CAASTLC
Community Action Agency of St. Louis County, Inc.
2709 Woodson Road • St. Louis, MO 63114
Office: (314) 863-0015 • Fax: (314) 863-1252 • http://www.caastlc.org/index.html

INVITATION FOR BID

June 1, 2026

TO ALL BIDDERS:

Attached please find a several part INVITATION FOR BID (IFB) for services to furnish and install weatherization materials. This copy will become the "Contract" if you are awarded the bid. This package must be fully completed to be valid. **Please note that it is necessary for an authorized person to sign not only the initial page of the proposal, but also all additional pages that indicate a signature.** Failure to complete all forms may invalidate the bid. Small oversights and minor clerical errors that will not change the bid price may allow a bid to be considered.

Community Action Agency of St. Louis County, Inc. (hereafter “CAASTLC”) is a non-profit Community Action Agency. Federal funds are made available to CAASTLC through the Missouri Department of Natural Resources, Division of Energy (hereinafter “DNR/DE”) for weatherization services to low-income residents of St. Louis County, Missouri. Funding for this program is provided by the U.S. Department of Energy, through DNR/DE. Additional funding is provided by Ameren Missouri, Spire, and the Missouri Department of Social Services.

The Program basically operates as follows: **We have an estimated 125 homes to weatherize beginning July 1, 2026, and ending on June 30, 2027**. Expenditures per home are permitted to average $8,547 for labor and materials (including heating system work, which is bid separately).

CAASTLC encourages small, minority and women-owned, and veteran-owned business enterprises to submit bids in response to this IFB.

We provide residential weatherization services for low-income clients in St. Louis County. The number of estimated homes to receive weatherization services is derived from the percentage of low-income households. Work is expected to be of high quality, performed under the NEAT audit procedure, standards, and cost limitations established by DNR/DE. Energy conservation measures typically applied include: 1) correction of general heat waste (caulking, weather-stripping, glass replacement, primary door and window repair, water heater jackets, pipe wrap, etc.); 2) insulation of sidewalls, attics, crawl spaces, etc.; and 3) storm windows and other work, as needed. Each home is assessed by CAASTLC auditors to determine the most cost-effective measures to be undertaken and is inspected again for materials and workmanship when the contractor's work is completed. Materials must conform to specifications listed in Attachment C.

June 1, 2026

Prospective bidders are hereby invited to furnish and install infiltration and/or insulation materials specified in this IFB. Bids are sought only from contractors with the demonstrated capability to perform. The criteria listed in Attachment A will be used to judge this capability. All bidders must provide a bid bond or similar guarantee of $500.00. Bidders who have not successfully completed a contract with CAASTLC in the past two years must provide reference letter(s) (see Attachment A). The specifications and requirements in this package, including this cover letter, Attachments A-E, and the Contractual Requirements, are considered a part of this IFB.

Your attention is called in particular to the provisions regarding insurance requirements, a performance bond, test data for certain materials, and subcontractor approval. These items must all be obtained by the successful bidder(s) within three (3) working days from winner notification. Please note also that not less than the minimum wage must be paid, and that employees and applicants for employment are not to be discriminated against because of race, religion, color, national origin, or sex.

Costs must be clearly shown for items on the IFB for the bid to be accepted. Complete each blank using ink or typewriter, showing material and labor costs separately for each item. Multiply these amounts by the estimated quantity given to reach the total cost for each item. The category subtotals are summarized at the end to reach the grand total, which is compared among the eligible bidders to determine the winning bid(s). Percentages for labor may vary between material items or priorities.

CAASTLC will utilize a multiplier effect on each item to emphasize measures according to their relative work order frequency. The use of the multiplier minimizes the influence of extremely low pricing on isolated measures to reduce the overall bid. The multiplier effect, indicated on each item, is as follows: high frequency measures (multiplier 200) down to very low frequency measures (multiplier 1). The multiplier will be applied to the bid price and then the totals will be computed to indicate the lowest bid as the one with the lowest cost after the multiplier effect. CAASTLC's use of these multiplier numbers is in no way guarantees of quantity to be ordered from the contract once awarded.

Jobs are scheduled on a weekly or as-needed basis. Under normal circumstances, fifteen (15) business days will be allowed to complete each assignment. Credit for the completed work shall be provided when all weatherization work (including any rework) for the job has passed final inspection by CAASTLC. Upon passing final inspection, CAASTLC shall make every reasonable effort to provide payment for completed work within forty-five (45) days, however, contractor is advised that payment may take up to ninety (90) days pending release of funds from DNR/DE.

CAASTLC reserves the right to retain client work orders for services that require low material cost measures. It will always be CAASTLC's prerogative to perform certain weatherization measures on client homes assigned to a contractor. Labor costs will be deducted from bid cost when materials are installed by CAASTLC, and materials costs will be deducted from bid cost when labor is used to install CAASTLC materials.

CAASTLC may elect to hire employees to do the work at its discretion in an area without a contractor due to lack of bidders; due to original or subsequent contractor's loss of contract; or in the event CAASTLC should elect to perform any work itself. Any new measure called for during this contract period by DNR/DE or CAASTLC that is not on this contract will be negotiated by CAASTLC and contractor at that time.

June 1, 2026

CAASTLC reserves the right to select more than one responsive and responsible contractor for this contract period (see Contractual Requirements section on “Primary, Secondary, Tertiary, Etc. Contractors”). All contractors must be registered and in good standing with the Missouri Secretary of State.

A pre-bid conference will be held via online Zoom Conference at **2:00 p.m., Tuesday, June 9, 2026**. The meeting link for this Conference will be available on CAASTLC’s homepage (https://www.caastlc.org/) the day of the Conference and the login attendee ID and password for this Conference are as follows:

Topic: Pre-Bid Conference
Time: June 9, 2026, 2:00 PM Central Time (US and Canada)

Join Zoom Meeting
https://us02web.zoom.us/j/86441723561?pwd=NEfN0Bz6pwV2oVOcx8drQllCE0lf2T.1&jst=1

Meeting chat link
https://us02web.zoom.us/launch/jc/86441723561

Meeting ID: 864 4172 3561
Passcode: w4bZg0z!

One tap mobile
+13126266799,,86441723561#,,,,*76771506# US (Chicago)
+13092053325,,86441723561#,,,,*76771506# US

Join by SIP
• 86441723561@zoomcrc.com

Bids must be sealed, marked "Sealed Bid," and delivered to CAASTLC Inc., 2709 Woodson Road, Overland, Missouri 63114, no later than **5:00 p.m., Monday, June 15, 2026**.

To be eligible for evaluation, the bid must meet stated standards for materials and comply with all conditions listed in the IFB. As determined by CAASTLC, the award will be made to the lowest priced, responsive and responsible bidder. CAASTLC reserves the right to choose more than one (1) contractor

to perform the work under the Contract (see Contractual Requirements section on “Primary, Secondary, Tertiary, Etc. Contractors”).

Bids will be opened and read publicly, via online Zoom Conference, at **2:00 p.m., Tuesday, June 16, 2026,** at CAASTLC's main office. The meeting link for this Conference will be available on CAASTLC’s homepage (https://www.caastlc.org/) the day of the Conference and the login attendee ID and password for this Conference are as follows:

Topic: Bid Opening
Time: June 16, 2026, 2:00 PM Central Time (US and Canada)

Join Zoom Meeting
https://us02web.zoom.us/j/89031009315?pwd=lNI0uaT2jg9yiISvfrXK9ZtpnEEL3x.1&jst=1

Meeting chat link
https://us02web.zoom.us/launch/jc/89031009315

Meeting ID: 890 3100 9315
Passcode: ahvh@+06

One tap mobile
+13126266799,,89031009315#,,,,*01193362# US (Chicago)
+13092053325,,89031009315#,,,,*01193362# US

Join by SIP
• 89031009315@zoomcrc.com

Join instructions
https://us02web.zoom.us/meetings/89031009315/invitations?signature=aY5ZcZWxvMsDkJ6prwH5mlP6ARoLhLioNQp_6G-hEXs

All bids shall be awarded on the basis of criteria listed in Attachment A. CAASTLC reserves the right to reject any and all bids, or to call for rebids if necessary.

Hopefully, you can gain a fair profit, and the Program can run as efficiently as possible within government regulations. We look forward to a mutually beneficial relationship.

June 1, 2026

If you have any questions, please contact me at **(314) 446-4417** or **Dale Hickman at (314) 446-4442.**

Sincerely,

Keith Robinson
Director of Weatherization & Support Services

Enclosures: Attachment A – Evaluation

Attachment B - Work Priorities and Cost Limitations
Attachment C - Minimum Material Specifications
Attachment D - Weatherization Work Standards
*Attachment E - Invitation for Bid (Bid Forms)
*Contractual Requirements Pursuant to Weatherization Program Contract
Certification regarding Debarment, Suspension, and other Responsibility Matters
Contractor Self-Attestation
IFB Pre-Bid Conference Insert
Recycled Products in Insulation Requirement

*Items to be completed, signed, and returned with the bid along with the capability to perform and bid bond.

DUE: June 15, 2026
5:00 P.M.

ACKNOWLEDGMENT OF BID PACKAGE CONTENTS

UC: PY26/27

BID PACKAGE CONTENTS

1. Letter “To All Bidders”
2. Attachment A, Bid Evaluation and Selection
3. Attachment B, Work Priorities
4. Attachment C, Material Specifications
5. Attachment D, Work Standards
6. Attachment E, Bid Form
7. Contractual Requirements
8. Certification regarding Debarment, Suspension and other Responsibility Matters
9. Self-attestation statement letter of compliance with Missouri’s Wage and Hour rules and regulations and OSHA-10-Hour safety training
10. IFB Pre-Bid Conference Insert
11. Recycled Products in Insulation Requirement

Receipt by CAASTLC, Inc. of Attachment E and Contractual Requirements, properly completed and signed, will constitute your bid.

Your signature on this page indicates that you have received the complete bid package as listed here. Please return this page with or prior to, your bid.

_____
Contractor Signature

ATTACHMENT A TO WEATHERIZATION PROGRAM CONTRACT
NO. UC: PY26/27
BID EVALUATION AND SELECTION

CAASTLC, INC.
ATTACHMENT A – WEATHERIZATION PROGRAM CONTRACT
BID EVALUATION AND SELECTION

All bids received will be evaluated according to the following criteria. A "no" answer to any one of the items 1 through 9 will disqualify the bidder's proposal from further consideration. If all answers are "yes" the total bid price will be compared to the other eligible bids.

FOR CAASTLC, INC. USE ONLY

		YES	NO
Number of jobs bid on is 1 Contractor_____			
TOTAL AMOUNT (BASED ON __125__ HOMES) $__650,000____		___	___
1.	Was bid received by time and date of closing?	___	___
2.	Was the bid submitted in a sealed envelope marked "Sealed Bid"?	___	___
3.	Was sealed bid accompanied by a photocopy of the original bid in a second sealed envelope marked "Sealed Bid-Photo Copy"?	___	___
4.	Was all requested information supplied?	___	___
5.	Was Attachment E completed (all items bid on, amounts shown separately for labor and material, and correctly totaled) and each page signed in ink?	___	___
6.	Was the original bid either handwritten in ink or typed?	___	___
7.	Was "Contractual Requirements" signed and returned with the bid?	___	___
8.	Did bidder submit a bid bond, a letter of credit or cashiers check for no less than $500.00?	___	___
9.	Capability to perform:		
a)	Has successfully completed a contract with CAASTLC, INC. in the past	___	___
	OR		
b)	Has submitted letters of reference from other Missouri Weatherization agencies	___	___
	OR		
c)	Has submitted letters of reference from other sources	___	___

CONTRACTOR NAME: _____ **AUTHORIZED SIGNATURE:** _____

ATTACHMENT A – cont'd

All bidders must submit a guaranteed surety, such as a bid bond, irrevocable bank letter of credit, cashiers check with CAASTLC, Inc. as beneficiary, in an amount no less than $500. The instrument selected will be held in escrow to provide assurance that all contractual documents, including the performance bond, will be executed by the successful bidder within ten (10) working days from the notice of award. The bid bond or other instrument will be returned if the bid is unsuccessful, or the contract documents are provided in time. Otherwise, it will be forfeited.

Capability to perform must be demonstrated by all bidders in at least one of the following three ways. (Documentation for items 2. or 3. must be submitted **with the bid**.)

1. Bidder has successfully completed at least one weatherization contract with CAASTLC, Inc. in the previous two years. Successful completion includes, but is not limited to, timely and proper performance of work.

The following procedures will be used in evaluations of bids from contractors previously unsuccessful in completions:

If, prior to June 30, 2024, a contract has been terminated by CAASTLC, Inc. for bankruptcy, insolvency, default, or other failure to perform, or if 25% of such previous contract was incomplete or failed to be completed for some other reason at the contract's expiration, CAASTLC, Inc. may at its discretion, apply the appropriate exclusionary period to such business.

If it is found that any of the principles and/or a substantial percentage of the employees, of a business which withdrew from a contract with CAASTLC, Inc. or had such contract terminated prior to June 30, 2022, have joined or formed a business with a different name, CAASTLC, Inc. may, at its discretion, apply the appropriate exclusionary period to the differently named business.

Any contractor that had breached its contract with CAASTLC, Inc. since July 1, 2024, whether such contractor is currently operating under the same business name or a different business name, is not eligible to bid on this Contract.

2. Showing of successful completion of a contract similar in amount and type of work, with another Missouri Weatherization agency within the past two years. Reference letter(s) must be submitted verifying that the amount of weatherization work performed was comparable, (i.e., at least 70% of the size in dollar amount of bid or estimated number of homes bid on), that the work was satisfactory, and must be signed by an authorized agency representative.

3. Showing of successful completion of work for any purchaser with whom the bidder has had similar contract(s) within the past two years. Reference letter(s) must verify that type of work performed was similar (i.e., at least 70% of the size in dollar amount of bid or estimated number of homes bid on), that the work was satisfactory, and must be signed by the purchaser or authorized representative.

CONTRACTOR NAME: _____ **AUTHORIZED SIGNATURE:** _____

ATTACHMENT A – cont'd

Sealed bid envelopes and bid photocopy envelopes should be clearly marked with the bidder's name. The photocopies will remain in the sealed envelopes in CAASTLC, Inc. files for future review, if necessary.

Rebates and/ or discounts shall not be considered or allowed.

During the bid qualification process, CAASTLC, Inc. may make documented, minor corrections to the bid, but only if the changes do not affect the unit prices or the validity of the bid. In case of error in extension costs, the unit price will govern.

As determined by CAASTLC, Inc., the eligible responsive and responsible bidder with the lowest total price will win the number of homes indicated on the bid. In case of a tie, a third party with no vested interest will draw the winning bid. CAASTLC, Inc. reserves the right to reject any and all bids.

Written notice will be furnished to each bidder of the selection made. Five (5) business days from the date of notification will be allowed for protest by bidders. All formal protests must be submitted in writing. Awards may be made after the five-day protest period ends. If no written protest is received by CAASTLC, Inc. within five (5) working days, the selection will be considered final and award made. The award may be made even if a protest is submitted if CAASTLC, Inc. believes the protest is without merit.

During the five (5) day period following the date of bid opening, any bidder may petition for withdrawal of their bid. Final judgment to allow a bidder to withdraw without penalty rests with CAASTLC, Inc. Once a bid has been withdrawn from consideration after bid opening, corrections or re-submissions shall not be allowed. (Before bid opening, withdrawal of a bid is allowed. The bidder may then re-submit a bid if prior to the bid deadline.)

Bidders selected as winners are obligated to fulfil the conditions of the bid. Non-fulfillment of the requirements of the invitation for bids and attachments shall be deemed as a breach of contract, and the bid bond shall be forfeited.

To summarize, bidders must submit the following prior to or with the completed IFB:

CONTRACTOR NAME: _____ **AUTHORIZED SIGNATURE:** _____

ATTACHMENT A - cont'd

1. Proof of capability to perform, including bid bond, and letters of reference, if necessary.

2. Signed and completed Invitation for Bid, (Attachment E) with amount of work requested clearly specified on cover page.

3. Signed "Contractual Requirements Pursuant to the Weatherization Program Contract."

When awards are made, the successful bidder must submit any of the following not already on file before the Contract is executed. (Bidders are encouraged to submit any or all of the following documents with the bid to expedite processing time.) Three (3) working days from the date of notice will be allowed to submit the following documents:

1. Performance bond from an insurance company, or other generally recognized and acceptable surety institution guaranteeing timely completion, or an irrevocable letter of credit from a financial institution, unless the bidder has successfully completed a contract in the past with CAASTLC, Inc. or the bidder has submitted name(s) of other purchasers for whom they have successfully completed a contract. The amount of the instrument shall be $25,000. The bonding document shall name CAASTLC, Inc. as beneficiary, and shall cover the entire contract period of July 1, 2026, through June 30, 2027. CAASTLC, Inc. reserves the right to reject any instrument that does not comply with this paragraph.

2. Insurance certificate(s) with minimum amount as follows:

   a. Workman's Compensation - As required by laws of the State of Missouri, including Employees Liability -- $500,000.000.

   b. Public Liability - Limits of not less than $500,000.00 per occurrence and $1,000,000.000 aggregate, to protect the Contractor against claims for injury to, or death of, one, or more than one, person due to occurrences which may result from operation under the contract. Products/Completed Operations and Broad Form Property Damage Insurance, with limits not less than $300,000.00 aggregate. Public Liability Insurance and Property Damage Insurance shall each include coverage for owned, non-owned, hired cars and trucks of not less than: Bodily Injury - $500,000.00 per person, $500,000.00 per occurrence, Property Damage - $300,000.00 per occurrence for a Split Liability Limit (SLL) policy or $800,000.00 for a Combined Single Limit (CSL) policy.

3. List of any subcontractors for which approval is requested. Note that approval must be obtained from both CAASTLC, Inc. and Missouri Department of Natural Resources.

CONTRACTOR NAME: _____ **AUTHORIZED SIGNATURE:** _____

ATTACHMENT A - cont'd

4. Signed “Certification regarding Debarment, Suspension and other Responsibility Matters”.

5. All required licenses including, but not limited to, current business license and/or occupational license(s).

6. Self-attestation statement letter that Contractor shall remain in compliance with all aspects of Missouri’s Wage and Hour rules and regulations and that all weatherization workers, Supervisors, and other personnel have completed the OSHA-10 Hour safety training.

7. Signed Attachments A, B, C and D.

An extension of time allowed to furnish the Contract documents may be requested by the bidder, if good and sufficient reason exists for delay. CAASTLC, Inc. shall determine whether or not the reasons presented by bidder warrant an extension. If the request is not granted, CAASTLC, Inc. reserves the right to offer the contract to the next lowest eligible bidder. The original winner's bid bond will be forfeited.

All material standards and specifications stated in the invitation for bid must be complied with by bidders, whether federally mandated or established by CAASTLC, Inc. Failure to comply may result in disqualification of the bid or termination of the Contract.

PLEASE NOTE that bidders are expected to examine ALL specifications and instructions pertaining to the items and services rendered and procedures for bid submission. Failure to do so will be at the bidder's risk.

Funding for this program is provided by the U.S. Department of Energy, through the Missouri Department of Natural Resources / Division of Energy. Additional funding is provided by Ameren Missouri, Spire and the Missouri Department of Social Services.

CONTRACTOR NAME: _____ AUTHORIZED SIGNATURE: _____

ATTACHMENT B TO WEATHERIZATION PROGRAM CONTRACT
NO. UC: PY26/27
MODEL HOME WORK PRIORITIES

CONTRACTOR NAME: _____ **AUTHORIZED SIGNATURE:** _____

MODEL HOME NEAT AUDIT CATEGORIES

1. MODEL 1 - STANDARD FRAME/MASONARY DWELLINGS

The ECM's listed in the following categories are not listed in order of importance. Application shall be dependant upon site specific circumstances and the order of importance as determined by the NEAT audit.

Infiltration Category - General Heat Waste:

√ Caulk and/or seal major building envelope air leakage points emphasizing the following areas:

- Attic bypasses
- Basement/Crawlspace bypasses
- Major holes and cracks

√ Replace broken or missing glass.

√ Weatherstrip doors between heated and unheated space. Install door sweeps.

√ Weatherstrip extremely loose-fitting windows. Install sash locks only when necessary.

√ Seal leaks in supply air and return ductwork.

√ Perform heating system measures - clean and tune and general repairs.

√ Insulate ductwork in unheated areas.

√ Apply 6 mil. ground cover vapor retarder in crawlspaces.

√ Perform minor general heat waste measures such as pulley seals, switch/outlet gaskets, glazing, water pipe insulation, and minor air leakage sealing.

√ Consider installing storm windows over single glazed primary windows where storm windows are missing, or existing storm windows are deteriorated beyond repair, or where repairs and weatherizing the primary window is not cost effective. This may also be listed as a separate category as determined by the NEAT audit.

Repair Category

√ Install new primary doors and windows only where existing ones are beyond repair.

√ Perform repairs on existing doors and windows.

Miscellaneous Category:

√ Perform heat waste measures such as water pipe insulation, water heater blankets, duct wrap, and duct repair.

CONTRACTOR NAME: _____ **AUTHORIZED SIGNATURE:** _____

√ Perform other measures such as roof vents, minor roof repair/sealing, dryer vent installation, and attic/knee wall installation.

Wall Category: Insulate exterior walls to a minimum of R-15 as determined by the NEAT audit.

Attic Category: Insulate to R-value as determined by NEAT audit.

√ Insulate attic scuttle doors to a minimum of R-19. Dam access area allowing entry to attic.

Foundation Category:

√ Insulate crawlspace perimeter when accessible.

√ Insulate floors to R-value as determined by the NEAT audit.

√ Insulate rim joists.

Heating System Category:

Measures in this category are determined by health and safety concerns and efficiency ratings as determined by the NEAT audit.

√ Heating system clean and tune.

√ Installation of electronic set back thermostats.

√ Primary heating system replacement.

√ General heating system repair.

2. MODEL 2 - MOBILE/MODULAR/TRAILER WEATHERIZATION CATEGORIES:

The ECM's within this category are presently following the same categories as MODEL 1 homes. The MHEA audit has now been released and may be used for mobile homes. Some exceptions due to the nature of the construction are listed below.

√ Reconnect misaligned ductwork. Tape/seal ductwork connections.

√ Installation of new interior storm windows where missing and where existing inserts are beyond repair if called for by the NEAT audit.

√ Primary heating system replacement only with type approved for MODEL 2 homes.

√ Insulation values for floors, ceilings, and walls may be less than maximum due to limited physical construction.

ATTACHMENT C TO WEATHERIZATION PROGRAM CONTRACT
NO. UC: PY26/27
MINIMUM MATERIAL SPECIFICATIONS

The Federal Specifications shown are from the Federal Register 10 CFR, Part 440, Revised Appendix A, June 2006 edition. Material used must conform to these standards, or other subsequent ASTM, ANSI, or F.S. approved standards, which supersede the specification given.

CONTRACTOR NAME: _____ **AUTHORIZED SIGNATURE:** _____

APPENDIX A—STANDARDS FOR WEATHERIZATION MATERIALS

If the standards listed in this appendix conflict with those required by current local codes, the local code shall have precedence and a copy of the applicable section will be retained with procurement records.

The following Government standards are produced by the Consumer Product Safety Commission and are published in title 16, Code of Federal Regulations:

Thermal Insulating Materials for Building Elements Including Walls, Floors, Ceilings, Attics, and Roofs Insulation—organic fiber—conformance to Interim Safety Standard in 16 CFR part 1209;

Fire Safety Requirements for Thermal Insulating Materials According to Insulation Use—Attic Floor—insulation materials intended for exposed use in attic floors shall be capable of meeting the same flammability requirements given for cellulose insulation in 16 CFR part 1209;

Enclosed spaces—insulation materials intended for use within enclosed stud or joist spaces shall be capable of meeting smoldering combustion requirements in 16 CFR part 1209.

The following standards which are not otherwise set forth in part 440 are incorporated by reference and made part of part 440. The following standards have been approved for incorporation by reference by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. These materials are incorporated as they exist on January 3, 2002 and a notice of any change in these materials will be published in the FEDERAL REGISTER. The standards incorporated by reference are available for inspection at the Office of the Federal Register Information Center, 800 North Capitol Street, Suite 700, Washington, DC 20001.

The standards incorporated by reference in part 440 can be obtained from the following sources:

Air Conditioning and Refrigeration Institute, 4301 N. Fairfax Drive, Suite 425, Arlington, VA 22203; (703) 524-8800.

American Architectural Manufacturers Association, 1827 Walden Office Square, Suite 104, Schaumburg, Illinois 60173-4268; (847) 303-5664.

American Gas Association, 400 N. Capitol Street, NW, Washington, DC 20001; (202) 824-7000.

American National Standards Institute, Inc., 11 West 42nd Street, New York, NY 10036; (212) 642-4900.

American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990; (212) 591-7722.

American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959; (610) 832-9585.

Association of Home Appliance Manufacturers, 1111 19th Street, NW, Suite 402, Washington DC, 20036; (202) 872-5955.

Federal Specifications, General Services Administration, General Services Administration, Federal Supply Service, Office of the CIO and Marketing Division, Room 800, 1941 Jefferson Davis Hwy., Arlington, VA 22202; (703) 305-6288.

Gas Appliance Manufacturers Association, 2107 Wilson Boulevard, Suite 600, Arlington, Virginia 22201; (703) 525-7060.

National Electrical Manufacturers Association, 1300 North 17th Street, Suite 1847, Rosslyn, VA 22209; (703) 841-3200.

National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101; (617) 770-3000.

Sheet Metal and Air Conditioning Contractors Association, 4201 Lafayette Center Drive, Chantilly, Virginia 20151-1209; (703) 803-2980.

Solar Rating and Certification Corporation, c/o FSEC, 1679 Clearlake Road, Cocoa, FL 32922-5703; (321) 638-1537.

Steel Door Institute, 30200 Detroit Road, Cleveland, OH 44145-1967; (440) 899-0010.

Steel Window Institute, 1300 Sumner Avenue, Cleveland, OH 44115-2851; (216) 241-7333.

