals, if the air barrier between house and zone is airtight and the zone itself is well-connected to outdoors.
- If the reading is significantly less negative than –45 pascals, find the air barrier's largest leaks and seal them.
- Repeat steps 1 through 5, performing more air-sealing as necessary, until the pressure is as close to –50 pascals as possible.



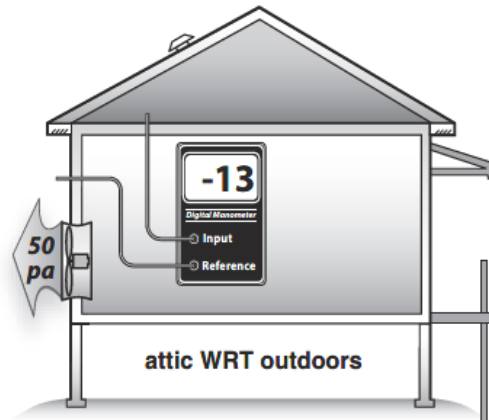
Pressure-testing building zones: Measuring the pressure difference across the assumed thermal boundary (house wrt zone) tells you whether the air barrier and insulation are aligned. If the manometer reads close to -50 pascals, the air barrier and insulation are aligned and the tested zones are well-connected to outdoors.

Interpreting house-to-zone

pressure: The greater the negative number the better the air barrier is performing.



House-to-attic pressure: This commonly used measurement is convenient because it requires only one hose.



Attic-to-outdoors pressure: This measurement confirms the first because the two add up to -50 pascals.

2.0704 Room to Room Pressure Test [SWS 5.0104.1o](#)

Room-to-room pressure testing measures the pressure difference between each room in the house and the main body of the house when **the air handler is running**. The test can indicate the degree to which:

- There is an imbalance of air distribution resulting from closed interior doors. The doors can act as dampers restricting the flow of air within the dwelling.
- There is an imbalance of air distribution resulting from airflow differences between the supply side and return side of the ductwork.
- By providing the room-to-room pressure balance, the return air to the furnace is unrestricted from inside the heated portion of the dwelling.

Documentation

Test Results can be entered on the WX19/20 and WX1 if applicable.

When Required

Room-to-room pressure testing must be done when a dwelling has a central return in a hallway or living room, etc. and only supply registers in bedrooms or other rooms with a door that prohibit air movement back toward the central return system. The test is also required for manufactured homes.

Procedure

- With all interior doors closed, stand in the main body of the house and place the hose from the pressure gauge input tap under each door.
- Record the pressure difference from each room WRT the main body.
- Pressure relief must be obtained by trimming the door by a maximum of 1½" or installing a transfer grille between rooms, when rooms are pressurized or depressurized by more than 3 Pascal (except for the bathroom).
- Return registers in exterior wall cavities on the second floor should be sealed off and the return air re-routed through the house by trimming the doors or installing transfer grilles. Return registers in exterior wall cavities on the first floor must be sealed directly above the register.

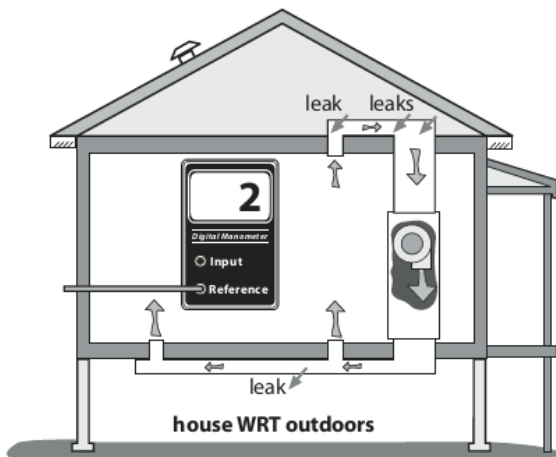
Manufactured Homes Room-to-Room Pressures

- Room-to-room pressure testing is necessary to ensure balanced airflow throughout the house.
- Measure room-to-room pressure differences and relieve pressure differences that are greater than 3 Pascal, except bathrooms and furnace closets, which may be higher.
- Pressure differences of greater than 10 Pascal in the furnace closets must be corrected.
- Turn on furnace blower and close all interior doors.
- While standing in the main body of the manufactured home, place the hose from the pressure gauge under each door.
- Record the pressure difference from each room WRT the main body on the Client Home Energy Audit.
- If there is a door that closes off the hallway, that door must then be closed and the hallway tested as a room itself.
- If the furnace is in a hallway closet, that hallway must be open to the main body of the manufactured home.
- Open the door slightly while measuring the pressure difference across the door.
- Open the door until the pressure difference is 3 Pascal or less and measure the square inches of opening.
 - This is the number of square inches of opening needed for pressure balancing.
- Pressure balancing is achieved by one of the two following methods:
 - The door must be undercut. (Doors are not to be undercut more than 1½".)
 - A direct grille, offset grilles, or jump duct must be installed properly to relieve the pressure imbalance caused by the distribution system when the door is closed.
- Return dwelling to the pre-test condition.

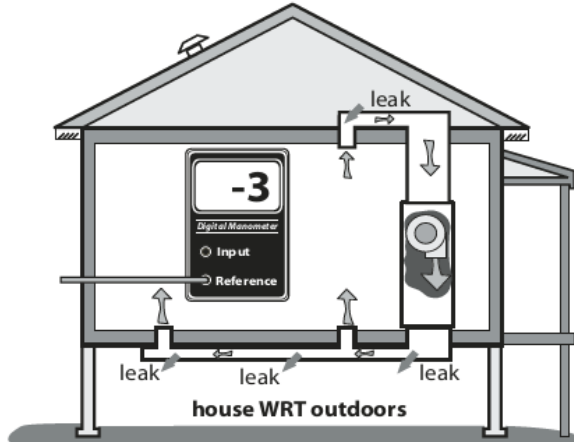
2.0705 Dominant Duct Leakage Test

The following test measures pressure differences between the house and outdoors, caused by duct leakage. Try to correct pressure differences greater than +2.0 pascals or more negative than -2.0 pascals because of the air leakage that the pressure differences create.

- Close all windows and exterior doors. Turn-off all exhaust fans.
- Open all interior doors, including door to basement.
- Measure the baseline house-to-outdoors pressure difference
- Turn on air handler.
- Measure the house-to-outdoors pressure difference. This test indicates dominant duct leakage as shown here:



Dominant return leaks: When return leaks are larger than supply leaks, the house shows a positive pressure with reference to the outdoors.



Dominant supply leaks: When supply leaks are larger than return leaks, the house shows a negative pressure with reference to the outdoors.

A positive pressure indicates that the return ducts (which pull air from leaky intermediate zones) are leakier than the supply ducts. A negative pressure indicates that the supply ducts (which push air into intermediate zones through their leaks) are leakier than return ducts. A pressure at or near zero indicates equal supply and return leakage or else little duct leakage.

2.08 Carbon Monoxide, Smoke and Propane Alarms

The use of combination alarms (CO/smoke) does not change the requirements for separate CO alarms as described in this section.

Carbon Monoxide Alarm(s) [SWS 2.01.02.1](#)

Carbon Monoxide alarms or detectors shall be installed as follows:

- Outside of each separate dwelling unit sleeping area in the immediate vicinity of the bedrooms
- On every occupiable level of a dwelling unit, including basements, excluding attics and crawl spaces. NFPA 72
- Other locations where required by applicable laws, codes, or standards.
- Each Alarm or detector shall be located on a wall, ceiling, or other location as specified in the manufacturer's published instructions that accompany the unit.

- If there is combustion appliance, CO alarms must be installed in combustion zones at time of audit.
- Kitchens and utility rooms with gas dryers are not considered a combustion zone.
- If a combustion appliance is accessible from a bedroom, a CO alarm must be installed in that room.
- Carbon monoxide alarms must be installed immediately by the energy auditor whenever an agency finds a combustion appliance that is putting off carbon monoxide at an unacceptable level.
- Alarms must meet UL2034 standards. Alarms should be warranted for a minimum of TEN (10) years.
- Installed alarms must be labeled with the expiration date, as warranted by the manufacturer, written on the front of the mounting plate or back side of alarm in permanent ink or on the label provided on the alarm.
- Verbal and written instructions are to be given to the client as to the use and maintenance of the alarm.

Smoke Alarms [SWS 2.0101](#)

Every house must have an unexpired working smoke alarm on each level. Alarms must be installed according to manufactures specifications and as required by NFPA 72/local codes, whichever is more stringent, Alarms should be installed as follows:

- One smoke detector in each bedroom.
- One in the hallway in the vicinity of any sleeping rooms.
- One on every level of the home.
- Smoke alarms installed by the program must have internal non-replaceable batteries for the life of the alarm (minimum of TEN (10) years).
- The product must be approved by the Underwriters Laboratories (UL).
- Installed alarms must have the expiration date, as warranted by the manufacturer, written on the front of the mounting plate or back side of alarm in permanent ink.
- Verbal and written instructions are to be given to the client as to the use and maintenance of the alarm.

Propane Gas Alarms [SWS 5.0504.1h](#)

- Working, unexpired propane alarms are required by weatherization in all houses using propane.
- A minimum of one (1) detector per dwelling unit is required, with additional units installed as necessary based on home layout and appliance location.
- All propane alarms must be connected to electricity.
- Detectors shall be installed in accordance with manufacturer instructions.
- When manufacturer guidance is not specific, detectors should be installed near the floor in areas where propane appliances are located or in adjacent living or sleeping areas.

2.09 Moisture and Mold

Each home shall be evaluated for existing moisture issues, evidence of past moisture damage, and conditions that may contribute to future moisture problems. When a moisture concern is identified, the Energy Auditor shall determine the source of the issue and identify appropriate measures to address or mitigate it. A visual inspection of the dwelling shall be conducted to identify signs of mold or mildew, as well as conditions that may promote mold growth.

2.0901 Moisture and Mold Assessment

Subgrantees will use the WX5 form for documenting any moisture and mold findings and notifying the client of what was found. The WX19/20 and WX1 can also be used along with photo documentation in the client file. The Nebraska Weatherization Program has \$300 in Health and Safety Funds that can be spent on Mold and Moisture related repairs. Approval to exceed that limit will be reviewed by the Nebraska Department of Water, Energy and Environment (DWEE). Please refer to the current Program Years approved Health and Safety plan for more information not found in this section.

2.0902 Moisture Indicators and Contributing Factors

While conducting the moisture assessment, Energy Auditors can use the following indicators to find potential moisture issues:

- Damp atmosphere and/or musty smell in house, basement, or crawlspace
- Client complaint of allergy-like symptoms
- Mold-like substance growth on walls and ceilings, especially in rooms with high moisture loads, such as bathrooms and kitchens, mold in corners or at the wall/ceiling junction (top plate)
- Mold-like substance growth on attic roof sheathing
- Signs of condensation on walls or windows
- Water damage or mold-like substance on the underside of roof decking
- Evidence of crawlspace moisture
- Peeling paint, particularly on bathroom and walls
- Rusted metal in basements, crawlspaces, bathrooms, and kitchens
- Efflorescence (white, powdery deposits) on concrete or masonry surfaces
- Water stains on foundation walls

The following table has moisture problems, their possible cause and potential solutions for mitigating the problems.

Moisture Issue	Cause	Possible Solution
Attic Condensation	• Insufficient Insulation • Uninsulated Ductwork • Stack Effect • Plumbing/Electrical Penetrations	• Attic Air Sealing • Moisture Control in Conditioned Space • Appropriate Insulation installed

	• Recessed lighting • Air Barrier Voids • Fans venting into attic • Leaky Ductwork • Insufficient Ventilation • Excess Humidity in Conditioned Space	• Air Seal recessed lights • Seal Ductwork/Insulate • Duct exhaust fans to outside • Add attic venting
Wet Walls	• Wind Driven Rain • Plumbing break • Contact with Damp Soil • Insufficient or poorly installed Insulation • Excessive Humidity level	• Air Seal Walls • Insulate Walls • Minor Plumbing Repairs • Alleviate Humidity level • Properly install flashing
Roof Leak	• Old, Damaged or Worn Roof • Ice Dams • Poor Roofing material	• Appropriate Insulation to correct Ice Dams • Minor Roof Repairs • Properly installed flashing • Black Jack
Wet Basement	• Plumbing Issue • Leaky Foundation • Condensate line issue • Poor grading • Gutter or downspout issue	• Minor Plumbing Repairs • Foundation Caulking • Downspout or extension to move water away from home
Existing Crawlspace	• Leaky Foundation • No Vapor barrier installed • Plumbing Issue	• Install Vapor Barrier • Foundation Caulk • Downspout or extension to move water away from home • Minor Plumbing Repair
Window Condensation	• High Humidity Level	• Lower Humidity Level
Indoor Air Quality Issue	• Home too tight • Pressure Imbalances • Unvented Space Heater/appliance • Unvented Dryer • Home Overcrowded • High Moisture Content	• Vent all fans to outdoors • Remove unvented space heaters • Pressure balancing • Remove High Moisture Items • Educate Client on use of kitchen and bath fans

2.0903 Moisture Problem Solutions

Identifying the source of moisture issues should be a priority when a moisture problem is found. Weatherization and tightening a home can possibly cause a more severe issue if not dealt with.

2.0903.01 Mechanical Ventilation

- Mechanical Ventilation is one of the main strategies for solving moisture issues in a home by providing effective ventilation with intermittent or continuous ventilation provided the fan is built for controlling moisture.
- Moisture problems may be reduced or eliminated by ventilating areas that routinely generate large amounts of moisture like Kitchens and Bathrooms.
- Educate Clients on the use of Kitchen Exhaust fans while cooking and Bath Exhaust fans when during and after shower or bath use.
- Refer to [Section 2.1003](#) Ventilation for guidance and procedures on installing mechanical ventilation.

2.0903.02 Site Drainage

Inadequate site drainage is a common cause of moisture problems affecting foundations, basements, crawlspaces, and slabs. The ground surrounding the home should be graded to direct water away from the structure, preventing it from collecting near the foundation. As a general guideline, the soil adjacent to the foundation should slope away from the home at a minimum rate of five percent, or approximately six inches over the first ten feet.

Inspect the property for the following drainage concerns:

- Whether rainwater or snowmelt is directed toward the foundation instead of away from it
- Low areas or depressions near the home where water may accumulate
- Sidewalks, patios, or driveways that slope toward the building
- The presence and effectiveness of gutters and downspouts in collecting and directing water away from the foundation

2.0903.03 Gutters and Downspouts

Inspecting the area around the home for proper and effective gutters and downspouts can ensure the home has proper drainage from roof run off. Gutters and downspouts can become clogged, damaged or missing completely. If fixing or replacing gutters or downspouts agencies should ensure proper sizing and installation is completed. Downspouts, if installed, should be a minimum of 3 ft away from foundation. Extending more than 3 ft may be needed depending on site conditions. Minor gutter and downspout repairs or replacement can be completed with the use of Health and Safety funds. The NeWAP has a limit to the amount of Health and Safety funds that can be used in these instances. Approval to exceed this limit must be granted by DWEE.

2.0903.04 Plumbing Repair

Minor plumbing repairs can be made to water pipes or sewer lines with Health and Safety funds. NeWAP has a limit of funds used to make these repairs and approval to exceed this limit must be granted by DWEE

2.0903.05 Sump Pumps

Installation of Sump Pumps is not a allowable cost with the NeWAP. Air sealing of existing sump pump pits is allowed. See the Radon [Section 2.17](#) for more information.

2.0903.06 Attic By-Pass Sealing

Attic By-Pass Sealing must be completed on all homes when site conditions exist where it is needed. This sealing prevents moisture from migrating into the attic where it could cause ice damming, damage to the roof deck and contribute to mold growth. See [Section 4.01](#) Air Sealing/Infiltration for more information on sealing attic by-passes.

2.0903.07 Crawlspace Ground Moisture Barrier

Moisture from crawlspaces can lead to condensation, mold and rot. Also air moving through the soil can contain radon and other dangerous vapors. Installing a vapor barrier in crawlspaces will alleviate these issues. See [Section 5.0402.02](#) Vapor Barrier for more information on installation of moisture barriers in crawlspaces.

2.0903.08 Client Education

Agencies shall provide general education to clients regarding moisture-related conditions, including the impacts of elevated indoor humidity and moisture intrusion. Clients shall also be informed of how household activities and practices may contribute to moisture problems.

Clients shall be advised on maintaining appropriate indoor relative humidity levels to help prevent moisture-related damage and indoor air quality concerns.

All measures installed to address moisture conditions shall be explained to the client, including proper use and maintenance of any installed equipment.

When occupant behaviors are identified as contributing to elevated moisture levels, agencies shall provide targeted education to address those conditions.

The following practices shall be discussed with clients, as they can affect moisture levels within the home:

- Use kitchen exhaust fans while cooking
- Use bathroom exhaust fans during bathing and showering
- Maintain airflow by opening closet doors and keeping furniture away from exterior walls
- Avoid excessive use of humidifiers
- Do not store firewood indoors

- Avoid covering windows with plastic if they can
- Keep gutters clean and functioning properly
- Repair plumbing leaks promptly

2.0904 If Moisture Issue Cannot be Eliminated

In the case the moisture issues cannot be resolved with existing Health and Safety funds the agency must explain to the client that other weatherization measures that tighten up the home can make the moisture issues worse and weatherization cannot be completed until these issues are corrected by the client or landlord. In these cases the home must be deferred until these issues are corrected.

2.0905 Existing Mold

Assessment

All homes shall be visually inspected for the presence of mold or conditions that may indicate mold growth, including staining, discoloration, musty odors, or visible fungal growth on building materials. The inspection shall also identify moisture sources contributing to mold, such as leaks, high humidity, or inadequate ventilation.

Evaluation

When mold is identified, the Energy Auditor shall determine:

- the likely source of moisture causing the condition, and
- whether the condition can be addressed within the scope of allowable weatherization work.

Mold conditions shall be evaluated based on severity, extent, and potential impact on occupants and workers.

Allowable Actions

Full mold remediation is not a allowable Health and Safety cost. However, limited mold remediation can be paid for with Health and Safety funds. The Newap has limited funds available for these actions. It is very important to document these issues on the WX5 form. Here is some issues and allowable actions when dealing with mold:

- Costs to remove mold can and must be included in the cost of a Energy Conservation Measure if the SIR is 1.0 or above for DOE funds and .5 SIR for use of LIHEAP funds.
- Mold cleanup can be made with limited Health and Safety funds. Approval to exceed this limit must be granted by DWEE.

The following actions are from the U.S. Environmental Protection Agency (EPA) and New York City Department of Health Bureau of Environmental and Occupational Disease Epidemiology. The procedures are designed to protect the health of the occupants and cleanup personnel during any mold cleanup. These procedures are based on the area and type of material affected by water damage and mold like

substance growth. Visual documentation and pictures should be taken before and after the clean up process and kept in client file.

- Non-porous (e.g., metals, glass, and hard plastics) and semi-porous (e.g., wood and concrete) materials that are structurally sound and visibly moldy can be cleaned and reused. Cleaning can be done using a detergent solution.
- Porous materials (e.g., ceiling tiles, insulation, and wallboard) that can be cleaned can be reused. Some porous material cannot be cleaned and should be discarded.

Small Isolated Areas (10 sq. ft. or less per affected area)

Recommended personal protection:

- Respiratory protection (e.g., N95 disposable respirator), gloves, and goggles.
- The work area should be unoccupied.
- Containment of the work area is not necessary. Vacating people from spaces adjacent to the work area is not necessary but is recommended in the case of children less than 12 months old, persons recovering from recent surgery, immune suppressed people, and people with chronic lung diseases (e.g., asthma, severe allergies).
- The mold-like substance should be cleaned with a detergent solution.
- Discarded material should be put in a sealed plastic bag. There are no other special requirements for the disposal.

Mid-Sized Isolated Areas (10 – 30 sq. ft. per affected area)

Recommended personal protection:

- Respiratory protection (e.g., N95 disposable respirator), gloves, and goggles.
- The work area should be unoccupied. Vacating people from spaces adjacent to the work area is not necessary but is recommended in the case of children less than 12 months old, persons recovering from recent surgery, immune suppressed people, and people with chronic lung diseases (e.g., asthma, severe allergies).
- The work area should be covered with plastic sheets and sealed with tape before cleaning to contain any dust or debris.
- Misting surfaces (to suppress dust) should be done prior to cleaning.
- The work area should be HEPA vacuumed and the mold-like substance should be cleaned with a detergent solution.
- Discarded material should be put in a sealed plastic bag. There are no other special requirements for the disposal.

Large-Sized Isolated Areas (30 – 100 sq. ft. per affected area)

Recommended personal protection:

- Respiratory protection (e.g., N95 disposable respirator), gloves, and goggles.
- The work area and areas directly adjacent to the work area should be unoccupied.
- The work area should be covered with plastic sheets and sealed with tape before cleaning to contain any dust or debris.
- Heating/cooling system registers in the work area should be sealed with tape or other material.

- Misting surfaces (to suppress dust) should be done prior to cleaning.
- The work area should be HEPA vacuumed and the mold-like substance should be cleaned with a detergent solution.
- Discarded material should be put in a sealed plastic bag. There are no other special requirements for the disposal.

Extensive Areas (greater than 100 sq. ft. per affected area)

Personnel trained in the handling of hazardous materials should do the clean-up.

Non Allowable Conditions/Deferral

Weatherization services shall be deferred when:

- mold contamination is extensive,
- the source of moisture cannot be identified or corrected within program scope, or
- conditions pose a risk to occupants or workers.

In such cases, the client shall be notified and referred to appropriate resources for further evaluation and remediation.

Client Education

Clients shall be informed of any observed mold conditions and the potential health and safety implications. Education shall include:

- the importance of correcting moisture sources, and
- practices to reduce moisture and prevent future mold growth.

Limitations

The Weatherization Program is not intended to perform full-scale mold remediation. All work shall be limited to addressing minor conditions directly related to weatherization activities and allowable under the Health and Safety Plan.

2.10 Ventilation and Indoor Air Quality

[SWS 6.01](#) [SWS 6.02](#) [SWS 6.03](#)

Ventilation and indoor air quality (IAQ) are critical components of a safe and effective weatherization program. As homes are tightened through air sealing and insulation measures, natural air exchange is reduced, which can lead to the accumulation of moisture, pollutants, and combustion byproducts. Proper ventilation is necessary to maintain acceptable indoor air quality, protect occupant health, and prevent building durability issues. Ventilation strategies implemented through the program shall be designed to manage indoor contaminants and moisture while complying with applicable standards and ensuring that weatherization activities do not create or worsen health and safety concerns.

2.1001 Ventilation limits

Ventilation systems shall be installed or evaluated to ensure the dwelling meets minimum indoor air quality requirements in accordance with ASHRAE 62.2 2016.