Tubular Exchanger Manufacturers Association, 25 North Broadway, Tarrytown, NY 10591; (914) 322-0040.

Underwriters Laboratories, Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096; (847) 272-8800.

Window & Door Manufacturers Association, 1400 East Touhy Avenue, Suite 470, Des Plaines, IL 60018; (800) 223-2301.

More information regarding the standards in this reference can be obtained from the following sources:

Environmental Protection Agency, 401 M Street, NW, Washington, DC 20006; (202) 554-1080.

National Institute of Standards and Technology, U.S. Department of Commerce, Gaithersburg, MD 20899; (301) 975-2000.

Weatherization Assistance Program, Office of Building Technology Assistance, Energy Efficiency and Renewable Energy, 1000 Independence Avenue, SW, EE-42, Washington, DC 20585-0121; (202) 586-4074.

THERMAL INSULATING MATERIALS FOR BUILDING ELEMENTS INCLUDING WALLS, FLOORS, CEILINGS, ATTICS, AND ROOFS

[Standards for conformance]

Insulation--mineral fiber:	
Blanket insulation	ASTM[1] C665-98.
Roof insulation board	ASTM C726-00a.
Loose-fill insulation	ASTM C764-99.
Insulation--mineral cellular:	
Vermiculite loose-fill insulation	ASTM C516-80 (1996)e1.
Perlite loose-fill insulation .	ASTM C549-81 (1995)e1.
Cellular glass insulation block	ASTM C552-00.
Perlite insulation board . . .	ASTM C728-97.
Insulation–organic fiber:	
Cellulosic fiber insulating board	ASTM C208-95.
Cellulose loose-fill insulation	ASTM C739-00.
Cellulose wet-spray insulation	ASTM C1149-97.
Insulation–organic cellular:	
Preformed block-type polystyrene insulation	ASTM C578-95.
Rigid preformed polyurethane insulation board	ASTM C591-00.
Polyurethane or polyisocyanurate insulation board face with aluminum foil on both sides	FS[2] HH-I-1972/1 (1981).
Polyurethane or polyisocyanurate insulation board face with felt on both sides	FS HH-I-1972/2 (1981) and Amendment 1, October 3, 1985).
Insulation–composite boards:	
Mineral fiber insulation board	ASTM C726-00a.
Perlite board	ASTM C728-97.
Gypsum board and polyurethane or poliso-cyanurate composite board	FS HH-I-1972/4 (1981).

[1] ASTM indicates American Society for Testing and Materials.

[2] FS indicates Federal Specifications.

THERMAL INSULATING MATERIALS FOR BUILDING ELEMENTS INCLUDING WALLS, FLOORS, CEILINGS, ATTICS, AND ROOFS–Continued

[Standards for conformance]

Materials used as a patch to reduce infiltration through the building envelope	Commercially available.

THERMAL INSULATING MATERIALS FOR PIPES, DUCTS, AND EQUIPMENT SUCH AS BOILERS AND FURNACES

[Standards for conformance]

Insulation–mineral fiber:	
Preformed pipe insulation .	ASTM[1] C547-00.
Blanket and felt insulation (industrial type)	ASTM C553-00.
Blanket insulation and blanket type pipe insulation (metal-mesh covered, industrial type)	ASTM C592-00.
Block and board insulation	ASTM C612-00.
Spray applied mineral fiber thermal and sound absorbing insulation	ASTM C1014-99ae1.
High-temperature fiber blanket insulation	ASTM C892-00.
Duct work insulation	ASTM C1290-00.
Insulation–mineral cellular:	
Calcium silicate block and pipe insulation	ASTM C533-95.
Cellular glass insulation . .	ASTM C552-00.
Expanded perlite block and pipe insulation	ASTM C610-99.
Insulation–organic cellular:	
Preformed flexible elastomeric cellular insulation in sheet and tubular form	ASTM C534-99.
Unfaced preformed rigid cellular polyurethane insulation	ASTM C591-00.
Insulation skirting	Commercially available.

[1] ASTM indicates American Society for Testing and Materials.

FIRE SAFETY REQUIREMENTS FOR INSULATING MATERIALS ACCORDING TO INSULATION USE

[Standards for conformance]

Attic floor	Insulation materials intended for exposed use in attic floors shall be capable of meeting the same smoldering combustion requirements given for cellulose insulation in ASTM[1] C739-00.
Enclosed space	Insulation materials intended for use within enclosed stud or joist spaces shall be capable of meeting the same smoldering combustion requirements given for cellulose insulation in ASTM C739-00.
Exposed interior walls and ceilings	Insulation materials, including those with combustible facings, which remain exposed and serve as wall or ceiling interior finish, shall have a flame spread classification not to exceed 150 (per ASTM E84-00a).
Exterior envelope walls and roofs	Exterior envelope walls and roofs containing thermal insulation shall meet applicable local government building code requirements for the complete wall or roof assembly.
Pipes, ducts, and equipment	Insulation materials intended for use on pipes, ducts, and equipment shall be capable of meeting a flame spread classification not to exceed 150 (per ASTM E84-00a).

[1] ASTM indicates American Society for Testing and Materials.

STORM WINDOWS

[Standards for conformance]

Storm windows:	
All storm windows . .	AAMA/NWWDA[1] 101/I.S. 2-97.
Aluminum frame storm windows	AAMA[2] 1002.10-93.
Rigid vinyl frame storm windows	ASTM[3] D4726-00.
Frameless plastic glazing storm	Required minimum thickness for windows is 6 mil (0.006 inches).
Movable insulation systems for windows	Commercially available.

[1] AAMA/NWWDA indicates American Architectural Manufacturers Association/National Wood Window & Door Association (now the Window & Door Manufacturers Association).

[2] AAMA indicates American Architectural Manufacturers Association.

[3] ASTM indicates American Society for Testing and Materials.

REPLACEMENT WINDOWS

[Standards for conformance]

Replacement windows:	
All windows	AAMA/NWWDA[1] 101/I.S. 2-97.
Steel frame windows	Steel Window Institute recommended specifications for steel windows, 1990.
Rigid vinyl frame windows	ASTM[2] D4726-00.

[1] AAMA/NWWDA indicates American Architectural Manufacturers Association/National Wood Window & Door Association (now the Window & Door Manufacturers Association).

[2] ASTM indicates American Society for Testing and Materials.

STORM DOORS

[Standards for conformance]

Storm doors:	
All storm (glass) doors	AAMA/NWWDA[1] 101/I.S. 2-97.
Aluminum frame storm doors	AAMA[2] 1102.7-89.
Sliding glass storm doors	AAMA 1002.10-93.
Rigid vinyl storm doors .	ASTM[3] D3678-97 and D4726-00..
Vestibules:	
Materials to construct vestibules	Commercially available.

[1] AAMA/NWWDA indicates American Architectural Manufacturers Association/National Wood Window & Door Association (now the Window & Door Manufacturers Association).

[2] AAMA indicates American Architectural Manufacturers Association.

[3] ASTM indicates American Society for Testing and Materials.

REPLACEMENT DOORS

[Standards for conformance]

Replacement doors:	
All replacement doors	AAMA/NWWDA[1] 101/I.S. 2-97.
Steel doors	ANSI[2] A250.8-98.
Wood doors:	
Flush doors	ANSI/NWWDA[3] I.S. 1-97 (Amendment, exterior door provisions).
Stile and rail doors	NWWDA[4] I.S. 6-97.

[1] AAMA/NWWDA indicates American Architectural Manufacturers Association/National Wood Window & Door Association (now the Window & Door Manufacturers Association).

[2] ANSI indicates American National Standards Institute.

[3] ANSI/NWWDA indicates American National Standards Institute/National Wood Window & Door Association (now the Window & Door Manufacturers Association).

[4] NWWDA indicates National Wood Window & Door Association (now the Window & Door Manufacturers Association).

CAULKS AND SEALANTS

[Standards for conformance]

Caulks and sealants:	
Glazing compounds for metal sash	ASTM[1] C669-00.
Oil and resin base caulks	ASTM C570-00.
Acrylic (solvent types) sealants	ASTM C920-98e1.
Butyl rubber sealants	FS[2] Commercial Item Description A-A-272 (6/7/95).
Chlorosulfonated polyethylene sealants	ASTM C920-98e1.
Latex sealing compounds	ASTM C834-00e1.
Elastomeric joint sealants (normally considered to include polysulfide, polyurethane, and silicone)	ASTM C920-98e1.
Preformed gaskets and sealing materials	ASTM C509-00.
Duct sealing mastic	UL[3] 181A-M, Second Edition, 1994 and UL 181B-M, First Edition, 1995.

[1] ASTM indicates American Society for Testing and Materials.

[2] FS indicates Federal Specifications.

[3] UL indicates Underwriters Laboratories.

WEATHERSTRIPPING

[Standards for conformance]

Weatherstripping	Commercially available.
Vapor retarders	Selected according to the provisions cited in ASTM[1] C755-97. Permeance not greater than 1 perm when determined according to the desiccant method described in ASTM E96-00.
Items to improve attic ventilation	Commercially available.

[1] ASTM indicates American Society for Testing and Materials.

HEAT EXCHANGERS

[Standards for conformance]

Heat exchangers, water-to-water and steam-to-water	ASME[1] Boiler and Pressure Vessel Code, 1998, Sections II, V, VIII, IX, and X, as applicable to pressure vessels. Standards of Tubular Exchanger Manufacturers Association, Eighth Edition, 1999.
Heat exchangers with gas-fired appliances[2]	ANSI/UL[3] 462, Ninth Edition, approved by ANSI February 28, 1997.

[1] ASME indicates American Society for Mechanical Engineers.

[2] The heat reclaimer is for installation in a section of the vent connector from appliances equipped with draft hoods or appliances equipped with powered burners or induced draft and not equipped with a draft hood.

[3] ANSI/UL indicates American National Standards Institute/Underwriters Laboratories.

BOILER/FURNACE CONTROL SYSTEMS

[Standards for conformance]

Automatic set back thermostats	Listed by UL[1]. Conformance to NEMA[2] DC3-1989 (R1996).
Line voltage or low voltage room thermostats	Listed by UL. Conformance to NEMA DC3-1989 (R1996).
Clock thermostats	Listed by UL. Conformance to NEMA DC3-1989 (R1996).
Automatic gas ignition systems	ANSI[3] Z21.21-2000. AGA[4] Laboratories Certification Seal.
Energy management systems	Listed by UL.
Hydronic boiler controls	Listed by UL.
Other burner controls . .	Listed by UL.

[1] UL indicates Underwriters Laboratories.

[2] NEMA indicates National Electrical Manufacturers Association.

[3] ANSI indicates American National Standards Institute.

[4] AGA indicates American Gas Association.

WATER HEATER MODIFICATIONS

[Standards for conformance]

Insulate tank and distribution piping	(See insulation section of this appendix)
Install heat traps on inlet and outlet piping	Applicable local plumbing code.
Install/replace water heater heating elements	Listed by UL[1].
Electric, freeze-prevention tape for pipes	Listed by UL.
Install stack damper, gas-fueled	ANSI[2] Z21.66-1996, including Exhibits A & B, and ANSI Z223.1-1999 (same as NFPA[3] 54-1999).
Install stack damper, oil-fueled	UL 17, Third Edition, 1994, NFPA 31-2001, NFPA 211-2000 (same as ANSI A52.1), and ANSI/ NFPA 70-1999 (same as IEEE[4] National Electrical Code).
Install water flow modifiers	Commercially available.

[1] UL indicates Underwriters Laboratories.
[2] ANSI indicates American National Standards Institute.
[3] NFPA indicates National Fire Prevention Association.
[4] IEEE indicates Institute of Electrical and Electronics Engineers.

REPLACEMENT WATER HEATERS

[Standards for conformance]

Electric (resistance) water heaters	10 CFR[1] 430 and UL[3] 174.
Heat pump water heaters	UL 1995, Second Edition, 1995. Electrical components to be listed by UL.
Gas water heaters:	
Rated ≤ 75 kBtu/hr . .	10 CFR 430 and ANSI[4] Z21.10.1-1998.
Rated ≥ 75 kBtu/hr . .	ANSI Z21.10.3-1998.
Oil water heaters	UL 732, Fifth Edition, 1995.

[1] CFR indicates Code of Federal Regulations.
[2] UL indicates Underwriters Laboratories.
[3] ANSI indicates American National Standards Institute.

SOLAR WATER HEATING SYSTEMS

[Standards for conformance]

Solar water heating systems including forced circulation, integral collector storage, thermo-syphon, and self-pumping systems	System must be certified per SRCC[1] OG 300, July 16, 1998.

[1] SRCC indicates Solar Rating and Certification Corporation.

WASTE HEAT RECOVERY DEVICES

[Standards for conformance]

Desuperheater/water heaters	ARI[1] 470-1995 and UL 1995, Second Edition, 1995.
Condensing heat exchangers	Commercially available components installed per manufacturers' specifications. NFPA[2] 211-2000 (same as ANSI A52.1) may apply in certain instances. See also the Heat Exchangers section of this appendix.
Heat pump water heating heat recovery systems	UL 1995, Second Edition, 1995. Electrical components to be listed by UL.
Energy recovery equipment	Energy Systems Analysis and Management, 1997 (SMACNA[3]).

[1] ARI indicates Air Conditioning and Refrigeration Institute.
[2] NFPA indicates National Fire Prevention Association.
[3] SMACNA denotes Sheet Metal and Air Conditioning Contractors' National Association.

BOILER REPAIR AND

Install gas conversation burners	ANSI[1] Z21.8-1994 (for gas- or oil-fired systems), ANSI Z21.17-1998, and ANSI Z223.1-1999 (same as NFPA 54-1999). AGA[2] Laboratories Certification Seal.
Replace oil burner	UL[3] 296, Ninth Edition, 1994 and NFPA 31-2001.
Install burners (oil/gas)	ANSI Z223.1-1999 for gas equipment and NFPA[4] 31-2001 for oil equipment.
Re-adjust boiler water temperature or install automatic boiler temperature reset control	ASME[5] CSD-1-1998, ANSI Z223.1-1999, and NFPA 31-2001.
Replace/modify boilers	ASME Boiler and Pressure Vessel Code, 1998, Section II, IV, V, VI, VIII, IX, and X. Boilers must be Hydronics Institute Division of GAMA equipment.
Clean heat exchanger, adjust burner air shutter(s), check smoke no. on oil-fueled equipment. Check operation of pump(s) and replacement filters.	Per manufacturers' instructions.
Replace combustion chambers	Refractory linings may be required for conversions.

BOILER REPAIR AND MODIFICATIONS/EFFICIENCY IMPROVEMENTS—Continued

[Standards for conformance]

Replace heat ex-changers, tubes	Protection from flame contact with conversion burners by refractory shield.
Install/replace thermo-static radiator valves	Commercially available. One-pipe steam systems require air vents on each radiator; see manufacturers' requirements.
Install boiler duty cycle control system	Commercially available. ANSI/NFPA 70-1999 (same as IEEE National Electrical Code) and local electrical code provisions for wiring.

[1] ANSI indicates American National Standards Institute.
[2] AGA indicates American Gas Association.
[3] UL indicates Underwriters Laboratories.
[4] NFPA indicates National Fire Prevention Association.
[5] ASME indicates American Society for Mechanical Engineers.

HEATING AND COOLING SYSTEM REPAIRS AND TUNE-UPS/EFFICIENCY IMPROVEMENTS

[Standards for conformance]

Install duct insulation . .	ASTM[1] C612-00 (see insulation sections of this appendix).
Reduce Input of burner; derate gas-fueled equipment	Local utility company and procedures if applicable for gas-fueled furnaces and ANSI[2] Z223.1-1999 (same as NFPA[3] 54-1999) including Appendix H.
Repair/replace oil-fired equipment	NFPA 31-2001.
Replace combustion chamber in oil-fired furnaces or boilers	NFPA 31-2001.
Clean heat exchanger and adjust burner; adjust air shutter and check CO_2 and stack temperature. Clean or replace air filter on forced air furnace	ANSI Z223.1-1999 (same as NFPA 54-1999) including Appendix H.
Install vent dampers for gas-fueled heating systems	Applicable sections of ANSI Z223.1-1999 (same as NFPA 54-1999) including Appendix H, I, J, and K. ANSI Z21.66-1996 and Exhibits A&B for electrically operated dampers.
Install vent dampers for oil-fueled heating systems	Applicable sections of NFPA 31-2001 for installation and in conformance with UL[4] 17, Third Edition, 1994.

HEATING AND COOLING SYSTEM REPAIRS AND TUNE-UPS/EFFICIENCY IMPROVEMENTS—Continued

[Standards for conformance]

Reduce excess combustion air: A: Reduce vent connector size of gas-fueled appliances B: Adjust barometric draft regulator for oil fuels	ANSI Z223.1-1999 (same as NFPA 54-1999) part 9 and Appendices G & H. NFPA 31-2001 and per furnace and boiler manufacturers' instructions.
Replace constant burning pilot with electric ignition device on gas-fueled furnaces or boilers	ANSI Z21.71-1993.
Readjust fan switch on forced air gas-or oil-fueled furnaces	Applicable sections and Appendix H of ANSI Z223.1-1999 (same as NFPA 54-1999) for gas furnaces and NFPA 31-2001 for oil furnaces.
Replace burners	See install burners (oil/gas).
Install/replace duct furnaces (gas)	ANSI Z223.1-1999 (same as NFPA 54-1999).
Install/replace heat pumps	ARI[5] 210/240-1994. UL 1995, Second Edition, 1995.
Replace air diffusers, intakes, registers, and grilles	Commercially available.
Install/replace warm air heating metal ducts	UL 181, Ninth Edition 1996, including UL 181A, Second Edition 1994 and 181B, First Edition, 1995.
Filter alarm units	Commercially available.

[1] ASTM indicates American Society for Testing and Materials.

[2] ANSI indicates American National Standards Institute.

[3] NFPA indicates National Fire Prevention Association.

[4] UL indicates Underwriters Laboratories.

[5] ARI indicates Air Conditioning and Refrigeration Institute.

REPLACEMENT FURNACES, BOILERS, AND WOOD STOVES

[Standards for conformance]

Chimneys, fireplaces, vents and solid fuel burning appliances	NFPA[1] 211-2000 (same as ANSI[2] A52.1).
Gas-fired furnaces	ANSI Z21.47-1998 and ANSI Z223.1-1999 (same as NFPA 54-1999).
Oil-fired furnaces	UL[3] 727, Eighth Edition, 1994 and NFPA 31-2001.
Liquefied petroleum gas storage	NFPA 58-2001.
Ventilation fans:	
Including electric attic, ceiling, and whole-house fans	UL 507, Ninth Edition, 1999.

[1] NFPA indicates National Fire Prevention Association.
[2] ANSI indicates American National Standards Institute.
[3] UL indicates Underwriters Laboratories.

AIR CONDITIONERS AND COOLING EQUIPMENT

[Standards for conformance]

Air conditioners:	
Central air conditioners	ARI[1] 210/240-1994.
Room size units	ANSI/AHAM[2] RAC 1-1992.
Other cooling equipment:	
Including evaporative coolers, heat pumps, and other equipment	UL[3] 1995, Second Edition, 1995.

[1] ARI indicates Air Conditioning and Refrigeration Institute.
[2] ANSI/AHAM indicates American National Standards Institute/Association of Home Appliance Manufacturers.
[3] UL indicates Underwriters Laboratories.

SCREENS, WINDOW FILMS, AND REFLECTIVE MATERIALS

[Standards for conformance]

Insect screens	Commercially available.
Window films	Commercially available.
Shade screens:	
Fiberglass shade screens	Commercially available.
Polyester shade screens	Commercially available.
Rigid awnings:	
Wood rigid awnings	Commercially available.
Metal rigid awnings .	Commercially available.
Louver systems:	
Wood louver awnings	Commercially available.
Metal louver awnings	Commercially available.
Industrial-grade white paint used as a heat-reflective measure on roofs, awnings, window louvers, doors, and exterior duct work (exposed)	Commercially available.

REFRIGERATORS

[Standards for conformance]

Refrigerator/freezers (does not include freezer-only units)	UL[1] 250. Replaced units must be disposed of properly per Clean Air Act 1990, Section 608, as amended by 40 CFR[2] 82, May 14, 1993.

[1] UL indicates Underwriters Laboratories.
[2] CFR indicates Code of Federal Regulations.

FLUORESCENT LAMPS AND FIXTURES

[Standards for conformance]

Compact fluorescent lamps	ANSI/UL[1] 542, Seventh Edition, February 6, 1997 and UL 1993, First Edition, 1993.
Fluorescent lighting fixtures	UL 1570, Fourth Edition, 1995.

[1] ANSI/UL indicates American National Standards Institute/Underwriters Laboratories.

ATTACHMENT D TO WEATHERIZATION PROGRAM CONTRACT
NO. UC: PY26/27

EXCERPT FROM

MISSOURI WEATHERIZATION WORK STANDARDS

(AUGUST 2023)

The WEATHERIZATION FIELD GUIDE FOR Missouri explains in detail how weatherization measures should be installed; however, procedures in the Missouri Weatherization Work standards supersede the Field Guide. To read the full Field Guide, visit http://wxfieldguide.com/mo/

All insulation must contain the following minimum recycled content:

Type of Insulation	% Recycled (based on weight of core materials)
Cellulose	75%
Rockwool	75%
Perlite composite board	23%
PIR/PR rigid foam	9%
Foam-in-place	5%
Phenolic rigid foam	5%

CONTRACTOR NAME: _____ **AUTHORIZED SIGNATURE:** _____

Section II: **Health and Safety**

Health and safety issues have become an important part of the Weatherization Assistance Program (WAP) as knowledge about the hazards within dwellings has increased since the Program's inception. When a health or safety hazard is detected, it is the policy of the Department of Natural Resources' Division of Energy (Department), administrator of the Missouri Weatherization Assistance Program, to address the hazard. This policy is tempered by recognition that the primary goal of the WAP is energy conservation and that funds should focus on that goal. Although balance is needed between these competing issues, the health and safety of the building, occupants and weatherization crews or contractors shall not be compromised by any retrofit material, technique or practice.

According to 10 CFR Part 440, allowable energy related health and safety actions are those actions necessary to maintain the physical well-being of both the occupant(s) and/or weatherization workers where:

- Costs are reasonable as determined by DOE in accordance with the Grantee's approved Grantee Plan; AND
- The actions must be taken to effectively perform weatherization work; OR • the actions are necessary as a result of weatherization work.

A sub-grantee must ask themselves two questions:

- What must we do within reasonable costs to get the home to a point we can go forward with weatherizing, where the weatherization work will be lasting and effective?
- What must we do to ensure that the weatherization work we conducted does not create a health or safety problem for the occupant(s)?

Code corrections are allowable health and safety costs when they are required by the local Code Authority in order for weatherization work to be performed. You must note the specific code requirement with reference to the efficiency measure(s) that triggered the code activity. If the code correction cannot be related to weatherization work, then WAP funds cannot be used to make the code correction. An example of this would be bringing handrails up to code. Since it is not related to the installation of the efficiency measures, it would not be an allowable cost. When health and safety costs are not reasonable or beyond the sub-grantees budget, the home may need to be deferred.

Sub-grantees may not provide only health and safety measures on a home without conducting other cost effective weatherization measures. For example, a sub-grantee is not allowed to only install a smoke detector or carbon monoxide detector as a health and safety measure, without energy conservation measures (ECM), such as insulation or air sealing.

The following sections establish areas of concern that may affect the health and safety of the workers and the clients. In most cases, the best approach to limiting the health and safety risk is to minimize their exposure to the hazard. The inability to minimize exposure may result in some or all of the work being stopped on any particular dwelling.

A. Worker Safety

A sub-grantee is responsible for complying with Occupational Safety and Health Administration (OSHA**)** requirements in all weatherization activities that involve staff personnel. When contractors are employed by sub-grantees, those contractors also are required to comply with OSHA. For detailed information on worker health and safety, refer to *Construction Industry OSHA Safety and Health Standards* (29 CFR 1926).

The department expectation is for crews, contractors and auditors to be able to work under conditions that do not jeopardize their own health and safety. The office, warehouse and other workspace owned or rented by each sub-grantee should be a safe and healthy environment.

The contractor cost to comply with OSHA, as applicable, is part of the contracted bid price. Related costs for sub-grantees to comply with OSHA requirements may be charged as tools and equipment. Sub-grantees are responsible for purchasing all OSHA required tools and equipment and are required to immediately repair or replace any defective tool or equipment. Work that threatens worker or client health or safety may not be undertaken.

1. General Guidelines.

The following are general guidelines for accident prevention and should be followed by agencies, crews, auditors and general contractors involved in weatherization work. In addition, this section outlines some of the employer responsibilities to the weatherization crews.

a. The sub-grantee or contractor has the responsibility, as employers, to initiate and maintain such programs as may be necessary to comply with this part.

b. The employer shall provide training in the area of health and safety that will allow weatherization personnel to identify existing and potential threats to the client’s or crew's health and/or safety. Upon the identification of a threat to the client's health and/or safety, the client will be informed in writing as to the available options for dealing with this threat.

c. Design will be incorporated to eliminate or minimize hazards (e.g., material selection, access to equipment for installation and maintenance, placement of equipment, ductwork and condensate lines).

d. The employer shall allow for frequent and regular inspections of the job sites, materials and equipment to be made by competent persons designated by the sub-grantee or state grantee.

e. The employer shall tag all machines, tools, materials or equipment identified as being unsafe making them inoperable by locking the controls or physically removing them.

f. The employer shall permit only those employees qualified by training or experience to operate equipment and machinery.

g. The employer shall require its employees and its representatives to take all reasonable precautions against performing work on homes that will subject clients to health and safety risks. At the time of initial client contact, the weatherization worker will make a cursory evaluation of the individual health of the homes occupants. In cases where a person's health is fragile and/or the crew work activities constitute a health or safety hazard, those occupants at risk will be asked to leave during the work activities.

h. The Department will allow technical waivers for non-performance of audits, installations and/or inspections, or any portion of these functions, if such action will expose workers to conditions regarded as unsafe or unhealthy as determined by OSHA Construction Industry Standards.

i. Expenditure of weatherization funds for materials, protective clothing, respirators, medical exams, proper tools and equipment and other items or activities related to the health and safety of workers are allowable costs under the Missouri Weatherization Assistance Program.

j. When in doubt, sub-grantees should seek consultation services from an OSHA subsidized professional safety consultant (See: OSHA Publication #3047, Consultation Service for the Employer) for identifying hazards and developing a worker health and safety program.

k. First responders (911) will be called when necessary.