Mechanical ventilation shall be considered when existing conditions do not provide adequate air exchange or when weatherization activities reduce natural infiltration.

Documentation

All existing exhaust systems or fans in a home will be measured and documented Pre and Post weatherization on the Red Calc form. A copy of these forms will be included in the client file.

When Required

Pre and Post Weatherization

Procedure

Whole-house ventilation rates shall be determined using the DOE approved RED Calc calculation method. Selected ventilation strategies shall account for dwelling size, occupancy, and existing ventilation systems. When possible, existing functional systems may be utilized to meet ventilation requirements.

- Measure fan flow from existing and newly installed fans shall be completed using a monometer and Exhaust fan flow meter. Kitchen fans or irregular fans can use a modified procedure covering the fan area as a whole and having a hole available to tightly cover and measure with the Exhaust fan flow meter if it does not cover the fan by itself.
- Connect one end of the hose to the pressure tap on the Exhaust fan flow meter and the other end to the Channel B Input Tap on your monometer
- Select door position on the metering box based on estimated fan flow (E1-60-124 CFM, E2-21-59 CFM, E3 10-28 CFM)
- Turn on Monometer (DG-700 or DG-1000)
- Press Mode until you get PR/FL
- Press Device until you get EXH (Exhaust Fan)
- Set up monometer to match your door position (E1-A1, E2-B2, E3-C3)
- Turn on Exhaust Fan
- Place metering box tightly over the exhaust fan
- Determine the air flow of the fan by reading the CFM on the Channel B display. Compare the metered flow with the chart on the metering box using the pressure reading on Channel A. If the CFM is fluctuating, change the time average setting on the monometer
- If "LO" flashes on channel B, change the door setting on the metering box to a smaller opening.
- If you change the door position, be sure to change the Config setting on the monometer to match the new door position.

2.1002 Mechanical Ventilation (Ducted and through the wall)

SWS 6.0201.1

Mechanical ventilation is not required in every home and should only be installed when clearly justified by measurable moisture issues.

If ASHRAE 62.2 2016 (Red Calc) does not require whole-building ventilation, an exhaust fan may only be installed with Health and Safety funds if there is documented evidence of any of the following conditions:

- Visible mold growth within the living space.
- Excessive condensation identified by moisture readings.
- Structural damage caused by high humidity, such as rotting wood or deteriorating finishes.
- Occupant complaints regarding persistent damp conditions confirmed by site inspection.
- Existing fan that is not operating properly
- If Existing fan has a minor fix to it and not replaced, Sone ratings do not have to met.

Documentation and Justification

- Clear, decisive reasoning must be provided in the Audit Form before an exhaust fan is installed for moisture removal.
- Documentation in the house file must include supporting photos, humidity readings, or additional moisture assessments to justify the installation.
- If justification is inadequate, the installation may be a disallowed cost.

Installation Criteria and Restrictions

Acceptable Fan Types:

On-demand fans (exhausting at least 50 CFM and up to 80 CFM) controlled by an on/off wall switch.

Continuously operating exhaust fan set to 20 CFM minimum.

Fan Placement Requirements:

- Must be installed near the center of the space where odor, moisture, or contaminants originates.
- Cannot be installed inside a shower unless specifically rated for wet location installation.
- All installed fans must have a back-draft damper at both the fan and the duct termination.
- The duct termination must be outdoors—no venting into attics or enclosed spaces.
- DE humidistats may be used in bathroom fans if it is a self-contained module switch, and the fan is only used for moisture removal.
- DE humidistats must be used in basement fans when controlling moisture.
- Sone level requirements listed in Section 2.10.03.06 must be met.
- All fans must be installed and vented to manufacturers specifications.

Refer to Section 2.10.03.07 for venting requirements.

2.1003 Bathroom Ventilation (Ducted and through the wall)

SWS 6.0201.1

- If installed as spot ventilation must have a on demand or timer switch.
- Fans installed in bathrooms should have a fan rating between 50 and 80 CFM

- Bath fans can serve as whole building ventilation as part of your Ventilation Strategy and must meet ASHRAE 62.2 2016 requirements. See [Section 2.1005](#).
- Newly installed bath fans must have the pressure across the door that does not exceed 3 Pa.
- Must be terminated to the outdoors. See Exhaust Fan Venting [Section 2.1008](#) below.
- Installed in the center of the space where odor, moisture and other contaminants are generated, but not inside a shower unless it is rated for wet location installation.
- Fan flows of existing bath fans that are to be left in place must be measured. If the flow rate cannot be measured, then determine the fan flow by referencing the fan label according to the most current adopted ASHRAE 62.2 requirements (see most recent adopted ASHRAE 62.2, Section A4.2)
- De humidistats must not be used in bathrooms if fans are used to meet ASHRAE 62.2 2016.
- Sone Ratings for newly installed fans must be met. See [Section 2.1007](#) below.
- Fan housing must be air sealed to the ceiling plane in installed in the ceiling or wall.
- Fans must have a backdraft damper at the fan and termination.

2.1004 Kitchen Ventilation (Ducted and through the wall)

Installation Standard 6.3

SWS 6.0201.2

- Kitchen fans to be installed must be rated for use in a kitchen.
- Can be used as part of your ventilation strategy if required by ASHRAE 62.2 2016 requirements.
- Must be a minimum of 100 CFM intermittently or 5 Air Changes per Hour continuously after installation, ducting and termination is complete.
- Installed within 5 feet of cooking surfaces if not a range hood.
- Must have a backdraft damper on the fan and termination.
- Must be terminated to outdoors. See Exhaust Fan Venting [Section 2.1008](#)
- Sone rating for newly installed fans must be met. See [Section 2.1007](#) below.
- Air sealing completed where fan passes through air barrier.
- Fan flows for existing kitchen fans that are to be left in place must be measured. If the flow rate cannot be measured, then determine the fan flow by referencing the fan label according to most current adopted ASHRAE 62.2 requirements (see most recent adopted ASHRAE 62.2, Section A4.2).
- Outdoor makeup air should be provided for kitchen fans if fan interferes with combustion appliance operation.

2.1005 Whole Building Ventilation

[SWS 6.0302.1](#)

Whole-building ventilation operating continuously shall be determined by the most current adopted ASHRAE 62.2. RED Calc and will be run at time of audit (using Air Sealing Target CFM) and again at QCI (using final actual CFM reading).

- This will determine whole house ventilation needed.
- If temperature difference between the indoors and outdoors is 40 degrees or more, use “Advanced Blower Door Inputs” when using the RED Calc tool.
- If the house is too tight, the ventilation requirement must be met.
- A copy of both Red Calc calculations showing ventilation requirements and program inputs must be in the client file.
- RED Calc will be run at time of audit to consider what effect estimated tightness will have on the house.
- Must not be installed in CAZ zones without written permission from DWEE.
- Must meet Sone ratings for Continuous use. See [Section 2.1007](#) below.
- Must be terminated to outdoors. See Exhaust Fan Venting [Section 2.1008](#)
- Fan Controls must be clearly marked and labeled as to their use.
- A readily accessible override control must be provided to the occupant. This is done in the event outdoor air quality is at a level it can become hazardous to the client. (wildfires, dust storm or other environmental event)
- Fan must be tested at its highest and lowest settings after installation is complete to ensure proper CFM draw according to required ventilation.

2.1006 Other Ventilation Strategies

There is times that a agency will have a home that has no easy way to install ventilation if it is required by ASHRAE 62.2 2016. In these instances there is other options that include but not limited to:

- In Line Fans located in attics
- Supply air ducted into Air Handler

Contact DWEE for more information on these strategies.

2.1007 Fan Sound Ratings

The following is Sone ratings for all newly installed fans at max speed. Fans must be equal to or less than the following sone ratings. Existing fans that are to stay in place do not have to meet these ratings:

On Demand Fan_____	2.0 Sones	SWS 6.0201.1a
Continuous Fan_____	1.0 Sones	SWS 6.0301.1a
On Demand Kitchen Hood_____	3.0 Sones	SWS 6.0201.2a

2.1008 Exhaust Fan Venting

[SWS 6.0201.2i](#) [SWS 6.0101.1](#)

- All operational existing kitchen or bathroom exhaust fans must be vented to the outside using proper termination.
- The size of ducting material must not be reduced from the outlet of the fan.

- Duct runs must be as short as possible or feasible.
- Kitchen fan venting must be rigid, smooth metal of at least 28 gauge thickness
- Rigid, PVC and Metal flex ducting is allowed if allowed by local code
- Metal Flex duct must be UL 181 listed or Air Diffusion Council approved
- Rigid duct must be 28 gauge metal or greater
- Plastic flexible ducting is not allowed
- Ducts outside the thermal envelope will be sealed and insulated to a minimum R-8
- Duct Insulation shall have a flame spread/smoke development index of 25/50 or less when tested according to ASTM E84 or UL 723
- Metal Flex and Rigid ducts shall be supported every 2 feet if suspended and horizontal.
- Fasten all duct connections as follows:
 - Round metal-to-metal or metal-to-PVC with a minimum of three equally spaced screws
 - For other metal-to-metal or metal-to-PVC with welds, gaskets, mastics (adhesives), mastic-embedded-fabric systems, or tapes
 - Flexible duct-to-metal or flexible duct-to-PVC with tie bands using a tie band tensioning tool
 - PVC-to-PVC materials with approved PVC primer and cement
 - Fasten other specialized duct fittings in accordance with manufacturer specifications

2.1009 Duct Terminations

SWS 6.0101.2a

- The termination collar shall be at least the same equivalent size as the exhaust fan outlet.
- Termination fasteners shall not inhibit damper operation.
- Exterior termination will be flashed or weather sealed.
- Terminations shall be at least three feet from any property line.
- Terminations shall be at least three feet from any operable opening to a house.
- Terminations shall be at least 10 feet from any mechanical inlet.
- If the termination is at the soffit, seal all soffit vents within 6' of the termination
- All existing mechanical exhaust ventilation systems should terminate outside the building shell by extending the ventilation duct through the roof, sidewall, foundation, or skirting.
- Installed fans must have a back-draft damper at the fan and at the duct termination.
- Exterior termination fitting will be flashed or weather sealed.
- Water will be directed away from penetration.
- Termination fitting installation will not inhibit damper operation.
- Manufacturer specifications will be followed.

2.11 Lead Paint

Installation Standard 2.1 and 2.2

Subgrantees must comply with the EPA's Lead, Renovation and Repair and Painting Program (RRP) rules when working on Pre 1978 housing unless testing confirms the work area to be lead free. This includes but not limited to:

- Client File documentation including:
 - Certified Renovators Certification
 - Training Provided on Site
 - Description of specific actions taken
 - Lead Testing and documentation
 - Photos of the site set up and clean up
- Certification and Training requirements of the RRP rule
- Job site set up and cleaning verification by a Certified Renovator.

Only costs directly associated with lead safe work practices for surfaces directly disturbed during weatherization activities are allowable NeWAP Health and Safety expenses.

Testing for lead based paint hazards is allowed with a EPA approved Lead Testing method. Crews and Contractors must follow EPA's Lead Renovation, Repair and Painting program (RRP) guidelines unless testing confirms the home is lead free.

If testing is not performed, all homes built prior to 1978 are treated as if they have lead-based paint and all work follows the requirements of the EPA's RRP program employing lead-safe methods while working on painted surfaces that are being repaired or retrofitted for energy efficiency. All documentation must be saved in the client file and client shall be informed of the test results.

Deferral is required when the extent and condition of the lead-based paint in the house would potentially create further H&S hazards, the sub-grantee will inform the client of the of the issues associated with a deferral in the Weatherization Deferral Notice (Form WX4) completed by the Weatherization Representative and signed by the client or building owner.

Using DOE WAP H&S funds for lead abatement is prohibited.

Using DOE WAP H&S funds for purchase, resourcing, or maintenance of X-ray Fluorescence (XRF) devices is prohibited.

Client Education

- Present Client a copy of the EPA Pre-Renovation education documentation regarding RRP.
- When deferral is necessary, provide information in writing describing conditions that must be met in order for weatherization to commence and a copy of the

Weatherization Deferral Notice completed by the Weatherization Representative and signed by the client or building owner.

2.12 Section Reserved

2.13 Section Reserved

2.14 Electrical Safety

[SWS 2.0301.1](#)

The two primary energy-related H&S electrical concerns associated with weatherization work are insulating homes that contain knob-and-tube wiring and overloaded electrical. Electrical safety is a basic need that impacts home weatherization and repair.

- If it is determined a hazardous situation exists, the problem must be corrected before weatherization work starts.
- A licensed electrical contractor will be used to perform electrical repair work needed to correct a issue.
- Inspect all electrical fuses and breakers for proper sizing
- Enclose all wiring splices inside a location-appropriate (e.g. wet-location, outdoor, indoor, etc.) UL listed electrical enclosure per the NEC
- Electrical boxes in attics must be marked with a flag that is visible above the insulation.
- Provide sufficient over-current protection and damming prior to insulating building components containing knob and tube wiring, as required by the AHJ.
- Determine the location of live knob-and-tube wire locations and document their location in the client file.
- In attics where Knob and Tube Wiring has been previously covered with insulation determine where the wiring is located and verify that it is actually still "active". This determination may be completed by a licensed electrician, the use of a thermal imager/scanner, visually or physically locating the wires or another verifiable option approved by the DWEE.

NeWAP allows \$300.00 in Health and Safety funds where minor electrical repairs need to be completed on homes where a issue is found. Approval to exceed this amount must be made by DWEE before work can commence.

2.15 Asbestos in the Home

The presence of asbestos or suspected asbestos containing material (ACM) in a weatherization home requires Subgrantees to take reasonable and necessary precautions to prevent asbestos contamination in the home. This will be determined by an appropriately trained crew leader, auditor, inspector by completing a visual inspection and in the case of Vermiculite, by testing.

Visual inspections will be completed of all surfaces and subsurface, piping and equipment for suspected ACM.

In homes where a *friable* suspected ACM is found, the sub-grantee must take precautionary measures as if it contains asbestos, utilize personal air monitoring and follow the following requirements based on the location/type of suspected ACM material.

2.1501 Asbestos in Walls, Roofs and Foundations

- In homes where a ***friable*** suspected ACM is present the sub-grantee must take **precautionary measures** as if it contains asbestos, such as utilizing personal air monitoring.
- In homes with asbestos siding is present and in good condition **weatherization work may continue**.
- In homes where ***friable*** suspected ACM siding is present, **blower door testing**, using positive pressure techniques, must be completed.
- In homes with asbestos siding is present and in good condition, **blower door testing**, using either negative or positive pressure techniques, must be completed.
- In homes where asbestos siding is present and in good condition installing dense-pack insulation from the exterior is allowed.
- In homes where asbestos siding is present and in bad condition wall insulation measure work must be completed from the interior of the home.
- Removal of siding is allowed to perform energy conservation measures; however, precautions must be taken not to damage the siding. Asbestos siding should never be cut, sanded or drilled. Where possible, insulate the exterior walls through the interior of the home.
- The costs associated with testing, abatement or replacement with new siding are not eligible expenditures in the NeWAP.

2.1502 Asbestos on Pipes, Furnaces and other Small Covered Surfaces

- An appropriately trained crew leader, auditor or inspector shall complete an initial visual inspection of all surfaces and subsurface, piping, and equipment for a suspected ACM.
- Assume asbestos is present in suspect covering materials.
- In homes with asbestos is present, encapsulated and in good condition blower door testing, using either negative or positive pressure techniques, must be completed.
- In homes where ***friable*** suspected ACM is present blower door testing must **not** be completed.
- In homes where friable suspected ACM is present the costs associated with asbestos testing, abatement or encapsulation not eligible expenditures in the Nebraska Weatherization Assistance Program.

2.1503 Vermiculite

- If the presence of asbestos has been previously confirmed or if the sub-grantee believes that vermiculite insulation is present, when blower door tests are performed, it must be performed using pressurization instead of depressurization.
- If the presence of asbestos has been previously confirmed or if the sub-grantee believes that vermiculite insulation is present, when blower door tests are performed, it must be performed using pressurization instead of depressurization.
- The costs associated with vermiculite/asbestos testing is an eligible Health & Safety expenditure, to specified expenditure limits, and when AHERA sample testing is conducted by a certified tester. The current limit to this testing is \$150.00. A copy of this test must be in the client file.
- The costs associated with vermiculite Abatement or Encapsulation are *not* eligible expenditures in the NeWAP.

Client Education

- Inform the client, and landlord if applicable, in writing if suspected ACMs are present and what precautions will be taken to ensure the occupants' and workers' safety during weatherization.
- Inform the client, and landlord if applicable, of results if testing is performed.
- Instruct client in writing not to disturb suspected ACM.
- Provide a copy of the Asbestos Factsheet information to the client.
- When deferral is necessary, provide information in writing describing conditions that must be met in order for weatherization to commence.

2.16 Biological and Unsanitary Conditions

The program covers costs (to specified limits) to remediate minor conditions that may lead to or promote biological concerns and/or unsanitary conditions that can impact client, crew or contractor health concerns and may cause deferral of weatherization services. Addressing bacteria, viruses or major biological and/or unsanitary conditions is not an allowable reimbursable cost.

NeWAP does allow a maximum cost of \$300 to remediate minor conditions that may lead to or promote biological concerns and unsanitary conditions. Approval to exceed this limitation can be reviewed on a case by case basis by the Nebraska Department of Water, Energy and Environment prior to any work being implemented.

Deferral may be necessary in cases where conditions in the home pose a health risk to occupants and/or weatherization workers.

2.17 Radon

Radon Mitigation and Testing is not a allowable Health and Safety cost with the NeWAP.

The following precautions will be implemented in all weatherized homes with accessible basements and crawlspaces to reduce the possibility of exacerbating any potential radon issues:

Required:

- Whenever site conditions permit, cover exposed dirt floors within the pressure/thermal boundary with 6 mil (or greater) polyethylene sheeting, lapped at least 12" and sealed with appropriate sealants at all seams, walls and penetrations.
- Air seal existing sumps in such a way that water can drain from above and below the sump cover.

Allowed:

- Sealing and caulking visible, accessible penetrations, openings or cracks in below-grade walls and floors that contact the ground with a sealant that meets the requirements of ASTM C920.
- Other precautions may include, but are not limited to, sealing any observed floor and/or foundations penetrations isolating the basement from the conditioned space, and ensuring crawlspace venting is installed if applicable.

The following radon precautions will be implemented in weatherized homes with **inaccessible** crawlspaces, to reduce the possibility of exacerbating any potential radon issues:

- Zonal Pressure (ZPD) Tests will need to be completed and documented between crawlspaces and/or attached garages and houses.
- The ZPD test will address radon concerns with monitor's documenting areas that should be sealed (electrical runs, plumbing runs (sinks, kitchens, laundry, HVAC runs/boots around registers in floor).
- All efforts to physically seal the areas from conditioned/livable space will be documented in the client file.

The following additional radon precautions will be implemented in all weatherized homes equipped with active radon mitigation systems:

- Verify that the radon vent fan is operating.
- If a previously installed radon mitigation system is not operating correctly advise the client to consult the system installer of the state radon office.

ASHRAE 62.2 – 2016 ventilation requirements will be implemented as required/needed.

Client Education

- Provide all clients EPA's *A Citizen's Guide to Radon* and inform them of radon related risks.
- Provide all clients the radon informed consent/consent to perform work form (Wx6) signed. A copy of the signed form must be included in the client file prior to receiving weatherization services.

2.18 Building Structure and Roofing

Subgrantees will complete a visual inspection of the building structure and roofing for damages that compromise building durability and to verify that portions of the home where weatherization will occur are safe for entry and performance of assessments, work and inspections.

Subgrantees are limited to a maximum cost of \$300.00 to implement minor repairs when necessary to effectively weatherize the home. Approval to exceed this limitation will be reviewed on a case-by-case basis by DWEE prior to any work being implement.

Building rehabilitation is beyond the scope of the *Nebraska Weatherization Assistance Program*.

2.19 Pests

- Pest removal is allowed only where infestation would prevent weatherization.
- Subgrantees are limited to a maximum cost of \$300 for pest removal, although approval to exceed this limitation will be reviewed on a case-by-case basis by the Nebraska Department of Water, Energy and Environment prior to any work being implemented.
- Screening repair of windows and points of access and incorporating pest exclusion into air sealing practices to prevent intrusion.
- Infestation of pests may be cause for deferral where it cannot be reasonably removed or poses H&S concern for workers.
- Pest removal issues in homes that would exceed the maximum cost of \$300 or cannot be feasibly completed with use of available funds, must be deferred.
- Inform client in writing of observed condition and associated risks.
- When deferral is necessary, provide information in writing describing conditions that must be met in order for weatherization to commence.

2.20 Hazardous Materials, VOC's and Refrigerants

- Hazardous Waste Materials generated during weatherization work (e.g., refrigerant, lead dust, mercury, CFL lighting/ ballasts, etc.) shall be disposed of according to local laws, regulations and/or Federal guidelines, as applicable.
- Subgrantees must document proper disposal requirements in contract language with responsible party.
- Limited removal of pollutants is allowed and required if they pose a risk to workers.
- If pollutants pose a risk to workers and removal cannot be performed or is not allowed by the client, the unit must be deferred.
- The NeWAP allows \$200 for the removal of hazardous materials.
- Testing of suspected hazardous materials is not allowed.
- Inform client in writing of hazards associated with hazardous waste materials being generated/handled in the home.

- Inform occupant in writing of observed hazardous conditions.
- Provide client written materials on safety and proper disposal of household pollutants.

Chapter 3.0 Field Evaluation

3.01 Energy Audit and Inspection

An Energy Audit and Inspection shall be completed on all dwelling types, including single-family, modular, manufactured homes, and multi-family units that do not meet the Low-Rise Multifamily definition outlined in the NeWAP Policies and Procedures manual. The Energy Audit process consists of four primary steps:

1. Ongoing communication with the client throughout the process helps the Energy Auditor identify existing or potential health and safety concerns, comfort issues, and opportunities for weatherization. This is also an opportunity to provide energy education to the client.
2. A Health and Safety Assessment to identify existing or potential hazards.
3. An on-site Energy Audit, during which the auditor inspects the home and identifies deficiencies and potential energy savings opportunities using both visual observations and diagnostic testing.
4. An Energy Efficiency Assessment, where potential energy-saving measures are evaluated using a computerized audit tool.

Communication with the client, including use of the WX13 Client Questionnaire Form, assists the Auditor quickly identify health and safety concerns, energy deficiencies, and general issues within the home. The Auditor shall explain the audit process to the client and provide information on what the program can address, as well as any limitations related to funding or scope of work.

3.0101 Photo Documentation

Photo documentation is required during the Energy Audit, throughout installation, and during the Final Inspection. Proper documentation helps protect Subgrantees in the event of discrepancies during the weatherization process. Required photos include, but are not limited to, the home exterior, appliances, windows, doors, attics, crawlspaces, safety devices (existing and installed), lighting, ventilation equipment, and diagnostic testing setups. Any identified Health and Safety concerns must also be photographed.

All photos shall be digital, in color, and maintained in the client file. These images must be available upon request by DWEE or other governing entities. Black and white or scanned photos are not acceptable unless no other option is available.

3.0102 Energy Audit and Assessment

The Energy Audit, Assessment, work and inspection to include photos can include but not limited to:

Auditor	• Crawlspcace • Attics • Existing water heaters and heating units with CO and Efficiency readings • Cookstove CO readings • Existing and installed Safety devices (CO, Smoke and LP alarms) • Existing Lighting • Refrigerator • Exterior of home and any issue found • Problem areas • Venting of Appliances or fans • IR camera pictures • Infiltration issues • Existing and installed utility measures • Windows and Doors • Roofline • Venting of attics • Drainage issues
Crew or Contractor	• All measures installed in home. Before, during and after installation may be needed in some cases • Installed appliances with CO and Efficiency readings

	• Problem Areas • Appliance venting • Installed IRM's • Lead Safe work • Change Order items
Inspector	• All installed measures in the home or around • All Attic work to include installed insulation levels, attic bypass's, heat shielding, electrical and fan venting • Water heater and heating unit CO and Efficiency readings • Infiltration work installed • Installed Utility Measures • Installed Refrigeration appliances • Problem Areas • IR pictures • Change Order Items • Appliance Venting • Cookstove CO Readings • Installed Safety Devices • Installed Lighting

3.02 Recommended Energy Audit Procedures

The following procedures provide general guidance for Energy Auditors when evaluating homes. Additional detail is provided throughout this manual. These procedures are not exhaustive, as each home presents unique conditions that may require additional consideration. Auditors should proceed methodically and avoid attempting multiple tasks simultaneously.

1. Upon arrival, visually assess the property and surrounding area for conditions that may result in deferral, such as "For Sale" signs, major renovations, or unsafe conditions.
2. Introduce yourself and briefly discuss the energy audit procedure and approximate length of time procedure will take.
3. Throughout the energy audit process, be aware of existing or potential health and safety problems (electrical, CO, drafting problems, leaks in gas lines, unsanitary conditions, etc.) and Red Flag situations (mold, moisture problems, plumbing defects, evidence of water penetrating the home, etc.). The Home Energy Audit (WX19/20) and all Health and Safety forms are to be completed throughout the energy audit process documenting health and safety problems and red flags.

Take pictures of the problems/red flags to document that they were pre-existing conditions. [Section 2.01](#)

4. Walk through the house to review the arrangement of rooms (makes it easier to draw the house from the outside). Also check for any problem areas that will need to be dealt with or possibly cause a deferral situation. [Section 1.11](#)
5. Ask about number and location of refrigerators and freezers. Plug in the meters to the refrigerators and freezers. Write down make, model number, size, etc. of each appliance.

6. Outside the house

- Proceed outside and draw each side of the house. Start at the front, far left of the house (side facing the street or road) and continue to the right each time (counter-clockwise).
- Move to the right around the house to look at the windows (also measure them for NEAT) and number each one (this will help keep track of the windows), as well as each door; foundation (look for cracks and drainage problems); measure the length of the walls; check for any roof, gable & soffit vents; note siding type; and look at the gutters for any problems. Record size, type, glazing type and existing storm windows. Also record type and condition of all exterior doors. If there are grade entrance doors, one must be made airtight, preferable the lower door. Do this on all four sides. Note any Red Flags according to the health and safety forms, such as drainage problems, gutters, or lack thereof.
- Go back around the house with a digital camera and take pictures of the house and any particular problems the crews/contractors need to address. Looking at everything again may bring something to your attention that was missed the first time around.
- Check sidewalls for insulation by either drilling a pilot hole on the outside of the house or by removing an outlet cover on the interior of the house. Drill small hole on inside wall in area that is out of the line of sight of home owner (closet, behind photo or under cabinet, etc.). Do not drill through the siding if not necessary.
- Document the lot and any obstructions which would require special ladders or other safety equipment. Determine appropriate measures needed to assure worker safety.

MANUFACTURED HOMES

- If the home has an installation deficiency that may affect worker safety, corrections must be made before beginning work.
- Structural problems affecting insulation measures must be corrected prior to installing insulation.
- Inspect belly barrier, it must be repaired if insulation will be installed or if significant air leakage is occurring.
- Check for depths of insulation in sidewalls, attics, and underbelly.

7. Inside the house

- Go back in the house and start with the very first window and go the same direction as on the outside. While looking at the windows and doors, also look for any other concerns, such as, holes in the walls, lowered or suspended ceilings that may need to be looked above (missing plaster, holes in lath, leaking areas, etc.), and any other problems that may need attention.
 - While walking around, be sure all windows are closed and all registers are open
 - Look in the attic or attics for amounts and kinds of existing insulation for required work to be done. Measure any knee wall, slopes, and attic areas to calculate required insulation. Check for by-passes in both the knee wall and attic areas (such as floor joists, rafter runs and open stud runs). Note all attic accesses and required treatment. Obtain a sample of vermiculite if existing or testing is needed.
 - Note any exhaust fans and dryers and whether they are adequately vented outside (refer to [Sections 2.03](#) and [2.10](#) for more information).
 - Note the location and condition of the main service entry box. Note if it is properly mounted in the appropriate location. Determine the type and amp rating of the main service box. This information should be available on the main service box. If the Energy Auditor determines that a hazardous situation exists, the client must correct the problem before weatherization work is started.
8. Proceed to the basement and/or crawlspaces. Check band joists and crawlspaces for needed insulation and vapor barrier. Also check outside basement doors and basement windows. While doing this, look for any problem moisture areas caused by outside water or inside plumbing problems. Measure the basement and crawlspaces for area and height for the NEAT audit.
 9. Check the water heater and furnace.
 10. Take pictures of the furnace and water heater and all problem areas that may need attention.
 11. Document the type and size of combustion appliances. Record model number, serial number, Btu's, temp rise, type of furnace (forced-air, boiler, etc.), etc.
 12. Document the volume of the CAZ and whether there is adequate combustion air. [Section 2.0202](#)
 13. While downstairs, count the number of supply air registers. Proceed upstairs and look for all of the supply and return registers, ensuring they are open and unobstructed. Note any supplies and returns in the CAZ.
 14. Any supply registers in garage must be truncated and sealed as close to the supply as possible.
 15. Check all gas lines for leaks, drip legs, proper flex lines, and shut off for each appliance.
 16. Set up the house in worst case scenario. [Section 2.0602](#)

17. Test furnace for CO, static air pressures, and temperature rise. Test the water heater for CO, and spillage. The order of testing the water heater and furnace will be determined on-site based on whether the appliances are induced-draft or atmospheric burning. [Section 2.0603](#)
18. While the furnace is on and running, check all the supply registers for airflow. Perform room-to-room air pressure testing if needed. [Section 2.0704](#)
19. Check oven for CO. [Section 2.0204](#)
20. Set up the blower door on a exterior door that is easily accessible and has the fewest restrictions.
21. Run hoses to any attics, knee walls, garages, etc. to be tested.
22. Test supply runs or returns that may be run through an area outside of the thermal boundary.
23. Install or note any required lighting and water heating measures.
24. Document the meter readings and duration of readings for the refrigerators and freezers. [Section 6.0101.01](#) for more information.
25. Install required CO and smoke alarms. [Section 2.08](#)
26. Collect all gauges and equipment. Ensure the water heater and furnace is returned to normal operating condition.
27. Review the energy audit with the client. Explain what the program can do and tell the client why the program cannot do the other things the client wants done.
28. Use WX2 and give the Asbestos Fact Sheet, ASHRAE 62.2 Fact Sheet, Combustion Safety Fact Sheet, Radon Gas Fact Sheet, Lead Safe Education, Energy Consumption Education, Mold and Moisture to the client.
29. Obtain client signatures on all state and agency forms. State forms include: WX2 Client Education, WX3 Lead Hazard Pre Renovation, WX5 Mold Assessment, WX6 Radon, WX7 Health Screening Questioner, Deferral Documentation Form if necessary, and the Client Refrigeration Appliance Agreement if necessary.
30. Answer any further questions the clients may have and give them your contact information. If possible, give the client an approximate time when the work may be completed. Explain to them all requirements of them throughout the process.

3.03 Recommended Final Inspection Procedure

The following is a summary of procedures Inspectors should follow when work is complete on the home. Sections above in this document provide more detailed information on required tests and documentation. These procedures are not all inclusive and are a guide and recommendations as every home is different and the Auditor may find unusual situations that may not be addressed here. Solve each task and try not to do too many things at once.

1. Look at the house from the exterior as approaching the door to get an idea of attic locations, sidewall insulation, chimney locations, and general layout of the house (porches, overhangs, potential knee wall locations, foundation types, etc.).
2. After introduction to the client, ask about materials installed, furnace work done, and if the client had any problems with the work done or not done. Also ask if any insulation came in anywhere. If there are suspended ceilings, ask the condition of the ceiling above and if any repairs were done to it. The upper ceiling should be visually checked.
3. Determine the thermal or air boundary of the home. If different from the Energy Auditor's determination, try to ascertain why, giving benefit of the doubt to the Energy Auditor. If the thermal boundary is not air-sealed and insulated it must be corrected. If the Energy Auditor clearly made the wrong choices, it must be corrected. If the Energy Auditor extended the thermal boundary beyond what is necessary (i.e., heating a porch for plants or animals, or a double ceiling) it should be noted and corrected if possible.
4. During the inspection process, always be looking for any hazardous situation as well as health and safety problems. This would include wiring, plumbing, mold, ventilation, and other issues. Determine whether a smoke alarm or CO alarm should be installed. The dryer needs to be checked to ensure it is properly vented to the outside. Confirm that all exhaust fans, both new and existing, are in working order and exhausted to the outside. New exhaust fans must meet the sone requirement.

5. Inside the home

- All measures installed must be according to standards.
- Verify all required materials have been installed including light bulbs and appliances.
- If new appliances were installed, verify they are working properly and the client is satisfied.
- All areas of the house must be visually checked for holes in ceilings and walls. Leakage of any holes can be checked at the time of the blower door test.
- The client's comments about any insulation coming into the home should be taken into consideration at this time and any other comments about air coming into the house should also be checked.

- While walking around the home with the blower door operating, you should feel the registers for air movement. Pan pressures should be checked whenever there is a possibility that they are over 2 Pascal.
- Verify that registers are open to the house and not covered. Check rooms for returns. Check baseboards to see if exterior walls were used as return ducts. If the house has a central return, room pressures must be checked.
- Make note of construction details that might be linked to attic by-passes to be checked when the attic.
- The windows and doors of the home should be checked for major leakage or safety problems.

6. In the Attic/Upstairs

- Check the attic for insulation. Note depth, level and consistency throughout the attic with all heated areas being insulated. Ensure Attic Sticker(s) are present and clearly visible with all required information if attic insulation was added. This goes for each attic that was insulated.
- Shielding barrier is to be around all potential heat sources with a three-inch clearance.
- Recessed lights should be boxed around with proper material and a lid installed.
- Ducts from exhaust fans need to be checked to make sure they go to the outside and are installed and insulated to standards.
- If there is ductwork in the attic, it should be sealed and insulated.
- Slopes of attics are to be dense packed. If they cannot be dense packed, they need to be hard sealed at the top and bottom or at least from either the top or bottom if both cannot be done.
- Check the by-passes noted on the audit and during inspection walk through. All by-passes must be sealed or dense packed. Pictures must be taken prior to and after sealing bypasses and maintained in the client file.
- Any chimney that passes through the attic must be inspected to make sure it is intact. If the brick around a liner terminates in the attic, the opening between the liner and brick must be sealed with proper materials.
- All attic doors need weatherstrip. Caulking the access door shut is only permitted if there is another entrance.
- Ensure all Knee wall insulation existing or added is installed correctly and covered with a air barrier.

7. In the basement

- Ensure box sill insulation is installed correctly if called for by Energy Audit
- Crawlspace insulation must be complete and meet standards.
- Vapor barrier must be installed according to standards.
- Crawlspace vents are to be sealed if applicable.
- If the floor is insulated, the batts must be un-faced fiberglass, secured in place or dense-packed cellulose.
- Any heat ducts in unheated areas must be sealed and insulated.
- Below Grade doors or exterior basement doors are to be built according to standards.

- Foundations are to be as tight as possible to minimize the need for duct sealing and to eliminate infiltration.
- Check for allowable repairs for moisture problems.

8. Combustion appliances

- The furnace must be visually inspected to ensure the blower and burners are clean.
 - Other work performed by the furnace contractor must be verified and inspected.
 - Check for signs of carbon in the flue opening.
 - Spillage and CO tests must be completed on all combustion appliances in accordance to the standards under worst case conditions.
 - All required tests must be completed and properly documented (temperature rise, static pressure, spillage, etc.).
 - Any client comments about furnace problems should also be checked.
 - Check for gas leaks.
 - Check for adequate volume of combustion air.
 - New furnaces must meet the same standards as existing and meet code requirements (local codes or the United Mechanical Code). All replacements must meet NeWAP Standards as well.
 - Visually inspect the duct system for large openings and disconnected ductwork. Large openings, holes and open return registers must be sealed. The return air drop should not have any sign of insulation in it. If it does, locate the origin of the insulation.
 - Pressure Pan testing must be completed with the blower door at 50 Pascal for ducts outside thermal boundary.
 - Whenever possible, ducts are to be in the heated thermal boundary. Ducts in unheated areas are to be insulated (i.e., garages, attics or unheated crawlspace).
 - When there is a central return or a suspicion of high room pressures, the room pressures must be checked with reference to the main body with the air handler running. The room pressures WRT main body must be less than 3 Pascal.
 - Pipe wrap is to be properly size and secured. It must be 3" away from flue and draft hood unless the unit is power-vented.
 - New installation of water heaters must meet all codes and standards.
 - While inspecting the furnace and water, the flue must be checked to make sure they are connected, in good condition and secure. The chimney must be inspected to make sure it has no opening into the basement.
9. Blower door testing is required, including garage leakage tests if there is an attached or tuck-under garage. The garage leakage test results must be reported in the database.
10. When the blower door is used, zone leakage testing can be done to ascertain the by-pass leakage or tightness in the basement and/or attics. If the leakage in the attic is high, by-passes should be checked again. It could create a moisture concern in the attic if the air barrier is the roof rather than the ceiling. If moisture problems exist and by-pass leakage is significant, more by-pass sealing should be done.

11. All CO and smoke alarms (existing and new) must be in proper location and installed correctly.

12. Outside the house

- Wall insulation should be checked to make sure it is dense packed and complete. If walls were previously insulated, verify that the correct amount of insulation was entered into the audit. The infrared camera should be used to check wall insulation.
 - Using the blower door with the infrared will help find air leakage sites and by-passes. If there are questions about what you are seeing with the camera, test holes should be drilled to make certain there are no problems with the insulation. Drilling the siding should be a last resort. Removing siding to insulate is preferable. Removed siding needs to be properly reinstalled and neat in appearance. There should be no structural damage that will allow moisture into the walls.
 - Check the exhaust terminations, dryer vent termination, furnace and water heater venting.
 - Check attic ventilation.
 - Check structural condition of the exterior wall.
 - Check for cracks in the foundation.
 - Check any newly installed wood. New wood is to be painted or varnished, unless it is pressure-treated wood.
13. Client needs to be informed about any new appliances in the home. The operation of the new furnace, water heater, and/or refrigerator might require some explanation to the client. The thermostat may also need to be explained. The reasons for using the exhaust fan may need to be explained. When possible, the furnace filter should be looked at with the client. They should know how to replace the filter and the size that is needed.
14. The client final inspection sign-off needs to be completed. If available leave information concerning agency contacts. Also leave any printed energy savings tips.
15. The paperwork in the file (audit, NEAT/MHEA, etc.) must be reviewed for completeness and accuracy. We are to leave the house in better condition than when the job was started.

3.04 NEAT/MHEA and Low Rise Multi-Family Audits(Priority List)

NEAT/MHEA

The Nebraska Weatherization Program uses the most current version of the site specific WAweb Energy Audit Tool (NEAT/MHEA Audit) as approved by the U.S. Department of Energy (DOE) and shall be used by all Subgrantees to conduct audits on site-built and manufactured homes.

The audit tool will be used in determining the Savings to Investment Ratio (*SIR*) of each weatherization measure and the correct priority of weatherization improvements for each dwelling unit.

- The NEAT audit will be used for all site-built single-family homes and buildings with four units or less.
- The MHEA will be used on all manufactured homes.
- Either the NEAT or MHEA audit can be used for manufactured homes where the *building envelope* has been altered with light conventional framing, manufactured homes installed on permanent foundations, *conditioned basements*, and modular homes.

Auditors will select the audit tool which will provide the best opportunity to maximize the energy savings for these irregular combined construction types.

The NeWAP does not have an approved *multi-family* audit tool for multi-family units that do not meet the Low-Rise Multifamily unit description described below. Subgrantees should contact the DWEE for guidance prior to accepting any application of a project larger than four units. Multi-family building audits must receive approval from DWEE and DOE prior to implementation.

Low Rise Multi-Family Audits(Priority List)

The NeWAP utilizes the DOE developed Low-Rise Multifamily, Region 3, Priority List, in multifamily buildings that meet all the following criteria:

- The structure is a wood-framed, low-rise multifamily building containing five (5) or more dwelling units.
- The building is no more than three (3) stories above grade.
- The building characteristics match those defined in the DOE Region 3 Low-Rise Multifamily Priority List.
- Incidental Repair Measure (IRM) costs funded with DOE Weatherization Assistance Program funds do not exceed ten percent (10%) of the total Energy Conservation Measure (ECM) package cost, as defined in the Nebraska Weatherization Assistance Program State Plan.

If a building does not meet the criteria required for use of the Priority List, the Subgrantee must perform a site-specific energy audit using an approved audit tool.

[See Section 1.13](#) for information on how to proceed with the Low-Rise Multifamily, Region 3 Priority List.

Chapter 4.0 Air Sealing, Infiltration and General Heat Waste

4.01 Air Sealing and Infiltration Reduction

SWS [3.0101.1](#); [3.0102](#); [3.0103.3](#); [3.0102.1](#); [3.0102.2](#); [3.0102.11](#); [4.0104.1c](#); [3.0102](#)

Air Sealing

Air sealing is required to reduce uncontrolled air leakage and moisture movement between conditioned and unconditioned spaces, particularly in areas such as chases, open stud cavities, attics, and basements. Air leakage at the upper and lower portions of the building envelope is typically the most significant due to higher pressure differences and larger leakage pathways. These areas shall be prioritized for sealing.

Air sealing measures that produce measurable reductions in air leakage (infiltration) shall be evaluated as Energy Conservation Measures (ECMs) and must meet cost-effectiveness requirements using an approved energy audit tool. These measures include major air sealing activities such as attic bypass sealing, rim joist sealing, and other significant leakage pathways that contribute to energy loss.

Blower door-guided air sealing is an exception to individual measure Savings-to-Investment Ratio (SIR) requirements. In accordance with WPN 23-6, blower door-guided air sealing may be installed even if the individual measure SIR is less than 1.0, provided the cumulative SIR of the total package of measures is equal to or greater than 1.0, excluding Health and Safety measures. [WPN 23-6](#)

Infiltration Reduction

Infiltration refers to the uncontrolled movement of outside air into the home through leaks in the building envelope. Infiltration reduction is the *result* of properly completed air sealing work. Smaller leakage areas, such as those found around windows, doors, and minor penetrations, contribute to infiltration but are generally lower priority than major leakage pathways.

- Infiltration materials may include weatherstrip, caulking, glass, glazing, mortar mix, and thresholds.
- The blower door should be used to assess the problem areas and determine where the greatest need for infiltration reduction exists.
- The estimated cost for infiltration reduction must be entered in the NEAT/MHEA Audit in the Duct & Infiltration Screen and included in the SIR.
- By distinguishing between major air leakage pathways and minor infiltration points, priority shall be given to sealing larger and more impactful leaks that significantly affect energy use and building performance.
- All materials used for air sealing and infiltration reduction shall comply with the requirements outlined in [Appendix A](#).

4.02 General Heat Waste (GHW)

Minor air leakage reduction activities that are not practical to model individually may be classified as General Heat Waste (GHW). GHW measures are limited to low-cost, common-sense improvements that reduce energy loss but do not warrant individual cost-effectiveness analysis. These measures should be reasonable in cost and limited in scope. The NeWAP has a list of DOE approved measures to be paid for with GHW below. DOE limit of GHW funds is \$250. LIHEAP GHW funds have a limit of \$1000.00 as of January 2026 WPB put out by DWEE. GHW measures may be skipped for documented reasons (including client refusal). GHW measures are not prioritized by the Energy Audit Tool even if they are at the top of the list. ([WPN 23-6 Attachment 8 Measure Skipping](#)). All GHW measures must be entered into the audit for documentation and consideration by entering them as Itemized Costs, with “Include in SIR” unchecked, the same as Health and Safety Measures. However, the measure name should be Pre-fixed by GHWM to differentiate it from HSM's in the Audit.

DOE Approved GHW Measures:

- Limited door and window weatherstripping, caulking, and sealing of direct penetrations
- Outlet and switch plate insulation
- Replacement of missing HVAC system filter covers
- Replacement of Furnace Filters when needed
- Installing Outside Combustion Air to Existing Furnaces when diagnostic testing shows a need
- Sealing holes in walls, plumbing, and building entry points
- Replacement or repair of cracked panes of glass

Additional NeWAP Approved GHW Measures (LIHEAP GHW)

- Ductwork Repair, Sealing and insulation
- Sealing of exposed or accessible ductwork outside the building envelope

4.03 Identifying the Air and Thermal Boundaries

To complete appropriate air sealing and ensure consistent energy audit results, the auditor shall identify and document the **air boundary**, **thermal boundary**, and **pressure (thermal-pressure) boundary** of the home. In general, ceilings, walls, and floors separating conditioned space from unconditioned space establish both the air and thermal boundaries; however, these boundaries may not align and must be verified in the field.

Where to air seal and insulate are important retrofit decisions. Zone pressures are one of several factors used to determine where the thermal boundary should be located.

When there are two choices of where to insulate and air seal, zone pressures along with other considerations help decide where to locate the pressure and thermal boundaries.