2. Sub-grantee Health and Safety Policy

A sub-grantee must have a Health and Safety Policy in place to protect worker health and safety. At a minimum, this policy must contain the following:

a. Safety Data Sheets (SDS) on the job site and available to medical personnel.

b. Employees should know where to go for treatment.

c. A written procedure for reporting medical emergencies.

d. A written procedure for reporting non-emergency accidents.

e. Provision for prompt medical attention for serious injuries.

f. Prompt transportation or a system for contacting an ambulance, in the case of a serious emergency.

g. Telephone numbers of physicians, hospitals or ambulances should be conspicuously posted.

3. Sub-grantee First Aid Program

A first aid program must be in place. At a minimum, the program must include the following:

a. First aid training provided to at least one member of each crew.

b. CPR training provided to at least one member of each crew.

c. One complete first aid kit per vehicle.

d. One eyewash station with at least one refill per vehicle.

4. Sub-grantee Personal Protection Program

Sub-grantees must establish a Personal Protective Equipment Program which will require providing training and wearing of protective clothing. At a minimum, this program must include the following:

a. Respiratory equipment and use training:

(1) Proper respiratory protection will be provided and worn if the risk of airborne contaminants cannot be prevented. (e.g., N-95 or equivalent face mask).

(2) Air purifying masks with an organic vapor cartridge and P-100 particulate filter will be used when applying low-pressure 2-component spray polyurethane foam. Consult SDSs for respiratory protection requirements.

(3) Supplied air respirators (SARs) will be used when applying high-pressure spray polyurethane foam (SPF) insulation. Consult SDSs for respiratory protection requirements.

(4) Supplied air respirator equipment must be fit tested by a trained person and employees must be trained on respirator use.

b. Eye protection shall be made available and worn when appropriate. (e.g., safety glasses, goggles if not using full-face respirator).

c. SDSs and *OSHA* regulations will be consulted for protective clothing and equipment requirements and usage guidelines.

d. Protective coveralls should be made available and worn when needed to protect worker health or safety. If contaminants are present (e.g., insulation materials), removable protective clothing will be worn.

e. Durable and wrist-protecting gloves will be worn that can withstand work activity when hand protection is necessary.

f. Appropriate footwear and clothing will be worn as well as personal protective equipment (PPE) will be used (e.g. knee pads, bump caps, additional padding, etc. on the job sites when needed).

g. Proper lifting techniques will be used when lifting over-size and over-weight objects.

h. Appropriate ventilation, hydration, rest breaks, and cooling equipment will be provided.

i. Ensure staff is aware of risks during summer months, including the symptoms of heat stroke and heat exhaustion.

j. Ensure that auditors are aware of contaminants that can be encountered in and around the home. Sources of contamination such as sewage, dead animals, needles, etc. will be corrected, repaired or removed before performing inspections. If appropriate, the contaminant will be neutralized and/or a protective barrier will be installed in the area. If the contaminates cannot be corrected or protected from the auditor or crewmembers, the home must be deferred.

5. Sub-grantee Tool Safety Program

Agencies must have in place a Tool Safety Program designed to protect employees from work place hazards. This program should ensure the following:

a. All power tools will be inspected and used in accordance with manufacturer specifications to eliminate hazards associated with missing ground prongs, ungrounded circuits, misuse of power tools, noise, and improper or defective cords or extension cords.

b. All tools, including electrical tools, will be assessed and found safe and adequate for the job. Worn or frayed electrical cords will not be used. A three-wire type extension cord will be used with all portable electric tools.

c. All devices used will be verified as ground-fault circuit interrupters (GFCI) or double insulated.

d. Water sources such as drains and condensation pans will be kept separate from all electrical sources.

e. Employees are trained in the safe and proper operation of tools and equipment used in their work. Employees are trained in the hazards of arc flash (refer to NFPA 70E).

f. Safety guards are in place on all tools that come equipped with such devices.

g. Precautions will be taken when ladders are used, when working at heights, or when balancing on joists. Metal ladders will be avoided when possible to prevent electric shock. When scaffolding is used, manufacturer set-up procedures will be followed. Walk boards will only be used when practical.

h. Hearing/ear protection will be provided to individuals working around high-decibel equipment or in high-dust environments.

i. That special precautions are taken if knob and tube wiring is present.

j. Exhaust gases from compressors and generators will be prevented from entering interior space.

k. Hand tools will be used for their intended purpose.

l. It is required that all agency crew and contract workers complete a ten hour Occupational Safety and Health Administration (OSHA) construction safety program (OSHA-10). All crew and contract workers shall complete the course in construction safety and health approved by OSHA or a similar program approved by the Department that is at least as stringent as an approved OSHA program. All employees are required to complete the program within sixty (60) days of beginning work on such construction project. Furthermore, agencies may elect to have contractors, crew leaders and/or crewmembers complete a thirty-hour OSHA construction safety program (OSHA-30). Crew leaders and crewmembers must be able to provide documentation to confirm compliance with OSHA training requirements. Certified AHERA Professionals have met asbestos-specific safety training requirements; therefore, are not required to complete the OSHA-10 training requirement.

6. Sub-grantee Fire Protection Program

Agencies must implement a Fire Protection Program. This program should include the following:

a. Charged fire extinguishers are provided and are located in the sub-grantee offices and warehouse, located in each vehicle and that each is inspected regularly.

b. Training on fire extinguisher use.

c. Fire emergency procedures.

d. The identification and elimination of ignition sources, such as pilot lights, when flammable materials are being used.

e. A reduction in the use of flammable materials and fire rated materials will be implemented.

7. Sub-grantee Job Hazards and Chemical Safety Identification Program

Agencies need to implement a Job Hazards Identification Program. Inspection will be conducted for hazards, such as damaged or exposed electrical conductors, mold, sewage effluent, potential asbestos containing materials, friable fiberglass, pests, and other potential hazards. Agencies Job Hazards Identification Program should include the following:

a. Investigation for job specific safety hazards. Hazardous materials will be handled in accordance with manufacturer specifications or SDS standards to eliminate hazards associated with volatile organic compounds (VOCs), sealants, insulation, contaminated drywall, dust, foams, asbestos, lead, mercury, and fibers. The least toxic suitable material will be chosen.

b. Hazard Communication Procedures that include the following:

(1) Written policies for dealing with job hazards.

(2) All hazardous materials containers labeled with:

(a) Hazardous chemical contents.

(b) Hazard warning appropriate for employee protection.

(c) Legible and prominent labels on all containers.

(3) Means of communication for non-routine tasks and unlabeled chemicals.

(4) A means for the exchange of information between sub-grantees and contractors regarding hazardous materials.

(5) Access and egress points will be located before beginning work.

(6) Identification of spaces with limited ingress and egress and restricted work areas will be considered confined spaces.

(7) Adequate ventilation will be provided.

8. Safety Data Sheet Catalog

Agencies and contractors must develop and maintain a catalog of Safety Data Sheets (SDS) for all hazardous material. A SDS catalog must be made available to all employees, kept on file at the sub-grantee offices and on all job sites. SDS catalogs should be organized and

tabbed, by product, in a binder for quick reference in case of an emergency. The SDS catalog should contain the following:

a. Specific identity of chemical and common name.

b. Physical and chemical characteristics.

c. Known acute and chronic health effects and related health effects.

d. Precautionary measures.

e. Exposure limits.

f. Identification of carcinogens.

g. First aid procedures.

9. OSHA Confined Space Requirements

A confined space is:

- Any space large enough for a worker to enter;
- Has limited means of entry or exit; and
- Is not designed for continuous occupation

According to the OSHA definition, (29 CFR 1926 Subpart AA) attics and crawl spaces are generally considered to be confined spaces. All confined spaces must be evaluated by a trained 'Competent Person', prior to entry, to determine if the confined space is a permit required confined space. If a confined space is determine to be a permit required space, no weatherization work shall take place within that space until the identified hazard(s) has/have been eliminated. For the purpose of weatherization, most permitted confined spaces can be reclassified by removing or controlling the hazard(s). Once the hazard is removed or controlled, weatherization activities can proceed.

B. Building/Occupant Safety

To ensure appropriate consideration for health and safety, relevant procedures and assessments will be conducted as part of the building analysis. Each home weatherized must be individually assessed to determine the existence of potential hazards to workers or clients. When conditions within the home are such that the health and safety of the client, crew or contractor will be jeopardized prior to providing assistance, weatherization must not proceed until such problems are remedied. In some cases, mitigation of problems may be beyond the scope of the WAP. In these instances, the agency must invoke the "Deferral" policy and the client must be notified in writing and referred to any alternative resources that are available for resolution of the problem.

In those instances where the existing conditions pose a threat to the crew or contractor's health and/or safety, the Missouri Weatherization Assistance Program allows technical waivers for any audit or inspection process installation or any portion of the weatherization activity. Efficient auditing protocol would make a deferral determination as early in the inspection process as possible, yet thorough to the point of documenting necessary actions to be taken by the client for weatherization to proceed. Refer to Section II, Subsection D: Required Minimum Sub-grantee Deferral Policy for additional information.

Under the department Health and Safety Standards, the following subsections describe the health and safety assessments and associated actions that must be performed:

1. Carbon Monoxide (CO)

a. When combustion appliances are present in the dwelling, or where there is reason to suspect a significant level of carbon monoxide (CO**)** present in the ambient air (such as with an attached garage) the ambient air will be tested for CO at the initial building audit and immediately after the implementation of weatherization measures. The testing procedure is:

(1) Establish building in the winter (heating season) mode with exterior windows and doors closed.

(2) Calibrate the personal CO monitoring equipment in the outdoor ambient air.

(3) Enter the home and walk-through the various rooms and locations and note any areas where CO above the outdoor ambient air level is found.

(a) If indoor ambient CO levels are lower than 9 ppm above outdoors, proceed with testing of combustion appliances.

(b) If the personal CO monitor indicates an indoor ambient CO level between 9 ppm and 70 ppm, the auditor may complete the mechanical systems audit. The auditor shall advise the homeowner/occupant that CO has been detected, and recommend that all possible sources of CO be checked. Windows and doors will be opened after the mechanical systems audit is complete. 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 owner shall be advised to contact a qualified servicing agent or the agency may proceed following the guidelines given in Section II, Subsection B, Topic 6: Non-Emergency, One-Day Follow-Up Required.

(c) If measurable levels are 70 ppm or higher than outdoors, discontinue testing, remove the occupants, turn off combustion appliances, ventilate the building and contact fuel vendor(s). Sources of high carbon monoxide must be mitigated prior to continuing or completing weatherization work, refer to Section II, Subsection B, Topic 5: Emergency Situations, Immediate Follow-Up Required.

2. **Combustion Safety Alarms**

a. Smoke alarms should be in every home and must be installed if not present in a home receiving weatherization services. Existing smoke alarms will be tested to ensure that they are operational. A smoke alarm should be installed near combustion zone(s) and one near bedrooms. Smoke alarms may be hardwired or battery operated. Refer to the Missouri Weatherization Field Guide for additional detail on installation and consult manufacturers' recommendations.

b. All homes will have at least one functioning CO detector/alarm. Existing CO detector(s)/alarm(s) will be tested to ensure that they are operational. CO detector(s)/alarm(s) must be installed if not present in every home receiving weatherization services. CO detector(s)/alarm(s) will be installed outside of each separate sleeping area in the immediate vicinity of the bedrooms in accordance with *ASHRAE* 62.2 and authority having local jurisdiction. Homes having combustion appliances must have a CO detector/alarm installed in the immediate vicinity of the combustion appliance zone (CAZ). **CO detector(s)/alarm(s) must be installed by the end of the first day of any work commencing at the home.** CO detector(s)/alarm(s) may be hardwired or battery operated. Refer to the Missouri Weatherization Field Guide for additional detail on installation and consult manufacturer's recommendations.

3. Combustion Systems

a. Unvented Space Heaters: the Department considers an operable, unvented space heater in a dwelling a potential health and safety hazard. U.S. DOE now distinguishes between primary and secondary unvented space heaters as heat sources (See Attachment *1.1).* Unvented heaters will be removed from the home except when only used as an emergency heat source, and when it can be confirmed that the unit meets *ANSI* Z21.11.2 standards. Refer to Section III, Subsection G, Topic 2: Unvented Space Heaters for additional information.

b. All conventionally vented (this excludes direct-vent appliances) combustion appliances must be tested for spillage using the worst-case depressurization procedures in Section III. Worst-case depressurization testing **must** always be done before and after all weatherization measures are installed.

(1) If present, the operability of the draft regulator will be verified and tested.

(2) Combustion venting systems will be inspected for damage, leaks, disconnections, inadequate slope, and other safety hazards.

c. Sub-grantees must seek to eliminate conditions where carbon monoxide levels are at or over the levels stated in Section III, Subsection C, Topic 3: Measuring Spillage and CO Under Worst Case Depressurization.

d. Carbon monoxide testing of space and water heating appliances must be done with a digital combustion gas analyzer before dilution air enters the vent system. If there is a flue port opening for each burner, the test must be done in each flue port opening individually.

e. When an atmospheric combustion appliance is located in a bedroom but passes all combustion safety tests, then no action is required since this is a pre-existing condition.

f. When an atmospheric combustion appliance is located in a bedroom and does not pass all combustion safety tests, then as part of correcting the safety issue:

(1) The appliance must be isolated from the bedroom air by drawing combustion air from another appropriate source;

(2) If the appliance is replaced, a sealed combustion system must be installed; or

(3) The appliance should be moved to a more appropriate location.

g. When an atmospheric combustion appliance installed by the Sub-grantee is located in a residential garage and/or adjacent space open to the garage, all equipment and appliances having an ignition source shall be elevated such that the source of ignition is not less than 18 inches above the floor unless listed as flammable vapor ignition resistant.

h. A heat shield must be installed when it is determined that a venting system is too close to combustible materials or the venting system must be moved to ensure proper clearance.

i. All visible fuel lines must be tested for fuel leaks both outdoors and indoors, starting at the meter or LP tank.

j. All non-functioning humidifiers from forced air furnace systems may be removed with prior client approval.

k. All gas valves should have at least a single safety. If a gas valve has no safety, then the sub-grantee should replace the gas valve with the most cost-effective replacement:

(1) A 100% safety millivolt gas valve.

(2) A 100% safety 24 volt gas valve.

(3) A remote bulb gas valve.

l. When there is a suspicion that the pilot safety system is not functioning properly, sub-grantees should perform a simple test of the pilot safety device to ensure that it is functioning properly. Procedures for this test are:

(1) Light pilot and let it warm the thermocouple for at least one minute. Do not operate the heater during this time.

(2) Observe the second hand on a watch or clock, then either blow out the pilot flame or put controller to the off position.

(3) Count the number of seconds from when the pilot is shut off until you hear the sound of the electromagnet valve closing shut. A good drop out time is usually 20 to 30 seconds; longer is better. Heaters equipped with power vents have drop out times of 10 to 15 seconds.

(5) Repeat the test to confirm it is consistent.

m. Sub-grantees should use a non-contact voltage sensor to ensure that the main switch will properly turn off the electricity to a space-heating unit.

n. All 110 volt wiring connections should be secured with wire nuts and electrical tape, and enclosed in an electrical junction box or other appropriate enclosure.

o. The proper size and type of wire should be used. The wire should have the correct rating for voltage, amperage and heat exposure.

p. Draft hoods, draft diverters, and barometric dampers should be well secured to the appliance, level, and should not reduce or restrict the size of the vent.

q. All gas ranges should be tested for carbon monoxide according to Section III: Mechanical Systems and Combustion Appliances.

r. Flexible gas connectors should be installed so that they do not pass through the appliance housing, cabinet or casing. Semi-rigid tubing and listed connectors shall be permitted to extend through an opening on an appliance housing, cabinet or casing where the tubing or connector is protected against damage.

s. All direct vent (sealed combustion) water heating and space heating appliances must be tested for carbon monoxide, as per Section III, unless the tests cannot be safely performed due to access limitations.

4 **Response to Combustion Appliance Problems**

a. The sub-grantee should determine if it is best to contact the local gas company or oil dealer to correct these problems. Gas utilities have their own emergency response protocols and these should be respected. The items listed below are not intended to interfere with gas utilities emergency protocols (often called tagging procedures).

b. In each of the situations in Section II, Subsection B: Building and Occupant Safety, Topics 4-7, the auditor or appliance technician will evaluate the client's situation, in

consultation with the Sub-grantee Weatherization Director, for the purpose of determining if:

(1) The client can safely remain in the home if an alternative source of heat (portable electric space heaters) can be obtained or whether the client must relocate for a short time.

(2) If the technician believes the client cannot safely remain in the home, the client will be advised to make arrangements to stay with family or friends until the unit can be occupied again.

5. Emergency Situations: Immediate Follow-up Required

Some safety problems may warrant a discontinuing of the combustion appliance testing or shutting off the appliance until the repairs can be made. The client must be notified of any issues and of any methods used to address the emergency situation until repairs can be made. Whenever a technician questions the safety of a situation, they should consult a supervisor.

Examples of this type of situation are:

a. ***Major Natural Gas Leak*:** Gas can be smelled more than two feet from the gas line.

b. ***Major Propane Gas Leak*:** Propane can be smelled more than three feet from the leaking fitting.

c. ***Clogged or Disconnected Flue*:** A clogged or disconnected flue that cannot be fixed, causing significant spillage of combustion products into a heated space or working area of the technician.

d. ***Back drafting or Spillage under Natural Conditions*:** Any combustion appliance that back drafts or has combustion gas spillage from the flue or vent connector under natural conditions. Refer to Section III, Subsection C: Combustion Appliance Zone (CAZ) and Carbon Monoxide Testing for additional information.

e. ***Cracked Furnace Heat Exchanger*:** Any visually identified cracked heat exchanger leaking combustion products in combination with carbon monoxide or others.

f. ***Other Hazards*:** Any other situation or combination of situations which the technician or supervisor judges hazardous to the health of the client or others (e.g. ambient indoor CO above 70 ppm as compared to outside).

6. Non-Emergency: One-day Follow-up Required

Some situations may not warrant discontinuing testing or shutting down the heating system, but are serious enough to require attention within twenty-four hours. The client must be

notified of any issues and of any methods used to address the situation. Examples of this type of situation are:

a. ***Cracked Heat Exchanger*:** Visually identified cracked heat exchanger that is leaking combustion products, with no carbon monoxide indications.

b. ***Spillage*:** Spillage but no carbon monoxide indications inside the thermal boundary.

c. ***Propane or Natural Gas Leak*:** Combustible gas can be smelled, but not more than three feet from the leaking fitting for propane and not more than two feet away from the leaking fitting for natural gas.

d. ***Carbon Monoxide*:** Measured carbon monoxide levels must comply with standards set in Section II, Subsection B, Topic 1: Carbon Monoxide (CO) and/or Section III, Subsection C, Topic 3: Measuring Spillage and CO Under Worst Case Depressurization and there must be an adequate draft and no spillage.

e. ***No Limit Switch*:** A furnace with no limit switch that poses a safety issue or a limit switch that is disconnected.

7. Non-Emergency: Five-day Follow-up Required

All other safety related follow-up must begin within five days unless the system or service can be shut-off until repairs are made. The client must be notified of any issues and of any methods used to address the situation until repairs can be made. Examples of this type of situation are:

a. ***Draft*:** Unacceptable draft with spillage outside the thermal boundary.

b. ***Propane or Natural Gas Leak*:** Gas can be detected by a combustible gas leak detector but not prominently by smell.

c. ***Limit*:** A furnace limit switch that does not shut the gas off by 225° F.

d. ***Suspicion of a Cracked Furnace Heat Exchanger*:** A cracked heat exchanger is suspected, but there are no other apparent problems with the furnace.

e. ***Back drafting or Spillage under Worst Case Depressurization Conditions*:** Any combustion appliance that back drafts or has combustion gas spillage from the flue or vent connector under worst-case depressurization conditions. Refer to Section III, Subsection C: Combustion Appliance Zone (CAZ) and Carbon Monoxide Testing for additional information.

Note: In the event of a Health and Safety Emergency on a home that requires Section 106 review, performing the emergency measures prior to SHPO approval may be required. This is allowed as long as no other measures are addressed without the

required SHPO approval. See Section XIII, Subsection A, Topic 4: Emergency Situation Undertakings for more information

8. Blower Door Safety

a. Do not conduct a depressurization blower door test while a wood stove, fireplace or a vented space heater is operating. If one of these appliances is operating, it **will not** be considered sufficient reason for never conducting a blower door test. Weatherization personnel are expected to shut down the appliance to conduct the test or revisit the dwelling at a time when the appliance is not operating.

b. Do not conduct a depressurization blower door test when any combustion appliance is operating. Standard practice is to positively shut off conventionally vented combustion appliances before the blower door test is conducted. A procedure should be in place to ensure that the appliance is returned to the pretest condition. Exceptions to appliance shut down include:

(1**)** Direct-vent (sealed combustion appliances)

(2**)** Unvented gas appliances, such as most gas ranges.

c. For homes that contain vermiculite or friable asbestos, refer to Section II, Subsection B, Topic 10: Hazardous Conditions and Materials, Subtopic e, Detail 2 for further information.

9. Moisture

All homes should be checked for previous or existing moisture problems. Every client must receive the EPA booklet: *A Brief Guide to Mold, Moisture and Your Home*. Repair of moisture problems that might result in health problems for the client, damage the structure over the short- or long-term, or diminish the effectiveness of the weatherization measures, must be done before the weatherization job is completed. Major drainage issues beyond the scope of the Weatherization Assistance Program or homes with conditions that may create a serious health concern should be deferred.

Limited water damage repairs that can be addressed by weatherization workers and correction of moisture and mold creating conditions are allowed when necessary in order to weatherize the home and to ensure the long-term stability and durability of the measures. Mold cleanup is generally not an allowable Health and Safety cost. Where severe mold and moisture issues cannot be addressed, deferral is required. Severe mold issues would include, but are not limited to moldy areas larger than about 10ft², mold in HVAC system or mold caused by sewage or other contaminated water. Moldy areas less than a total of 10 ft² can be remediated if it inhibits the installation of an ECM. The cost must be included in the ECM and the ECM must remain cost-effective.

Testing for high moisture in a material is an allowable health and safety expense. However, testing for mold is not an allowable health and safety expense. The agency must notify the

client when mold is found and provide the client with notification and disclaimer on mold and moisture awareness.

a. The moisture assessment section of the Auditor Field Form must be filled out along with special attention to the following:

   (1) Evidence of condensation on windows and walls indicated by stains or mold.

   (2) Standing water, open sumps, open wells, dirt floors, water stains, etc. in basements. Also, check to see if firewood is stored in the basement and/or whether laundry is hung to dry during the winter months.

   (3) Leaking supply or waste pipes.

   (4) Attic roof sheathing shows signs of mold or mildew.

b. Identification of existing or potential moisture problems shall be documented in the client file.

c. If existing moisture problems are found, the home should be deferred until the source of the moisture can be substantially reduced or effective mechanical ventilation can be added to remove the moisture. In some cases, air sealing must be done in order to reduce the source of the moisture (e.g. sealing off crawl spaces from the house, or sealing attic leakage to eliminate condensation on the roof deck).

g. Because air tightening may cause an increase in relative humidity, client education should include information about moisture problems and possible solutions.

h. In the course of weatherization, low-cost measures that help reduce the humidity levels in the house should be installed. Examples of these activities are venting dryers, venting existing bath or kitchen exhaust fans to the outdoors or installing moisture barriers on dirt floors.

i. A dwelling that is in compliance with ASHRAE 62.2 is no guarantee that moisture will not be a problem in that home.

j. Whenever site conditions permit, exposed earth must be covered with a vapor barrier, except for mobile homes or site built homes with a vented crawlspace in which the floor above the crawl space is the thermal and pressure boundary.

   (1) For crawl spaces, install a 6-millimeter or thicker (no more than 0.1 perm) polyethylene vapor barrier on the earthen floor. When seams exist, they should overlap at least 12 inches and the seams sealed with a durable sealant compatible with the barrier. The polyethylene should extend 6 inches up and be sealed to the crawl space wall. One hundred percent of the exposed crawl space floor will be covered, where possible.

(a) Care will be taken to prevent punctures during installation.

(b) When vapor barrier or other weatherization measures are installed in a crawl space, then a lockable access will be provided if access to the crawl space is from the exterior.

(c) When vapor barrier or other weatherization measures are installed in a crawl space, then a durable, easily seen sign will be installed inside the crawl space at all accesses providing the following information:

- Those entering the crawl space will be cautioned not to damage the air barrier, ground moisture barrier, insulation, and mechanical components specific to the crawl space type.
- Anyone entering the crawl space will be alerted that immediate repairs are needed in case of damage.
- Language prohibiting storage of hazardous and flammable materials will be provided on site.

(d) When vapor barrier or other weatherization measures are installed in a crawl space, then the clients will be educated on the crawl space system and how to maintain it; as follows:

- Occupants will be given written documentation that describes components of the system, maintenance requirements, and health and safety considerations at a minimum. Information will be provided in simple terms using text and pictures.

- Documentation may be provided electronically.

- Literacy levels and language of occupants will be considered in selecting appropriate materials.

(2) For basements, install a 6-millimeter or thicker (no more than 0.1 perm) polyethylene moisture barrier on the floor. When seams exist, they should overlap at least 12 inches and the seams sealed with a durable sealant compatible with the barrier. The polyethylene should extend 6 inches up and be sealed to the basement wall. The sub-grantee may lay rolled roofing on top of this polyethylene to provide a safe walkway for clients. Talk with clients about where this rolled roofing should be placed and try to minimize the amount used.

k. In homes that do not have a sump pump installed, it **is** an allowable expense to install a sump pump into a home. If a sump pump is present but not working, it is also allowable to replace a sump pump as a health and safety measure. All sump pumps must be in a sealable pit/container with a lid to help minimize soil gases and excess moisture.