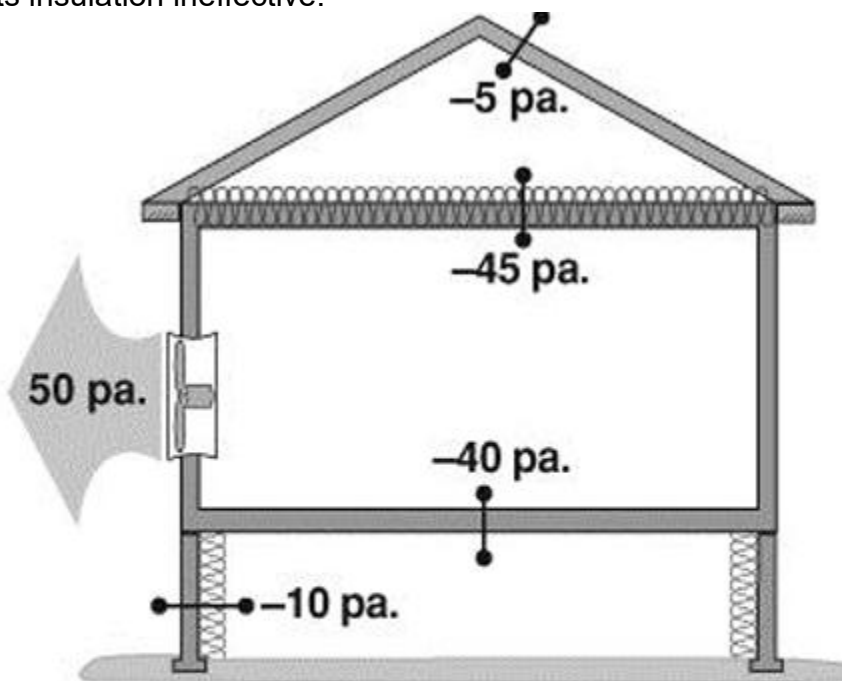
For zone leak-testing, the house-to-zone pressure is often used to determine which of the two pressure boundaries is tighter (has smaller sized holes).

For example, a house-to-zone pressure differential of 26 to 50 pascals means the primary pressure boundary is likely tighter than the secondary boundary. If the secondary boundary is quite airtight, achieving a 50-pascal house-to-zone pressure differential is difficult. However, if the roof is well ventilated, creating a nearly 50-pascal differential is possible. If the roof is over-ventilated, creating a nearly 50-pascal differential is easy.

By contrast, a house-to-zone pressure differential of zero to 25 pascals means the secondary pressure boundary is tighter than the primary boundary. If the roof is well ventilated, then these readings indicate the ceiling has even more leakage surface area than the roof.

Floor vs. Crawl Space

The floor shown below is tighter than the crawl space foundation walls. If the crawl space foundation walls are insulated, holes and vents in the foundation wall should be sealed until the pressure difference between the crawl space and outside is as close to 50 pascals as possible—ideally more than 48 pascals. A leaky foundation wall renders its insulation ineffective.



Pressure measurements and air barrier location: The air barrier and insulation are aligned at the ceiling as they should be. The crawl space pressure measurements show that the floor is the air barrier and the insulation is misaligned—installed at the foundation wall. We could decide to close the crawl space vents and air seal the crawl space. Then the insulation would be aligned with the air barrier.

It might be more effective to weatherize the floor above the crawl space. If the floor is insulated instead of the foundation walls and completely air sealed, then the pressure and the thermal boundary would be in alignment at the floor. When the crawl space is adjacent to a basement and the thermal boundary is to be moved to the floor, remember the thermal boundary now includes the wall separating the basement from the crawl space. Insulate and air seal this wall appropriately.

However, it will usually make more sense to locate the thermal boundary at the crawl space foundation walls, rather than at the floor. Locating the thermal boundary at the foundation walls eliminates the concern about frozen pipes in the crawl space. In addition, treating the foundation walls usually requires less work and material than treating the floor.

Table 1-2: Crawl Space: Where Should the Air Barrier Be?

Factors Favoring Foundation Wall	Factors Favoring Floor
Ground moisture barrier and good perimeter drainage present or planned	Damp crawl space with little or no improvement offered by weatherization
Foundation walls test tighter than floor	Floor tests tighter than foundation walls
Furnace, ducts, and plumbing located in crawl space	No plumbing or heating located in crawl space
Foundation wall is insulated	Floor is insulated

Table 1-3: Unoccupied Basement: Where Should the Air Barrier Be?

Factors Favoring Foundation Wall	Factors Favoring Floor
Ground drainage and no existing moisture problems	Damp basement with no solution during weatherization
Interior stairway between house and basement	Floor air sealing and insulation is a reasonable option, considering access and obstacles
Ducts and furnace in basement	No furnace or ducts present
Foundation walls test tighter than the floor	Floor tests tighter than foundation walls
Basement may be occupied someday	Exterior entrance and stairway only
Laundry in basement	Rubble masonry foundation walls
Floor air sealing and insulation would be very difficult	Dirt floor or deteriorating concrete floor
Concrete floor	Badly cracked foundation walls

4.0301 Determination of Conditioned, Unconditioned, and Buffer Spaces

Unfinished foundation spaces (basements, crawlspaces) shall be evaluated and classified as conditioned, unconditioned, or buffer spaces. Classification shall not be assumed and must be based on the following:

- Thermal Boundary Location

- Insulation location and continuity (floor above vs. foundation walls)
- Air Leakage / Pressure Connection
 - Degree of air communication with conditioned space
 - Zonal pressure diagnostics, when applicable
- Intentional Conditioning
 - Presence of supply registers, returns, or duct leakage
 - Installed heating or cooling equipment serving the space
- Occupant Use and Configuration
 - Finished vs. unfinished space
 - Presence of separation (doors, air barriers)
- Combustion Appliance Zone (CAZ)
 - Presence of combustion appliances
 - Impact of the space on pressure dynamics and combustion safety

The final classification shall be consistent with how the space is entered and modeled in the approved energy audit tool. In order to have a consistent evaluation when determining conditioned floor area in a home, further guidance is provided:

1. **General Rule**

Foundation spaces that fall within the home's pressure boundary shall only be classified as conditioned floor area when they meet all criteria listed in this section. The intent is to ensure consistent measure selection across agencies in accordance with WPN 23-6.

2. **Finished Space Requirement**

A foundation space may be counted as conditioned floor area only when it is finished in a manner comparable to the primary living areas of the dwelling.

A "finished" foundation space includes:

- Completed wall surfaces (such as drywall, paneling, or plaster)
- Completed ceilings
- Finished flooring (such as carpet, tile, laminate, or sealed flooring intended for living spaces)

Unfinished spaces, including utility basements, mechanical rooms, or storage areas, are not considered conditioned floor area even if they fall within the pressure boundary.

3. **Minimum Ceiling Height**

To be considered conditioned floor area, a foundation-level space must have a minimum ceiling height of 7 feet.

Exceptions may be allowed only where local building codes define habitable space differently; however, WAweb users must document the applicable code reference.

4. **Heating and Cooling Requirement**

A foundation space does not need to contain a dedicated heating or cooling unit to qualify as conditioned floor area. The space must, however, be intentionally or passively conditioned. This may include:

- Direct supply or return registers
- Radiant or hydronic heating elements
- Spaces that receive passive conditioning due to open air pathways, duct leakage from supply ducts within the space, or intentional inclusion within the home's thermal system

Spaces that experience incidental temperature changes without intentional conditioning do not qualify.

5. Documentation Requirements

When a foundation-level space is classified as conditioned floor area, the auditor must document the justification within the WAweb audit file. Documentation must include:

- Confirmation that the space meets the finished-space requirement
- Measured ceiling height
- Description of the conditioning mechanism (direct or passive)
- Photos showing relevant conditions

6. Impact on Measure Selection

Only foundation spaces that meet the above criteria shall be used when determining building geometry, heat-load calculations, or eligibility and prioritization for insulation or air-sealing measures within WAweb.

4.0302 Thermal-Pressure Boundary

The thermal-pressure boundary is the continuous plane separating conditioned space from unconditioned or buffer spaces. The auditor shall:

- Identify and maintain a continuous boundary
- Align air sealing work with the pressure boundary
- Ensure insulation corresponds to the established thermal boundary

4.0303 Interior Adjacent and Buffer Spaces

Thermal boundaries shall include interior shell components adjacent to unconditioned or buffer spaces, including:

- Stairways to unconditioned basements or crawlspaces
- CAZ rooms or closets
- Attached garages or mechanical rooms
- Unconditioned additions or enclosed porches

These assemblies shall be:

- Modeled as buffered components (walls, ceilings, floors)
- Evaluated for both heat transfer and air leakage
- Included in the work scope as applicable

Documentation

The auditor shall document:

- Air, thermal, and pressure boundary locations
- Basis for classification of foundation and buffer spaces
- Diagnostic results supporting determinations
- Photo documentation of key conditions
- All inputs must be consistent with the energy audit and resulting work scope in accordance with WPN 23-6.

4.04 Air Sealing Target

The Nebraska Weatherization Assistance Program (NeWAP) recognizes that using blower door guided air sealing can be a cost-effective air sealing procedure to determine when to continue and when to stop air sealing a dwelling.

NeWAP Sub Grantee's will perform an pre-weatherization blower door test reading to establish a baseline of air leakage and use the NeWAP Target Blower Door Calculation to achieve an Air Sealing Target number. This calculation considers the size of the home and Initial reading to achieve a Target number. Air Sealing work will be located and completed using diagnostic testing, visual observation and blower door guided air sealing.

Interior door configuration during testing shall be determined based on the location of the pressure boundary. Generally:

- Doors between conditioned spaces should be open.
- Doors separating conditioned spaces from unconditioned areas such as basements, crawlspaces, or garages should typically be closed.

The testing configuration must be documented in the client file.

4.05 Blower Door Guided Air Sealing

Installation Standard 3.1 through 3.8

Utilizing blower door guided air sealing allows you to locate and seal the largest sources of leakage and helps you to determine the effectiveness of your sealing work by providing an instantaneous reduction in the home's CFM50 Reading. The CFM50 reduction should be checked at the end of each air sealing measure, or step completed, to determine cost effectiveness. As the air sealing work progresses the amount of CFM50 reduction experienced diminishes, you can determine the point where continued air sealing is no longer cost-effective.

Cost Effective Blower Door Guided Air Sealing is air sealing guided by calculating effectiveness after each round of infiltration repair work completed. See example below:

Cost Effective Blower Door Guided Air Sealing

First Blower Door reading:

- 5500 CFM50

Air Sealing Work Done:

- Close opening above and around interior pocket door and hole in the wall behind the kitchen range

Materials Used:

- 1/2 sheet of dry wall, 1/4 roll R-11 batt, 2 tubes caulking, drywall tape, mud and screws.

Labor Cost:

- 2.5 hours at \$25.00 = \$62.50

Material Cost:

- \$63.00

Total: \$125.50

Second Blower Door reading:

- 4100 CFM50 - A reduction of 1400 CFM50

Savings ratio:

- $\$125.50 \div 1400 \text{ CFM50} \times 100 = \$8.96 \text{ per } 100 \text{ CFM50}$

The ratio is less than \$50 per 100 CFM50. Keep looking for air sealing opportunities.

Second Blower Door reading:

- 4100 CFM50

Air Sealing Work Done:

- Seal around furnace flue and fireplace chimney (at attic insulation line)

Materials Used:

- 10 sf tin, 6 tubes of high temp caulk, screws, and 1 small "L" bracket to secure tin to masonry chimney

Labor Cost:

- 3 hours at \$25.00 = \$75.00

Material Cost:

- \$140.00

Total:

- \$215.00

Third Blower Door reading:

- 3450 CFM50 a reduction of 650 CFM50

Saving ratio:

- $\$215.00 \div 650 \text{ CFM50} \times 100 = \$33.07 \text{ per } 100 \text{ CFM50}$

The ratio is less than \$50.00 per 100 CFM50. Keep looking for air sealing opportunities.

Third Blower Door reading: 3450 CFM50

Air Sealing Work Done:

- Caulk interior window and door trim, install window rope pulley covers, caulk attic access trim

Materials Used:

- 10 sf tin, 6 tubes of high temp caulk, screws, and 1 small "L" bracket to secure tin to masonry chimney

Labor Cost:

- 2-1/2 hours at \$25.00 = \$62.50

Material Cost:

- 11 tubes of caulking @ \$4.50, 20 pulley covers @ \$3.50, and 25 feet backer rod @ \$1.00 total materials cost \$123.50

Total:

- \$186

Fourth Blower Door reading:

- 2700 CFM50 a reduction of 750 CFM50

Saving ratio:

- $\$186.00 \div 750 \text{ CFM50} \times 100 = \$24.80 \text{ per } 100 \text{ CFM50}$

The ratio is less than \$50.00 per 100 CFM50. Keep looking for air sealing opportunities.

Fourth Blower Door reading: 2700 CFM50

Air Sealing Work Done:

- Seal rim joist and seal unused coal chute.

Materials Used:

- 13 tubes of caulking @ \$4.50, 20 feet of backer rod @ \$1.50 = total materials \$88.50

Labor Cost:

- 2 hours at \$35.00 = \$70.00

Total:

- \$158.50

Fifth Blower Door reading:

- 2400 CFM50 a reduction of 300 CFM50

Saving ratio:

- $\$158.50 \div 300 \text{ CFM50} \times 100 = \$52.80 \text{ per } 100 \text{ CFM50}$

The ratio is more than \$50.00 per 100 CFM50. Stop air sealing.

Air sealing blower door readings should be appropriately recorded in the client file.

NeWAP provides reduction reimbursement of the costs directly associated with blower door air sealing as an Energy Efficiency Measure based on cost-effectiveness as indicated in the Energy Audit of the home.

Payment for blower door air sealing requires documentation verifying the costs of *infiltration* reduction (materials and labor) work completed, for which reimbursement is being requested and that are directly associated with blower door guided air sealing.

Air Sealing Exceptions

Some dwellings may not reach the air sealing target because of structural conditions or other factors.

Exceptions are allowed when:

All reasonable attempts have been made to reach the standard, or

Further air sealing is not cost-effective

Subgrantees must complete all cost-effective air sealing opportunities and all project files must provide clear and adequate documentation of the installer's efforts to appropriately air seal the home.

4.06 Work Standards

The Energy Auditor should document the existence of any penetration throughout the home including:

- Open interior or exterior walls
- Utility penetrations [Installation Standard 3.6](#)
- Recessed light fixtures [Installation Standard 3.5, 3.9](#)
- Exhaust fan housings
- Cantilevered Floors [Installation Standard 3.5](#)
- Kitchen and bathroom Soffits [Installation Standard 3.2](#)
- Chimney chase way [Installation Standard 3.3, 4.1](#)
- Balloon framed walls [SWS 3.0102.4](#)
- Rim Joists [Installation Standard 3.4, 3.14](#)
- Tops and Bottoms of interior walls [Installation Standard 3.1](#)
- Dropped Ceilings [Installation Standard 3.2](#)
- Joists under Knee Walls [Installation Standard 3.11](#)

Any chimneys which do not go through the roof. They must be sealed at the top with appropriate materials.

Unfloored knee wall (outer ceiling joists) shall be sealed between each joist at the wall joint with a rigid air impermeable material and seal. The remainder or exposed portion of the knee wall floor (OCJ attic) shall be insulated as if it were an attic floor according to NEAT.

Material used for attic air sealing includes, but is not limited to, rigid foam, liquid foam, sheet metal, dry wall, and caulk.

Material used to seal around heat sources include: sheet metal, fire rated liquid foam, and caulk that will withstand at least 400°. [SWS 3.0102.2](#)

Existing fiberglass insulation or loose-filled cellulose in sloped areas or rafter runs must be sealed at the top or bottom of each cavity if possible to prevent convective looping in the cavity.

Tongue and groove ceilings must be backed with a continuous air barrier and permanently sealed if accessible. Talk to DWEE with any questions. [SWS 3.0102.3](#)

Any existing whole house fans must either be disconnected with client permission or removed with client permission and the ceiling area finished matching the surrounding area or an insulated box must be built as a cover for these fans during winter weather.

- An option to this would be a magnetic cover designed to attach to the face of the fan which then could be removed to operate the fan.
- If a cover box is built it must be built of $\frac{3}{4}$ " plywood deep enough to protect the fan housing and motor from insulation. Weatherstrip the box to ensure a tight fit.
- Non-compressible insulation equal in R-value to surrounding attic floor will be permanently attached to the top and sides of the box.

Attic thermal bypasses result in heat loss and must be sealed. [SWS 3.0101.1](#)

Attic by-pass sealing must be verified in the client file by use of photographs taken before insulation is installed. These photos may be taken by either the crew/contractor or other agency staff.

Seal all major attic bypasses such as vent pipes, open interior and exterior wall stud runs, wire penetrations, chimney chase ways, area between brick chimney and flue liner, etc. (check local building codes on chimney chase ways).

Air sealing materials, such as rigid foam board must be in alignment with the attic's pressure boundary, must be sealed in place with caulk or non-expanding foam to make them airtight.

Fiberglass is not to be used as an air sealing material but may be used to stuff the top of wall cavities which will be dense-pack insulated. Plastic bags, stuffed with fiberglass, are not an acceptable air sealing material.

4.0601 Door Weatherstrip [SWS 3.0202.1f](#)

Installation Standard 3.12, 3.13

- Weatherstrip can be installed on all house-to-garage doors (if none existing) or when there is significant air leakage around the exterior door.
- All existing weatherstrip is to be removed from the door if installing new.
- Door trimming and adjustments, including hinge tightening and strike plate adjustments, may be necessary and must be done before installing weatherstrip.
- If available, the color of the weatherstrip should match the color of the jamb.
- Installation is to be in accordance with the manufacturer's instructions.
- Weatherstrip is to consist of a semi-rigid strip with vinyl or neoprene flap. A bulb-type weatherstrip is also acceptable if the bulb is made of siliconized rubber and a minimum of ¼" diameter. A third type that can be used is a tough vinyl tear-resistant skinned material enclosing cellular foam.
- New weatherstrip must form a tight seal, be neat in appearance, shall not interfere with the operation of the door, and be fastened in such a way as to prevent buckling or gaps.
- A small bead of caulk is to be applied to make the weatherstrip and the door stop airtight.

4.0602 Sweeps [SWS 3.0202.1f](#)

Sweeps can be installed on all house-to-garage doors (if none existing) or when there is significant air leakage at the bottom of a door and a threshold already exists.

- Sweeps are to be a metal strip with a vinyl or neoprene insert, or a brush type installed with screws on the interior side of the door.
- Sweeps are to be cut to the same width as the door.
- Sweeps shall be secured within 2" of the door edge on each end.
- Sweeps shall have a threshold or carpet bar to seal against.

- Installation is to be neat in appearance, form an airtight seal and not interfere with the operation of the door.

4.0603 Thresholds

Thresholds can be installed when there is significant air leakage at the bottom of a door and a sweep will not work properly or when the exterior door rubs the floor.

- Except for lower grade and attic access doors, half thresholds (bumper type) are not to be installed.
- Thresholds are to fit snugly between the jambs and fasten to the sill and the floor with screws.
- All thresholds are to be wood with metal and vinyl insert, unless the work order lists otherwise.
- Thresholds are to be caulked on both the interior and exterior to form a tight seal with the doorsill.
- Thresholds are to be set entirely on the sill or a continuous shim from end to end so no gap exists between the threshold and doorsill.
- All unfinished wood installed is to be painted or varnished to a smooth finish, unless the wood is pressure-treated.

4.0604 Caulking

Caulk shall be applied according to the manufacturer's instructions. Caulk shall be applied to a smooth, clean, dry surface.

- Caulk shall be applied in a continuous bead and free of voids, with a smooth and neat appearance.
- All openings 3/8" to 7/8" wide shall be filled to within 1/2" of the surface with an appropriate packing material specifically manufactured as a packing material, such as closed cell polyethylene rod prior to caulking. All packing material shall be compatible with the type of caulk used.
- Excess caulk shall be removed before it cures.
- Silicone caulk to be used on metal joints or two different materials shall have an elongation rating of at least 200%.

For interior application:

- Caulk shall be non-toxic, low VOC, clear, paintable, or a color complimentary to the surface to which it is to be applied. Remove any material from the sealing area that will prevent full adhesion of the selected sealant

For exterior applications:

- All exterior cracks or openings wider than 1/4" must be packed with a material (flexible polyurethane, oakum, neoprene, butyl rope, or sponge rubber) specifically manufactured as packing or stuffing material. The crack is to be sealed with caulk to make it air and watertight. Any existing loose or brittle material must be removed before caulking.
- Caulking compound conformance
 - Acrylic F.S. TT-S-00230C(ASTM834)
 - Latex ASTM 834-76(1986)
 - Butyl Rubber F. S. TT-S-001657

- Chlorosulfonated Polyethylene F. S. TT-S-00230C
- Polyurethane or Polysulfide F. S. TT-S-227E
- Elastomeric joint sealants (including polysulfide, polyurethane and silicone) ASTM C920-87
- Oil and Resin Base caulks are not acceptable.
- All caulking compounds must meet 15-year warranty minimum.

4.0605 Spray Foam

- Must be neat in appearance – trim if necessary
- May not be used on exterior surfaces unless painted to protect against deterioration.

4.0606 Glass [SWS 3.0201.4](#)

[Installation Standard 3.20, 3.22](#)

- Glass shall not be less than “B” grade single strength.
- Glass will be sized 1/8” – 3/16” smaller than opening to allow for movement of frame.
- Glass over twenty-five (25) inches in either dimension shall not be less than “B” grade double strength.
- Glass shall be secured with glazing points (2” from each corner and not more than 8” apart) and puttied with latex or oil-based glazing compound, or sealed with plastic or vinyl glazing strips.
- Glass set in metal frames is to have metal-glazing clips no more than 12” apart and within 4” of each corner and the joint between the two surfaces puttied.
- Safety glass is required in windows located within 12” of a door when the bottom edge is less than 60” above the floor or if panes are larger than 9 sq. ft. when the bottom edge is less than 18” above the floor.
- Safety glass is not required for windows protected with 1½” mullion or guard rail located 2 to 3 feet above the door. It is required in all windows located in entrance doors, in fixed and sliding panels of sliding doors and in panels in swinging doors other than wardrobe doors.
- Safety glass must be permanently labeled.
- Plexiglass may also be used in lieu of safety glass on doors and windows; however, discoloration may occur.
- Replacement window glass must be tempered when required by state and local code jurisdictions.
- Damaged decorative window glass must be replaced with a standard glass pane.
- If the client refuses a standard window glass pane, the decorative window glass must be repaired with clear silicone caulk.
- If the existing window glass is a thermal pane or *insulated glass* and the interior or exterior pane is cracked, the cracked glass must be removed or repaired.
- If both the interior and exterior panes of thermal pane window glass are broken, the window glass may be replaced with a thermal pane glass or a single glass pane.

- Apply sealants with rated adhesion and movement characteristics to prevent air leakage, condensation, and rain leakage between the window frame and other building materials.
- Replacing missing or severely deteriorated window frame components that are beyond repair.

4.0607 Glazing [SWS 3.0201.4d, e](#)

- Caulk may not be used in lieu of a glazing compound.
- Glazing compound must conform to F.S. TT-P-00791B ASTM C669-75(1989).
- Glazing is not to extend above the rabbet edge of the sash.
- Glazing is to be tooled smooth to form a concave surface and be neat in appearance.
- Glazing compound will be applied in accordance with manufacturer's specifications.

4.0608 Drywall (may also be a repair cost in some cases - Energy Auditor decision)

- Only ½" drywall shall be used when installing on the entire wall or ceiling (if ceiling joist is on 16" center). If the ceiling joist is on 24" center, 5/8" drywall will be used.
- 5/8" Fire-rated drywall must be used over or between a garage and the house.
- Drywall installed on ceilings must be installed perpendicular to the ceiling joist.
- Whenever possible, drywall installed on walls should also be installed perpendicular to the studs.
- Drywall is to be installed using 1¼" drywall screws.
- Screws shall be placed no more than 12" apart on each stud or ceiling joist. Screws shall be countersunk into the drywall without breaking through the paper.
- Metal corner beads are to be installed to all outside corners. Inside corners must be taped with perforated paper tape. If fiberglass tape is used for other seams, be sure to use the proper joint compound to ensure against cracking.
- All gaps wider than ¼" must be filled with a non-shrinking compound manufactured for that purpose prior to taping.
- If installing drywall in order to ready it for wall insulation, one (1) coat of joint compound is to be applied and made ready for a second coat.
- If existing drywall must be sealed, one coat of joint compound is to be neat in appearance and made ready for a second coat.
- Drywall repairs shall be made with the same thickness material as existing.
 - The hole should be squared and a properly sized patch nailed or screwed in place.
 - The drywall patch shall receive tape and joint compound and be applied to make a neat patch.
- If repairing drywall due to damage caused by the weatherization crew or contractor, the drywall shall receive three (3) coats of joint compound, textured and painted to return it to its original appearance.
- All work is to be neat in appearance

All light fixtures, wiring, plumbing, venting, ducting, and gas piping penetrations in an attached or tuck-under garage must be sealed.

All cracks in house and garage separation wall will be sealed.

Client will be educated on the need to keep door from garage to house closed and not to warm up vehicles or use any gas engine or grills in the garage.

All penetration points must be tested with smoke, smoke pencils and/or an infrared camera, along with the blower door, and sealed.

4.0609 Manufactured Homes

- Exterior water heater compartments to be sealed and isolated from the interior of the home.
- All openings from the water heater compartment into the *conditioned* space to be sealed with metal or 5/8" fire code gypsum board.
- Water heater compartment doors that are beyond repair may be replaced. Appropriate photo and written documentation regarding the condition of the door must be included in the client file.
- Openings in the ceiling need to be sealed with appropriate materials. Sealing holes and cracks in the ceiling should be considered by-pass sealing and completed.
- In visible areas sealing material should be similar to the existing material, especially for a large area.
- When accessible, sewer and drain vents need to be sealed where they penetrate the ceiling.
- Furnace and/or water heater vents need to be sealed with metal where it penetrates the ceiling.
- If the connection between the new furnace and the trunk line will not be accessible after installation, the heating contractor must seal the connection.
- When the return air system is blocked and sealed a minimum 16 inch x 24 inch vent must be installed in the furnace compartment door.
 - If the vent is not installed, the mobile home floor must not be insulated.

Mobile Home Skirting [SWS 4.0388.1](#)

Insulated Skirting Installation Requirements

- See [Section 5.0402.04a](#) for more information on Mobile Home Skirting.
- The access must be constructed of ¾ inch pressure treated plywood and be a minimum of 20 inches in width. It must be attached with 2 hinges and a latching mechanism. The access must be insulated with minimum R-13 batt or a minimum R-7 rigid insulation and weather-stripped with the last fastener or screw no more than 2-1/2 inches from the end of the weather-strip.
- A manufactured insulating skirting kit may be used. The kit must be a minimum R-8 insulation and include 1 access.

4.07 Water Heater Measures

To ensure a safe and dependable hot water system that adequately serves occupants and building operations while minimizing life-cycle costs, the domestic water heater and associated piping shall be evaluated for potential upgrades

4.0701 Water Heater Turn Down [SWS 7.0302](#)

Savings can be achieved by reducing the temperature setting.

- Examine the temperature setting on the gas valve or thermostat.
- Consult with the client to determine if the temperature can be lowered to 120°F without affecting the client's lifestyle.
- Provide consumer energy education to the client regarding the management of hot water usage.

4.0702 Low Flow Showerheads [SWS 7.0201.1b](#)

[Installation Standard 7.4, 7.5](#)

Examine plumbing fixtures to determine whether low-flow devices are present.

- Consult the client to determine whether low-flow showerhead can be installed in the shower.
- Low Flow Showerheads installed are to be rated at 2.5 gallons per minute.
- If multiple heads are provided in a shower stall, the total flow rate may not exceed 2.5 GPM.
- Select features that meet any special needs of the occupant (e.g., shut off, swivel, handheld showers)

4.0703 Water Pipe Insulation [SWS 7.0301.1](#)

[Installation Standard 7.3](#)

- Hot and cold water lines must be insulated a minimum of 6 feet (to a maximum of 18 feet, if cost effective) in all directions from the water heater, using properly sized preformed pipe wrap or insulation specifically designed as pipe wrap.
- Accessible pipes must be insulated with 1-inch material having a minimum R-4 pipe insulation specifically manufactured as pipe insulation.
- Each section of preformed pipe wrap must be fastened with a minimum of 3 wires, cords, plastic clips or nylon bands.
- Joints and elbows must be insulated.
- Duct tape must not be used as a means of fastening pipe wrap.
- Maintain a minimum of 6", or the distance specified by the manufacturer, between combustible pipe insulation and fuel-fired water heater draft hood and/or single wall metal vent materials.
- Water lines that have asbestos pipe wrap must not be insulated or sealed in the area containing the asbestos.

4.0704 Water Heater Tank Insulation [SWS 7.0301.2](#)

[Installation Standard 7.1, 7.2](#)

- Water Heater Tank insulation may be installed on existing water heaters if it does not void the warranty.
- Water heater tank insulation must be a minimum R-10 blanket secured with tape and bound with a minimum of 2 wires, cords, plastic or nylon bands on the tank.
- Insulation must not cover the pressure relief valve, end of the drip leg, draft hood, burner air inlet, pilot light access door, thermostat control, drain valve or the top of the water heater on natural gas or propane water heaters.
- Electric water heaters must have the top insulated and the thermostat control access panels clearly accessible or marked and labeled.

4.0705 Manufactured Homes

All accessible water lines in the water heater compartment must be insulated using properly sized preformed pipe wrap or insulation specifically designed as pipe wrap.

4.08 Windows and Doors

Window and door air tightening and repair measures such as caulking, glazing, weatherstripping and re-weatherstripping, sash locks, or glass replacement are considered air sealing measures and are eligible General Heat Loss Measure expenditures in the NeWAP. The following issues must be considered prior to Implementation.

Window and door replacements completed through the NeWAP, using Department of Energy (DOE) funding, must be shown as cost-effective through the home's Energy Audit based on energy savings.

Replacements may be completed, using non-DOE funds, if the unit(s) is appropriately documented in the client file as "beyond repair".

The NeWAP also covers costs associated with cost-effective repair and air sealing work on exterior doors, exterior windows, storm doors and storm windows.

All work related to window and door repair/replacement must be completed using lead-safe weatherization practices unless testing confirms the work area to be lead free.

4.0801 Window Repair [SWS 3.0201](#)

- When feasible, windows must be repaired, rather than replaced.
- Screen repair is allowable Health and Safety "Pest" issue. See section Pests [Section 2.19](#) in this document.
- Replace missing or broken glass that is severely cracked and noticeably separated that affects the structural integrity of the window.
- A window with a cracked pane of glass, where degradation of the frame or sash is not occurring, will have only the glass repaired or replaced as an air sealing measure.

- Cloudiness inside existing *insulated glass* (IG) units because of seal leakage does not constitute “failure” of the window or of the IG unit.
- Window glazing compound shall only be replaced if the existing glazing is deteriorated to the degree that the window glass is in jeopardy of falling out of the sash.
- Window repair/glazing work completed can be completed as a General Heat Loss Measure. See Sections above on [Glass 4.0606](#) and [Glazing 4.0607](#).
- Apply one coat of primer and one coat of exterior paint, as per manufacturer’s installation requirements, to all new wood exposed to the weather.
- Adjusting window stops to reduce leakage between the stop and the jamb and ensuring that the window operates smoothly.
- Replacing or repairing missing or non-functional top and side sash locks, hinges or other hardware.

4.0802 Window Replacement [SWS 3.0201.9](#)

The NeWAP replaces windows, using Department of Energy (DOE) funding, only when the window achieves an *SIR* that meets or exceeds funding source requirements. Windows that do not meet the *SIR* cost-effective requirement may be replaced when the window is damaged beyond repair, using non-DOE funds, if the unit(s) condition is appropriately documented in the client file as “beyond repair”.

All windows replaced through the NeWAP in framed or modular homes, or multifamily buildings must have:

- an NFRC (National *Fenestration* Rating Council) tested U-factor of 0.30 or lower.
- damaged framing repaired prior to the installation of the new window.
- the cavities around the window frame insulated and sealed with non-expanding foam sealant.
- the existing casing reinstalled if it is in good condition.
- all new casings matched as closely as possible to the existing in design and dimension.
- any interior and/or exterior walls damaged when replacing the window are to be repaired with like materials.

4.0802.01 Sash Replacement [SWS 3.0202.1](#)

- new sash sections match, as closely as possible, the existing in design.
- new sash lock(s) installed, if the existing sash was equipped with a sash lock.
- a new sash lock installed, if both the upper and lower sash are replaced.
- Jamb liners may be installed.

4.0803 Storm Window Repair and Replacement

[SWS 3.0201.5](#) [SWS 3.0201.6](#) [SWS 3.02010.7](#) [SWS 3.0201.8](#)

Storm window and screen replacements are generally not cost-effective energy conservation measures.

- Replace or install storm windows only if they are indicated as cost-effective by meeting or exceeding funding source requirements.

- Storm windows repaired or replaced through the NeWAP in single family homes, manufactured homes and multi-family buildings must not be installed over fixed windows.
- When feasible and determined as cost-effective in the energy audit, existing storm windows may be repaired as an air sealing measure.
- Weep holes are not to be sealed shut.

Additionally, storm windows replaced through the NeWAP in manufactured homes must have:

- one-light storms fastened with clips, full-length magnetic strips or using other means that completely seals the window and allow for easy attachment and/or removal.
- self-storing storms in aluminum frame combination windows.
- the storm window installed with a screen insert if the primary window lacks a screen.

4.0804 Manufactured Homes Window Repair/Replacement

Windows replaced in manufactured homes through the NeWAP also should have:

- an NFRC (National *Fenestration* Rating Council) tested U-factor of 0.30 or lower.
- existing putty tape removed, and new putty tape installed.
- a drip cap installed above non-manufactured home replacement windows.
- all interior window casings caulked.
- damaged framing repaired prior to installing the new window.
- the cavities around the window frame insulated and sealed with non-expanding foam sealant.
- the existing casing reinstalled if it is in good condition.
- all new casings matched, as closely as possible, to the existing in design and dimension.
- any interior and/or exterior walls damaged when replacing the window, repaired with like materials.
- new sash sections match, as closely as possible, the existing in design.
- new sash lock(s) installed, if the existing sash was equipped with a sash lock.
- a new sash lock installed, if both the upper and lower sash are replaced.
- if the exterior walls in the manufactured home will accept house type replacement windows, they may be installed.
- jamb liners may be installed.

4.0805 Door Repair [SWS 3.0202.1](#)

Doors can be a source of air leakage. Repair and air sealing work on existing exterior doors is an eligible General Heat Loss Measure expenditures using both DOE and non-DOE funds. This work includes, but is not limited to:

- installing or removing and replacing weather-stripping, thresholds, door bottoms and/or door sweeps. See Sections [Sweeps 4.0602](#) and [Door Weatherstrip 4.0601](#)

- Foam or felt tape door weather-strips are not eligible for reimbursement under the NeWAP.
- adjusting door hardware to reduce air leakage
- applying sealants with rated adhesion and movement characteristics to prevent air leakage, condensation, and rain leakage

4.0806 Door Replacement [SWS 3.0202.2](#)

Installation Standard 3.21

The NeWAP replaces doors, using Department of Energy (DOE) funding, only when the door replacement meets or exceeds funding source requirements.

Doors that do not meet the *SIR* cost- effective requirement may be replaced when the door is damaged beyond repair, using non-DOE funds, if the unit(s) condition is appropriately documented in the client file as “beyond repair”.

All exterior doors replaced through the NeWAP must have:

- an NFRC (National *Fenestration* Rating Council) tested U-factor of 0.17 or lower.
- existing locksets reinstalled on the new door, if possible.
- two (2) keys provided to the client, if a new lockset is installed. [SWS 3.0202.3](#)
- any safety lock installed on the existing door removed and reinstalled on the new door.
- the existing casing reinstalled if it is in good condition.
- all new casings matched, as closely as possible, to the existing in design and dimension.
- the cavities around the door frame insulated and sealed with non-expanding foam sealant.
- all door casings caulked.
- doors that conform to the thickness of the existing jamb.
- three hinges.
- the door bottom trimmed at a 5 degree angle, if trimming is necessary.
- minor door adjustments such as tightening the hinges or adjusting the strike plate, completed to ensure proper operation.

4.0807 Manufactured Homes Door Repair/Replacement

- Outside water heater compartment doors, on manufactured homes, that are beyond repair must be replaced. Appropriate photo and written documentation regarding the condition of the door must be included in the project file.

4.0808 Below Grade Doors

Below and Grade Level doors replaced through the NeWAP in single family, *manufactured housing*, or multi-family buildings must:

- be constructed of ¾ inch pressure treated exterior grade plywood or ½” pressure treated exterior grade plywood on both the interior and exterior faces with 1 ½”, min. R-10 rigid insulation interior.

- be reinforced with a common lumber and insulated with a minimum R-7 rigid insulation and framed
- with pressure treated wood, redwood or cedar.
- be attached with a minimum of 2 hinges and a minimum of one latching mechanism.
- be weather-stripped.
- have the bottom of the door appropriately air sealed.
- have a handle on both the interior and exterior of the door.
- have wood or aluminum thresholds.
- be caulked at the sill.
- the door bottom trimmed at a 5 degree angle, if trimming is necessary.
- have weather-strips, thresholds, door bottoms and sweeps with a vinyl or silicone insert.
- have minor door adjustments such as tightening the hinges or adjusting the strike plate, completed to ensure proper operation.
- no foam or felt tape door weather-strips which are not eligible for reimbursement under the NeWAP.

Chapter 5 Insulation Measures

Appropriate installation levels are necessary for insulation to provide energy savings and increase occupant comfort. To provide the most effectiveness, the insulation must be installed:

- in conjunction with an effective air barrier,
- covering the entire area intended for insulation without voids or edge gaps,
- according to manufacturer's instructions, in the case of blown insulation, at sufficient density to resist settling, and
- observing lead-safe weatherization practices with all tasks that may disturb paint.

Fiberglass batt insulation installed in a *living area*, with the exception of sill box insulation, must be covered with paneling, plywood, chipboard, hardboard or drywall. If the installed covering is:

- drywall; it must be taped with no more than two (2) coats of drywall mud applied.
- plywood, chipboard or hardboard; the joints must be caulked.
- paneling is installed; it must be a minimum 3/16 inch and the joints must be caulked.

5.01 Attics

Prior to installing attic insulation subgrantees must evaluate the insulation installation for cost-

Effectiveness. Subgrantees should evaluate the attic ceiling to ensure it can carry the weight of the insulation that may be called for and inspect and prepare to address the following issues or concerns.

5.0101 Attic Air Sealing

- Complete and document in the client file Attic to home Zone Pressure testing to verify that all attic planes in the home have been appropriately sealed to provide an effective air barrier that allows the attic insulation to be effective.
- Verify the presence of an aligned air barrier and thermal boundary between the attic and living space.
- All attic by-passes must be sealed before insulating the attic.
- Photo or other visual documentation must be taken of **all** by-pass sealing work and any other measures that will be covered by insulation. See [Section 4.06](#)
- Photos must be taken prior to and after weatherization measures are installed and must be maintained in the house file.

5.0101.01 Recessed Lighting

Non IC rated Recessed lights shall be covered with a air-barrier system that an air tight cover allowing 3 inches of clearance from the inside of the cover and the light fixture. One cost effective way is to build a drywall cover box constructed of 5/8 fire code gypsum wall board. Same rule applies of allowing 3 inches of clearance inside the box to the fixture. Caulk, mastic or foam will be used to create a air tight seal all around the box. [SWS 3.0102.1](#)

IC-rated recessed light fixtures are permitted to be in direct contact with insulation; however, they shall not be assumed to be airtight. All recessed lighting fixtures shall be evaluated for air leakage and sealed as necessary to maintain the integrity of the air barrier. Fixtures that are not rated as airtight (AT) shall be sealed or otherwise treated to prevent air leakage into unconditioned spaces.

5.0102 Knob and Tube Wiring [SWS 2.0301.2](#)

The Nebraska State Electrical Board does not permit directly covering knob & tube wiring with insulation. Under the Nebraska Weatherization Assistance Program, attics with existing active knob & tube wiring must be evaluated as cost-effective as discussed below for the installation of attic insulation as follows:

Option #1

Evaluate the removal of the existing knob & tube wiring, the rewiring of the attic and the insulation of the attic installed as per the remaining requirements of this Section, with all completed work installed according to manufacturer's installation standards.

Subgrantees and contractors must:

- comply with all local and state fire, building and electrical safety codes and procedures,
- ensure that all electrical work is completed by an electrician in the State of Nebraska

- ensure that, if required, lead safe practices are followed,
- ensure that appropriate heating and cooling sizing calculations are completed for the sizing of the mechanical equipment using appropriate area/size calculations of replaced and/or active knob & tube wiring attics in the NEAT Energy Audit, and
- document in the client file the name and contact information of the licensed electrician responsible for the removal and rewiring completed in the home.

If the removal, rewiring and insulation of the attic is not shown as cost-effective then move to evaluation option #2 below.

Option #2

Evaluate the cost-effectiveness of installing an appropriate wire shielding, as described below, to ensure, as per the Nebraska State Electrical Board, that insulation does not directly cover the active knob & tube wiring. Subgrantees and Contractors must:

- Complete appropriate shielding procedures of any active Knob & Tube Wiring following fire and electrical safety procedures before insulating.
- Inspect all attic areas for knob & tube wiring.

Attic areas with knob & tube wiring, that are indicated as cost-effective for implementation on the Energy Audit, must be insulated after the wiring has been appropriately covered to prevent direct contact with the insulation and to provide adequate air space (a minimum of 3 ½" clearance) for "cooling" of the wire.

- The costs associated with covering the knob & tube wiring should be included in the cost, the *SIR* calculation, and the invoicing of the Measure so that the costs associated with the shielding can be included as an Energy Conservation Measure (ECM) in the BCJO.
- In situations where the additional costs associated with shielding the knob-and-tube wiring impacts the *SIR* of the ECM, making the ECM ineligible, those costs may be evaluated as an *Incidental Repair Measure* (IRM), associated with the attic insulation ECM.
- In situations where the additional costs associated with shielding the knob-and-tube wiring impacts the Cumulative *SIR* of the home, making the IRM and the home ineligible, those costs may be invoiced as a Health and Safety cost.

Appropriate shielding materials for concealing the knob & tube wiring must include gypsum board, plywood or oriented strand board.

Mark all live knob-and-tube wiring with caution tape that is visible from at least 5' away and post appropriate signage [SWS 2.0301.2b](#)

Attics where knob & tube wiring has been previously covered with insulation, and the Audit indicates that it is cost-effective to install additional insulation, can be insulated when it has been determined where the wiring is located and that it is actually still "active". This determination may be completed by:

- a licensed electrician
- the use of a thermal imager/scanner

- visually or physically locating the wires or
- another verifiable option determined by the sub-grantee and approved by the Department of Water, Energy and Environment.

Once the determination of the wire locations is documented in the client file, the wiring may be appropriately shielded as indicated above to prevent direct contact with the additional insulation and to provide adequate air movement space for cooling of the wire. Following appropriate shielding, insulation may be installed over the shielding.

In attic areas where knob & tube wiring penetrates the plane of the attic and extends up into a side or *knee wall*, a fire resistant baffling must be installed around the wire to provide sufficient space for air movement around the wire to provide adequate air space to accommodate the cooling of the wire. If a baffle can not be installed like in a Roof Rafter run, do not insulate that section of the roof.

If attic insulation is being installed as per the directive above, the Nebraska State Electrical Board recommends the use of a licensed electrician for the installation of safety fuses as is indicated in the National Electrical Code.

Existing fuses must remain intact if no insulation is being completed in the home.

5.0103 Attic Access [SWS 3.0103.1](#)

In all homes that have accessible attics the access itself must be treated and evaluated to ensure the opening between conditioned space and the attic area is sealed off. This can be a regular attic access in ceiling, knee wall access, pull down access, or walk up access. Each access type in some cases will be treated differently, but available funding for each access type does not change as long as the SIR for a ECM measure and Cumulative SIR for the home is at or above allowable standards for DOE or Non DOE funds(LIHEAP). In this section each access type is broken down on how to treat and meet current standards. How each access type is evaluated with available funds is as follows:

1. New Attic Access installation, including all costs, can be evaluated as part of the Attic Insulation ECM for the work in whole if the SIR for the ECM meets or exceeds the funding source requirement or;
2. New or Existing Attic Access installation or treatment, including all costs, can be evaluated as a separate attic area ECM to determine the SIR for the work
3. New or Existing Attic Access installation or treatment, including all costs, can be evaluated as a IRM tied to a ECM measure if the access installation or treatment is necessary for the effective performance or preservation of the Attic insulation ECM.
4. New or Existing Attic Access installation or treatment, including all costs, can be evaluated as part of Infiltration and Air Sealing Costs. See [Section 4.06](#)

If none of the above funding options evaluated are sufficient and impact the Cumulative SIR of the home making it ineligible, the home may not be weatherized.