10. Hazardous Conditions & Materials

a. A Hazard Identification and Notification Form (Attachment 2.5) must be completed at every home. One signed copy must be left with the client and one signed copy must be placed in the client's file.

b. If any testing is performed to identify or quantify hazardous materials (asbestos, lead, radon, etc.), the client (and landlord/property manager, if applicable) must be notified in writing of the results of the tests.

c. Sub-grantees should minimize or restrict the use of materials that may be hazardous to the client, however if the sub-grantee must utilize hazardous materials, including chemicals, such use must be discussed with the client prior to using.

d. A sensory inspection (visual/olfactory) for volatile organic compounds (VOCs) and flammable liquids. If VOCs or flammable liquids are detected, which would make weatherization impossible, impractical, inhibit the installation of significant weatherization measures, or would pose a hazard to weatherization workers, the home should be deferred.

e. The installation of hazardous materials that must be used for effective weatherization must be used in well-ventilated areas.

f. Radon Procedures:

(1) All clients must be provided with and sign a copy of the *Radon Informed Consent Form* (Attachment 2.12) prior to any work being performed on the home. If a client will not sign the form, the home must be deferred.

(2) All clients must be provided a hard copy of the *EPA Consumer's Guide to Radon Reduction*, available at https://www.epa.gov/sites/default/files/2016-12/documents/2016_a_citizens_guide_to_radon.pdf

(3) In homes where radon may be present, precautions should be taken to reduce the likeliness of making radon issues worse. This may include installing a vapor barrier, sealing floor/foundation penetrations, capping open sump pump pits, installing crawlspace venting or improving existing venting, mechanical ventilation, isolating basement (air sealing) from the living space, etc.

(4) DOE allows radon testing in areas where there is a high radon potential (zone 1). The following ten northwestern and one southeastern counties are in zone 1 which are in the EPA's high potential for indoor radon levels where testing is allowed as a health

and safety expense; Cass, Jackson, Clay, Clinton, Platte, Buchannan, Andrew, Nodaway, Holt, Atchison and Iron counties. If testing is performed, it will be done in accordance with the Environmental Protection Agency (EPA) Healthy Indoor Environment Protocols for Home Energy Upgrades and the results will be provided to the client.

g. Asbestos Procedures:

(1) Prior to performing work or conducting blower door tests, the energy auditor must conduct an inspection for materials suspected of containing asbestos if there is the possibility that they may be disturbed during the weatherization testing or work.

(2) If it is determined that friable asbestos is present in a dwelling, a blower door test must not be performed. If vermiculite is present in a dwelling and has not returned a negative test for asbestos, a depressurization blower door must not be performed; however, a pressurization blower door test may be performed.

(3) Decisions on approaches to weatherization work where asbestos is present shall be based on the judgment of the most qualified individual available to the sub-grantee.

(a) If suspected asbestos containing materials (ACM) are in good condition, do not disturb.

(b) If suspected ACM is damaged (e.g., unraveling, frayed, breaking apart) but will not be disturbed by weatherization activities, avoid the area and any contact with the suspected ACM. Clients should be informed of the ACM and should be instructed not to disturb suspected asbestos containing material.

(c) For suspected ACM that must be disturbed as part of the retrofit activity, contact an AHERA certified asbestos professional for abatement or repair in accordance with federal, state, and local requirements; only a licensed or trained professional may abate, repair, remove, or encapsulate ACM.

(4) Asbestos siding cannot be cut or drilled. Removal of siding is allowed to perform energy conservation measures. Only the siding necessary to perform the weatherization measures may be removed. If the asbestos siding is removed and disposed of, then disposal is an allowable health and safety expense. Asbestos siding must be disposed of in accordance with local ordinances and landfill protocol. Sub-grantees must contact associated landfills for disposal procedures prior to disposal.

(5) When major energy saving measures might be sacrificed as a result of suspected asbestos containing materials, the sub-grantee must have the suspected material tested for asbestos content. This testing is an allowable health and safety expense or may be included as a part of the cost of the associated energy conservation measures. EPA standards are; if a material has less than or equal to one percent asbestos, the material is considered to be below the hazardous threshold and therefore weatherization may

proceed as if asbestos is not present. If the material contains greater than one percent asbestos, the material may be encapsulated by an AHERA asbestos control professional. Containing the asbestos is an allowable health and safety expense.

(a) Any potential asbestos-containing material that is tested for the presence of asbestos must be collected on-site by an AHERA certified professional. The certified professional must be listed on the Missouri Department of Natural Resources' Asbestos Building Inspector List: http://dnr.mo.gov/env/apcp/asbestos/inspectors/index.php.
If the sub-grantee has the potential asbestos containing materials tested, the sub-grantee must formally notify the client by mail if the tests results are positive for asbestos and the notification shall be signed by the client.

(b) The testing results from suspected asbestos containing materials must be kept in the client file.

(c) Homes containing vermiculite must be evaluated for the installation of insulation. If insulation has a SIR of 1.0 or greater, then the vermiculite must be tested for asbestos. If the vermiculite contains greater than one percent asbestos, then the insulation must be removed from the computerized audit and work order.

(6) All sub-grantee workers must wear high quality respirators when working with suspected ACM's.

(7) When materials containing asbestos are worked with, the asbestos materials should be dampened with water whenever possible to reduce the risk of airborne asbestos fibers.

(8) When working around ACM's, do not:

- Dust, sweep, or vacuum asbestos containing debris
- Saw, sand, scrape, or drill holes in the material
- Use abrasive pads or brushes to strip materials

(9) Sub-grantees may use abatement contractors to remove and/or dispose of ACM's with prior written authorization from the Missouri Weatherization Program Administrator however; removal of vermiculite, which has been tested to contain greater than one-percent asbestos, is not allowed.

h. Confined Space (attic and crawlspace) Procedures

(1) Attic and crawlspaces are covered under the OSHA confined space regulations. All work in crawlspaces and attics must comply with OSHA confined space regulation 1926.1200.

(2) A home that contains a permit required confined space in which weatherization measures are to be performed must be deferred pending the remediation of the hazard(s) creating a permit required confined space.

Examples:

(a) If loose electrical wiring in an attic is creating an electrical hazard, which causes the attic to meet the requirements of a permit required confined space; work must be deferred until the electrical hazard is remediated. Remediation could include switching off the breaker associated with the wiring allowing for weatherization work to be completed without the electrical hazard.

(b) If a sewer leak in a crawlspace creates an atmospheric hazard, which causes the crawlspace to meet the requirements of a permit required confined space; work must be deferred until the atmospheric hazard is remediated. Remediation would likely require deferral of all work on the home until the client is able to have the sewer leak fixed.

11. Electrical Safety

a. Minor upgrades and repairs to knob and tube wiring, when necessary for weatherization measures and where the health or safety of the occupant is at risk are allowed as a health and safety measure. Knob and tube wiring cannot be replaced as a health and safety.

(1) A contractor, assessor, auditor, or similar will inspect and assess the house to identify knob and tube wiring.

(2) A non-contact testing method will be used to identify live wiring.

(3) If live knob-and tube wiring is to remain in an attic and the attic is to be insulated, the knob and tube wiring will not be covered or surrounded. A dam that does not cover the top will be created to separate insulation from the wire path. Any insulation must be kept at least three inches from the wiring.

(4) If any live knob and tube wiring is to remain in the dwelling, the walls of the dwelling must not be insulated unless a certified electrician inspects the building and provides a letter, on company letter head, that no knob and tube wiring is present in the exterior walls of the home.

(5) Live knob and tube wiring may be replaced with WAP funds in attics and walls provided that the cost of the replacement, when added to the cost of the attic or wall insulation, has an SIR of 1.0 or greater. Knob and tube wiring may also be replaced as an incidental repair tied to attic or wall insulation, but the cost of replacing knob and tube wiring cannot be split between an incidental repair and being included as part of the cost of the associated ECM. Knob and tube wiring cannot be replaced as a health and safety measure.

(a) When replaced, knob and tube wiring will be replaced with new appropriate wiring by a licensed electrician in accordance with local codes. Any remaining knob and tube wiring will be rendered inoperable in accordance with local codes. If knob and tube wiring has been deactivated and the dwelling has been rewired with approved electrical cable, the attic may be insulated without special precaution.

b. Replacing an electrical service panel is not an allowable measure. Minor electrical repairs, other than knob and tube wiring, are allowed as a health and safety measure when the occupant is at risk. Minor upgrades and repairs are allowed when necessary to perform specific weatherization measures.

c. Ground-fault circuit interrupter (GFCI**)** devices should be tested to ensure that they are working properly in dwelling bathrooms and kitchens.

12. Lead-safe Weatherization

Lead-based paint dust and other residues are hazards that Weatherization workers are likely to encounter in older homes. HUD estimates that four million homes have significant lead-based paint hazards. Furthermore, Weatherization work may directly disturb lead-based paint, possibly creating hazardous conditions. DOE's policy is that Weatherization workers must be aware of the hazard and conduct Weatherization activities in a safe work manner to avoid contaminating homes with lead-based paint dust and debris, and to avoid exposing the occupants, themselves and their families to this hazard. Presence of lead based paint in pre-1978 homes will be assumed unless testing confirms otherwise. The protocols used to safe guard people from lead-based paint hazards are called Lead Safe Weatherization (LSW**)**. Deferral is required when the extent and condition of lead-based paint in the house would potentially create further health and safety hazards.

Compliance is required with EPA's Renovation, Repair, and Painting (RRP) Rule. To comply with EPA's RRP Rule requirements renovations must be performed by Certified Renovation firms. Each sub-grantee must become a Certified Firm. To become a Certified Firm, sub-grantees and renovation firms must submit an application to EPA and pay a fee. Sub-grantees are also reminded that compliance with any other state/local requirements are the sub-grantees' responsibility to research and to include in their curriculum. The EPA, RRP published rule (40 CFR Part 745) and the proposed changes to this rule (Federal Register/Vol. 75, No. 87/May 6, 2010) will be complied with, to be superseded by any subsequent final rulemaking or any more stringent state or federal standards. The Certified Firm responsibilities as detailed by the RRP rules are:

- Ensure overall compliance with the RRP rule.
- Ensure that all renovation personnel are Certified Renovators or have been trained on the job by Certified Renovators.
- Assign a Certified Renovator to all jobs.
- Meet pre-renovation education requirements.

- Meet recordkeeping requirements.

Certified Renovators will be a required position for pre-1978 job sites, which have not been certified as lead free. The Certified Renovators must be trained and receive their credential at an EPA-accredited training facility and be onsite at all LSW sites to perform the mandated functions of the Certified Renovator. Sub-grantees will be required to provide documentation of the Certified Renovator credentials, ensuring they are qualified to perform the specific functions of the Certified Renovator. The Certified Renovator responsibilities as detailed by the RRP rules are:

- Perform work and direct LSW practices.
- Provide on the job training to non-certified workers.
- Keep a copy of the initial and/or refresher training certificates on site.
- When requested, use EPA recognized test kits or collect paint chip samples for laboratory lead analysis to identify lead based paint.
- Be physically present while posting signs, containing work areas and cleaning work areas.
- Be available by telephone when offsite.
- Maintain the containment to keep dust and debris within the work area.
- Implement the cleaning certification procedure.
- Prepare and maintain required records.

a. Lead Safe Weatherization should be performed by Weatherization agencies when all of the following criteria are true:

(1) The dwelling was constructed pre-1978, and

(2) The dwelling has not been certified to be lead-based paint free, and

(3) Either, the total amount of disturbed lead-based painted surface exceeds six square feet per room of interior surface, twenty square feet of exterior surface or a window or door will be replaced.

b. Lead Safe Weatherization protocol should include the following:

(1) Weatherization sub-grantees will provide a copy of the pamphlet, “Renovate Right: Important Lead Hazard Information for Families, Child Care Providers and Schools” Pamphlet, to inform the household of the potential risk of the lead hazard exposure.

(2) Sub-grantees are required to have the client sign a form confirming receipt of the lead pamphlet.

(3) Weatherization workers are required to be trained in LSW. This training may take place on the job site by a Certified Renovator. This training is an allowable use of DOE funds. Documentation of the training must be available onsite and follow all applicable EPA rules.

(4) For all pre-1978 homes that are not exempt from LSW based on the work being performed, documentation in the client file must include:
- Copy of Certified Renovator certification;
- Documentation of any lead safe work training provided on-site;
- description of specific lead safe work actions taken, if any;
- documentation of lead testing and assessment when performed;
- photos of site and containment setup (or reference to location of digital pictures) if lead safe work performed

13. Mercury

When new thermostats are installed as a weatherization measure, identify, remove and dispose of any mercury-containing thermostats. Mercury-containing thermostats must be either recycled or disposed of in accordance with Environmental Protection Agency (EPA) and department regulations, which require that mercury-containing thermostats be recycled or disposed of as a hazardous waste.

Thermostat Recycling Corporation is a non-profit organization that lists collection sites or can have a subgrantee become a collection site, which collects mercury-containing thermostats for proper recycling. More information may be found at www.thermostat-recycle.org.

14. Pest Infestation

Pest removal is allowed only where infestation would prevent weatherization. Infestation of pests may be cause for deferral where it cannot be reasonably removed or poses health and safety concern for workers. Screening of windows and points of access is allowed to prevent intrusion.

a. The agency must first assess the situation and the severity of the infestation. If the infestation cannot be easily corrected, then the home must be deferred. If the infestation is not severe, the pests can be easily eradicated and entry holes plugged, then it is an allowable health and safety expense, given that the costs are within reason. Reasonable costs for pest infestation remediation should be less than $600. If the cost is higher than $600, contact the department prior to remediation. For example, if there is a squirrel getting into the attic, and the agency can easily get the squirrel out and repair the entry holes into the attic to prevent re-entry, then it would be a health and safety expense. On the other hand, if the attic is infested with bats the subgrantee must contact the Department for next steps, then the home should be deferred until the bats can be removed, entry hole repaired and any waste material removed from the attic.

b. The agency must notify the client of any infestation and inform them of the hazards associated with the pest.

15. Additional Safety

a. Special precautions must be taken if the occupant of the home has respiratory ailments, allergies, is pregnant or has unique health concerns. Subgrantees should try to protect all clients from inhalable particles, such as paint or insulation dust, during the weatherization process. When the occupant is identified as having a health risk which may be affected by any part of the weatherization process, the agency must ensure the client takes appropriate action to protect them self from the hazard. It is not the responsibility of the agency to remove and or relocate the occupant from the home to allow for weatherization; however, it is the responsibility of the agency to assure the occupant is protected, or has taken adequate precautions to protect themselves. If the client has a health risk, which may be exacerbated by the weatherization measure, and the client refuses to take the appropriate precautions, such as leaving the home during weatherization, then the home may be deferred.

b. At a minimum, auditors and crewmembers should inform property owners of safety problems, code problems and other health and safety issues. Minor repairs and installation may be conducted only when necessary to effectively weatherize the home; otherwise, these measures are not allowed. For problems that are life threatening, or otherwise serious, the subgrantee supervisor should contact the jurisdiction having responsibility for the observed problem.

c. The auditor should be cognizant of fire hazards and address them only when necessary to perform weatherization. If the agency identifies a fire hazard that is not related to a weatherization measure, the agency may not make the repair; however, the agency must notify the client of the fire hazard.

d. Fire extinguishers may be installed as a health and safety measure whenever the client is using a solid fuel source of heat such as wood, wood pellets, etc. A maximum of one fire extinguisher per floor may be installed by the agency. All fire extinguishers installed by the agency must be mounted.

e. All materials replaced or removed from a client’s property must be disposed of according to the manufacture’s specifications and appropriate federal guidelines, as well as all applicable codes and ordinances.

C. Mechanical Ventilation/ASHRAE 62.2 Standards

A Subgrantee is responsible for complying with the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standards 62.2-2013. Work should be deferred on any home that cannot be brought in compliance or client will not allow to be brought in compliance with ASHRAE 62.2 Standards as it relates to the Missouri State Plan.

1. General Guidelines

a. All clients who have a mechanical ventilation installed must be provided a copy of Attachment 3.6- Ventilation for You and Your Home.

b. All homes will be required to comply with ASHRAE 62.2 standards to the fullest extent possible as determined within these standards.

c. All existing exhaust fans that do not vent to the exterior of the building must be vented to the exterior of the building. Herein venting to the exterior of the building requires that the vent exhaust directly to the outdoors. Exhaust air shall not discharge into an attic, soffit, crawl space or other areas inside the building shell.

(1) No more than 6 feet of flexible tubing per ventilation fan may be used on ventilation system ductwork installed by the subgrantee. Existing ventilation fans are not required to have new ductwork installed, given the existing ducting is vented to the exterior of the building.

(2) All ventilation system ductwork installed by the subgrantee, which is outside the thermal boundary, must be insulated to a minimum R-8 value. Bubble wrap (foil faced or non-foil faced) should not be used to comply with the minimum R-8 value required for ventilation system ductwork, as bubble wrap applied to the surface of ductwork only provides a value of R-1.0 to 1.1.

(3) A backdraft damper must be present or will be installed between the outlet side of installed fans and the exterior.

(4) The terminations of all ventilation ductwork installed by the subgrantee must include screen material with no less than ¼ inch and no greater than ½ inch hole size in order to prevent pest entry. The installation of the screen must not inhibit damper operation or restrict airflow.

(5) All ventilation ductwork installed by the subgrantee must terminate a minimum of 3 feet from any operable opening to houses and a minimum of 10 feet from any mechanical intake.

(6) If any mechanical ventilation installed by the subgrantee shares a common exhaust duct with one or more additional exhaust fan, each fan shall be equipped with a backdraft damper to prevent the recirculation of exhaust air from one room to another through the exhaust ducting system.

(a) Exhaust fans shall not share a common exhaust duct with a dryer.

(b) Exhaust fans in separate dwelling units shall not share a common exhaust duct.

d. Garages that are attached to the thermal boundary space of a home must be isolated to prevent the migration of contaminants from the garage into the home prior to commencing weatherization work. An attached garage are those which are in direct contact with or within the thermal boundary of the home, fully enclosed on all sides when

all windows, doors and points of egress are closed and be readily available for the storage of a motorized vehicle, excluding the accumulation of personal belongings.

(1) To be considered isolated, all joints, seams, penetrations, and other sources of air leakage through wall and ceiling assemblies separating the garage from the residence shall be caulked, weather stripped, wrapped or otherwise sealed to limit air movement. Doors between garages and habitable spaces shall have weather stripping, door sweep, and threshold installed if not present to prevent air leakage and pollutant entry.

(2) If supply vents or return grills are located in the garage, these vents/ grills must be permanently removed and sealed. (For detailed guidelines, see SWS 6.6188.1)

(3) All supply and return air ductwork located in garages shall be sealed or removed, unless the ductwork cannot be accessed due to safety restrictions. When removing the ductwork, the supply run feeding the register will be truncated as near to the supply plenum as possible. A return duct located in the garage will be removed in the same manner. All holes in the duct system created by removal will be patched with sheet metal and sealed with mastic.

(4) If no wall is present to separate a tuck-under garage from a conditioned basement, a wall may be constructed as a Health and Safety measure to comply with ASHRAE 62.2 standards.

(5) An overhead garage door shall be removed and replaced with a wall and walk through exterior door when a garage has previously been converted to a conditioned space and the overhead door is still present. If the occupant/owner will not allow the garage door to be removed, the garage must be removed from the conditioned space or the home deferred.

e. All supply and return air ductwork located outside of the thermal boundary shall be sealed, unless the ductwork cannot be accessed due to safety restrictions. Ductwork may be considered sealed if the ductwork is encased by existing duct insulation or the ductwork meets the duck leakage standards given in Section IV, Subsection F, Topic 2: Duct Leakage Standards.

f. All clothes dryers, both gas and electric, must be vented to the exterior of the building. Every attempt to vent the dryer to the exterior of the home must be made. If it is not possible to vent the dryer to the outside, please consult the department for guidance.

g. A basement or crawl space with exposed earthen floors, where a 6 mil polyethylene vapor barrier cannot be installed or only partially installed, must be considered outside of the thermal boundary of the home.

h. A ventilation fan manual of operation designed by the subgrantee shall be provided to the client. The manual must include operation instructions and the basic maintenance

required for all retrofit or installation/replacement ventilation systems and the appropriate ventilation system settings to comply with ASHRAE 62.2.

i. The handout "Ventilation for You and Your Home" (Attachment 3.6) should be given out to every client that has mechanical ventilation installed or retrofit to comply with ASHRAE 62.2 Standards.

j. Whole house fans and kitchen range recirculating fans are not considered in the ASHRAE 62.2 Standards. Whole house fans and kitchen range recirculating fans shall not be measured and cannot be used to comply with ASHRAE 62.2.

k. Care needs to be taken when determining how infiltration reduction will be performed on the home. Points of infiltration to allow for fresh air to enter the home should remain in direct connection to the exterior of the home, such as around doors and windows. Fresh air infiltrating into the home should not be drawn from the attic, crawl space or other undesirable location, as these locations have a higher likelihood of drawing undesirable sources of air into the home.

l. The retrofit of an existing ventilation fan or the installation/replacement of a ventilation fan to comply with ASHRAE 62.2 must be considered a health and safety measure.

m. If a home situation, configuration or compliance within a home is not otherwise covered within Section II, Subsection C: Mechanical Ventilation/ASHRAE 62.2 Standards, contact the department for further guidance.

2. Inspection of Existing Ventilation

a. All existing exhaust fans in the kitchen and bathrooms must be tested to measure the actual cubic feet per minute (CFM) of airflow that is being exhausted. CFM measurements must be taken on all existing fans during both the initial audit and final inspection. The manufacturers CFM rating of the fan cannot be used to determine the actual CFM flow of the fan.

b. Any exhaust fans that are not in the kitchen or bathrooms should also be tested to measure the actual CFM of airflow that is being exhausted and considered in the ventilation requirements.

c. The actual CFM shall be taken directly from the test results of a commercially available fan flow meter or by using a pitot tube or a custom-built box to simulate a fan flow meter.

(1) Pitot Tube Procedure:

(a) Connect Pitot tube to channel A on DG700.

- Connect bottom port to input and side port to reference.
- Must have a positive reading when measuring Pascal.

(b) Take a single reading in the center of the duct and multiply the reading by 0.9.

(c) Divide that answer by 250 to convert Pascal to inches of water column (IWC).

(d) Take the square root of the IWC times 4,005. This is the FLOW VELOCITY.

(e) Determine the Cross Sectional Area of the duct in **square feet**.

- Round Ducts: $A = \pi r^2$
- Square Ducts: A= height x width

(f) FLOW VELOCITY times CROSS SECTIONAL AREA = CFM

(2) Custom Built Box Procedure:

(a) Construct a box to simulate a fan flow meter when measuring fan intakes that the commercially available fan flow meter will not fit. The box will have a specific size hole similar to the opening in a fan flow meter.

(b) A hose will connect the box to the input of a manometer.

(c) The square root of the pressure difference in Pascal as read on the manometer times the square inches of the hole in the box = CFM. CFM = ($\sqrt{}$pressure difference in Pascal on manometer) * (sq. inches of hole in measuring device).

d. It must be determined and documented during the testing of the existing exhaust fans if the fan is rated for continuous use or is rated as an intermittent use fan. If it cannot be determined if a fan is rated for continuous use, the fan shall be considered to be an intermittent rated fan.

e. It must be determined and documented during the inspection of the exhaust fans if the bathroom or kitchen has an operable window. To be considered an operable window, the window must be in such a condition that the window may be readily opened by the client and provide a minimum 1.5 square feet of opening.

3. Required Ventilation Determination

After the on-site information has been collected, the determination of what measures need to be taken to comply with ASHRAE 62.2, if any, shall be determined using the digital ASHRAE 62.2 Form (See Attachment 2.9). Contact the DE for a digital copy of Attachment 2.9.

For multi-family buildings, refer to Section XI, Subsection X, for additional information on how to determine the required ventilation.

a. A digital copy of the ASHRAE 62.2 Form should be completed during the initial audit before any weatherization measures are installed to determine the estimated compliance for the ASHRAE 62.2 Standards.

b. A digital copy of the ASHRAE 62.2 Form must be completed during the final inspection. Before the home may pass final inspection, the home must be re-evaluated using a digital copy of the ASHRAE 62.2 Form with the actual exhaust fan(s) CFM and post blower door results from the final inspection. The home must be compliant based upon the results of the updated ASHRAE 62.2 Form and a copy of the digital form must be printed and included in the client file and uploaded into MoWAP.

c. On the Existing Home Information section of the ASHRAE 62.2 Form, please enter the information based on the following definitions:

(1) Living Space: Enter the square footage of all above and below grade - finished areas of the home.

(2) Volume: Enter the volume in cubic footage of all areas within the thermal boundary of the home.

(3) Total Structure Height: Enter the average height in feet between the average grade of the building and the highest ceiling of the thermal boundary of the building.

(4) Final Inspection CFM50: Enter the actual CFM_{50} of the home as determined from the blower door test taken during the final inspection. This number must match the final blower door reading from the Final Inspection Form (See Attachment 2.1).

(a) After the initial audit is performed, the target infiltration reduction that is entered into NEAT/MHEA shall be entered as the Final Inspection CFM_{50}. See Section IV, Subsection D: Target Infiltration Reduction for additional information.

(b) Homes where a blower door test cannot be performed due to health and safety concerns (i.e. vermiculite, friable asbestos, etc.), must have zero (0) entered as the Final Inspection CFM_{50} of the home.

(5) Location: Select the city location with the nearest proximity to the home that is being evaluated. This selection uses the climate data available for that location.

d. The kitchen exhaust fan in each home must be entered into the ASHRAE 62.2 Form.

(1) If the kitchen does not have an exhaust fan, the exhaust fan is not vented to the exterior of the building shell or the actual CFM of the exhaust fan could not be measured, the measured kitchen fan flow rate will be entered into the ASHRAE 62.2 Form as zero (0).

(2) The volume of the kitchen shall be determined by the useable footprint of the kitchen times the average ceiling height of the kitchen.

e. All bathrooms and their exhaust fans, or lack of, must be entered into the AHSRAE 62.2 Form.

(1) If a bathroom does not have an exhaust fan, the exhaust fan is not vented to the exterior of the building shell or the actual CFM of the exhaust fan could not be measured, the bathroom fan flow rate will be entered into the ASHRAE 62.2 Form as zero (0).

(2) A bathroom is considered to be any room containing a bathtub, shower, spa or similar source of moisture. If a bathroom is not used as a bathroom, the source of moisture may be permanently removed with signed written consent of the client. If a room other than a kitchen, that does not meet the given definition of a bathroom, has an exhaust fan, this fan shall be entered into the ASHRAE 62.2 Form the same as a bathroom. The measured flow rate of the fan should be entered; however, “NO” should be selected in the ‘Does this bathroom exist?’ section of the form.

f. The necessary CFM of ventilation that is required at a home to comply with ASHRAE 62.2 Standard shall be given in the ‘Continuous Mechanical Ventilation Needed’ box of the ASHRAE 62.2 Form.

g. Homes that are determined to require 15 CFM or less " Continuous Mechanical Ventilation Needed' as determined by the ASHRAE 62.2 Form, are exempt and will not require the retrofit of an existing ventilation fan or the installation/replacement of a ventilation fan to comply with ASHRAE 62.2 standards. However, if there are signs of moisture issues or excessive indoor pollutants, mechanical ventilation should be installed.

4. Retrofit of Existing Ventilation

To comply with ASHRAE 62.2, the retrofit of an existing fan may be done. This retrofit may include repairing an existing fan to operate properly or by converting an existing intermittent fan to run at an interval that will allow compliance with ASHRAE 62.2.

a. The exhaust fan retrofit must provide adequate ventilation as determined by the ASHRAE 62.2 Form.

b. When an existing intermittent fan is converted to run at a designated interval to comply with ASHRAE 62.2, the existing fan must:

(1) run at a minimum of ten percent of the time per day; AND

(2) be converted to operate without occupant intervention.

d. A readily accessible, dedicated system shut off must be provided to the occupant. If the exhaust fan is supplied by a dedicated circuit, then a circuit breaker may be considered as a readily accessible system shut off.

(1) Existing exhaust fans that are converted to meet the ASHRAE 62.2 standards are not required to comply with the sone sound requirements.

(2) Controls to the ventilation system must be labeled as to their function, unless that function is obvious, such as toilet exhaust fan switches.

5. Installation and Replacement of Ventilation

To comply with ASHRAE 62.2, the installation of a ventilation fan or replacement of an existing exhaust fan may be done to comply with ASHRAE 62.2.

a. Ventilation fans that are installed or replaced must provide adequate ventilation as determined by the ASHRAE 62.2 Form.

b. The installation of ventilation fans is not limited to kitchens or bathrooms. Ventilation fans that are installed in utility rooms or non-occupied spaces, such as unfinished basements or crawl spaces within the thermal boundary, and draw air from these areas must have a permanent and adequate path of passive air transfer to the occupied spaces of the home.

c. When a ventilation fan is installed or replaced to comply with ASHRAE 62.2 whole house ventilation:

(1) The ventilation fan must be designed to continuously operate without occupant intervention.

(2) The ventilation fan must be designed to operate with a sound rating of 1.0 sone or less. Exceptions to this are remote mounted fans and systems using HVAC air handlers. In order for this exemption, remote mounted fans must be mounted outside the thermal boundary or in a non-occupied space, and there must be at least four feet of ductwork between the fan and the intake grill.

(3) The ventilation fan must run at a minimum of ten percent of the time per day.

(4) A readily accessible system shut off must be provided to the occupant.

(a) If the exhaust fan is supplied by a dedicated circuit, then a labeled circuit breaker may be considered as a readily accessible system shut off. The dedicated circuit may include other minor electrical draws such as existing bathroom lights and receptacles.

(b) The readily accessible system shut off switch for ASHRAE fans may be located within the fan housing. The fan must have an adjustment switch that allows the

CFM to be turned to zero. If a client is not capable of accessing this location, a typical wall mounted switch should be installed and labeled.

(5) Controls to the ventilation system must be labeled as to their function, unless that function is obvious, such as toilet exhaust fan switches.

d. When an intermittent use exhaust ventilation fan is installed or replaced but is not used to comply with ASHRAE 62.2 whole house ventilation (for example, a standard bathroom fan or kitchen range hood installed):

(1) Exhaust fans in bathrooms must have a minimum rating and performance of 50 CFM. The ventilation fan must be designed to operate with a sound rating of 3.0 sone or less during operation.

(2) Exhaust range hoods in kitchens must have a minimum rating and performance of 100 CFM. Other kitchen exhaust fans, including downdraft exhaust fans, must have a minimum rating and performance of 300 CFM. All kitchen exhaust fans and range hoods must be designed to operate with a sound rating of 3.0 sone or less at the lowest setting that complies with the minimum required CFM.

e. If a supply ventilation fan is installed at a home, it is highly recommended to install an exhaust ventilation fan that exhausts the same CFM of air that the supply ventilation fan is supplying to the home to alleviate potential moisture issues.

f. All installed exhaust ventilation must be vented to the exterior of the building. Venting to the exterior of the building requires that the vent exhausts directly to the outdoors. Exhaust air shall not discharge into an attic, soffit, crawl space or other areas inside the building shell.

6. Inspection of Installed Ventilation

All installed ventilation systems must be tested during the final inspection, along with all other existing ventilation fans, and re-evaluated to ensure compliance with ASHRAE 62.2 Standards. Newly installed ventilation systems that are located in the kitchen and/or bathroom must be entered into the ASHRAE 62.2 Form as they are measured at the final inspection. If compliance is not obtained, the subgrantee must take the necessary steps to ensure compliance with ASHRAE 62.2. See Section II, Subsection C, Topic 2: Inspection of Existing Ventilation for testing ventilation fans.

D. Required Minimum Subgrantee Deferral Policy

There are some situations in which a subgrantee should not weatherize an otherwise eligible unit. In order to deal with these situations, each subgrantee must, adopt and adhere to this minimum deferral policy. When implemented, this policy allows weatherization staff to defer a dwelling unit due to conditions or circumstances that may be outside of the scope of the WAP or hazardous to the health and safety of the occupants or weatherization workers. A subgrantee

may choose to expound on this minimum policy and develop a subgrantee specific deferral policy to meet the needs of the service area. If the policy is expounded upon, documentation of this expounded policy must be located at the subgrantee office and applied equally and without discrimination to all homes addressed in the subgrantee's service area.

The following is the required minimum deferral policy. It is intended to list the more common conditions and situations a subgrantee may encounter while preparing to deliver weatherization services. This list is not intended to be all inclusive of those instances in which a subgrantee may choose not to weatherize a unit. In some instances, corrective measures by the client/owner may allow program services to proceed. In addition, the subgrantee may use alternative funding that is not administered by the department, to assist the client with corrective measures to allow the home to be weatherized. Health and safety remediation completed by another non-for-profit organization coordinated with weatherization work is allowable. Health and safety remediation with private or for-profit organizations need to be reviewed by the department on a case-by-case basis for allowance.

1. Required Minimum Deferral Policy

A subgrantee must withhold weatherization services under the following conditions:

a. A single-family dwelling unit is vacant.

b. A dwelling unit is for sale or in foreclosure.

c. A dwelling unit is scheduled for demolition.

d. A dwelling unit is found to have structural problems that would make weatherization impossible, impractical, or would inhibit the installation of significant weatherization measures. Structural problems include, but are not limited to:

(1) Dwelling unit(s) lacking proper interior sheathing (drywall, paneling or lathe and plaster) on ceilings or exterior walls.

(2) Dwelling unit(s) lacking exterior sheathing (siding, sheathing, brick, etc.) that is designed and sold for exterior use. If the product manufacturer recommends paint or other finish to be applied to the exterior sheathing, this finish must be applied prior to weatherization.

(3) A mobile home that is improperly installed (for example inadequate supports, not level, not anchored down, etc.).

(4) The dwelling unit or parts thereof are being remodeled and this remodeling would inhibit or alter the installation of any weatherization measures.

(5) Unsafe wiring found in the dwelling, that cannot be corrected as a part of weatherization and would inhibit the installation of weatherization measures or pose a threat to the health or safety of the crew, subcontractor or client.

(6) Major water or moisture issues found in the dwelling unit that cannot be corrected as a part of weatherization. These would include, but are not limited to plumbing leaks, roof leaks, and standing water in foundation areas.

(7) Severe mold issues that are beyond the scope of weatherization. These would include, but are not limited to moldy areas larger than a total of 10ft², mold in HVAC system or mold caused by sewage or other contaminated water.

(8) The extent and condition of lead based paint in the home would potentially create further health and safety hazards. It should be noted that weatherization services where proper lead safe protocol can be followed, would not create further health and safety hazards and, therefore, not require deferral.

(9) The dwelling unit is deemed by the auditor to pose a threat to the health or safety of the crew, subcontractor or client and will not be remediated by weatherization work or another program in conjunction with weatherization.

e. A dwelling unit is uninhabitable (for example, a burned out apartment), condemned or there are “red tagged” health and safety conditions that cannot be corrected as a part of weatherization.

f. The client is uncooperative with the weatherization subgrantee, either in demanding that certain work be done, refusing priority work which is needed but the refused work is not deemed as a legitimate refusal by the subgrantee, by being physically or verbally abusive to the work crew or subcontractor, or by being unreasonable in allowing access to the unit. Every attempt should be made to explain the program and the benefits of the work.

g. Obvious discrepancies are found between the information supplied by the client on the application and observed conditions at the time of weatherization. The subgrantee must resolve these discrepancies before weatherization work can continue.

h. If at any time the subgrantee determines that the client is no longer eligible or subgrantee personnel believe that circumstances may have changed, the unit shall not be weatherized until updated information can be obtained from the client.

i. There is an infestation of rats, bats, roaches, reptiles, insects or other vermin.

j. There are existing health or safety hazards, to the weatherization workers, that must be corrected before weatherization services may begin. These may include, but are not limited to:

(1) There are animals on the premises that are not appropriately contained.

(2) The presence of animal feces and/or other excrement.

(3) Unvented space heaters are present in the home and the unvented space heater regulations outlined in Section III, Subsection G, Topic 2 cannot or will not be met.

(4) Excessive garbage, trash or debris that may pose a health and safety risk or would prevent the installation of weatherization measures.

(5) Hoarding which would prevent the installation of weatherization measures.

k. Diagnostic tests cannot be performed at the initial audit. Reasons for this would include the dwelling unit lacking fuel or electric at the time or lack of cooperation from the client. A non-operable heating system, however, is not grounds for deferral. Agencies may choose to defer rental properties without operable heating systems where the local jurisdiction requires the property to be equipped with a safe heating system as a requirement to rent the unit. If agencies choose this option, they must include language in their deferral policy stating this policy.

l. There are illegal drugs or illegal activities occurring on the premises.

m. The eligible household members move from the dwelling unit where weatherization activities and services are in progress. In such a case, the subgrantee must determine whether to complete the work and the circumstances must be documented in the client file. It is recommended to contact DE prior to making this determination.

n. The client will not sign the Missouri Radon Informed Consent Form prior to starting work.

2. Documentation

In the event that a subgrantee defers a dwelling unit, the subgrantee must notify the client and owner/authorized agent in writing. The notification needs to be signed by the client, a copy of the signed notification shall be provided to the client, and a copy kept in the client file. Alternatively, a certified letter with the notification may be mailed to the client and a copy of the notification and return receipt shall be kept in the client file. If the client cannot be notified in writing as described above, contact the department for further guidance. All correspondence justifying the decision to defer the dwelling unit must be kept in the client file.

The notification must include the following items:

a. The nature and extent of the problem(s) and how the problem(s) relate to the determination to defer the unit.

b. Any and all corrective actions required before weatherization services can be considered.

c. A time limit for correcting problems so that weatherization services may be rescheduled. A minimum period of 30 days for correction of the problems must be provided; however, more time may be granted depending on the circumstances.

d. The right of appeal and the name of the subgrantee staff to whom the appeal should be directed.

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Section III: Mechanical Systems and Combustion Appliances

All homes with combustion appliances shall be tested to determine if the carbon monoxide levels exceed those limits set by the National Standard Work Specifications (SWS). Combustion appliances include any appliance, water heater, wood stoves, furnace/heating system (including freestanding kerosene, natural gas or propane space heaters) or lighting that has a flame or burns fuel in an open or enclosed chamber. Gas fired clothes dryers may be excluded from this requirement; however, the clothes dryer must be properly vented to the outside of the home. Except as noted, this includes all active combustion heating systems and appliances whether they are primary, secondary, off-peak or dual-fuel systems.

The mechanical systems audit includes all of the following: carbon monoxide test, worst-case depressurization of all combustion appliance zones, spillage evaluation, and draft measurement (optional). Combustion safety test results must be acted upon appropriately according to the combustion safety action levels, see Section III, Subsection C: Combustion Appliance Zone (CAZ) and Carbon Monoxide Testing for additional information. As applicable, every combustion appliance will be checked for a safe flue pipe, chimney or vent, adequate combustion air and gas leaks. Whenever an appliance fails any of the combustion safety tests, appropriate repairs must be completed or specified in the weatherization work scope. For homes with unvented space heaters see Section III, Subsection G, Topic 2: Unvented Space Heaters for additional information.

A complete mechanical systems audit is required on every home during the initial audit and as part of the final inspection. Diagnostic equipment needs to be calibrated per manufacturers' instructions. All relevant information must be recorded on the Mechanical Systems Audit Form and all combustion tests performed with a combustion gas analyzer must have the associated printout from the combustion gas analyzer attached to the Mechanical Systems Audit Form (i.e. Bacharach tapes, etc.). The procedure includes collecting general information; interviewing the client; collecting and recording mechanical systems information; visual and diagnostic inspection of the venting and distribution system and combustion analysis and diagnostic tests for gas/oil-fired equipment.

For all combustion systems, fuel switching as either an Energy Conservation Measure or a Health and Safety Measure is not allowable, unless written approval is obtained from the department.

The following sections describe the actions that should occur on specific combustion systems to include additional safety tests, best practices and remedies for combustion related problems.

A. Primary and Secondary Heating and Cooling Systems

1. Primary Heating and Cooling Systems

a. Only one (1) heating system may be considered the primary heating system for a home. Only this primary system may be replaced as a cost effective or health and safety measure.

I. Gas Ranges and Ovens

Gas range cook tops and ovens are often significant generators of CO in a kitchen. Frequent causes of CO production are from over firing, dirt buildup and foil installed around the burners. Ovens are prone to produce CO regardless of condition. The following tests and recommended actions are relevant to gas range and oven safety:

1. Natural Gas or Propane Stovetop Burner Testing:

Although not required, it is recommended to test each stovetop burner separately using a digital combustion gas analyzer by holding the probe about 8 inches above the flame for 2 minutes. Specify a clean and tune if the flame has any discoloration, flame impingement, or an irregular pattern or if burners are visibly dirty, corroded, or bent. Clean and adjust burners producing more than 25 ppm. Burners often have an adjustable gas control or orifice.

2. Natural Gas or Propane Oven Testing Instructions and Action Levels:

a. Remove any items/foil in or on the oven

b. Make sure self-cleaning features are not activated and set the oven to the highest setting.

c. Test the oven for CO in the oven vent, before dilution air.

d. After 5 minutes of operation, check for steady state. Record the steady state CO reading and the ambient air CO level. A clean and tune will be conducted if CO in the flue gas in the oven vent exceeds 225 ppm (as measured, not air free), at steady state.

(1) Sub-grantees may defer a home when an oven exceeds these CO limits until the client corrects the issues.

(2) If a sub-grantee does complete a clean and tune and the oven still exceeds the CO limits, an exhaust hood venting to the exterior of the home must be present or installed prior to completion of the home.

e. Replacement of gas ovens is not an allowable weatherization expense.

J. Dryers

1 General Requirements

Gas dryers are generally not significant producers of CO when the burner is firing. No specific tests are required. The Weatherization auditor may conduct any appropriate tests that could remedy a safety concern.

2. Dryer Venting Requirements

a. All dryer vents must be vented directly to the exterior of the building shell, which does not include unconditioned spaces such as attics and crawl spaces that are ventilated with the outdoors.

b. Uninsulated dryer ducts cannot pass through unconditioned spaces, such as attics and crawl spaces. If dryer ducts are installed as part of the weatherization process and are to pass through unconditioned areas, the ducts must be insulated to R-8.

c. Dryer vents should be as short as practical and made of rigid sheet metal or semi-rigid sheet metal.

d. Agency installed dryer vents must be rigid or semi-rigid metal. Flexible, foil or plastic venting material will not be used.

e. Dryer ducts exceeding 35’ in duct equivalent length will have a dryer booster fan installed. This maximum duct equivalent length will be reduced 5 feet for every 90º elbow and 2½ feet for every 45º elbow.

f. Ducts will be appropriately connected and sealed.

g. Dryer vent pipe should not be installed with sheet metal screws or other intrusive fasteners that will collect lint and block the vent gases.

h. A termination fitting manufactured for use with dryers will be installed. A backdraft damper will be included with the termination fitting.

K. Water Heaters

1. General Requirements

In addition to the general gas combustion requirements described above, water heaters must meet the following specifications:

a. Inspect the existing water heater for health and safety hazards. A water heater lacking a pilot access door or a pressure and temperature relief discharge pipe may be considered a health and safety issue. A water heater lacking a pressure or temperature relief valve shall be considered a health and safety issue. Water heaters shall be inspected for adequate combustion air and a safe and proper flue gas venting system (refer to the National Fuel Gas Code – NFPA 54).

b. Documentation stating reasoning for the repair or replacement shall be located within the client file.

2. Water Heater Repairs

Water heaters may be repaired as a health and safety measure if the water heater has high carbon monoxide, a leaking water tank creating a moisture problem, insufficient draft, pulls combustion air from a bedroom or bathroom, is working but unsafe or on a case-by-case basis with Department approval.

3. Water Heater Replacement

a. Replacement of any water heater due to the water heater not being operational is allowed. Replacement water heaters must be rated for the application and type of structure that they are being installed in.

b. Electric water heaters may only be replaced as a health and safety measure, only if the tank of the water heater is leaking, creating a moisture problem and cannot be repaired or on a case-by-case basis with department approval.

c. Gas water heaters may be replaced as a health and safety measure if the cost of the repairs exceeds two-thirds the cost of replacement, if the tank of the water heater is leaking, creating a moisture problem and cannot be repaired, has a draft issue or high C/O production that cannot be corrected (within reason for labor and materials), or on a case-by-case basis with Department approval.

d. Gas water heater replacements should be either direct-vented or power-vented and ENERGY STAR qualified. Best practice for installation is to provide a dedicated electrical outlet that the vent fan of the direct-vent or power-vent water heater can be plugged into without the need of any extension cord. Case-by-case approval to replace an existing naturally drafting water heater with like-kind equipment must be submitted for prior review.

e. A water heater installed by the sub-grantee must have a pressure and temperature relief valve installed in compliance with P2803 of the 2012 IRC and according to manufacturer specifications. A discharge pipe will be installed in accordance with P2803.6.1 of the 2012 IRC. The discharge pipe should terminate no more than 6 inches above the floor or as specified by local codes. The discharge pipe must be made of rigid metal pipe or approved high temperature plastic pipe and cannot have threads on the end of the pipe.

f. A replaced water heater will have an emergency drain pan installed if leakage would cause damage to the home and in accordance with P2801.5 of the 2012 IRC. A drain line will be connected to tapping on pan and terminated in accordance with P2801.5.2 of the 2012 IRC.

g. When replacing a water heater, a potable water expansion tank will be installed on the cold-water side. A direct connection with no valves between the storage tank and expansion tank will be installed in accordance with the 2012 IRC, authority-having jurisdiction, and according to manufacturer specifications.

4. Water Heater Insulation General Requirements and Temperature settings

a. Water heaters should be insulated to at least R-11 unless the water heater label gives specific instructions not to insulate or water heater is already insulated.

b. Water heater insulation must not obstruct draft diverter, pressure relief valve, thermostats, high limit switch, plumbing pipes or access plates.

c. Adjust water temperature to a maximum of 120°F with clients' approval, unless the client has an older automatic dishwasher without its own water-heating booster. In this case, the maximum setting is 140°F.

5. Gas-Fired Water Heater Insulation

a. Keep insulation at least 2 inches away from the access door to the burner.

b. Insulation should be cut away from the water heater's gas valve and drain valve to provide ample clearance for access.

c. Do not insulate the tops of gas fired water heaters.

6. Electric Water-Heater Insulation

a. The installation of water heater blankets on electric water heaters may be evaluated for installation unless this will void the warranty of the water heater.

b. With client permission, set both upper and lower thermostat to keep water at 120°F before insulating water heater.

c. Insulation may cover the water heater's top if the insulation will not obstruct the pressure relief valve.

d. Access holes should be cut in the insulation for the heating element thermostats, or better, thermostat location should be marked with a permanent marker to preserve the insulation's integrity until the access is needed.

7. Water Heater Blankets

a. Water heaters should be insulated with the following materials:

(1) Fiberglass batt insulation with a protective covering is the preferred material for the water heater blanket; however, other appropriate materials may be used if designed for such purpose or approved by the LIWAP Program Administrator.

(2) Water heaters should be insulated to at least R-11 with an external insulation blanket, unless the water heater label gives specific instructions not to insulate or the water heater is already insulated properly.

(3) A water heater blanket must be secured to the water heater with at least two (2) straps. The installed straps must be securely connected, and not excessively pressing the water heater blanket.

b. Installation

(1) The water heater tank must be inspected to determine the type of water heater (gas, electric, other), and whenever possible, the amount of existing insulation.

(2) If there are signs that the water heater is leaking, this problem must be solved before insulation is added.

(3) Water heaters outside the living space, including mobile home water heaters in exterior closets, must be insulated if the total existing tank insulation is less than R-11.

8. Water Heater Pipe Insulation

a. The first 6 feet of inlet and outlet piping will be insulated in accordance with manufacturer specifications.

b. Interior diameter of pipe sleeve must match exterior diameter of pipe and cover over all elbows, unions and other fittings to same thickness as pipe.

c. Keep pipe insulation at least 6 inches away from draft hood and/or single wall metal flue pipe. Clearance from "B" vent should be maintained per vent manufacturer's specifications.

d. Do not insulate pipes below the draft diverter.

L. Air Conditioners and Heat Pumps

1. Air Conditioner and Heat Pump Repair

a. All repairs and tune-ups must be performed by a qualified technician with EPA Section 608 Technician Certification, except the cleaning of evaporative and conditioning coils when there is no potential to release refrigerant. A copy of the Section 608 Technician Certification must be kept on file by the sub-grantee and available for review, as needed.

Section IV: Shell & Duct Air Leakage Diagnostics

A. Blower Door Testing & Diagnostics

The blower door is highly valued as a weatherization tool as it is used to determine the pre-and post-weatherization dwelling leakage rates. The pre-test will aid the auditor in determining the air sealing work scope with the post-test providing an accurate idea of the effectiveness of the air sealing efforts and to assure the building tightness is satisfactory. In addition, the blower door is used for zone pressure testing and duct leakage testing to aid building diagnostics.

In order to obtain consistent test results, it is important the blower door is setup and used properly at each weatherization job. The depressurization blower door test is preferred by Missouri's Weatherization Assistance Program and it is the standard test used in the low-income weatherization program across the U.S. However, the pressurization test is an acceptable alternative when conditions warrant its use.

Blower door tests are required at the initial audit and final inspection. Exceptions to this requirement are only for friable asbestos and vermiculite and must be thoroughly documented in the client file. If it is determined that vermiculite is present in a dwelling, a depressurization blower door test must not be performed; however a pressurization blower door test may be performed. If a depressurization blower test is not performed, it is recommended to use two times the living space square footage of the home for the estimated blower door test to be entered into the computerized audit. Therefore, if a home is 1,200 square feet, the estimated blower door would be 2400 CFM_{50}.

Homes where a blower door test cannot be performed during the final inspection due to health and safety concerns, must have zero (0) entered as the Final Inspection CFM50 of the home. This must be entered on the QCI form, the Diagnostic Field Form, the ASHRAE 62.2 form, and reported in MOWAP.

1. Preparation for Blower Door Test

The blower door testing procedures below assumes the use of The Energy Conservatory (TEC) Minneapolis Blower Door, Model 3, with the TEC digital manometer, Model DG-700. The Minneapolis Blower Door Operation Manual should be referenced for additional instructions (https://energyconservatory.com/wp-content/uploads/2014/07/blower_door_applications_guide_-_beyond_single_family_residential_ver_1-0_0.pdf) on how to prepare for and conduct a blower door test, or refer to the Weatherization Field Guide Chapter 12: Air Leakage Diagnostics for more information.

a. Subgrantees should inspect all blower door equipment and maintain accurate calibration of blower doors and related equipment. This includes:

(1) Blower door fan.

(a) There should be no physical damage to the fan or flow rings.

(b) The flow sensor on the Minneapolis Blower Door, Model 3, is the white ring that is permanently attached to the end of the motor opposite the fan blade. The ring is perhaps the most critical part of the Blower Door fan. Make sure the sensor is in its proper position, not damaged, that the connected hose is in good condition, and that the four holes in the sensor are not obstructed or blocked.

(c) If there is a problem with the fan or the flow sensor, contact the manufacturer before further use.

(2) Digital pressure gauges should be calibrated annually by the manufacturer.

(3) Hoses should be checked for breaks, cracks or other imperfections that may affect test results.

(4) The blower door panel and frame should be checked to ensure that the condition will not affect test results.