5.0103.01 Attic Access Hole [SWS 3.0103.1](#) [Installation Standard 4.2](#)

5.0103.01a New Access Installation

- Install new attic accesses in an area agreeable to the client and conducive to adding insulation.
- Install new attic accesses as per state and local codes.
- Must be properly framed and should have a minimum opening of 13 x 20 inches if possible.
- New access lid must be of $\frac{3}{4}$ plywood, painted or stained to match surroundings.
- $\frac{3}{4}$ plywood surround that is at or above the insulation line of the attic if applicable.
- New Casing installed must be painted or stained to match surroundings.
- Flap Weatherstrip installed and caulked to seal with new lid. Foam cell weatherstrip is not allowed
- Caulked with paintable caulk or color complimentary to the existing surface
- New lid must have insulation attached to attic side and be at the level of existing or installed insulation level. (If attic insulation is a R49, lid must have 5 layers of R10 board for example).
- All accessible attics less than 100 sq ft do not require a access.

5.0103.01b Existing Access Treatment

- When applicable must have $\frac{3}{4}$ plywood surround installed and securely fastened to ceiling joist at or above the attic insulation line.
- Existing Lid must be $\frac{3}{4}$ wood thickness, not warped or damaged, and effectively serve as the access lid. No drywall can be used for the lid as it becomes damaged easily.
- Casing and lid painted or stained to match surroundings if applicable.
- Flap Weatherstrip installed and caulked to seal with new or existing lid. Foam cell weatherstrip is not allowed.
- If applicable, lid must have insulation attached to attic side at the level of existing or new insulation level. (If attic insulation is a R49, lid must have 5 layers of R10 board for example).
- If applicable, existing casing must be caulked with a clear or complimentary color to the surface area.

5.0103.02 Walk Up Attic Door [Installation Standard 4.3](#)

There are some options for this type of walk-up attic access depending if the door is at the bottom of the stairs or top of stairs. The Energy Auditor will determine which is to be completed.

Door at bottom of stairs

- Install an attic lid at the top of the stairs putting the stairway inside the thermal boundary, Or;
- Consider the stairway and walls part of the thermal boundary.
 - Weatherstrip, sweep and insulate the door.
 - Dense pack the stairway walls.
 - If back side of stairway is open, finish with ½" drywall and dense pack insulation.

Door at Top of Stairs

- The stairway walls above the level of the conditioned area will be treated as knee walls and insulated as such.
- Weatherstrip, sweep and insulate the door.
- Insulate the ceiling above the stairway as an attic.

5.0103.03 Pull Down Stairs

Installation Standard 4.3

- Where feasible, pull-down stairs shall have a 2x12, 1"x12" or 3/4" plywood or OSB that can accommodate the folding stairs and be higher than the level of the surrounding attic floor insulation built around them to act as damming for the insulation.
- The exterior of the damming box must be insulated or surrounded with a minimum R10 rigid insulation or equivalent if exposed to or above insulation line.
- The damming box will be covered with a lid made of 3/4" (minimum) plywood or OSB and be hinged in a manner to open up into the attic.
- Weatherstrip is to be installed either on the inside of the damming box surround or on the outside of the damming box surround so that the cover box will sit on the weatherstrip.
- Handle installed for easy opening and closing if applicable.
- Hook and Eye fasteners or turnbuckle Hook and Eye fasteners to secure lid to damming when closed.
- Counterweight/pulley system should be considered to ease accessibility for excessively heavy hatches.
- The back of the lid (attic side) will be insulated to the maximum R-value structurally possible, up to the level of the surrounding attic insulation.

5.0103.04 Knee wall Doors

5.0103.04a New Access Installation

- Install new knee wall accesses in an area agreeable to the client and conducive to adding insulation.
- Install new knee wall accesses as per state and local codes.
- Must be properly framed and should have a minimum opening of 13 x 20 inches if possible.

- New access door must be of $\frac{3}{4}$ plywood, painted or stained to match surroundings.
- $\frac{3}{4}$ plywood damming at the door area that is at or above the insulation line of the attic if applicable.
- New Casing installed must be painted or stained to match surroundings.
- Flap Weatherstrip installed and caulked to seal with new lid. Foam cell weatherstrip is not allowed
- Caulked with paintable caulk or color complimentary to the existing surface
- New door must have minimum of R10 rigid insulation attached to attic side.
- Secured with minimum 2 bolt locks and hinges or 4 bolt locks if hinges are not feasible to seal door to weatherstrip.
- All accessible attics less than 100 sq ft do not require a access.

5.0103.04b Existing Access Treatment

- When applicable must have $\frac{3}{4}$ plywood damming installed and securely fastened to ceiling joist at or above the attic insulation line.
- Existing door must be $\frac{3}{4}$ wood thickness, not warped or damaged, and effectively serve as the access door. No drywall can be used for the door.
- Casing and lid painted or stained to match surroundings if newly installed.
- Flap Weatherstrip installed and caulked to seal with new or existing door. Foam cell weatherstrip is not allowed.
- If applicable, existing casing must be caulked with a clear or complimentary color to the surface area.

5.0104 Attic Insulation- All Types

- Photo or other visual documentation must be taken of all work completed in the attic area.
 - Photos must be taken prior to and after weatherization measures are installed and must be maintained in the client file.
 - Insulate the attic according to the work order.
 - Attic insulation is not to be installed in non-repairable attics with water leaks or damaged wiring.
 - Appropriate marked and labeled attic insulation markers must be installed every 300 sq. ft. facing the attic access.
 - Insulation documentation posted in the attic by the access including: [SWS](#)
- 4.0103.4e
- One per attic that new insulation is installed in
 - Contractor or Crew name and signature
 - Date installed
 - Installed insulation type
 - Coverage area
 - Installed thickness
 - Minimum settle thickness
 - Installed R Value
 - Number of bags installed

- Insulation is to be installed so as to be uniform in depth throughout the attic area and installed in accordance to the R-value of the settled density on the bag.
- Insulation should be installed to cover the top plate of the outside walls without going into the soffit area, using a damming material such as fiberglass, soffit chutes, etc.
- All ventilation installed before the installation of insulation.
- Screens of existing vents are to be cleaned after the insulation is installed if needed.
- Insulation dams and enclosures will be installed as required.
- Exposed open electrical junctions will have UL listed cover installed per NEC.
- All exposed electrical junctions will be marked with a flag to indicate their existence.
- Enclose all wiring splices inside a location-appropriate (e.g. wet-location, outdoor, indoor, etc.) UL listed electrical enclosure per the NEC.
- Seal all major attic bypasses such as vent pipes, open interior and exterior wall stud runs, wire penetrations, chimney chase ways, area between brick chimney and flue liner, etc. (check local building codes on chimney chase ways).
- Holes drilled from the interior shall be filled with non-shrinking compound and returned to a paint-ready surface
- Knob & tube wiring will be isolated from blown cellulose. See [Section 5.0102](#)
- When insulation is missing, deteriorated or damaged a Parallel Path Equivalent R-Value calculation (i.e. Red Calc [Parallel Path R-Value | Building America Solution Center](#)) must be completed to evaluate the cost-effectiveness (SIR) of installing additional insulation. A copy of the calculation for Equivalent R-Value must be included in the client file.

Manufactured Homes

[Installation Standard 4.23, 4.24, 4.25, 4.26, 4.27, 4.28](#)

- Cellulose insulation must not be used due to weight and moisture absorption.
- Access to attics can be completed through ends of home if attic has no clearance.
- Interior entry holes must be sealed with wood or plastic plugs.
- The plugs must be caulked in place.
- Exterior entry methods must form a permanent and watertight seal.
- Flat roofs or roofs that do not have adequate slope to ensure proper drainage must not be penetrated to install the insulation.
- If a minimum R-11 of additional insulation cannot be installed, the ceiling must not be insulated.

5.0104.01 Open Attic [SWS 4.0103](#)

[Installation Standard 4.4](#)

- Priority is given to Cellulose Insulation in Site Built homes as a recycled material.
- If cellulose cannot be used because of client allergy, weak ceiling, or other reason, fiberglass may be used.

- All insulation will be installed to the depth indicated on the manufacturer coverage chart for desired R-value.
- If installed over existing insulation, install to prescribed R-value in every joist bay in full contact with the existing insulation or the air barrier without gaps, voids, compressions, or misalignments.

5.0104.02 Floored Attic [SWS 4.0103.6](#)

[Installation Standard 4.5](#)

- Check for possible heat-producing sources going through the ceiling and the floor. Care should be taken not to insulate over and around heat producing sources when tube insulating attic areas unless using blown fiberglass.
- If cellulose is used, it must be dense packed under 100% of the floor (3.5 lbs. /ft³). Dense-pack insulation must be done by using the tube-fill method if there is existing insulation floor. If floorboards are removed they must be reinstalled.
- Blown fiberglass will only be installed if justified on the audit. Blown fiberglass material will be installed and will be specifically approved for air flow resistance to a minimum density of 1.5 to 2 pounds per cubic foot.
- The one-inch hole method can be used when there is no insulation under the floor. When using the one-inch hole method, holes are not to be more than 3 ft. apart, and all the holes must be plugged with wood or plastic plugs.
- On a case-by-case basis, with prior State approval, agencies may be allowed to blow over floored attics, if the floored attic has K&T under the boards. Floor boards must be pulled up in order to seal the ends and the bypasses. Photo documentation must be taken prior to and after sealing below the floorboards. This work should be entered into the NEAT Audit as open blow.
- The first priority with a floored attic is to seal bypasses and dense-pack under the floor. Bypasses such as open stud runs must be found and sealed at the air barrier prior to insulating under floored attic.

5.0104.03 Knee Wall

[Installation Standard 4.7, 4.8, 4.9](#)

When Knee walls are present in a home there are 3 main components, the knee wall access, the vertical knee wall and the OCJ area or Knee wall attic floor. Knee wall access doors are covered in Section 5.0103.04 above. Below is standards for installing insulation in Knee Wall Vertical planes and the OCJ area.

5.0104.03a Knee Wall Attic (OCJ)

- The un-floored portion (outer ceiling joist) of the knee wall area shall be insulated to the R-value called for by work order.

Un-floored knee walls (outer ceiling joist) must be sealed between each joist at the wall joint with a rigid air impermeable material and sealed. [Installation Standard 3.10](#)

- The remainder or exposed portion of the knee wall floor shall be insulated as if it were an attic area.

- Floored knee wall areas shall be insulated by either removing the necessary number of boards to allow tube-filling or the floor may be drilled with 1" holes every 3' and insulated, using a 1" nozzle, and plugged with wood or plastic plugs.
- All wood removed for tube-filling, must be reinstalled.

5.0104.03b Knee Wall Vertical Wall [SWS 4.0104](#)

- Adjust all existing batt insulation to ensure it is in full contact with the interior cladding and the top and bottom plates. [SWS 4.0104.3c](#)
- Ensure that existing insulation is appropriately secured.
- Cover existing batt insulation with moisture permeable material such as house wrap [SWS 4.0104.3d](#)
- If Existing Batt insulation has vapor barrier backwards (on cold side), vapor barrier should be slit.

Insulate knee walls with either batt insulation, blown insulation or spray-applied insulation.

Batt Insulation: [SWS 4.0104.2](#)

- Batt insulation should be minimum of R11 or greater
- If using faced insulation, vapor barrier should be to warm side of wall.
- Ensure it is in full contact with interior cladding at top and bottom plates.
- Cover with an moisture permeable material such as house wrap.

Blown Insulation: [SWS 4.0104.1](#)

- If blown insulation is installed, use a netting or barrier on back side and follow dense pack wall insulation standards of 3.5 lbs/cu ft.
- Then slit paper and fill each cavity to 100 percent
- Do not cover any existing knob and tube wiring, dam around it if possible.
- Cover hole used to install insulation

Spray Applied Insulation: [SWS 4.0104.6](#)

- Two-part closed-cell polyurethane foam must be rated as Class 1 Fire Retardant. The card/certificate from the box must be left with the insulation foam because it identifies the foam as fire retardant.
- Must be installed 2" thick.
- Insulation must be neat in appearance and of a consistent depth.
- When cost effective according to the NEAT Audit, the two-part closed-cell polyurethane foam may be installed at the Energy Auditor's discretion.
- If installed in a confined space, there should be a negative pressure in the area. Follow NIOSH Standards regarding the definition of a confined space.
- Recommend tenants, especially children, vacate the premises while being installed and for one hour (or as long as the manufacturer recommends) after completion or until all VOC gases are gone.
- Weatherization workers must wear a NIOSH certified respirator as well as eye and skin protection as specified in the product SDS.
- Clean up any overspray or excess of the two-part foam.
- Do not use it in areas with knob and tube wiring.

- Do not cover electrical boxes.
- If Spray Applied insulation is installed no air barrier is needed.

5.0104.04 Sloped Attic/Flat Roof/Roof Rafters

- Insulate Sloped Attics, flat roofs and roof rafters to the R value called out on the work order.
- Dense pack sloped attics or roof rafters by tightly stuffing with fiberglass or some other stuffing material at either the top or the bottom of each run.
- Holes drilled from the interior shall be filled with non-shrinking compound and returned to a paint-ready surface
- Setup a dust control enclosure for all interior access locations that limits insulation and construction dust exposure to the occupant and occupant belongings
- Install airtight, rigid, blocking material at all cavity openings that aligns with the pressure boundary and will not fail under dense pack pressures
- Each cavity must be insulated with dense-packed cellulose insulation (3.5 lbs./cubic foot) by tube-filling the cavity. Blown fiberglass material may also be installed to a minimum density of 2.2 pounds per cubic foot.
- If the sloped areas have existing fiberglass insulation or loose-filled cellulose, the top and the bottom of each cavity must be sealed, if possible, instead of re-insulating.
- If both top and bottom cannot be sealed, one or the other must be sealed to prevent convective looping in the cavity.
- Small ceiling areas such as over bay windows or flat roof areas are to be insulated with dense packed insulation.
 - This can be done by drilling or removing the fascia board and tube-filling each cavity or the lift and blow method under shingles.
- Ventilation is not needed when dense packing flat roofs.

5.0104.05 Walk Up Attic Stairwell

Installation Standard 4.6

In attics with walk-up stairs and door, subgrantees must establish a continuous insulation and air barrier over the top of the stairwell or by sealing and insulating the walls of the stairwell and the angled plane of the stair treads/risers and weatherizing the stairwell door. This can include:

- Dense packing sidewalls of stairwell
- Insulating any landing or stairs under treads
- Patch all holes drilled and have ready to paint.

5.0104.06 Shielding, Damming, and Junction Boxes [SWS 2.0301.1](#)

Installation Standard 3.8

- When adding additional insulation to the attic, install shielding around heat and high-heat sources.

- Shielding must be kept a minimum of 3 inches from any *heat source* and a minimum of 6 inches from a *high-heat source*.
- Sheet metal shielding around heat producing devices or chimneys, must be fastened securely so the barrier won't collapse.
- All shielding must be installed at a height to accommodate the depth of the existing and/or added insulation.
- Install damming around attic accesses, exhaust fans, soffit vents and uninsulated attics adjacent to insulated attics.
- All damming must be installed at a height to accommodate the depth of the existing and/or added insulation.
- Damming must be installed to ensure insulation will be full depth over all exterior top plates of the wall if possible.
- Install chutes, dams, tubes, or other blocking materials to prevent blown insulation from plugging air channels between soffit vents and the attic.
 - These devices maximize the amount of insulation installed over top plates and help to prevent the wind-washing of insulation caused by cold air entering soffit vents.
- All junction boxes must have approved covers, and their location must be marked with a flag or other visible marker. [SWS 2.0301.1](#)

Manufactured housing specific work standards

- If a *manufactured home* has a double sleeve flue, the chimney does not need to be shielded.

5.0105 Attic Venting [SWS 4.0103.2c](#)

Attic ventilation, when required, shall be installed in accordance with applicable building codes and the U.S. Department of Energy Standard Work Specifications (SWS).

Ventilation shall be calculated using the 1:150 ratio, or 1:300 where conditions permit, with a minimum of 1 square foot of Net Free Vent Area (NFVA) per 300 square feet of attic area when a vapor retarder is present on the warm side of the ceiling and ventilation is balanced.

- Ventilation systems should be balanced between high and low venting, when feasible, to promote effective airflow across the attic space.
- High venting (Exhaust) shall include static vents, turbine vents, or ridge vents located within 2 feet of the roof peak.
- Low venting (Intake) shall include soffit vents, gable vents, or shingle-over edge vents installed at the lower portion of the attic or roof edge.

Use the following tables to calculate the net free area of the existing roof/attic venting:

ATTIC VENTILATION – NET FREE VENT AREA (NFVA) QUICK REFERENCE CHART

Ventilation shall be calculated using Net Free Vent Area (NFVA) in accordance with building codes.

VENTILATION REQUIREMENT

Minimum ventilation shall be:

- 1 sq ft NFVA per 300 sq ft of attic area (REQUIRED when a vapor retarder is on the warm side of the ceiling AND ventilation is balanced)
- 1 sq ft NFVA per 150 sq ft of attic area (STANDARD option)

BALANCED VENTILATION

Provide approximately:

- 50% Intake (low vents)
- 50% Exhaust (high vents)

Intake and exhaust shall be balanced as closely as practical.

CALCULATE NFVA

1. Determine attic floor area (sq ft)
2. Divide by 300 (or 150 if allowed)
3. Convert to square inches (1 sq ft = 144 sq in)
4. Split intake and exhaust roughly 50/50

ROOF VENTS (EXHAUST)		
VENT TYPE		NFVA (SQ IN)
	8" Diameter	50
	9" Diameter	60
	9.5" Diameter	70
	10" Diameter	80
	13" Diameter	144
	Turbine Vent	239

SOFFIT VENTS (INTAKE)		
VENT SIZE		NFVA (SQ IN)
	4" x 16"	32
	8" x 16"	64
	4" x 8"	16

RECTANGULAR GABLE VENTS (EXHAUST)		
VENT SIZE		NFVA (SQ IN)
	8" x 12"	48
	12" x 14"	108
	14" x 24"	168
	18" x 24"	216
	24" x 30"	360

TRIANGLE GABLE VENTS (EXHAUST)		
BASE WIDTH		NFVA (SQ IN)
	30" Base	82
	48" Base	144
	72" Base	197

SHINGLE-OVER EDGE VENTS (INTAKE – LOW VENTING)

Use when soffit or gable intake venting is not available (Common in knee wall / short roof attics)

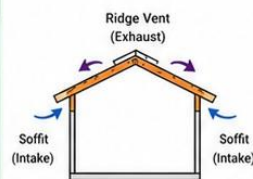
VENT (OUR CREWS USE)	FUNCTION	NFVA
	Installed at roof edge (eave line) INTAKE ONLY	~9 sq in per linear ft

Calculation: Required intake NFVA (sq in) ÷ 9 = Linear feet of vent needed

BALANCED VENTILATION – EXAMPLE SYSTEMS

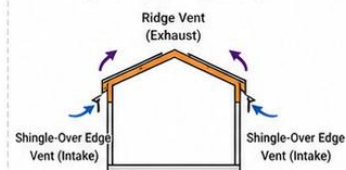
PREFERRED SYSTEM

Soffit Intake + Ridge Exhaust



ALTERNATE SYSTEM

Shingle-Over Edge Intake + Ridge Exhaust (When soffits not available)



HOW TO USE THIS CHART – EXAMPLE (USING 1:300 RATIO)

EXAMPLE ATTIC SIZE: 1,200 sq ft	STEP 1: CALCULATE REQUIRED NFVA	STEP 2: SPLIT INTAKE/EXHAUST	STEP 3: SELECT VENTS (EXAMPLE)
	Using 1:300 ratio (most common) 1,200 ÷ 300 = 4 sq ft NFVA total 4 sq ft × 144 = 576 sq in total	Intake (low): 288 sq in Exhaust (high): 288 sq in	INTAKE (Choose one option) • Soffit Vents: 4" x 16" (32 sq in each) 288 ÷ 32 = 9 vents • Shingle-Over Edge Vent (9 sq in/linear ft) 288 ÷ 9 = 32 linear ft EXHAUST (Choose one or combine) • Ridge Vent (continuous) + Roof Vents 10" Roof Vents (80 sq in each) 288 ÷ 80 = 3.6 → 4 vents • OR Gable Vents (18" x 24" = 216 sq in each) 288 ÷ 216 = 1.33 → 2 vents

IMPORTANT NOTES



Air seal the attic before adding or changing ventilation.



Ventilation shall only be added or modified when necessary to address moisture or performance concerns.



Keep ventilation balanced between intake and exhaust.



Use baffles or chutes at soffits to keep vents clear of insulation.



Do not block vents with insulation.

1 sq ft = 144 sq in

5.02 Sidewall Insulation

Installation Standard 4.10, 4.11

A continuous thermal boundary shall be maintained between conditioned and unconditioned spaces through the installation of dense-pack insulation to the prescribed R-value, when determined to be cost-effective by the NEAT audit. Cellulose insulation shall be utilized as the primary material unless site conditions or structural limitations prohibit its installation.

Dense-pack insulation shall be installed using equipment equipped with an airlock system capable of producing a minimum operating pressure of 3.5 psi. Installation shall achieve a minimum density of 3.5 pounds per cubic foot to ensure complete cavity fill, resistance to air movement, and long-term material stability. In 2×4 wall assemblies, this equates to approximately one (1) pound of insulation per square foot of wall area.

Installation shall result in full cavity filled with no voids, gaps, or compression that would reduce the effective thermal performance or compromise the integrity of the air barrier.

5.0201 Preparation [SWS 3.0102.4](#)

Prior to installing wall insulation subgrantees must evaluate the insulation installation for cost-

effectiveness and inspect for, repair and document the following issues/concerns:

- Evidence of moisture damage, if condition of the siding, sheathing, or interior wall finish indicates an existing moisture problem, no sidewall insulation should be installed until the moisture problem has been identified and corrected.
- Gaps in external window trim and other areas that may permit water into the wall.
- Ensure that the interior and exterior surfaces of the walls are sealed and capable of withstanding the force of insulation blowing.
- Minor surface repair on interior and exterior surfaces to be completed prior to insulating.
- Interior openings from which insulation may escape, such as pocket doors, balloon framing, un-backed cabinets, interior soffits, and closets to be located and sealed prior to insulating.
- Exterior walls that have active knob & tube wiring must be evaluated for the cost-effectiveness of removing existing wiring, rewiring and being insulated as per [Section 5.0102.](#)
- Walls in additions on these homes that do not have active knob & tube wiring must be insulated if the Energy Audit of the home indicates the insulation is cost-effective for implementation.

5.0202 Accessible Walls [SWS 4.0201.2](#)

In homes with accessible/open wall cavities Subgrantees must:

- Insulate with batt, blown or *spray-applied insulation* and cover the cavity.
- Fill the entire cavity.
- If faced batt insulation is installed in an open wall cavity, the *vapor barrier* must be installed to the warm side and fit snugly between the studs and wall.
- Cut the batt insulation to the exact length of the cavity.
- Install the insulation around wiring, piping, etc. by splitting the batt, not by compression.