Note: For detailed maintenance recommendations for equipment manufactured by The Energy Conservatory, go to https://energyconservatory.com/support/ and download Maintenance Tips.

b. Deactivate all vented combustion-type appliances before depressurizing the structure by turning the thermostat down, the appliances to pilot or the appliance off.

c. Prevent the ashes of wood/coal burning units from entering the living space by closing/sealing doors and dampers or by cleaning out or covering the ashes.

d. Inspect the house for loose or missing hatchways, paneling, ceiling tiles or glass panes. Secure any items that may become dislocated during the test and seal any missing hatchways.

e. Close all primary windows, self-storing storm windows (if possible), sky lights and exterior doors and latch them, as they normally would be found closed during the winter.

f. Open all livable areas to the interior of the structure, even if the occupants close them off during the winter.

g. Open the basement doors during test if the basement is within the thermal boundary.

h. The basement **may** be considered out of the thermal boundary if any of the following conditions are present:

(1) Insulation has been installed in the basement ceiling.

(2) The garage is in the basement and the garage is not separated from the basement by a wall.

(3) The basement has an earthen floor that cannot be covered in its entirety with a 6 mil polyethylene moisture barrier.

(4) It is determined by the auditor that due to on-site conditions the basement should be considered outside of the thermal boundary. Documentation must be provided in the client file on why the basement should be considered outside the thermal boundary.

i. Set up the blower door unit in a favorable location in an area free from obstructions and wind interference.

2. Blower Door Depressurization Test (preferred)

a. Set the blower door up in an exterior door with the least number of obstacles within 3 feet of the blower door fan. If the doorway leads to an enclosed area, make sure the space is open to the outdoors. Do not set up in a door facing the wind if an acceptable alternative exists.

b. Install the frame and panel securely into the doorframe, making sure that there are no gaps between any of the components or between the components and the doorframe.

c. Set the fan into the panel/frame assembly, making sure that the panel opening fits snugly around the fan. Install the fan so that the flow ring assembly (or low flow plate) is facing toward the inside of the house. Set up the fan in a level or nearly level position.

d. Make sure the variable speed control is in the off position. Plug the fan electric cord into a safe and fully functional electrical outlet.

e. Insert the tube from the house pressure gauge into the hole in the door panel. Make sure that the end of the hose is not in front of the fan outlet or positioned so that it is exposed to windy conditions. Ensure that the fabric cover or all the rings and the center plug are on the fan.

f. Set the manometer to read PR/FL@50.

g. Measure the baseline building pressure. This reading is usually a result of stack pressure.

h. Perform a one-point test by depressurizing to -50 Pascal house pressure or the highest house pressure if unable to reach -50 Pascal. If wind seems to be affecting test results, take several one-point tests and average the results.

i. Record the CFM_{50} of the dwelling from the digital monometer.

Note: A depressurization blower door test cannot be performed at a home that has friable asbestos or vermiculite insulation, unless a certified AHERA tester has confirmed the material does not contain greater than one percent asbestos.

3. Blower Door Pressurization Test

If a pressurization blower door test is to be performed at a home, reference the manufacturer's equipment manual on proper pressurization blower door test procedures for the equipment to be used.

B. Blower Door Guided Air Sealing

When performing air sealing, the department highly recommends using blower door guided air sealing.

1. Pre-Guided and Guided Air Sealing

Air sealing work is best performed with the use of the blower door to focus the work in the most cost-effective areas. Agency crews and contractors are expected to make use of the blower door as a valuable tool and shall make every reasonable effort to incorporate blower door guided air sealing strategies into their weatherization services.

Air sealing work on dwellings consists of the following categories:

a. *Pre-guided air sealing*. Examples include replacing window glass where glass is missing and sealing gross holes in the building envelope. There is little question that sealing or repairing these gross holes in the dwelling envelope will be cost-effective.

(1) Prior to any work done on the dwelling, an "as-is" blower door test should be performed as a means of finding these gross holes. This test will indicate whether pre-guideline air sealing is required in order to perform a more representative blower door test.

b. *Guided air sealing*. This is air sealing completed with the guidance of the Air Sealing Cost-Effective Guidelines (ASG). The ASG must be used on all blower door guided air sealing. As with other measures, air-sealing work is cost-effective only up to a point. Once that point is reached, air-sealing work on a dwelling should cease. Agencies are expected to use their experience and expertise to control the air sealing costs and assure the CFM_{50} reduction is cost-effective.

c. *Estimating leakage areas*. There are several ways to convert blower door CFM_{50} measurements into square inches of total leakage area. The simplest way to convert CFM_{50} into an approximate leakage area (ALA) is to divide CFM_{50} by 10. The ALA can help you visualize the square inches of openings you are looking for in a home or section of a home. The formula is **$ALA = CFM_{50} \div 10$.**

C. Air Sealing Cost-Effective Guidelines (ASG)

This following ASG should be used to guide the level of air sealing and serve to aid in the estimation of cost-effective air sealing. The value of the air sealing activity is relevant to the cost of obtaining the CFM_{50} reduction in relation to the cost of heating/cooling fuel. The primary focus of the Missouri Weatherization Program is on air sealing to reduce heating costs. Higher or lower fuel costs will alter the outcome of the Savings to Investment Ratio (SIR) of the air sealing work. Agencies desiring to obtain more accuracy in their air sealing work are recommended to purchase the Techtite Software program distributed by The Energy Conservatory.

1. Procedure

Air sealing should prioritize the largest leakage paths first. These largest leaks include replacing window glass where glass is missing and sealing gross holes in the building envelope.

a. Upon sealing the largest leakage paths, bypasses in the attic followed by bypasses in the crawl space and the basement should be air sealed.

b. All supply and return air ductwork outside of the thermal boundary shall be sealed.

c. Minor air sealing, such as caulk and weather stripping, should be kept to a minimum and performed only after all major leakage paths, attic bypasses, crawl space/basement bypasses and ductwork sealing is completed.

d. When the strategy for air sealing costs more than the amount necessary to meet the desired SIR, the air sealing should stop unless there are documented reasons to continue, such as health and safety issues or potential for damage to the structure.

D. Target Infiltration Reduction

Target infiltration reduction is the estimated infiltration reduction that will occur at the home. The target infiltration reduction is used in calculating a SIR for infiltration reduction within the computerized audit and estimating the necessary ventilation requirements to comply with ASHRAE 62.2 Standards after the initial audit.

When determining the target infiltration reduction for a home, a realistic level of infiltration reduction must be used. The target infiltration reduction level must be an obtainable reduction based upon the conditions at the home and the infiltration reduction having an SIR of 1.0 or greater. Consideration should also be given to how the target infiltration reduction will correlate with compliance with ASHRAE 62.2.

E. Air Handler Pressure Testing

1. Air Handler Dominant Duct Leakage Testing

a. This test procedure is performed only in dwellings with air handlers and ductwork located outside of the thermal boundary. The purpose of the test is to determine if supply or return duct leakage to the outside is predominate in the home. This test does not quantify the amount of leakage.

b. The test procedure is as follows:

(1) All exterior doors and windows must be closed and all interior doors open.

(2) Run a pressure hose from the main body of the house to the outdoors and connect the pressure hose to the input tap on the manometer. Record any pressure difference between the main body of the dwelling and the outdoors. This is the reference baseline pressure.

(3) Turn the air handler on at the home.

(a) With the air handler on, if the home becomes more **negative** than the baseline, the predominant duct leakage is in supply duct leaking to the outside.

(b) With the air handler on, if the home becomes more **positive** than the baseline, the predominant duct leakage is in the return duct leaking to the outside.

(c) With the air handler on, if the home **does not change** from the baseline pressure, then the return and supply leakage are equal.

2. Air Handler Pressure Balance Testing

a. This test procedure is performed only in dwellings with air handlers. Room-to-room pressure(s) should be measured in all rooms with forced air heating return or supply ducts and operable doors. The procedure indicates the magnitude of:

(1) Imbalances of air distribution resulting from closed interior doors. These closed doors can act as dampers to the free flow of air within the conditioned space of the dwelling.

(2) Imbalances of air distribution resulting from airflow differences between the supply side and return side of the ductwork, for example, a restricted return trunk.

b. The test procedure is as follows:

(1) Set house up in winter operating mode and turn the air handler on.

(2) Make sure that registers and grilles are not blocked, even though they appear open, and all ducts connected.

(3) Use a manometer to measure the pressure difference across all interior doors. Pressure test and record the measurements for all rooms with reference to the main body of the house.

(4) Provide pressure relief to any room with readings greater than 3 Pascal by opening the door slightly while measuring the pressure difference across the door. Open the door until the pressure difference is less than 3 Pascal and measure the square inches of opening that the door is providing.

- This is the number of square inches to undercut the door, or
- The size of an installed direct grille, offset grilles or jump duct to be installed to properly relieve the pressure imbalance caused by the distribution system when the door is closed.

(5) Turn off air handler and return house to the condition it was in before testing began.

F. Duct Leakage Testing

1. General Information

Duct leakage can detect many problems in a dwelling, ranging from wasted energy, thermal discomfort, substandard indoor air quality and CAZ depressurization.

Ductwork leakage can take place within the confines of the conditioned envelope of the building or to and from the outdoors. Duct leakage to or from the outdoors wastes more energy than leakage within the confines of the thermal envelope. Mobile home ducts and site built homes with ductwork in crawl spaces or attics are susceptible to leakage to and from the outdoors.

On the other hand, although duct leakage within the conditioned envelope usually does not have a significant energy impact; it might impose a hazard to occupant health by causing poor indoor air quality or back drafting of combustion appliances. These potential problems are addressed with the ASHRAE 62.2 Standards and by performing the worst-case draft test.

2. Duct Leakage Standards

a. Pressure Pan Standards

Pressure pan testing must be done at all dwellings with ducts outside the pressure boundary. This would include all mobile homes. Pressure pan testing is done to determine where ducts are leaking to the outdoors. The pressure pan must be performed while the blower door is depressurizing the home to -50 Pascal, if possible. All results of duct leakage testing needs to be recorded on the Diagnostic Field Form (Attachment 2.4).

If the ducts are perfectly sealed with no leakage to the outdoors, there will not be a measurable pressure difference (0.0 Pascal) during the pressure pan test. The higher the measured pressure reading, the more connected the duct is to the outdoors. Registers attached to stud cavities should also be tested, as these stud cavities may be connected to unconditioned spaces.

(1) If the median pressure pan reading is 4 Pascal or more and/or if one reading is more than 8 Pascal, duct sealing is usually cost effective.

(2) After duct sealing, no more than 3 registers should have a pressure pan reading of greater than 2 Pascal. No single register should have a pressure pan reading of greater than 4 Pascal.

(3) The reduction you achieve depends both on the ability to find leaks and where the ducts can be accessed. The general goal is for each register to have a pressure pan reading of 1 Pascal or less.

(4) Mobile Homes

(a) Visually check furnace-plenum joint, repair, and seal with mastic, if necessary.

(b) Visually check all boots, repair, and seal with mastic, if necessary.

(c) Visually check furnace-plenum joint, repair, and seal with mastic, if necessary.

(5) Site-Built Homes, including Manufactured Housing, with ducts located in unconditioned spaces:

(a) Always repair disconnected ducts in all spaces.

(b) If possible, convert the unconditioned space where the ducts are located to a conditioned space, making sure the air and thermal barriers are installed effectively. Demonstrate the effectiveness of this weatherization work by performing a house-to-zone pressure and flow test (if possible) before and after converting the unconditioned space to a conditioned space.

(c) If it is not feasible to convert the unconditioned space to a conditioned space or it is determined impractical to convert to a conditioned space, repair, seal with mastic, and thermally insulate ducts to at least an R-8.

b. The subgrantee may choose to use a duct blower to determine the duct leakage to the outdoors. Examples of these types of unconditioned spaces include crawl spaces, unconditioned basements, attics, attached or tuck-under garages, and exterior walls.

3. Pressure Pan Testing Procedures

Pressure pan testing helps find ductwork leaks or disconnections that are connected to outdoor air. Testing before and after duct sealing, will give an indication of the effectiveness of duct sealing efforts. Pressure pans do not read duct leakage directly; they infer leakage to the outdoors by reading the pressure at individual registers. The test procedure involves the following:

a. Install the blower door for a depressurization test. Make sure the dwelling is set up for winter conditions.

b. Open all interior doors, including the door to the basement if the basement is considered conditioned space.

c. Make sure the furnace burner and air handler is off and will not start during the testing. Remove the furnace filter and ensure that all registers, grilles and balancing dampers are fully open.

d. Temporarily seal outside combustion air inlets or ventilation system connections that are directly connected to the duct system. These connections will show up as large leaks if not sealed prior to testing. If supply vents or return grills are located in a garage or other unconditioned space, these vents must be permanently sealed.

e. Open attics, crawl spaces, garages, and other unconditioned spaces to the outdoor air as much as possible, so that the spaces do not create a secondary air barrier. If the basement is being treated as an unconditioned space, open it to the outdoor air.

f. Only one person at a time should be taking pressure pan readings. Having two registers in different parts of the duct covered by a pressure pan at the same time can affect readings.

g. Depressurize the dwelling to -50 Pascal with the blower door.

h. Make sure the pressure pan is properly connected to the manometer. The proper connection should be reading the space under the pressure pan with reference to the main dwelling pressure.

i. Place the pressure pan completely over each register and grille in conditioned areas.

   (1) If a register or grille is larger than the pressure pan, cover the oversized portion of the register or grille with tape while the reading is recorded.

   (2) If access to a register or grille is difficult, for example at a kitchen counter kick space, cover the entire opening with tape and insert the pressure probe through the tape (near the center of the taped opening. while the reading is recorded).

(3) When two registers or grilles are closely connected to the same duct run (for example, two registers on opposite sides of the same partition wall), seal one and use the pressure pan on the other unsealed register or grille. Once you have taken the pressure pan reading, remove the seal before proceeding to the next register.

j. Record the pressure pan readings before and after duct sealing activities to get an idea of sealing effectiveness. It will sometimes be useful to record readings during duct sealing.

(1) If an unconditioned space is not well connected to the outdoors (e.g. unvented crawl spaces or unvented attics) or has very large connections to the house, then the unconditioned space will be at a pressure between the outside and inside house pressure during the blower door test. In this case, the pressure pan reading will show an artificially low number. To correct this misleading number:

(a) With the dwelling at -50 Pascal, measure the pressure difference between the main dwelling and the unconditioned space in question. (For example, the house to zone pressure is 10 Pascal and the pressure pan reading is 2.0 Pascal).

(b) Multiply the pressure pan reading by the multiplier in Table IV-1 to get the corrected and true reading. (For example, multiply the pressure pan reading of 2.0 Pascal by the multiplier of "5", resulting in a pressure pan reading of 10 Pascal).

Table IV-1. Pressure Pan Multipliers

	House/Zone Pressure									
	50	45	40	35	30	25	20	15	10	5
Pressure	1	1.1	1.25	1.42	1.66	2.0	2.5	3.5	5.0	10.0

k. If you are testing a house with a very leaky building shell, and are not able to create a 50 Pa pressure difference with the blower door, perform your pressure pan tests with the house at the highest achievable pressure. In this case you will need to interpret your pressure pan readings carefully. Compare the measured pressure pan reading with the maximum possible reading. Record the pre- and post-weatherization readings on the Diagnostics Field Form (Attachment 2.4).

4. Duct Blower Testing for Leakage to Outdoors

This recommended duct blower test requires measurement of duct air leakage to the outdoors, not total duct leakage (to outdoors and indoors).

During this test procedure, a blower door fan is used to pressurize the building to the test pressure, while the duct blower system is used to pressurize the duct system to the same pressure as the building. Because the duct system and the inside of the dwelling will be at the same pressure, there will be no leakage between the ducts and the dwelling during the test.

The blower door fan should be set up to blow air into the building for pressurization. Airflow through the blower door does not need to be measured during this test. The blower

door fan can either be set up in the pressurization test mode, or it can be set up in the standard depressurization test mode, with the fan direction switch reversed to blow air into the dwelling. For residential duct systems, 25 Pascal is generally recommended as the test pressure. This pressure has been adopted by the majority of residential duct testing programs in the U.S. because 25 Pascal represents a typical operating pressure seen in many residential systems.

For complete instructions on how to test for duct leakage to outdoors, refer to your Minneapolis Blower Door Operation Manual (http://energyconservatory.com/wp-content/uploads/2017/08/Blower-Door-Manual.pdf) or refer to the Weatherization Field Guide Chapter 4, Diagnosing Shell and Duct Air Leakage for more information.

G. Pressure Testing Air Barriers

1. General Information

Leaks in air barriers can cause energy loss and moisture problems in many homes. You can test air barriers for leakiness during blower-door testing. Air-barrier pressure testing uses a manometer to measure pressure differences between zones in order to estimate air leakage between zones.

Specifically air-barrier leak testing can help:

a. Evaluate the air tightness of portions of a building's air barrier, especially floors, ceilings and attached garage walls.

b. Decide which of two possible air barriers to air seal, for example, the floor versus foundation walls.

c. Estimate the approximate leakage area (ALA) of air leaks through a particular air barrier, for the purpose of estimating the materials and labor necessary to seal the leaks.

d. Determine whether building cavities like floor cavities, porch roofs and overhangs are conduits for air leakage.

e. Determine whether building cavities, intermediate zones and ducts are connected by air leaks.

Air-barrier leak-testing provides a range of information from simple clues about which parts of a building are leakiest to specific estimates of the airflow and hole size through a particular air barrier like a ceiling.

2. Primary versus Secondary Air Barriers

Intermediate zones are unconditioned spaces, sheltered within the exterior shell of the house. Intermediate zones include: unconditioned basements, crawl spaces, attics, enclosed porches, and attached garages. Some intermediate zones can be included inside the home's primary air barrier or outside it. Intermediate zones have two potential air barriers: one between the zone and house and one between the zone and outdoors. For example, an attic or roof space has two air barriers: the ceiling and roof.

The primary air barrier should be adjacent to the insulation to ensure the insulation's effectiveness, so testing is important to verify that insulation and primary air barrier are together. The most airtight of these two air barriers is the primary air barrier and the least airtight is the secondary air barrier. Sometimes we are surprised during testing to find that our assumed primary air barrier is actually secondary, and the secondary air barrier is actually primary. The air barrier should be a material that is continuous, sealed at seams, and is itself relatively impermeable to airflow.

You can find valuable information about the relative leakiness of rooms or sections of the home with closable interior doors during a blower-door test. Listed below are 5 simple methods:

a. Feeling zone air leakage: Close an interior door partially so that there is a one-inch gap between the door and doorjamb. Feel the airflow along the length of that crack, and compare that airflow intensity with airflow from other rooms, using the same technique. Discovering that there is a lot of leakage coming from one zone and only a little coming from another is this test's limitation.

b. Difference in CFM_{50}: Check the difference in CFM_{50} when an interior door is closed versus when it is open. You will probably have to adjust the blower door after opening or closing the interior door to restore 50 Pascal house pressure. This technique works well for basements, attached garages, hallways in multi-family buildings, crawl spaces with interior access hatches, and other zones that may contain significant air leaks.

c. Zone pressure difference: Check the pressure difference between a closed room or zone and the main body of a home. Larger pressures indicate larger potential air leakage within the closed room or zone or a tight air barrier between the zone and main body.

d. Observing the ceiling/attic floor: Pressurize the home to 50 Pascal and observe the top-floor ceiling from the attic with a good flashlight. Air leaks will show in movement of loose fill insulation, blowing dust, moving cobwebs, etc.

e. Observing smoke movement: Pressurize the home to 50 Pascal and observe the movement of smoke through the house and out of its air leaks.

All of these tests are approximate. Feeling airflow with your hand may be inaccurate, but this simple technique may point out many air leaks that could have remained hidden without it.

Air leakage, restricted by closing a door, may have almost equal alternative paths, rendering tests b and c inaccurate. However, closing doors to leakier rooms will usually produce a greater reduction in CFM_{50} than closing doors to tighter ones. Leakier rooms will usually have greater pressure differences with the main zone than tighter rooms. Only practice and experience can guide your decisions about the applicability and usefulness of these tests.

3. Simple Attic Leak Testing

a. Air-sealing crews commonly use simple diagnostic techniques like the attic-pressure procedure described below. This procedure assumes that the roof is well vented. There are many variations of this test used to evaluate other air barriers in other intermediate zones.

(1) Depressurize house to –50 Pascal with a blower door.

(2) Find an existing hole or drill a hole through the ceiling between the conditioned space indoors and the attic.

(3) Setup the manometer as follows:

(a) Connect the input port to a hose connected into the attic.

(b) Leave the reference port open to the indoors.

(4) Read the pressure given by the manometer. This is the house-to attic pressure, which will be close to -50 Pascal if the ceiling is airtight and the roof well vented.

(5) If the reading is significantly different from -50 Pascal, find the air barrier's largest leaks and seal them.

(6) Repeat steps 1 through 5, performing more air-sealing as necessary, until the pressure is as close to -50 Pascal as possible.

4. Zonal Pressure Testing

The digital manometer, used for blower door testing and worst-case depressurization testing, can also measure pressures between intermediate zones, indoors, and outdoors during blower-door tests.

When the blower door depressurizes the house to –50 Pascal, the home's intermediate zones will also be depressurized between 0 and –50 Pascal. The amount of depressurization depends on the relative leakiness of the zone's two air barriers. For example, in an attic with a very well ventilated roof and a fairly airtight ceiling, the attic will not be depressurized much by a blower-door test. The leakier the ceiling and the tighter the roof, the more an attic will be depressurized. This holds true for other intermediate zones like crawl spaces, attached garages and unconditioned basements.

For additional reference on how to perform zonal pressure testing, refer to the Missouri Weatherization Field Guide, Section 12: Air Leakage Diagnostics.

a. Zonal pressure testing is required to be performed at homes at the following locations:

(1) Between the house and all separate unconditioned attic spaces. House to attic space zonal pressure testing is not required in mobile homes.

(2) Between the house and all separate unconditioned basements and/or crawlspaces. House to belly space zonal pressure testing is not required in mobile homes.

(3) Between the house and any and all attached garages.

b. Use the following test procedures for measuring zone pressures in attics, crawl spaces, building cavities, and attached or tuck under garages.

(1) Set-up blower door for house air-leakage test.

(2) Ensure that the hose to the outside will not be affected by the blower door airflow.

(3) Close any openings (door, access hatch) between the intermediate zone and conditioned space, taking care not to pinch hose if it goes through the door or hatchway.

(4) Depressurize house to -50 Pascal. If the house cannot be depressurized to -50 Pa, depressurize to highest multiple of 5 and use blower door conversion table.

(5) Connect hose from zone to input tap on manometer.

(6) Record pressure of zone with reference to the inside.

(a) Readings of 25-to-50 Pascal house-to-attic pressure mean that the ceiling is tighter than the roof.

(b) Readings of 0-to-25 Pascal house-to-attic pressure mean that the roof is tighter than the ceiling.

(c) Readings around 25 Pascal house-to-attic pressure indicate that the roof and ceiling are equally airtight or leaky.

5. Interpreting Zone Pressure

Pressure readings between the zone and outside indicate whether the air barrier is aligned with the insulation. In all cases, both the air barrier and insulation should be in the same

building section. Pressure readings also give clues about the amount of air-sealing work required.

House to zone readings of -25 to -50 Pascal indicate that the air barrier between the living space and zone is tighter than the barrier between the zone and outside (for example, the ceiling is tighter than the roof in an unfinished attic). This is good in that the primary air barrier is adjacent to the insulation. However, the air barrier (ceiling) can be made tighter if the pressure reading is less than -45 Pascal.

House to zone readings of 0 Pascal to -25 Pascal indicate that the air barrier between the zone and outside is tighter than the air barrier between the living space and zone. For example, the crawl-space foundation walls are tighter than the floor between crawl space and conditioned area. If the crawl space foundation walls are the thermal boundary, holes in the foundation wall should be sealed until the pressure difference between the crawl space and inside is as close to 0 Pascal as can be achieved. This will align the pressure boundary with the thermal boundary.

If the floor above the crawl space is the thermal boundary, the air barrier (foundation walls) and the insulation (floor above the crawl space) are misaligned. A decision of where to locate the thermal boundary must be made, followed by appropriate air sealing and insulation work.

Zone-to-inside readings around -25 Pascal indicate that the air barrier between the zone and conditioned space and the air barrier between the zone and outside are equally leaky. If there is currently no insulation, decide where the thermal boundary should be and perform appropriate air sealing and insulation work accordingly.

Generally, the pressure and thermal boundary (air barrier and insulation) should be between the conditioned space and attic.

The pressure/thermal boundary can be either the foundation walls or floor above a crawl space.

The thermal boundary must always be between the conditioned space and tuck-under or attached garage, to separate the living spaces from this unconditioned and often polluted zone.

Building cavities like wall cavities, floor cavities between stories, and soffits in kitchens and bathrooms can also be tested as described above to determine their connection to the outdoors.

Section V: Air Sealing

A. Air Sealing Requirements

Refer to Section IV – Shell and Duct Air Leakage Diagnostics for guidance on cost-effective air sealing.

Before air leakage reduction measures are installed, the building envelope must be defined and existing health and safety problems must be corrected.

Infrared scanning should be used in conjunction with a blower door as a tool to identify areas of excessive air leakage. Subgrantees are advised to use infrared scanning whenever the equipment is available and the use is practical.

1. Air Sealing Guidelines

a. The approach to air sealing should be to seal high (attic) spaces first, low (crawl or unconditioned basement) spaces second and the middle spaces around windows, doors and other penetrations last as determined cost-effective.

b. Before attic insulation is installed, all obvious leaks must be sealed. These leaks might include, but are not limited to:

(1) Open top plates (usually in balloon-frame dwellings).

(2) Chases around masonry and metal chimneys.

(3) Missing or misaligned attic doors or hatches.

(4) Chases around plumbing stacks.

c. Additional leaks may include but are not limited to:

(1) Missing window sashes or lights.

(2) Installation of sash locks on double- and single-hung windows.

(3) Doors that are misaligned in their frames.

(4) Missing drywall or other interior finish materials.

(5) Other obvious holes or leaks in the dwelling envelope that:

(a) Are cost-effective to seal,

(b) Prevent the structure from damage, or

(c) Are necessary for the proper installation of insulation.

d. Backing or infill should be used to minimize hole size to ensure successful use of sealants. The infill or backing will not bend, sag, or move once installed in order to ensure that sealant does not fall out.

e. Sealants selected should be compatible with their intended surfaces and allow for differential expansion and contraction between dissimilar materials. Sealants will be continuous and meet fire barrier specifications, according to authority having jurisdiction.

f. Whenever it is cost-effective, the installation of spray polyurethane foam (SPF) is recommended where it can achieve both insulation and air sealing value. The cost for applying SPF can be split between both infiltration reduction and insulating of an area such as a band sill or ductwork. The cost of applying foam may be split between the two measures to have a better possibility that they both have a SIR of 1.0 or greater. Use EPA recommendations (available online at https://www.epa.gov/stationary-sources-air-pollution/national-emission-standards-hazardous-air-pollutants-flexible-0) when working within the conditioned space or when SPF fumes become evident within the conditioned space.

g. Whenever SPF is not practical or cost-effective, the installation of dense pack cellulose insulation in sidewalls, cathedral ceilings, convective bypass areas, open top plates, drop ceilings and other air leakage locations is preferred over the use of air sealing techniques using air barrier materials for achieving reductions in air leakage.

h. Documentation of materials, labor and CFM_{50} reductions must be retained in the client file.

2. Penetrations and Holes

a. All penetrations through the exterior sidewalls of a unit that are not sealed must be sealed from the interior with the exception of:

(1) Foundations, which may be sealed from either interior or exterior.

(2) Any hole or penetration requiring sealing to keep out rain or snow.

b. Openings in recessed light fixtures must not be sealed unless the fixture is rated as an “IC” fixture.

c. A fire-rated material, such as at least 26 gauge, galvanized tin, must be used to seal gaps around heat sources such as masonry or metal chimneys. This fire-rated material must be sealed with high temperature caulking to the chimney and to surrounding framing and

finish materials. Only non-combustible sealant will be used in contact with chimneys, vents, and flues.

(1) Un-faced fiberglass insulation with an ASTM rating as a non-combustible material of at least 3 ½ inches in thickness, or Rockwool© mineral wool insulation may be used to wrap a masonry chimney above this fire-rated material. This fiberglass/mineral wool serves as a fire shield for cellulose installed against the chimney.

(2) If an existing chimney or flue has been previously treated incorrectly, attempts should be made to comply with these standards. If it is not reasonable to bring a chimney up to these standards, document this fact in the client file and include photographs.

3. Fireplace Plugs and Equipment Covers

a. Removable fireplace "plugs" should be installed in a manner that prohibits the use of the fireplace unless the "plug" is removed.

b. When a fireplace “plug” is installed or the chimney is sealed, the subgrantee must provide a tag on or in the fireplace denoting that the fireplace flue is blocked and that the fireplace cannot be used until the “plug” is removed.

c. Covers for evaporative coolers, whole house fans and window air conditioners should be easy to remove and reinstall.

B. Ducted Distribution Requirements

1. Ductwork Inspection, Cleaning, and Sealing

a. Ductwork must be tested and sealed according to Section IV – Shell and Duct Leakage Diagnostics.

b. If asbestos tape or insulation is present, it will not be disturbed except for encapsulation or removal by an AHERA asbestos control professional. Department approval must be granted in writing prior to any removal. For additional information regarding asbestos, refer to Section II, Subsection B, Topic 10, Subtopic e: Asbestos Procedures.

c. Supply and return ductwork must be cleaned as necessary to remove large objects and debris, which may impede airflow through the heating system.

d. Uncover any blocked registers or grilles. Explain to the client the importance of maintaining unrestricted airflow. Registers or grills that have been blocked reduce the efficiency of the heating or cooling unit.

e. As necessary, delivery and return air grilles and registers may be removed and cleaned to remove excessive dirt and debris, which may impede airflow.

f. Remove or permanently seal off ducts, registers and grilles located in unconditioned spaces including attached garages.

g. Ductwork outside the thermal envelope of the dwelling must be connected and sealed.

h. All accessible return air ductwork within a combustion appliance zone (CAZ), except gravity systems, must be sealed enough to eliminate the potential for back drafting.

i. Ducts and registers into non-living areas of the structure may be sealed off with owner permission.

j. Existing crawl-space plenums should be abandoned and replaced with a sealed duct system.

k. Ductwork sealing shall be done with mastic, fiberglass mesh tape, sheet metal or SPF. Existing duct tape must be removed before installing duct mastic or other approved sealing materials.

(1) Seams, cracks, joints, holes, and penetrations less than ¼” will be sealed using fiberglass mesh and mastic. Mastic alone will be acceptable for holes less than ¼” that are more than 10’ from air handler.

(2) Seams, cracks, joints, holes, and penetrations between ¼” and ¾” will be sealed in two stages:

- They will be backed using temporary tape (e.g., foil tape) as a support prior to sealing
- They will be sealed using fiberglass mesh and mastic

(3) Seams, cracks, joints, holes, and penetrations larger than ¾” will be repaired using rigid duct material. Fiberglass mesh and mastic will overlap repair joint by at least 1” on all sides.

l. If a boot is loose it shall be reattached to the sub floor with roofing nails or staples. Wood screws may also be used. Ensure that the heads of the screws do not prevent the register or grille from fitting into the boot. If gaps exist between the boot and the floor and the space below the floor is unconditioned, fill the gaps with mastic or other appropriate materials.

m. If the furnace filter slot is not covered, a pre-manufactured or site manufactured durable filter slot cover will be installed to prevent air bypass around the filter on all new furnace installations and all existing heating systems located outside the thermal boundary.

C. Windows and Doors

Windows and doors were once thought to be a major air-leakage problem. However, it has been determined that higher priority areas exist, therefore, window and door air sealing has been de-emphasized. The application of window and door measures should be governed by cost-effectiveness as determined by the NEAT/MHEA computer audits.

Window and door energy efficiency is improved in two primary ways: increasing thermal resistance and reducing air leakage. The limiting factors to the application of these measures are money and time. In the past, window measures, especially storm windows and replacement windows, were over emphasized.

Windows and doors remain very important building elements and their repair or replacement is often essential for the survival of a building. The replacement of windows and doors are not allowable health and safety costs but may be allowed as an incidental repair if tied to a specific cost effective weatherization measure or group of measures. The repair of windows and doors to resolve bulk water intrusion that is causing visible biological growth is an allowable health and safety cost. For more information on Incidental Repairs, refer to Section XII, Subsection D: Incidental Repairs. All tasks relating to window and door repair must be accomplished using lead-safe weatherization methods, if required.

1. Primary windows

a. Window Assessment

(1) Windows must be assessed with the computerized audit to determine the need for potential repair for air leakage reduction.

(2) All existing egress windows must remain operable.

(3) Non-operable windows may receive air leakage work based on the guidelines in Section IV and in the following air sealing priority: big holes first, then attic, then basement, then windows/doors/interior.

b. Subgrantee installed storm windows in kitchens, baths and other high moisture areas should be operable if they provide the only source of fresh air ventilation into the space.

2. Window Air Leakage

With the exception of broken glass or missing panes, windows are rarely the major source of air leakage in a home. Window air-leakage measures are marginally cost-effective.

The measures listed below may be addressed as energy efficiency if they are found to be cost-effective through the use of the air sealing guidelines outlined in Section V.

a. Replace missing or broken glass or glass that is cracked and noticeably separated that affects the structural integrity of the window. Use glazing points or clips and glazing compound when replacing glass in frames that require glazing compounds. Glass cracks that are not noticeably separated may remain.

b. To prevent air leakage, condensation, and rain leakage, seal between window frame and other building materials on interior and exterior walls. Use sealants with rated adhesion and joint-movement characteristics appropriate for both the window frame and the building materials surrounding the window. Seals between the fixed components of the window (e.g., jambs, sill) will be continuous and complete while maintaining the operability of the window.

c. Replace missing or severely deteriorated window frame components, such as, stops, jambs or sills. Wood exposed to the weather must be primed and painted. Glazing window sashes is best accomplished as part of a comprehensive window rehabilitation project. Re-glazing wood windows may not be a durable repair without scraping, priming and painting.

d. Stops will be adjusted to eliminate visible gaps between the stops and the jamb while maintaining operability of the window.

e. Large gaps between sash and sill and sash and stops may be weather-stripped. Meeting rails may also be weather-stripped or planed.

f. Replace/repair missing or non-functional top and side sash locks, hinges or other hardware if such action will significantly reduce air leakage. Locks will be installed so that the rails of the upper and lower sashes are flush and in full contact.

g. Avoid expensive or time-consuming window-repair measures implemented to solve minor comfort complaints.

3. Window Repairs

a. When feasible, window repairs must be done, instead of replacement, whenever the total cost of the repair is less than seventy-five percent of the cost of a replacement window. If a window repair exceeds seventy-five percent of the cost of replacement, see Section V, Subsection C, Topic 4: Window Replacements.

b. 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.

c. Window sashes are not required to be made operable unless stipulated by building codes.

4. Window Replacements

Window replacements are generally not cost-effective energy conservation measures and are replaced when the window is missing or damaged beyond repair. When feasible, window repairs must be done rather than replacement.

a. A window may be replaced if the individual SIR is 1 or greater when evaluated using the approved computerized audit. The individual SIR shall include materials and labor to install the window, which should include lead safe work practices if required.

b. An agency may replace up to 5 windows per single family home without prior approval, given that individually each window is cost effective with a SIR of one or greater. If an agency feels 6 or more windows need to be replaced, a request to replace all windows must be submitted and approved by the department on a case by case basis. For approval to replace windows in multifamily buildings (duplexes or greater) refer to Section IX, Subsection A, Topic 4.

    1. The request must include:

        - The client name,
        - Job number,
        - The total number of windows to be replaced,
        - The total cost of windows to be replaced,
        - The NEAT/MHEA Recommended Measures,
        - The NEAT/MHEA Input Report,
        - A building diagram with the windows to be replaced denoted,
        - Digital photos of each window to be replaced with specific detailed photos showing the issues of the existing windows and
        - A short narrative explaining justification why 6 or more windows need to be replaced.

    2. Upon request to replace 6 or more windows, an on-site evaluation of the windows may be required by the department.

c. All replacement windows installed must be double pane windows constructed of thermally broke aluminum, vinyl or other non-thermal conductive material.

d. Window replacements must be based on an energy-conservation decision process rather than client requests or aesthetics. Operable windows that do not operate properly or do not operate with ease, is not a justification for replacement. Broken glass can be replaced as part of the infiltration reduction measure. When evaluating windows for replacement in the computerized audit, leakiness is based primarily on the window type and the condition of the frame, sashes, and weather stripping. Once the leakiness level is determined using those factors, the level may be modified to take into account the condition of the windowpanes and the presence of a storm window based on the descriptions outlined in Attachment 3.7: Window Leakiness Guide.

e. Twin (double) windows shall be considered as two (or more) separate windows and not as one large window.

f. For homes older than 45 years, refer to Section XIII: Section 106 Requirements.

5. Storm Windows

a. New storm windows must not be used to replace existing storms if the existing storms are in good condition or can be repaired at a reasonable cost. If storm windows are to be installed, select metal exterior storm windows with the following qualities:

- Frame should have sturdy corners and not tend to rack out-of-square during transport and installation.
- The gasket sealing the glass should surround the glass's edge and not merely wedge the glass in place against the metal frame.
- Storm-window sashes must fit tightly in their frames.
- The window should be sized correctly and fit well in the opening.
- Storm-window sashes must be removable from indoors.

b. Storm windows shall be caulked around the frame at time of installation, except for weep holes that shall not be sealed. If weep holes are not manufactured into the new storm window, weep holes shall be drilled into them.

c. Wood storm window inserts should fit neatly within window frame with the appropriate turn buttons, latches or closing hardware.

d. Fixed storm windows must not restrict the existing capacity and access required for emergency exits.

6. Non-Allowable Window Materials

Tinted window films, all sun shields and heat reflective materials are not allowable WAP expenses. Refer to Table XI-2 Measure selection for the WA and associated life spans for additional information.

7. Doors

Door measures are usually not cost-effective unless they have a very low cost. Doors have a small surface area and their air leakage is more of a localized comfort problem than a significant energy problem most of the time.

a. Doors must be assessed to determine the need for repair and for air leakage reduction.

b. All existing egress doors must remain operable.

c. Non-operable doors may receive air leakage work based on the guidelines in Section IV and in the following air sealing priority: big holes first, then attic, then basement, then windows/doors/interior.

8. Door Air Leakage

Door weather-strip, thresholds and sweeps are marginally cost-effective. These measures may be addressed if they are found to be cost-effective using the guidelines in Section IV.

a. Before installing weather-stripping, remove old weather-strip. Tighten door hardware and adjust stops so door closes snugly against its stops.

b. Use a durable stop-mounted or jamb-mounted weather-strip material to weather-strip the door. New weather-strip must form a tight seal (no buckling or gaps) when installed. Door should close without rubbing or binding on the stops and jambs.

c. Thresholds and door sweeps are installed to prevent infiltration and should not bind the door. Thresholds should be caulked at the sill and jamb junction.

9. Door Repairs

a. When feasible, a door must be repaired rather than replaced whenever the total cost of the repair is seventy-five percent or less than the cost of the replacement door.

b. Doors found in non-operable condition are not required to be made operable.

c. The following door repair items may be included in infiltration reduction or, if completed to insure the effective performance of weatherization materials, may be done as an incidental repair.

(1) Replace missing or inoperable locksets.

(2) Reposition the lockset/strike plate.

(3) Install a modernization kit so that the door can be held in a tightly closed position.

(4) Reposition stops if necessary.

(5) Seal gaps between the stop and jamb with caulk.

10. Door Replacements

Door replacements are generally not cost-effective energy conservation measures and are replaced when the door is missing, damaged beyond repair and cost effective. When feasible, door repairs must be done rather than replacement.

a. A door may be replaced if the individual SIR is 1.0 or greater when evaluated using the approved computerized audit. The individual SIR shall include all materials (including door hardware, door trim, thresholds, etc.) and labor to install the door.

b. Observe the following standards when replacing exterior doors:

(1) Replacement doors must have a solid wood core or an exterior-grade skin with foam core. Pre-hung doors are preferred; however, door slabs may be used when it is necessary to reduce the size to fit a non-standard opening. Replacing an exterior panel door with another panel door is not allowed. Sliding glass doors may be used to replace existing sliding glass doors.

(2) Replacement doors may include a single insulated unit of glass; however, a door viewer is the preferred installation.

(3) Pre-hung replacement doors may be installed if determined to be more cost-effective than the repair of the existing door and frame or the installation of a door that is not pre-hung.

(4) The agency must include a finish of either paint or clear sealer on all raw wood doors installed as part of the repair measure to protect the investment. All surfaces of the door, including the edges, shall be finished with a paint or sealer after any cutting and fitting of the door. Unsealed wood doors will weather and potentially deteriorate in a short period of time.

(5) Replacement doors installed between a garage and the living space must be a solid wood door not less than 1 3/8 inches thick, solid or honeycomb core steel door not less than 1 3/8 inches thick or a 20-minute fire rated door.

c. If a door is not cost effective, but the subgrantee determines the door needs to be replaced, a request for a case-by-case approval may be submitted to the department.

d. Door replacements must be based on an energy-conservation decision process rather than client requests or aesthetics. Operable doors that do not operate properly or do not operate with ease, is not a justification for replacement. Weather stripping and door sweeps can be replaced as part of the infiltration reduction measure.

e. For homes older than 45 years, refer to Section XIII: Section 106 Requirements.

11. Storm Doors

Replacement or repair to storm doors is not allowed with WAP funds.

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Section VI: Insulation

For insulation purposes, a living space is defined as any conditioned room or area inside the building shell that is used in the day-to-day activity of the occupants. These rooms or spaces include, but may not be limited to, kitchen/dining, living rooms, bathrooms, bedrooms, hall, family room, utility room, etc.

For e**very** type of insulation installation, including but not limited to: attic, wall, sill, floor and foundation, a dated receipt signed by the installer will be provided to the client and a copy placed in the client file. The receipt must include:

- Coverage area
- Thickness
- R-value

Additionally, any loose fill application must also include:

- Settled thickness
- Number of bags installed

A. Attic Insulation

1. General Procedures

a. Before installing insulation, a thorough inspection of the attic area should be performed.

b. The inspection should include the determination of the R-value and integrity of existing insulation, location of air leakage passages from the conditioned spaces to the attic, and the suitability of the structure for receiving insulation. Refer to Table VI-1, developed by the Building Performance Institute, for guidance in the evaluation of insulation.

c. Any attic that contains vermiculite must follow the guidelines given in Section II, Subsection B, Topic 10: Hazardous Conditions and Materials.

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Table VI-1 -- Effective R-values of Batt Insulation

	"Good"	"Fair"	"Poor"	
Measured Batt Thickness (inches)	Effective R-value (2.5 per inch)	Effective R-value (1.8 per inch)	Effective R-value (0.7 per inch)	1. Measure the insulation thickness. 2. Determine the condition of the installation using the following criteria: 🗐 Good – No gaps or other imperfections 🗐 Fair – Gaps over 2.5% of the insulated area. This equals 3/8 inch spacing along a 14.5 inch batt. 🗐 Poor – Gaps over 5% of the insulated area. This equals ¾ inch space along a 14.5 inch batt. *3.* Look up the effective R-value of the installed insulation using the condition and measured inches.
0	0	0	0	
1	3	2	1	
2	5	4	1.5	
3	8	5	2	
4	10	7	3	
5	13	9	3.5	
6	15	11	4	
7	18	13	5	
8	20	14	5.5	
9	23	16	6	
10	25	18	7	
11	28	20	8	
12	30	22	8.5	

d. The inspection should determine any repair work associated with the installation of the attic insulation. Repairs should be completed before installing insulation.

e. Any amount of drywall that is necessary to install attic insulation will generally be allowed as long as the insulation measure remains cost effective when the cost of the installed drywall is included.

(1) EXCEPTION: When an entire drywall surface is missing such as an entire ceiling in a room. Even if this amount of drywall could be added to the ECM such as attic or wall insulation, it is likely "beyond the scope of weatherization" and would need prior approval from the department.

(2) If a surface exists, such as a drop ceiling, that is not adequate to support insulation, then **any** amount of drywall may be included in the ECM as long as it is cost-effective.

2. Moisture Inspection and Repair

a. Roof leaks and all other attic moisture problems shall be repaired prior to the installation of attic insulation or the home must be deferred.

b. All vents from combustion appliances must be vented through the roof or sidewall.

c. All exhaust fans in bathrooms, toilet rooms and kitchens must be exhausted to the exterior of the building.

d. Repair any moisture problems that will degrade or diminish the effectiveness of weatherization measures.

3. Electrical Safeguards

a. Unsafe wiring, uncovered junction boxes or other hazardous electrical situations must be corrected prior to performing any other work in the attic(s). If insulation exists, ensure that wiring is safe and meets applicable codes.

b. All visible electrical junctions must be installed in covered junction boxes if additional insulation is installed. All electrical boxes will be flagged to be seen above the level of the insulation.

c. Non-Insulation Contact (IC) Recessed Lights

A fire-rated *air barrier* system (i.e., equivalent to 5/8 fire code gypsum wallboard will be used to separate non- *IC* rated recessed lights from insulation, using one of the methods below:

- A fire-rated airtight closure taller than surrounding attic insulation will be placed over non- *IC* rated recessed lights. The top of the enclosure will have an R-value of 0.5 or less, and will be left free of insulation. The entire closure will maintain a 3" clearance between the closure and the fixture including wiring, box, and ballast. Caulk, mastic, or foam will be used on all edges, gaps, cracks, holes, and penetrations of the closure material.

OR

- The non- *IC* rated light fixture will be replaced with an airtight and *IC* - rated fixture

OR

- The fixture(s) may be replaced with surface mounted fixture and opening sealed

d. Knob and tube wiring.

(1) A contractor, assessor, auditor, or similar will inspect and assess the house to identify knob and tube wiring.

(2) A non-contact testing method will be used to identify live wiring.

(3) If live knob-and tube wiring is to remain in an attic, it will not be covered or surrounded. A dam that does not cover the top will be created to separate insulation from the wire path. Any insulation must be kept at least three inches from the wiring.

(4) If live knob and tube wiring is to remain in a dwelling attic, walls or basement, the walls of the dwelling must not be insulated.

(5) Live knob and tube wiring may be replaced with WAP funds in attics and walls provided that the cost of the replacement, when added to the cost of the attic and/or wall insulation, has an SIR of 1.0 or greater. Live knob and tube wiring may also be replaced as an incidental repair tied to cost effective attic or wall insulation as long as the cumulative SIR of the home remains at 1.0 or greater. Knob and tube wiring cannot be replaced as a health and safety measure.

(6) If knob and tube wiring is replaced, new appropriate wiring will be installed by a licensed electrician in accordance with local codes. Any remaining knob and tube wiring will be rendered inoperable in accordance with local codes. If knob and tube wiring has been deactivated and the dwelling has been rewired with approved electrical cable, the attic may be insulated without special precaution.

4. Treatment of Other Hazards

a. Use appropriate personal protective equipment and work practices in the presence of animal or insect hazards. Ensure personal safety during work.

b. Repair any rotted, broken or damaged attic structural components. Ensure that the ceiling will safely hold the weight of the insulation. Repair or replace any weakened, damaged or missing interior ceiling surface.

5. Attic Access

a. If attic insulation is added, access doors and pull-down stairs over living areas must be insulated with non-compressible insulation as close as possible to the same R-value as the attic. The insulation will be permanently attached and in complete contact with the air barrier. Weather-strip will be applied to prevent air leakage.

b. When it is necessary to install an interior access in the ceiling, it must be at least 20 inches by 30 inches.

c. A ceiling access shall have an insulation dam, made of rigid materials, that exceeds the height of the insulation to be installed. The dam must be strong enough to hold the weight of a person entering or exiting the attic.

d. If any work is performed in the attic of a home, an attic access must be left for inspection purposes. If there are no interior accesses, at least one exterior access to each attic space shall be left for inspection purposes.

e. If attic insulation is added, knee wall doors from the living areas to the attic must be insulated with non-compressible insulation as close as possible to the same R-value as the knee wall. The insulation will be permanently attached and in complete contact with the air barrier.

f. When it is necessary to install an interior access in a knee wall, it must be at least the knee wall stud cavity width x 24 inches and shall be weather-stripped and insulated to the same R-value as the knee wall. A latch shall also be installed to ensure air tightness.

g. When the attic is accessed by a stairwell and attic insulation is installed, the stairwell must be evaluated for inclusion within or exclusion from the thermal boundary in order to create a continuous thermal boundary between the attic and conditioned spaces.

(1) Stairwells with doors at the bottom may be brought into the thermal boundary or kept out of the thermal boundary

(2) Stairwells with doors at the top must be brought into the thermal boundary

6. Insulation Shielding and Blocking

a. All electrical fixtures, excluding IC (insulation contact) rated recessed lights and covered junction boxes, shall be blocked with rigid material, to ensure a minimum insulation clearance of 3 inches and a maximum clearance of 6 inches.

b. Insulation barriers of fire-rated material shall be used around heat-producing sources. Barriers shall be slightly higher than the finished height of the insulation. If metal is used as an insulation barrier, a 3-inch clearance must be maintained between the metal insulation barrier and the heat-producing source and no insulation shall be left within the blocked area. Blocking must be installed so that it is effective in shielding the heat source from the insulation. Metal blocking must be notched so that it does not contact electrical wiring.

c. A fire-rated material, such as at least 26 gauge, galvanized tin, must be used to seal gaps around heat sources such as masonry or metal chimneys. This fire-rated material must be sealed with high temperature caulking to the chimney and to surrounding framing and finish materials.

(1) Un-faced fiberglass insulation with an ASTM rating as a non-combustible material of at least 3 ½ inches in thickness, may be used to wrap the masonry chimney above this fire-rated material. This fiberglass serves as a fire shield for cellulose installed against the masonry chimney.

(2) If an existing chimney or flue is treated incorrectly, correct it to comply with these standards. If it is not reasonable to bring a chimney up to these standards, document this fact in the client file and include photographs.

d. Requirements for furnaces installed in attics:

(1) Attic furnace blocking must be installed to ensure a minimum free air clearance of 18 inches, but not more than 24 inches.

(2) If a working platform is present for an attic furnace, or if one is installed by the subgrantee, 30 inches of clearance adjacent to the furnace controls must be provided.

(3) Attic furnaces must be checked after adding attic insulation to ensure they are free of insulation and operate properly.

B. Installation Methods for Attic Insulation

1. General Procedures

a. Locate and seal attic bypasses, chases and open-topped partition walls.

b. Properly treat ceiling height changes and stairwells as necessary to stop leakage. Seal knee wall floor cavities. Check for completion of bypass sealing before installing any insulation.

c. Attic insulation must be installed in such a manner that ensures complete coverage over heated areas, and is installed at an even depth except where physical constraints may exist.

d. Insulation must be installed according to the manufacturer's specifications for coverage and R-Value.

e. Attics must be tested using zonal pressure diagnostics. This test should be used to determine quality and completeness of air leakage and bypass sealing, prior to, and then after, installing insulation. For additional information on zonal pressure diagnostics, refer to Section IV, Subsection G, Topic 4: Zonal Pressure Testing.

f. Cellulose insulation is the preferred choice for installation in site built homes. It should be used unless technical issues warrant other product consideration.

g. A signed and dated attic certificate will be permanently fastened to the roof side of the attic. The certificate will include:

- Insulation type and brand
- Installed thickness and settled thickness
- Coverage area

- R-value
- Number of bags installed in accordance with manufacturer specifications
- Installation date
- Installed by

2. Insulation Coverage and Density

a. Insulate uninsulated open-joist attics and other areas that form the thermal barrier to the level recommended by the computerized audit program.

b. Insulation will be adequately marked for depth with rulers, a minimum of every 300 square feet of attic area, with measurement beginning at the air barrier.

c. At the beginning of each job, measure the density of the insulation for a selected test area before beginning the major installation. This should be done for insulation blowing jobs using any nozzle type or tubing method.