5.0203 Stick Built Homes – Interior/Exterior Standards

SWS 4.0201.3 SWS 4.0202.1

- Appropriate installation of wall insulation is essential to ensuring energy cost savings and client comfort. Insulation should be installed according to manufacturer's installation standards. In homes where exterior wall cavities are being blown, subgrantees must:
- Remove or drill siding and fill all enclosed wall cavities. Wall cavities that are less than 3 feet in height or where it is not possible to tube fill, may be insulated through a minimum 1 inch entry holes.
- Remove slate siding that may contain asbestos using precaution not to damage the siding, ensuring the siding material does not become *friable*.
- Remove metal or vinyl siding with the aid of an appropriate siding removal tool.
- Removed siding must be reinstalled using the original fastening system whenever possible. The seam tabs on slate siding must be reinstalled.
- The entry holes must be sealed with plastic or wood plugs, or covered with felt paper prior to reinstalling the siding if the siding was removed.
- Seal and plug holes before replacing siding.
- Plug and tape or seal holes with an appropriate material and make ready for paint, in homes insulated from the inside.
- Asbestos shingled siding may be carefully removed using precaution not to damage the siding, ensuring the siding material does not become *friable*. Refer to your agency policy and EPA procedures when working with asbestos materials.
- Probe all wall cavities through holes, as they are drilled, to identify fire blocking, diagonal bracing, and other obstacles. After probing, drill whatever additional holes are necessary to ensure complete coverage.
- Insulate stucco walls through either interior or exterior access.
- Entry holes in stucco or masonry siding must be sealed with mortar or a material specifically manufactured to repair stucco or masonry.
- Interior entry holes must be made ready for paint.
- Interior entry holes in drywall or plaster must be plugged and taped or sealed with a material specifically manufactured to repair drywall or plaster.
- Document in the client file back-plastered (two layer) walls that are too difficult to insulate properly.
- Verify and document in the client file the use of lead-safe weatherization procedures.
- Drill 2-to-3-inch diameter holes to access stud cavity.
- Prevent settling of cellulose insulation by using the *tube-fill method* and installing to a minimum density of 3.5 pounds per cubic foot.
- *Dense pack* wall insulation using blower equipped with separate controls for air and material feed.
- Repair walls using durable and permanent materials, matching the existing area as closely as possible.
- Use materials of suitable grade in areas of high moisture or areas exposed to the weather.

- Paint plugs to match the existing siding color whenever plastic or wood plugs are used on the exterior of the siding.
- Completely seal openings and paint and texture sealing materials to match the surrounding surface.
- Verify the location of existing supply and return duct systems prior to insulating.
- Seal floor cavities in balloon framed walls by installing insulation plugs (i.e. plastic bags filled with insulation or rigid insulation/air blocks)

Manufactured Home Wall Insulation

Installation Standard 4.21, 4.22

- The exterior siding and the interior wall materials must be inspected prior to the installation of insulation.
- Weak or damaged wall materials must be repaired or reinforced prior to installing insulation within program spending limits.
- If a manufactured home has aluminum wiring, sidewalls shall not be insulated.
- During the energy audit of manufactured homes, if the energy auditor cannot physically gain access to the sidewalls and attics to determine the existing R-values, the energy auditor should use the information from the manufactured home nameplate to make the determination.
- Appropriate installation of wall insulation is essential to ensuring energy cost savings and client comfort.
- Insulation should be installed according to manufacturer's installation standards.

5.03 Cantilever Floor Insulation

Verify that installation area is free of:

- active water leaks, fuel leaks (i.e., gas, oil, propane), and pest intrusions
- energized knob and tube wiring
- uncovered electrical junctions
- improperly terminated devices (ventilation fans, dryers, plumbing stacks, condensate lines, combustion appliance flues/chimneys, etc.)
- unshielded high-temperature devices (non-IC rated recessed lights, chimneys, flues, vents, etc.) unless they are zero clearance devices
- insulation escape openings

Any cantilever floor, such as under bay windows or rooms over unconditioned areas (except tuck-under garages), must have a ½" treated plywood sheathing or black jack sheathing to fully cover the bottom of the floor.

- The cantilever floor shall be insulated using the dense-pack method, a minimum density of 3.5 pounds per cubic foot.
- The drilled sheathing is to be plugged and painted.

5.04 Foundations

Foundations may be evaluated to form a consistent and uniform thermal boundary between conditioned and unconditioned space to prescribed R-value.

5.0401 Foundation Insulation [SWS 4.0402.4](#) [SWS 4.04050.5](#)

Installation Standard 4.13

Determine whether the basement functions as a conditioned or unconditioned area.

- If basements are considered a conditioned area, all walls must be modeled in the audit to consider whether the walls need to be insulated. All material and labor costs associated with installing the insulation must be included in the “additional costs” field (e.g., drywall, lumber, mud and tape, etc.).
- If the basement area is unconditioned, note the condition of any existing floor insulation. If there is no insulation, enter the area in the NEAT Audit and the audit will determine the amount of R-value needed.
- Measure the basement floor and wall area for the NEAT Audit.
- Inspect for signs of basement floor moisture and determine if necessary corrective actions can be completed within program spending limits.
- Note the presence of water lines and the potential for freezing because of the addition of floor insulation.
- Note the presence and location of any direct penetrations. Note any plumbing pipes, chase ways, or other by-pass air leakage sites. If these by-passes lead to the attic, they must be sealed in the attic if possible. Otherwise they must be sealed in the basement. If the by-passes lead to an exterior wall, they need to be sealed in the basement. Document areas that are to be sealed.
- Note the number, size, and condition of windows and exterior doors. Note any broken or missing parts or missing glass that would allow air infiltration.
- Foundation wall insulation products that are reimbursable through the NeWAP include:
 - Two-part spray foams
 - Polystyrene or Polyurethane rigid insulation board sealed on all edges.
 - Batt insulation
- If batt insulation is used the wall must be framed to adequately support the insulation.
- If foam board is used the insulation must be attached to the foundation wall with construction adhesive or masonry nails or a combination of the two.
- Insulation must be covered as required by local or state code jurisdiction requirements.
- **Basement** wall insulating systems must be installed according to manufacturer’s instructions and be a minimum R-10.

5.0401.01 Ledged Basement Wall Insulation

Installation Standard 4.14

Ledged basement wall must be insulated with faced batt, foam board or spray-applied insulation (in non-habitable spaces).

- The insulation must fill the sill box and extend down the foundation wall.
- If faced batt insulation is installed, the *vapor barrier* must be to the warm side.

5.0402 Crawlspace

Installation Standard 4.2

All accessible foundations need to have a point of access. If one does not exist, a new access may be installed. If one exists, and the foundation area is found to be part of the thermal boundary, the existing access must be treated.

5.0402.01 Foundation Access [SWS 3.0104.2](#)

5.0402.01a New Access Installation

- New *crawl space* accesses must be located in an area agreeable to the client and conducive to
- insulating.
- Must meet the size requirements of state and local codes.
- Any new framing in contact with concrete or soil must be *pressure treated*, redwood or cedar.
- New floor accesses must be properly supported.
- New exterior accesses doors must be constructed of $\frac{3}{4}$ inch *pressure treated* plywood.
- New Access doors need be attached with 2 hinges and a latching mechanism or latching on 4 corners completing a tight seal.
- Weatherstrip must be installed
- R10 board attached to backside of access door must be a minimum of R10.
- Seal edge of any new framing with appropriate caulking.
- Foam or felt tape door weather-strips are not eligible for reimbursement under the NeWAP.

5.0402.01b Existing Access Installation

- Existing foundation access must be treated if crawlspace is part of the thermal boundary.
- Access must be weather-stripped and have a minimum of R10 insulation on backside.
- A new access door may be made and any hardware may be added if necessary.
- A new access may be built if the existing access is beyond repair.
- Caulking may be applied to ensure a tight seal.
- Existing accesses that do not meet state and local code sizing requirements must be resized to
- provide appropriate access.
- Foam or felt tape door weather-strips are not eligible for reimbursement under the NeWAP

5.0402.02 Vapor Barrier [SWS 2.0202](#)

- The NeWAP requires a full ground laid moisture barrier must be installed whenever possible in accessible crawl spaces except when one exists, or the space has a concrete floor.

- The moisture barrier must be a Class I *vapor retarder*, a minimum of 6 mils thick, extended up the walls and the support columns at least 12 inches and the joints must overlap a minimum of 12 inches.
- All seams will be sealed in a manner that ensures a air tight seal.
- A vapor barrier will not be installed under mobile homes unless needed for work to be completed under home in a safe manner.

5.0402.03 Crawlspace Venting

- Existing vents in crawlspaces that are found to be in the thermal boundary will be sealed.
- Vent openings will be permanently closed and sealed except in cases where there is evidence of previous ground water intrusion. In those cases, documentation will be included in the client file and non-permanent vents covers will be installed.
- The occupants will be notified of the vent cover installation and will be educated on how to appropriately operate and maintain the covers.
- In many areas of Nebraska, high ground water tables can cause water in a *crawl space* once or twice in a very extended period of time.
- Installing semi-permanent vent covers (i.e. secured with screws that can be removed if needed) will allow temporary removal of the cover and evaporation of any ground that may enter the *crawl space* and cause potential mold, rotting and indoor air quality issues.

5.0402.04 Crawlspace Wall Insulation

[SWS 4.0402.1](#) [SWS 4.0402.2](#) [SWS 4.0402.3](#) [SWS 3.0104.1](#)

- Where crawlspaces are included within the conditioned or semi-conditioned space, insulation shall be installed along the crawlspace perimeter walls to establish a continuous thermal boundary between conditioned and unconditioned spaces. Floor insulation above the crawlspace shall not be installed when the crawlspace is treated as part of the building thermal envelope.
- Insulation shall be installed on the interior side of crawlspace foundation walls from the top of the wall down to the crawlspace floor or to the top of the footing
- Rim/band joist areas shall be insulated and air sealed to maintain continuity of the thermal boundary
- All seams, joints, and penetrations shall be sealed to prevent air leakage
- Insulation materials shall be installed in full contact with the wall surface with no gaps, voids, or compression
- Insulation shall be mechanically fastened or otherwise supported to prevent sagging or detachment over time
- Combustion air requirements shall be maintained where combustion appliances are present
- Crawl space walls must be insulated with faced batt, foam board or spray-applied insulation (in non-habitable spaces).
- Before insulation is installed air sealing measures of foundation must be completed.
- If faced batt insulation is installed, the *vapor barrier* must be to the warm side.

5.0402.04a Insulated Skirting [SWS 4.0388.1](#)

Insulated skirting shall be modeled as a measure that reduces air movement and wind exposure beneath the home. The space created remains unconditioned; energy savings are realized through improved floor system performance rather than creation of a new thermal boundary.

- If underbellies or exposed floors are un-insulated and belly insulation cannot be installed, insulated skirting may be installed with the use of **Non DOE Funds**. If insulated skirting is being considered in this case, a 6 mil vapor barrier must be installed as per Radon Precautions if any DOE funds are used on the home. Contact DWEE in this case.
- Minor repairs to existing skirting can be completed as a incidental repair to a ECM of belly insulation if the audit is calling for belly insulation.
- Minor repairs to existing skirting can be completed as a Health and Safety measure for Pest Prevention up to allowable costs and with justification provided in the client file as defined in the current Health and Safety plan.

Insulated Skirting Installation Requirements:

- The skirting must be metal, vinyl or pressure treated plywood supported by a wood frame and insulated with a minimum R-13 faced batt or a minimum R-10 foam board.
- The frame must have a pressure treated, redwood or cedar bottom plate and the vertical studs should be placed on a minimum 24-inch centers.
- All seams and joints in the skirting must be caulked.
- The access must be constructed of $\frac{3}{4}$ inch pressure treated plywood and be a minimum of 20 inches in width. It must be attached with 2 hinges and a latching mechanism. The access must be insulated with minimum R-13 batt or a minimum R-7 rigid insulation and weather-stripped.
- A manufactured insulating skirting kit may be used. The kit must be a minimum R-8 insulation and include 1 access.

5.0402.05 Floor Above Crawlspace Insulation [SWS 4.0302](#) [Installation Standard 4.15, 4.16](#)

The agency Energy Auditor will decide when and how to insulate the floor area over the crawlspace and the NEAT Audit will determine the R-value.

If floor over the crawlspace is to be insulated and there are no water lines, then all heat ducts in the crawlspace shall also be insulated.

If the floor is insulated, the crawlspace must be isolated from any conditioned or unintentionally conditioned areas.

Certificates for wall insulation, crawl space insulation, any sealed (non-accessible) attic and band joist insulation must be attached within one foot of the electrical panel in the basement.

The two acceptable methods for insulating floors are described below:

Method 1 - Fiberglass Batt

- The floor must be the air barrier when unfaced fiberglass batts are used.
- All fiberglass batts must be covered with a house wrap product stapled to floor joist.
- For extra support, wood lath and galvanized nails may be used to hold the insulation in place with a maximum spacing of 18" on center. Twine used to hold the insulation in place must be made of polypropylene, nylon or polyester.
- Wire used to hold the insulation must be zinc-coated, stainless, or similar corrosive resistant material. Wire must be spaced no more than 18" apart. Supports and anchors must be zinc coated, stainless steel, or similar corrosion resistant material.
- Wire hangers may also be used if spaced no more than 18" on center.
- Do not insulate water pipes from the heated side. Insulation should be installed between the pipe and the cold side of the crawlspace.
- Any covered water valves shall have a tag with "WATER VALVE" written on it and hung below the valve and insulation.
- Install flags that can be seen below the floor joists at any utility junctions that will be covered by insulation

Method 2 – Dense-Pack Cellulose

Any cavities with water lines must be insulated using Method 1.

- Dense-packed equals 3.5 pounds of insulation per cubic feet. To figure the number of pounds of insulation needed per square foot of joist thickness, multiply 0.29 times the cavity thickness.
- House wrap may also be installed on the floor joist. The house wrap must be installed with staples placed in such a manner to support the weight of the dense-pack insulation.
- The house wrap is then slit and cellulose is dense-packed into the cavities. The slits must be sealed when done insulating OR

Floors over unheated spaces such as crawlspaces which do not have water lines may have rigid insulation board applied to the ceiling joist.

- The insulation board must cover the entire floor assembly. Seams and penetrations must be sealed.
- The insulation board is then drilled and cellulose is dense-packed into the cavities. The holes must then be plugged.

Homes without foundations that have exposed floors are to be insulated using the dense pack method.

If neither of these two methods are feasible contact DWEE for further guidance.

5.0402.05a Manufactured Housing Floor Cavity Insulation [SWS 4.0302.9](#)

- In manufactured homes where a floor serves as an air/thermal boundary, prior to installing floor insulation subgrantees must complete an inspection of the floor assembly and document any issues/concerns.
- Prior to weatherizing the underbelly, the owner must repair plumbing leaks that will directly affect the weatherization of the underbelly.
- When insulation is missing, deteriorated or damaged a Parallel Path Equivalent R-Value calculation (i.e. Red Calc) must be completed to evaluate the cost-effectiveness (SIR) of insulating the floor system. A copy of the calculation for Equivalent R-Value must be included in the client file.
- Blow Fiberglass Insulation must be installed the full cavity depth whenever possible.
- Replace all deteriorated or damaged insulation with unfaced batt insulation and new *weatherboard* or by replacing the *weatherboard* and then installing blown insulation.
- The *weatherboard* must form an airtight seal and adequately support the insulation.
- If plywood is used as *weatherboard*, the plywood must be exterior grade.
- If insulation is installed through the rim joist, a rigid tube must be used.
- Entry holes in the rim joist must be plugged with wood plugs and glued in place.
- If insulation is installed through the *weatherboard*, the entry holes must be covered with plastic plugs or 30# felt paper. Both should be sealed with caulking.
- Rim joists that are 2 inches x 4 inches or less in construction must not be drilled.
- Special care needs to be taken not to isolate water pipes outside the envelope.

5.0403 Sill Box Insulation [SWS 4.0401](#)

Installation Standard 3.14, 4.12

Prior to installing rim joist insulation subgrantees must evaluate the insulation installation for cost-effectiveness, inspect for, prepare for and document the following issues/concerns:

- Sealing of floor cavities in balloon framed walls by installing insulation plugs (i.e. plastic bags filled with insulation or rigid insulation/air blocks).
- Sealing of all penetrations in the rim prior to installing insulation.

Rim sealing insulation products that are reimbursable through the NeWAP include:

- Two-part spray foams or Polystyrene or polyurethane rigid insulation board sealed on all edges.
- Rim joist insulation must be installed in all accessible cavities with a depth of 2 inches or more or to a minimum R-10.

5.0404 Attached or Tuck Under Garage [SWS 4.0301.4](#)

- Exposed floors over garages and common walls must be insulated and covered with fire code drywall as per state and/or local code.
- If adding insulation to unfinished ceilings or common walls in attached or tuck-under garages 5/8" fire-rated sheetrock must be installed.

- The drywall must be taped and receive one coat of joint compound or the joints and seams must be caulked to form an airtight seal.
- Accessible *exposed floors* that have an existing covering must be insulated with blown insulation installed at a minimum of 3.5 pounds per cubic foot. Entry holes must be sealed with wood or plastic plugs.
- Accessible exposed floors that have no existing covering, must be insulated if none exists and drywalled.
- If accessible, any ductwork must be sealed before insulating.
- A signed and dated Insulation Installation Requirements certificate within 1 foot of the electrical panel must include:
 - Insulation type
 - Installed thickness and settled thickness
 - Coverage area
 - R-value
 - Number of bags installed in accordance with manufacturer specifications

5.05 Duct Insulation

Installation Standard 4.17, 4.18, 4.19, 4.20

Sealing, repairing and insulating existing *accessible ductwork* provides Nebraska Weatherization Assistance Program (NeWAP) clients with reduced energy costs and improved comfort. Sealing leaky ducts also helps to improve indoor air quality. Prior to sealing and/or insulating ducts NeWAP subgrantees must:

- Inspect and evaluate the existing system to ensure that all ducts and plenums are properly fastened, supported and sealed to reduce air leakage.
- Evaluate/consider sealing supply and return registers in unoccupied basements/rooms.
- Prior to sealing and/or insulating ducts NeWAP subgrantees must verify and make reasonable
- attempts to ensure that duct systems are providing balanced, adequate airflow to living spaces.
- When airflow is a problem subgrantees must consider the following options:
 - Cleaning the filter or replacing disposable filters.
 - Repairing, realigning or replacing damaged, missing or restricted floor registers.
 - Realigning and securing disconnected duct work.
 - Moving/installing filter racks into an area that is convenient and conducive for the customer to access.
 - Removing obstructions to registers and ducts.
 - Eliminating kinks in existing flex duct and replacing collapsed ducts with metal duct.
 - Installing a transfer grille(s) to improve airflow in the building.
 - Under-cutting interior doors.

Insulate supply ducts that run outside the thermal boundary with a minimum of R-8.

- Vinyl or foil faced insulation, manufactured for use as duct insulation, or two-part spray foam insulation may be used.
- Do not insulate ducts that run through *conditioned* space unless they cause overheating in winter or condensation in summer.
- Seal the duct work as per Section before insulating. See [Section 2.0607](#)
- Cover all accessible exposed supply ducts, leaving no areas of uninsulated duct.
- Fasten the insulation by mechanical means such as plastic straps, cord, wire, plastic or nylon bands.
- Use only tape specifically manufactured for covering and securing joints.

Chapter 6.0 Electric Energy Efficiency Measures

6.01 Electric Baseload Measures

Baseload is the energy consumed in the home that is not related to heating and/or cooling the home. Baseloads include the energy used for lighting, appliances, and water heating, but also include plug loads for televisions, radios, computers, etc. and they are generally consistent from month to month.

6.0101 Refrigeration Removal/Replacement

EPA's ENERGY STAR program indicates that certified refrigerators are about 9 percent more energy efficient than models that meet the federal minimum energy efficiency standard. Replacing an old refrigerator with a new ENERGY STAR certified refrigerator can save more than \$200 over the lifetime of the product.

6.0101.01 Inspection and Audit

Inspect the existing unit, there are two methods allowed to estimate the savings that result from replacing an existing refrigerator. These methods must be incorporated into the initial inspection and energy audit:

- For the existing refrigerator, you may either select from the list of manufacturers and model numbers in the library, which will autofill the data, or directly enter the data on the form. All refrigerators being considered for replacement must be metered with an approved metering device or model number entered from the audit database and the results logged on the Base Load Record.
- The NEAT/MHEA Audit indicates a minimum of 30 minutes and a maximum of 1440 minutes, the appliance must be metered for a minimum of 30 minutes (1/2 hour). However, DOE recommends metering a minimum of 1 hour with 2 hours being preferred. Record the kWh usage and the number of minutes from the data logger on the NEAT/MHEA Input Data Form.

- Caution: If the refrigerator is running when ready to install the power meter, allow refrigerator to sit for a minimum of five (5) minutes before plugging into the Digital line logger. (This will allow compressor pressure to be relieved.)

If no manufacturer and model number information is available on the unit, the energy use of the existing unit must be verified by installing a digital power meter.

6.0101.02 Replacement Refrigerator SWS 7.0101.1

- Replacements will be completed based on a Savings-to-Investment Ratio (SIR) for replacing the unit that meets or exceeds funding source requirements.
- If the existing refrigerator is non-functional, it is ineligible to be replaced.
- The client must give up possession of the old refrigerator.
- One refrigerator per home may be replaced.
- Appliances located in unconditioned areas may not be replaced.
- Refrigerator replacement model(s) must be rated as ENERGY STAR®. All replacement refrigerators must meet the UL-250 standard.
- When making a straight one for one (1) replacement, the replacement refrigerator must not be larger than the size of the old refrigerator. For situations where two (2) or more refrigerators will be replaced by one (1) refrigerator, the new refrigerator may be a larger capacity than those being replaced if needed in order to meet appropriately documented capacity needs and the unit meets the SIR for replacing the unit that meets or exceeds funding source requirements.
- Replacement of an existing side-by-side refrigerator with a side-by-side refrigerator is allowed if the replacement is determined to be cost effective with a SIR for replacing the unit that meets or exceeds funding source requirements.
- Existing refrigerators with additional features such as ice makers may be replaced with equivalent features if the replacement is determined to be cost effective with a Savings-to-Investment Ratio (SIR) for replacing the unit that meets or exceeds funding source requirements. The cost of disconnecting the water-using features must be included in the replacement SIR calculation. ***The client is responsible for completing the hook up of any water lines required for an icemaker included with a new appliance.***
- Replacement units with the through-the-door ice and/or water delivery option are not allowed under the NeWAP.
- Replacement refrigerators must include a one-year warranty that provides a replacement appliance if repeated issues related to safety or performance occur.
- The color of the replacement appliance should be white or off-white, unless the existing appliance is part of a “matched set” and the cost of replacing the refrigerator in a matching color is determined to be cost effective. Subgrantees must include appropriate documentation in the client file if a matching color unit is installed.

- Refrigerator replacement in rental units is allowed if the replacement is determined to be cost effective with a SIR for replacing the unit that meets or exceeds funding source requirements.
- Refrigerator repair is not allowed under the NeWAP.

6.0101.03 Installation

- Permanently remove the old appliance from the home and recycle or dispose of appliance and refrigerant in accordance with local and federal law (the EPA Section 608 of the Clean Air Act (1990)).
- Permanently decommission the old appliance.
- Install appliances in accordance with manufacturer specifications and local codes.
- Any penetrations to the exterior of the home created by the installation of the appliance will be sealed and the cost to complete such work must be included in the Energy Audit cost- effectiveness evaluation.
- Appliance must be ENERGY STAR rated. Energy-related appliance controls will be demonstrated to the occupant.

6.0101.04 Client Education and Client File Documentation

- Provided specific information on the proper maintenance of the equipment to the occupant.
- Provide user's manual, warranty information, installation instructions, and installer contact information to the occupant.
- Appliance will carry a minimum one-year warranty that will provide a replacement appliance if repeated issues relating to health, safety, or performance occur.
- Appliance will fit in the available space without blocking access to light switches, cabinets, etc. and will fit through the smallest opening between the outside and installation location.
- The Refrigerator Appliance Agreement (Wx-23), including the client's signature, lists the replaced existing appliance(s) and the newly installed appliance(s). Give One (1) copy of the signed Form to the client; keep one (1) copy for the agency and give one (1) copy to the appliance vendor.

6.0102 Energy Efficient Lighting

Lighting upgrades are one of the most cost-effective options available for reducing a building's base load. Replacing traditional lights and upgrading can save 75% or more on your client's lighting energy costs. Lighting Measures that are indicated as cost-effective in the Energy Audit must be implemented.

- If Client refuse's a audit approved cost-effective lighting measure, the audit will be re-ran with lighting upgrades removed and may affect other measures on the audit. The client must be made aware of this.
- Lumen output should be matched as closely as possible to the lighting that was removed.
- Agencies are limited to replacing a max of 25 light bulbs in a home.

- Any bulb used for 1.5 hrs or more a day can be modeled for replacement.

6.02 Air Conditioning

When a space conditioning system does not qualify as an ECM, the following conditions must be met before the unit can be replaced or repaired with Health and Safety funds:

- Repair of air conditioning systems is an allowable Health & Safety Cost.
 - A maximum \$500 may be spent to repair heat pumps and central air conditioning systems.
 - In renter occupied homes, if the cost to repair the central air conditioner or heat pump exceeds \$800, the owner may choose to repair or replace the unit. However, if the central air conditioner or heat pump is replaced in accordance with the requirements of this Technical Standards Manual, the Nebraska Weatherization Assistance Program (NeWAP) may contribute a maximum of \$1,500 to the replacement cost.
- Replacement of central air conditioning systems is an allowable Health and Safety Cost in owner-occupied homes, where eligibility is verifiable through one of the following:
 - Redtag confirmation,
 - Written documentation provided by a qualified heating/cooling technician, or
 - On-site sub-grantee inspection.

And one of the following is true:

- With documentation verifying that the home's permanent resident(s) includes:
 - A child under six years of age who receives ADC<
 - A person 70 years of age or older, or
 - Has a severe illness or condition which is aggravated by extreme heat as verified by a medical statement, included on Form Wx-30 Priority Conditions for Coolin Assistance, signed by a licensed healthcare provider.

Repair/Replacement Standard [SWS 5.0108.1](#) [SWS 5.0801.2](#) [SWS 5.0801.3](#) [SWS 5.0301.2](#)

The following standards must be followed for air conditioner or heat pump repair or replacements installed through the Nebraska Weatherization Assistance Program:

- Drip pans in poor condition may be replaced.
- Air conditioner evaporator coils in existing operable units must be replaced if they do not fit in new heating plants installed as part of NeWAP services.
- Prior to completing repair and/or maintenance on existing central cooling systems the existing unit must be inspected and evaluated with appropriate documentation included in the client file.
- If the replacement heating plant is installed with existing central air conditioning, the air conditioner evaporator coil should be a cased coil or be raised and made accessible for periodic service and cleaning.

- Efficiency ratings for all replacement equipment must be listed in the most current edition of the Air Conditioning, Heating, and Refrigeration Institute (AHRI) Directory of Certified Product Performance.
- Replacement central air conditioners must be a minimum 15.2-SEER2 (Seasonal Energy Efficiency Factor).
- Replacement heat pumps must be a minimum 15.2-SEER2 and 7.8 HSPF2 (Heating Seasonal Performance Factor).
- Heat pumps must be installed with ramp-up type thermostats designed to bring backup heat in stages, and only when the heat pump can no longer keep up with demand and must be able to differentiate between a demand call and a 'return from setback' call for heat. [SWS 5.0101.1](#)
- Package Terminal Heat Pumps (PTHP) and Mini-Split Heat Pump systems may be eligible for installation through the NeWAP on a case-by-case basis following review and approval of the work prior to any work being implemented. [SWS 5.0301.2](#)
- Replacement central air conditioners or heat pump systems must be properly sized using the post weatherization characteristics of the home with system sizing documentation included in the client file.
- Replacement central air conditioners and heat pumps must be replaced by a Qualified Heating Technician.
- A service label must be placed on or near the furnace plenum containing the name, business address and phone number of the company performing the work, any repairs that were completed and the date the work was performed.
- Efficiency ratings for forced air-conditioners and heat pumps must be listed in the most current edition of the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Directory of Certified Product Performance.
- Replaced air conditioners and heat pumps must be properly disposed of and the refrigerant reclaimed in compliance with the Clean Air Act 1990, section 608, as amended by 40 CFR 82, 5/14/93. The vendor, DE manufacturing center or other entity recovering the refrigerant must possess EPA-approved Section 608 type I, II or III universal certification.

Manufactured housing specific Standards [SWS 5.0102.1](#)

The air conditioner condensates and combustion air sleeves to the underbelly must not be covered.

CHAPTER 7.0 REPAIRS

7.01 Incidental Repairs

Incidental repairs are defined as a repair necessary for the effective performance or preservation of newly installed weatherization materials, but not part of a standard installation. All repair measures must be installed to meet requirements listed below.

All repair measures must be tied to an energy conservation measure (ECM) **and the ECM must be identified in the NEAT/MHEA Audit Itemized Costs comments section** and justified with photo and written documentation in the client file

Window Sill

- If replacing the window sill, it must be either a factory-made sill or be made from treated lumber.
- Sill is to be beveled flush with the interior wall.
- Sill shall be the same distance from the house as the rest of the windows.
- Sill shall be installed at the same angle as other windows on the home.
- Only galvanized casement or finish nails are to be used.
- All seams shall be caulked after installation.
- Sills shall be painted to match the rest of the windows on the home.
- Primed coil stock may be used to wrap split sills. When wrapping sills, top, ends and all edges shall be covered.

Window Stop

- Window stops shall be installed in such a way as to ensure a tight seal between the jamb, sash, and stop.
- Wood installed shall be similar in size and shape to existing stop in the house.
- Installed window stop is to be planed or sanded smooth.
- New stop is to be painted or varnished to blend with current trim.
- Corners of installed materials are to be mitered or coped.
- If matching window stop is not available, then all stop on the window is to be replaced.
- All work to the window shall be neat in appearance.

Accesses

- Knee Wall Access See [Section 5.0103.04](#)
- Crawlspace Access See [Section 5.0402.01](#)
- Attic Access See [Section 5.0103](#)

Jamb Replacement/Repair

- For jamb repair, remove damaged or deteriorated portion of the jamb and replace with matching materials, butting uniformly to near members.

- All loose sub-members and casing is to be secured and all wood installed is to be finish grade or factory-made jamb material.
- Common stock materials such as #2 or #3 1" x 6" and 2" x 6"s are not an acceptable jamb material except for treated lumber for below grade door and/or access.
- All installed lumber is to be sanded smooth and painted or varnished to a smooth finish to match existing.
- All work is to be neat and form a tight seal.
- Crews/Contractors are to tighten or re-set hinges. Work is to be done in accordance with accepted carpentry standards. New installations require hinges to be mortised.
- Casing used is to match the existing casing on the house. If matching casing is not available, then all of the casing on the door and/or access is to be replaced. Wood is to be installed flush with the wall to ensure a tight fit.
- Any damaged interior wall is to be repaired with like materials.
- Crews/Contractors are to tighten or re-set the strike plate to hold the door and/or access flush with the stop.
- Strike plate is to be mortised into the jamb.
- All doorsills and/or access sills being replaced must be made from treated lumber or a factory manufactured sill.
- All doorsills installed must be flush with the floor of the house.
- When required, existing doors and/or accesses will be adjusted to properly fit the jamb and allow for ease of operation.
- All repair work must be within accepted carpentry standards.
- Doors and/or accesses should be repaired if possible and if less expensive than replacing the door and/or access.
- All replacement materials are to be of the type and size already existing on the door and/or access.
- All exposed wood (after cutting) is to be sanded smooth and painted or varnished.
- The finished door and/or access should make a tight seal and operate smoothly.

Drywall

- If walls are already insulated and are just being repaired, the drywall is considered infiltration.
- If the drywall is part of the installation of the ECM, the drywall is considered an ancillary measure and must be added to the cost of the ECM.
- If drywall is used to repair walls to be insulated, the drywall is considered an IRM.
- Only ½" drywall shall be used when installing on entire wall or ceiling if ceiling joist is on 16" center. If ceiling joist is on 24" center, 5/8" drywall will be used.
- 5/8 inch fire-rated drywall must be used over or between a garage and the house.
- Metal corner bead is to be installed to all outside corners. Inside corners must be taped with perforated paper tape or if 1/4" or less, caulk is acceptable.
- If installing drywall in order to ready it for insulation, one (1) coat of joint compound is to be applied and made ready for a second coat.

- If existing drywall must be sealed, one coat of joint compound is to be neat in appearance and made ready for a second coat.
- Drywall repairs shall be made with the same thickness material as existing.
- The drywall patch shall receive tape and joint compound and be applied to make a neat patch.
- If repairing drywall due to damage caused by the weatherization crew or contractor, the drywall shall receive three (3) coats of joint compound, textured and painted to return it to its original appearance.
- All work is to be neat in appearance.

Foundation Repair

- When caulking masonry joints, use foundation type caulking compounds. Caulk is to form an air and watertight seal and all work is to be neat in appearance.
- Spray foam may not be used on exterior surfaces unless painted to protect against deterioration.
- If the foundation has loose or missing bricks or holes in the foundation, the area is to have bricks properly re-set with mortar.
- If the foundation cracks involve a large area, the area should be back plastered. Back plaster is to be even, neat, and match the existing back plaster.

Plaster

- If walls are already insulated and are just being repaired, the plaster is considered infiltration.
- If the plaster is part of the installation of the ECM, the plaster is considered an ancillary measure and must be added to the cost of the ECM.
- If plaster is used to repair walls to be insulated, the plaster is considered an IRM.
- Plaster repairs shall include covering the exposed lath with a plaster mix to the same thickness as the original wall.
- Plaster mix or a non-shrinking drywall mix must be used.
- Large areas of missing plaster may be covered with a drywall patch, provided the edges can be finished flush with the existing plaster surface.
- Gaps between the drywall patch and the drywall shall be taped.

7.02 General Health & Safety Repairs

General Health and Safety Repairs are corrective actions undertaken to mitigate or eliminate hazards that must be addressed to safely complete weatherization work, or that arise as a direct result of weatherization activities. These measures shall be limited to those necessary to ensure occupant health and safety and to support the proper installation and performance of weatherization measures, in accordance with applicable Health and Safety guidance. See the most current and approved Health and Safety Plan for cost limits. General Health and Safety Repairs are limited to the following:

Air Conditioning, Heating System, and Combustion Appliances

- \$500.00 for repair to Heat Pumps and Central AC

- Renter occupied repairs up to \$800 or can contribute \$1500.00 towards replacement of Heat Pumps and Central AC.
- Owner Occupied replacement for Heat Pumps and Central AC has more qualifying factors. See [Section 6.02](#)
- Primary Heating System Replacements are allowed.

Asbestos Testing in a attic with Vermiculite

- \$150.00 for testing of ACM in Attics

Biologicals and Unsanitary Conditions

- \$300 to remediate minor conditions that contribute to biological concerns

Building Structure and Roofing

- \$300.00 to implement minor repairs

Code Compliance

- Installation of Fans to provide adequate ventilation to home
- Chimney liners
- Disconnect Switching
- Permits for work
- Contact DWEE for others

Electrical Repairs

- \$300.00 for minor repairs for Knob and Tube, Wiring Splices and Electrical boxes

Fuel Leaks

- Repairs needed on the client side of the meter

Gas Ovens/Stovetops/Ranges

- Replacement or repair not allowed with DOE Funds

Hazardous Materials

- \$200.00 of removal of Hazardous Materials

Injury Prevention of Occupants

- \$200.00 towards minor repairs to effectively weatherize a home

Lead Based Surface Coverings

- Testing via RRP rules

Mold and Moisture Repair and Control

- \$300.00 to implement minor Source Control
- \$300.00 to implement minor Water Damage

Occupant Pre-existing or Potential Health Conditions

- Not allowed with DOE Funds

Pests

- \$300.00 for pest removal and repair of points of access

Radon

- 6 mil, air seal sump pumps, sealing of below grade penetrations
- Radon Testing is not allowed

Safety Devices

- CO, Smoke and Propane detectors
- Testing of existing detectors

Ventilation and Indoor Air Quality

- ASHRAE 62.2 2016 guidelines

Water Heaters

- \$250.00 for repairs in Owner Occupied

- Replacement in Owner Occupied if repairs exceed \$250.00
- Contribution of \$500.00 towards replacement in Renter Occupied homes

Worker Safety

- PPE costs up to \$200.00

Chapter 8 Definitions and Terminology

A

Accessible Area: An area shall be considered accessible if it can be safely entered and worked in using standard methods and minor alterations.

Subgrantees are required to make reasonable efforts to gain access, including creation of access openings or limited removal of materials, provided that:

- Costs do not exceed program limits with material and labor that cause the measure to become not cost effective according to program guidance.

Areas requiring extensive demolition, structural modification, or work exceeding these thresholds shall be considered inaccessible.

Air Infiltration Barrier: A covering that will allow moisture out and not allow air into a space or wall cavity.

Atmospherically Vented Combustion Appliance: This common type of gas appliance uses natural ventilation to move the flue gases from the unit out with a vertical metal pipe, sometimes connected to the chimney, where the hot flue gases rise through the draft hood and flue pipe, and out into the atmosphere. The advantage of these types of appliances is the lower cost of the units and installation; however, they also generally have a lower efficiency rate than the other systems.

B

Backdraft Damper: A damper that allows air to flow in only one direction.

Basement: The bottom full height story of a building below the first floor. A basement may be partially or completely below grade.

Building Envelope: The elements of a building between the interior and exterior environments that includes a combination of both the air and thermal barriers.

C

CFM: Cubic feet per minute of airflow at a 50 Pascal pressure difference between the interior and exterior of a structure.

Combustion Appliance Zone (CAZ): An area containing one or more atmospherically vented combustion appliances.

Conditioned: A space or area that contains a source intended specifically to heat or cool that space.

Continuous Ventilation: The process of mechanically removing stale air from a building or room by providing fresh air on a slow, continuous basis.

Cost Effective Blower Door Guided Air Sealing: The process of using a blower door to pressurize a home or building to determine the energy savings ratio between the calculated air sealing cost and infiltration reduction.

Crawl Space: A space below the first floor of a conditioned or unconditioned building that is less than full story height.

Crossover Duct: Enclosed air pathway to move conditioned air from one side of a doublewide manufactured home to the other side or from a manufactured home to a frame edition.

D

Dense Pack: The process of installing loose-fill insulation at a density that allows it to reduce air flow and perform to a stated R-value.

Distribution System: The enclosed pathway for conditioned air to travel to and from the heating/cooling plant. It must include but is not limited to the metal or fiber duct, panned floor cavity, designated wall cavity and the point where funnels and boots meet the wall or floor.

Direct Vent Appliances: Direct vent units are generally newer units designed to supply outdoor air directly to the sealed combustion chamber and then exhaust the flue gases to the outside of the home. Direct vent units include most condensing furnaces, manufactured home furnaces, manufactured home water heaters and some space heaters.

Disabled/Inoperable Heating Plants: Heating plants that have had the fuel source disconnected and/or capped and the flue disconnected.

E

Egress Window: A window that people can escape through in an emergency. The location, size and clearance requirements are dictated by the local building jurisdiction.

Eligible Heating Plant: A furnace or boiler that utilizes natural gas, propane, fuel oil or electricity as the fuel/energy source. Eligible heating plants include forced air, gravity, wall, floor, electric baseboard, manufactured home furnaces, heat pumps and boilers.

Gravity furnaces that have been retrofitted with a blower or that have been converted from one fuel source or another are also eligible.

Exposed Floors: A floor that is in direct contact with the outside air (i.e. cantilevers, floors of bay or bow windows, garage ceilings, etc.).

F

Finished Attic: An attic space in a home that has been converted into additional living space.

Fenestration: Openings in the walls of a building structure (i.e. windows, doors, etc.).

Friable: Material that can be crumbled, pulverized, or reduced to powder by the pressure of an ordinary human hand.

H

Hard Wired Alarms: Alarms (Smoke, Propane, CO, Moisture) that are wired directly into the building's electrical system.

Heat Source: Type-B vent, masonry chimneys that vent natural gas or propane and exhaust fans.

Heating Plant: A boiler or furnace, not including the flue, fuel piping, thermostat, distribution system, etc.

Heating System: A heating plant and the associated connections necessary for operation including, but not limited to, the flue, fuel piping, thermostat, distribution system, etc.

High-Heat Source: Heat produced through the combustion process by solid fuel and/or fuel oil combustion appliances. Recessed lighting is also considered a high-heat source.

Hydronic Pipes: Piping system used to distribute water or steam to and from water boilers or steam boilers.

I

Inaccessible Underbellies: A manufactured home underbelly that is determined by the Energy Auditor to be inaccessible due to height restriction or hazardous conditions.

Incidental Repair Cost: Repair costs related to ensuring the effective performance or preservation of a new or existing weatherization measure.

Infiltration: The uncontrolled passage of outside air into a building through leaks in the building envelope.

Insulated Glass: The combination of two or more panes of glass sealed with air or inert gas between the panes.

K

Knee Wall: A vertical wall between an attic and a conditioned space.

L

Ledged Basement: A basement constructed with a concrete or dirt ledge less than 6 feet front to back, around the perimeter of the foundation. The ledge may be only around a portion of the foundation wall. Ledges more than 6 feet front to back are considered a crawl space.

Living Area: An area within the conditioned building envelope that is used on a regular basis for sleeping, eating, bathing etc.

M

Manufactured Housing: Commonly known as manufactured homes, is a type of prefabricated home that is assembled in a factory and transported to a site.

MERV (Minimum Efficacy Reporting Value) Filter: A filter that is tested, and rated, for its ability to filter and remove different size particles (pollutants) from the air. Typically, the higher the MERV rating, the higher the filtering performance.

Multi-family Buildings: The U.S. Department of Energy defines multi-family buildings based primarily on building size and heating characteristics:

- Small Multi-family: 5-25 units individually heated/cooled, and 3 stories in height
- Large Multi-family: 25+ units, and 4 stories in height and/or 5-25 units centrally heated/cooled, any height

O

Orphaned Equipment: A smaller combustion appliance (e.g., water heater) that remains in place after a larger appliance, that was commonly vented with the remaining unit, is removed or replaced and no longer utilizes the common vent.

The larger exhaust flue or chimney that the unit continues to utilize is generally larger than necessary for the remaining smaller appliance.

P

Perm Rating: The measurement of a material's ability to allow the transfer of water vapor through the material.

Pressure Treated: Lumber that has been commercially treated under pressure with a wood preservative to prevent damage from moisture, insects, fungi and other forms of biological decay.

Programmable Thermostat/Setback Thermostat: A thermostat designed to adjust temperature settings according to a series of programmed settings that take effect at different set times of the day.

Q

Qualified Heating Technician: An individual or company that is specifically involved in the installation and/or servicing of residential heating/cooling systems.

Qualified Plumbing Technician: An individual or company that is specifically involved in the installation and/or servicing of residential plumbing systems.

Quality Control Inspection: An inspection that verifies that the work completed on the home complies with quality work standards and program regulations as defined by the Nebraska Department of Water, Energy and Environment and the U.S. Department of Energy.

S

Safety Glass: A type of glass that is designed to resist breaking, and to break in a way that minimizes the risk of injuries in the event the glass cannot withstand the forces on it.

Safety Inspection: An inspection performed by a Qualified Heating Technician, a natural gas utility, a propane supplier or Trained Weatherization Staff.

SIR (Savings to Investment ratio): A ratio of economic performance as calculated by NEAT/MHEA and MULTEA audits. An SIR of 1.0 indicates the weatherization measure will pay for itself one time during its life.

Spray-Applied Insulation: Insulation manufactured specifically to be spray-applied.

Stack Effect: The tendency for warm air to move upwards in a building or chimney, creating pressure differentials.

T

Tempered Glass: Toughened type of safety glass processed by control thermal or chemical treatments to increase its strength compared with normal glass.

Trained Weatherization Staff: A sub-grantee staff person who has successfully completed appropriate training to perform a task in the weatherization program.

Tube-fill Method: An insulation technique developed to install high density blown insulation in enclosed cavities.

Type S-Fuse: A non-removable adapter that is screwed into the fuse socket permitting only one size fuse to be installed.

U

Unconditioned: A space or area having no source of heating or cooling.

Under-cut: To cut the bottom of an interior door to allow return air to flow from that area to the furnace compartment or common return.

Unsafe Water Heater: A unit that:

- has been red tagged by a utility company/supplier or a building code jurisdiction,
- shows visual signs of deterioration such as scorch marks indicating past backdrafting occurrences,
- shows signs of compromised water tank integrity as evidenced by signs of leakage, or
- when tested exceeds 200 ppm as measured in the flue gases or 70 ppm in the ambient air and the CO levels cannot be reduced.

Unvented Combustion Space Heater: An unvented gas heating unit generally intended to supply heat to a small area.

V

Vapor Barrier: A material that retards the passage of water vapor and contains a perm rating of less than 1.

Vapor Retarder: A material that slows the passage of water vapor and contains a perm rating above 1.

W

Weatherboard: A covering consisting of a minimum # 30 felt paper, exterior grade plywood, fiberboard, an air infiltration barrier or a material specifically manufactured as manufactured home weatherboard installed on the underside of a manufactured home to support and protect the floor insulation