(1) Insulate enclosed areas (under floors, slopes, under knee wall cavities, etc.) to high density level as follows:

(a) Blown cellulose 3.5 lb/ft³

(b) Blown fiberglass 2.2 lb/ft³

(2) Insulate knee wall areas as follows:

(a) Blown cellulose 3.5 lb/ft³

(b) Blown fiberglass 1.5 to 2 lb/ft³

(c) Fiberglass batts R-19

d. Calculating the number of bags is the preferred method for determining the proper amount of material to be installed into an attic area at a given R-value.

e. When a vapor barrier is installed with the insulation, the barrier should be installed on the warm side of the insulation and never more than 1/3 of the R-value away from the warm-side surface.

f. Add necessary insulation to eliminate voids and areas of incomplete coverage.

3. Enclosed Ceiling Cavities

When insulating enclosed ceiling cavities, it is preferred that insulation be installed from a location other than through roofing material. Such locations may include rafter cavities that open into an attic area, through the eave, or from the interior of the home.

4. Storage Space

Where attic space is being used for storage, subgrantees should request the client remove storage items from the area. In cases where the client is physically unable to perform this task, subgrantees should include the removal of items in the cost-effective analysis of installing insulation, and proceed with the measure if it is cost-effective (savings-to-investment ratio of 1.0 or greater).

5. Ductwork Insulation

a. When attic insulation is installed, all uninsulated ductwork in the attic must be insulated. Install a minimum of R-8 (preferably R-11 or greater, when possible) on ducts and plenums. Whenever it is cost-effective, the installation of spray polyurethane foam is recommended where it can achieve both insulation and air sealing value. If spray polyurethane foam is not cost-effective, it is preferred that attic ducts be draped with an un-faced blanket insulation and blown over with loose fill insulation, to at least the depth of the surrounding insulation. If faced duct insulation is installed, it is preferred that the facing be to the outside. Bubble wrap (foil faced or non-foil faced) should not be used to comply with the minimum R-8 value required for ductwork, as bubble wrap applied to the surface of ductwork only provides a value of approximately R-1.1. Ductwork with existing bubble wrap may be evaluated as uninsulated.

b. All joints, seams, and connections in ductwork shall be securely fastened and sealed with the proper materials (fiberglass mesh and mastics or spray foam) before insulation is installed. The cost for applying spray polyurethane foam can be split between both duct sealing and insulating of ductwork to have a better possibility of both having an SIR of 1.0 or greater.

c. A minimum of 6 inches clearance between duct insulation and heat sources must be maintained, unless the material is rated for closer proximity.

6. Drill-and-Blow Patching

If a drill-and-blow method is used for installing ceiling insulation, holes must be properly plugged, secured with adhesives, and sealed.

C. Attic Ventilation

1. General Installation

a. Ensure that existing vents are not blocked, crushed or otherwise obstructed. Correct problems as necessary, or replace.

b. When attic ventilation is installed, use the following guideline unless local code supersedes:

If air-sealing work has been completed at the attic floor then one square foot of net-free ventilation may be installed for every 300 square feet of attic floor area.

c. Attic vent types will be made of corrosion-resistant material for their specific location (e.g., exterior soffit, gable end, roof) and material and intended use (e.g., metal vent on metal roof).

d. All ventilation openings should have suitable louvers and screens to prevent snow, rain and pests from entering the attic. Screens will be made of non-corroding wire mesh with openings of 1/16" to 1/4" to prevent pest entry

e. Placement of attic vents will be considered for proper airflow and prevention of entry of wind driven rain or snow.

2. Soffit Vents

When soffit vents are present, baffling for attic soffit vents will be installed to:

(a) Ensure proper airflow

(b) Prevent wind washing of insulation

(c) Allow for maximum insulation coverage

3. High-Low Vents

a. Roof vents should be installed close to the peak.

b. Install high gable vents at least 3 feet above the soffit or gable vent used for low venting.

c. When roof vents are installed, they should be nailed and well-sealed to the roof to prevent water leakage.

4**. Gable Vents**

a. Gable-end vents should be installed as high in the gable as possible and positioned to provide cross ventilation.

b. Steps shall be taken to prevent wind washing of insulation around the attic vents.

5**. Knee Wall Ventilation**

Knee wall attics or attic spaces that are sealed from other attic spaces may need to be ventilated as if they are a separate attic.

D. Sidewall Insulation

1. General Procedures

a. An inspection from the interior and exterior of the home should be performed prior to installing insulation. This inspection should identify all potential hazards and needed repairs.

b. An inspection from the exterior of the home should include an examination of the following:

(1) Building construction details.

(2) Siding type and condition.

(3) The location of electrical, gas, oil and phone lines.

(4) Plumbing pipes.

(5) Existing moisture and drainage problems.

(6) Existing structural problems.

c. An inspection from the interior of the home should include an examination of the following:

(1) Interior wall siding type and condition.

(2) Electrical and plumbing utilities.

(3) Duct work in wall cavities.

(4) Dropped or suspended ceilings.

(5) Moisture problems.

d. An inspection from the attic should include an examination of the following:

(1) Open top plates and balloon framing.

(2) Type of electrical wiring in the walls.

(3) Knee wall areas.

e. Correct electrical problems such as unsafe wiring, uncovered junction boxes or electrical situations that must be corrected prior to performing any insulation work. If insulation exists, ensure that wiring is safe and meets applicable codes.

f. Live knob and tube wiring may be replaced with WAP funds in attics and walls provided that the cost of the replacement, when added to the cost of the attic and/or wall insulation, has an SIR of 1.0 or greater. Live knob and tube wiring may also be replaced as an incidental repair tied to cost effective attic or wall insulation as long as the cumulative SIR of the home remains at 1.0 or greater. Knob and tube wiring cannot be replaced as a health and safety measure.

(1) If active knob and tube wiring remains in the dwelling attic, walls or basement, the walls of the dwelling must not be insulated. Unless it is cost effective to rewire and the rewiring is completed before insulating.

(2) If knob and tube wiring has been deactivated and the dwelling has been rewired with BX, Romex, or other approved electrical cable, the walls may be insulated without special precaution.

g. Any wall that contains vermiculite must follow the guidelines given in Section II, Subsection B, Topic 10: Hazardous Conditions and Materials.

h. Any amount of drywall that is necessary to install sidewall insulation will generally be allowed as long as the insulation measure remains cost effective when the cost of the installed drywall is included.

EXCEPTION: When an entire drywall surface is missing such as all of the walls of a room. Even if this amount of drywall could be added to the ECM such as attic or wall insulation, it is likely “beyond the scope of weatherization” and would need prior approval from the department.

2. Moisture Inspection and Repair

a. Any leaks or other moisture problems must be repaired prior to installing wall insulation.

b. Repair any moisture problems that will degrade or diminish the effectiveness of weatherization measures.

3. Treatment of Other Hazards

a. Use appropriate personal protective equipment and work practices in the presence of animal or insect hazards. Ensure personal safety during work.

b. Remove any items that inhibit the ability to install wall insulation effectively.

c. Repair any rotted, broken or damaged structural components. Ensure that the finished wall material will safely withstand the pressure of the insulation. Repair or replace any weakened, damaged or missing interior wall surface.

4. Interior Inspection and Repairs

a. Repair or replace weak or damaged drywall or lath and plaster sections. Locate any interior areas of paneling with no sub-wall surfaces or that are not securely fastened. Determine an insulation strategy that will not damage the paneling. Repair or replace damaged or missing baseboard, casing, jambs, etc., that may allow insulation to escape from the wall cavity. Holes drilled for insulation must be finished and returned to a condition as close to the original as possible. Interior holes will be masked and dust controlled during drilling when accessing from interior.

b. Locate the positions of all wall-mounted switches and outlets before beginning insulation work. Locate all chases, utility runs, duct runs, wall heaters, vent fan penetrations, etc. prior to insulating. Block around these areas, if possible. If it is not possible to block around an area, avoid that area when insulating.

c. Find any interior soffit areas, pocket doors, or other structural details that may need preparation prior to insulating, and prepare as necessary. Locate critical framing junctures and ensure adequate insulation density.

5. Exterior Inspection and Repairs

a. Note all types of siding material. Note siding material that may contain asbestos and if present refer to Section II, Subsection B, Topic 10 Hazardous Conditions & Materials. Wherever possible, determine the presence and condition of previous layers of siding or sub-siding. Determine the best drilling strategy (the tubing method or the nozzle method. As the primary acceptable method, the siding must be lifted or temporarily removed to gain access for drilling. Permission is needed from the client to drill through any type of exterior siding.

b. Repair or replace severely deteriorated window or door components as needed to install insulation.

c. Patch holes in exterior walls.

d. Determine the source and correct any problem that has led to moisture in wall cavities prior to installing insulation. Repair or replace damaged, rotted or deteriorated siding to ensure the integrity of the insulation. If any missing siding, flashing, etc. would allow deterioration of installed insulation, replace it with a compatible material.

e. Access structural additions and critical junctures to determine the ability of these areas to contain high-density insulation. Correct any openings or gaps prior to installing insulation.

E. Installation Methods for Wall Insulation

1. General Procedures

a. Wall areas above windows and doors (except in mobile homes), and the area below windows must be insulated, whenever possible. These cavities made need to be drilled and blown separately.

b. Uninsulated exterior walls without drywall, paneling or other interior finishing material, must be insulated if adding interior finishing material and insulation is deemed cost-effective.

c. Fiberglass insulation must not be left exposed in living spaces or in other spaces that are routinely used by the client. Fiberglass may be encapsulated or covered with a durable, air-permeable material such as Tyvek or landscaping fabric.

d. Removal of siding before drilling the sheathing is considered “best practice” and should be the method used unless conditions make this impossible or an unacceptable risk.

e. Dense pack insulation will be installed using the tube-fill method. Using fill tube, 100% of each cavity will be filled to a consistent density. For additional information, see the Missouri Weatherization Field Guide, Chapter 5: Walls.

f. The cost for installing dense pack insulation can be split between infiltration reduction and insulating of an area such as walls. A maximum of 15% of the cost of the insulation measure may be applied to infiltration reduction. A comment must be included in the computerized audit noting that the cost was split.

2. Blocking

a. Construction details that allow insulation to escape from sidewall cavities such as balloon framed walls must be blocked or packed with insulation or other material in a manner that effectively retains the insulation material.

3. Materials

a. Site-built homes:

(1) Insulate all closed-cavity sidewalls with cellulose insulation unless this is not possible. If it is not possible, documentation for the reason must be included in the client file.

(2) Insulate open cavity walls with fiberglass, faced or unfaced, using a density and thickness appropriate for the cavity. Cover any flammable insulation facing or vapor

barrier installed in a living space with a fifteen-minute fire rated material such as 1/2 inch drywall (taped once) or 3/4 inch plywood.

(3) Rigid plastic insulation or spray polyurethane foam (SPF) may be used when appropriate. Cover any rigid insulation, SPF or vapor barrier installed in a living space with a fifteen-minute fire rated material such as 1/2 inch drywall (taped once), 3/4 inch plywood or a UL 1775 listed thermal barrier intumescent coating.

b. For mobile home wall insulation materials, refer to Section VIII, Subsection F: Sidewall Insulation.

4. Insulation Coverage, Density and Voids

a. Sidewall insulation must be installed according to manufacturers' recommended density, and in such a manner that does not allow settling of the material to occur.

b. Determine the appropriate sidewall insulation technique(s) to be used. When dense pack insulation is installed, the tube-fill method must be used.

c. Insulate all sidewalls to a minimum density of 3.5 lb/ft³ with cellulose insulation, unless a technical barrier prevents this technique.

d. When using blown fiberglass, install at a density of 1.5 to 2 lb/ft³.

e. The number of bags installed will be confirmed and will match the number required on the coverage chart.

f. Insulation density will be verified by bag count, core sampling, or with diagnostic methods such as infrared camera or chemical smoke with the blower door at 50 Pascal of pressure difference.

g. Subgrantees should obtain a warranty, of at least one-year, against voids of more than 5 percent from subcontractors installing wall insulation.

5. Plugs and Patching

a. Where possible, exterior lap siding must be removed and sheathing be drilled for the installation of insulation. Exterior holes will be weather barrier patched. If the exterior siding is properly shedding water, then patching of holes in the sub-siding is not required. Small pieces of fiberglass insulation can be inserted into the hole to prevent wicking of moisture from outside.

(1) Plugs that are compatible with the siding or wall type must be used to cover the exposed surface that has been drilled.

(2) Plugs must be sealed tightly and glued. They must be primed when exposed to weather unless vinyl/plastic plugs are being used.

b. Interior holes will be coated and patched to match as close to the original interior surface as possible. Subgrantees or their contractors should paint and may texture to match plugs to the surrounding wall, but may not paint or texture the entire wall.

6. Brick Siding

Interior drill and blow techniques are preferred for homes with brick veneer siding that are going to receive sidewall insulation.

7. Quality Control

When possible, infrared scanning should be used with a blower door as a quality control tool to check wall insulation work and identify areas of excessive air leakage. The infrared scanning device is a powerful tool for finding air leaks when used in conjunction with a blower door. Subgrantees are advised to use infrared scanning whenever the equipment is available and the use is practical.

F. Foundation Insulation

This section addresses rim joist insulation, basement wall insulation, and crawl space wall insulation.

1. General Procedures

a. An inspection from the interior and exterior of the home should be performed prior to installing insulation. This inspection should identify all potential hazards and needed repairs.

b. An inspection from the exterior of the home should include an examination of the following:

(1) Building construction details.

(2) Foundation type and condition.

(3) The location of electrical, gas, oil and phone lines.

(4) Plumbing pipes.

(5) Existing moisture and drainage problems.

(6) Existing structural problems.

c. An inspection from the interior of the home should include an examination of the following:

(1) Interior foundation wall type and condition.

(2) Electrical and plumbing utilities.

(3) Moisture problems.

d. Make any necessary repairs before installing insulation.

e. If any work is performed in the subspace of the home, an access must be left accessible for inspection purposes.

2. Moisture Inspection and Repair

a. All units must be inspected for problems associated with excess moisture.

b. Identification of potential moisture problems shall be documented in the client file.

c. Repair any moisture problems that will degrade or diminish the effectiveness of weatherization measures.

d. For crawl spaces and basements with exposed dirt floors, refer to Section II, Subsection B, Topic 9: Moisture.

3. Wall Moisture Barrier

If there is evidence of water leakage or moisture coming through the foundation wall from the exterior, a continuous moisture barrier must be attached from the top of the sill plate to the top of the slab. The barrier must be attached in a manner that drains the moisture behind the insulation to be installed, and covers the insulated section of the foundation or crawl space wall.

4. Treatment of Other Hazards

a. Use appropriate personal protective equipment and work practices in the presence of animal or insect hazards. Ensure personal safety during work and exercise the deferral policy when appropriate.

b. Repair any rotted, broken or damaged structural components as necessary to install ECM's.

5. Defining the Thermal Boundary

a. If the basement or crawl space meets the criteria to be a conditioned space as stated in Section IV, Subsection A, Topic 1: Preparation for a Blower Door Test, it must be treated as a conditioned area. In this case, the basement or crawl space walls are part of the boundary of the conditioned envelope. Therefore, it is preferred to air seal and insulate the basement or crawl space walls because this strategy encloses the furnace, ducts, pipes, water heater and other appliances within the conditioned envelope.

b. Unconditioned basements and crawl spaces must be tested using zonal pressure diagnostics when the housing construction type or the air leakage rate indicates that there may be hidden air leakage or bypass pathways into the basement or crawl space. This test should be used to determine quality and completeness of air leakage and bypass sealing, prior to, and then after, installing insulation. In addition, this test can help determine the appropriate location of the thermal boundary.

c. If the appropriate thermal boundary is determined to be the basement or crawl space wall, rather than the floor above the basement/crawl space, then the basement or crawl space wall should be sealed, as necessary, before any insulation is installed on these surfaces.

d. If a basement and crawl space are not separated by a continuous air barrier, both areas must be assessed the same (e.g., conditioned or unconditioned).

G. Foundation Insulation Installation Methods

1. Storage Space

a. Where the basement or crawl space is being used for storage, subgrantees should request the client remove storage items from the area that inhibit weatherization.

b. In cases where the client is physically unable to perform this task, subgrantees should include the removal of items that inhibit weatherization in the cost-effective analysis of installing insulation, and proceed with the measure if it is cost-effective with additional costs (savings-to-investment ratio of 1.0 or greater).

2. Materials

a. Interior wall insulation:

(1) If the wall is studded out on the interior, it may be filled with unfaced fiberglass batt of an appropriate thickness or with vinyl-faced fiberglass (metal building insulation).

(2) Vinyl-faced fiberglass (metal building insulation) may be fastened at the band joist area and hung down four feet.

(3) An alternative method for installing perimeter insulation is to attach metal-building insulation at the floor above the rim, so that the blanket extends from the floor above four feet down the foundation wall. It should be run horizontally in a continuous manner to eliminate as many seams as possible. The blanket may be slit at each floor joist to allow installation in a manner that minimizes gaps around the joist. The bottom of the bottom of this fiberglass batt insulation should be air sealed to the wall with a strip of wood nailed to the foundation or by sealing the vinyl facing to the wall with adhesive caulk.

(4) Interior rigid foam insulation may be glued and fastened or SPF applied to the basement or crawlspace wall. If the basement or crawlspace is used as a living space or a storage space, the rigid foam insulation and/or the SPF will be separated from the space using a thermal barrier material (e.g. ½-inch gypsum wallboard).

(4) All costs associated with this measure should be included in the cost-effective analysis of the wall insulation and proceed with the measure if it is has a savings-to-investment ratio of 1.0 or greater and cost controls will permit installation.

b. Exterior wall insulation:

(1) Foundation panels (factory pre-finished on exterior) may be used if they are glued and fastened, has drip caps installed, and is sealed around windows. They must extend at least 6 inches below the finished grade.

(2) Extruded polystyrene may be used that is not pre-finished if glued and fastened, has drip caps installed, and is sealed around windows. The insulation must extend at least 6 inches below the finished grade. The exterior surface of these panels must be covered with a material that will protect it from ultra-violet light.

(3) All costs associated with this measure should be included in the cost-effective analysis and proceed with the measure if it is has a savings-to-investment ratio of 1.0 or greater.

c. Insulation Coverage

(1) Insulation must be installed in a manner that provides as continuous a thermal boundary as possible.

(2) Perimeter insulation must not be installed in a manner that excessively compresses the insulation material.

d. Band and Rim Joist Insulation

(1) Rim joist insulation must be a minimum of R-10.

(2) Fiberglass, rigid foam board or spray polyurethane foam insulation may be used for this application. Whichever is used must result in a savings-to-investment ratio of at least 1.0.

(3) If there is significant air leakage, the band or rim joist area must be properly sealed before the insulation is installed. Spray polyurethane foam is recommended where it can achieve both insulation and an air sealing value. The cost for applying spray polyurethane foam can be split between both infiltration reduction and insulating of band or rim joist work to have a better possibility of both having a SIR of 1.0 or greater.

(4) If installed SPF is greater than 3.25 inches thick, then it must be covered with a 15-minute thermal barrier.

(5) Installed insulation must be secured in a permanent manner.

(6) Rigid foam board may be installed on band/rim joists without a cover but must be sealed at all edges.

(7) Vinyl faced fiberglass may be installed but must also be sealed at edges.

(8) Paper-faced or unfaced fiberglass batt insulation may not be installed on band/rim joists without a barrier sealing off the loose fiberglass insulation.

(9) Agency installed fiberglass insulation must not be left exposed in living areas or areas that are routinely used by the occupants.

e. Foundation Insulation

(1) Foundation walls should be insulated so that no portion above grade is left uninsulated.

(2) Fiberglass insulation must not be left exposed in living areas or in other spaces that are routinely used by the client. Fiberglass may be encapsulated or covered with a durable, air-permeable material such as Tyvek or landscaping fabric.

(3) Mechanical fasteners must be used to secure perimeter insulation in a permanent manner.

(4) Basement wall insulation must be a minimum of R-7.5.

3. Crawl Space Insulation

a. Separate an unconditioned crawl space from an adjoining conditioned basement with suitable materials.

b. Seal all direct air leakage sites into the crawl space from the exterior if the crawl space is conditioned.

c. Seal all bypasses and chases into and through the conditioned areas of the house.

d. Install perimeter insulation from the band joist to the crawl space floor. The crawl space wall insulation shall extend downward:

(1) to a distance that is two feet below the exterior grade, or

(2) to the crawl space floor and then horizontally across the floor for two feet, whichever is appropriate. Mechanically fasten the insulation and seal all joints with tape.

e. An alternative method for installing interior perimeter insulation is to attach metal-building insulation at the floor above the rim, so that the blanket extends from the floor above to four feet down the wall. It should be run horizontally in a manner that minimizes the number of seams. The blanket may be slit at each floor joist to allow installation in a manner that minimizes gaps around the joist. This insulation should extend downward to a distance that is two feet below the exterior grade or to the crawl space floor and then horizontally across the floor for two feet, whichever is appropriate. Mechanically fasten the insulation and seal all joints with tape.

H. Floor Insulation

1. General Procedures

a. Precautions must be taken to insure adequate combustion air is being supplied, through non-operable vents, for combustion appliances in crawl spaces.

b. If any work is performed in the subspace of the home, an access must be left accessible for inspection purposes.

2. Moisture Inspection and Repairs

a. All homes where floor insulation is being installed must be inspected for problems associated with excess moisture.

b. Identification of potential moisture problems shall be documented in the client file.

c. Repair moisture problems that will degrade or diminish the effectiveness of weatherization measures.

d. If floor insulation is installed over a crawl space area, install a 6-millimeter or thicker (no more than 0.1 perm) polyethylene vapor barrier on the earthen floor. Installing vapor barrier in a site built home with a vented crawlspace in which the floor above the crawl

space is the thermal and pressure boundary is optional. For additional information on vapor barrier installation, see Section II, Subsection B, Topic 9: Moisture.

3. Defining the Thermal Boundary

a. If the basement or crawl space meets the criteria to be a conditioned space as stated in Section IV, Subsection A, Topic 1: Preparation for a Blower Door Test, Subtopic g, Details 1-6, it must be treated as a conditioned area. In this case, the basement or crawl space walls are part of the boundary of the conditioned envelope. Therefore, it is preferred to air seal and insulate the basement or crawl space walls because this strategy encloses the furnace, ducts, pipes, water heater and other appliances within the conditioned envelope.

b. Unconditioned basements and crawl spaces must be tested using zonal pressure diagnostics when the housing construction type or the air leakage rate indicates that there may be hidden air leakage or bypass pathways into the basement or crawl space. This test should be used to determine quality and completeness of air leakage and bypass sealing, prior to, and then after, installing insulation. In addition, this test can help determine the appropriate location of the thermal boundary.

c. If the appropriate thermal boundary is determined to be the basement or crawl space wall, rather than the floor above the basement/crawl space, then the basement or crawl space wall should be sealed, as necessary, before any insulation is installed on these surfaces.

d. If a basement and crawl space are not separated by a continuous air barrier, both areas must be assessed the same (e.g., conditioned or unconditioned).

I. Installation Methods for Floor Insulation

1. General Procedures

a. Install a minimum of R-11insulation between the floor joists.

b. The insulation should be installed without voids or gaps. Fit insulation tightly around all cross bracing and any obstructions.

c. Floor insulation must be fastened securely in place with wire fasteners, nylon mesh or other appropriate methods. Friction fitting or stapling of floor insulation is not considered an appropriate method for securing the material. Do not support insulation with Tyvek or Typar sheeting stapled to the bottom edges of the joists.

d. Install insulation so that it is in contact with the underside of the sub floor above with no voids or gaps.

e. Faced fiberglass insulation must have the facing upward toward the heated area.

f. Ensure that floor insulation is in direct contact with the rim joints. If the dwelling is balloon-framed, air-seal the bottom of the stud cavities prior to installing insulation.

g. Fiberglass insulation must not be left exposed in living spaces or in other spaces that are routinely used by the client. Fiberglass may be encapsulated or covered with a durable, air-permeable material such as Tyvek or landscaping fabric.

2. Materials

a. Spray polyurethane foam, fiberglass (faced or un-faced) insulation is preferred for floor insulation material. Whichever is used must result in a savings-to-investment ratio of at least 1.0.

b. If there is significant air leakage, the floor area must be properly sealed before the insulation is installed. Spray polyurethane foam is recommended where it can achieve both insulation and an air sealing value. The cost for applying spray polyurethane foam can be split between both infiltration reduction and insulating the floor to have a better possibility of both having a SIR of 1.0 or greater.

c. It is preferred that vinyl faced insulation not be used for floor insulation.

3. Insulation Coverage Procedures

a. Floor insulation must be installed in a manner that provides as continuous of a thermal boundary as possible.

b. Floor insulation must not be installed in a manner that excessively compresses the material.

4. Storage Space

a. Where the basement or crawl space is being used for storage, subgrantees should request the client remove storage items that inhibit weatherization from the area.

b. In cases where the client is physically unable to perform this task, subgrantees should include the removal of items that inhibit weatherization in the cost-effective analysis of installing insulation, and proceed with the measure if it is cost-effective with the additional cost (savings-to-investment ratio of 1.0 or greater).

5. Ducts and Pipes Procedures

a. When floor insulation is installed, any water pipe that is susceptible to freezing, and all furnace supply and return ducts below the insulation, must be insulated as part of the floor insulation measure or insulated as a duct insulation measure, given it has an SIR of 1.0 or greater.

b. Do not insulate over pumps, valves, pressure relief devices or vents; do not insulate over heat tape unless manufacturers' specification indicate that such insulation is safe.

6. Crawl Space Ventilation

a. Conditioned crawl spaces:

If crawl space walls are insulated, the crawl space shall not be vented to the outdoors.

b. Unconditioned crawl spaces:

Crawl space ventilation is not necessary if the crawl space is well drained and dry.

c. Crawl space vents shall be louvered and screened or otherwise designed to prevent the entry of snow, rain and pests into the building.

d. If operable crawl space vents are installed, the client must be informed of the benefits of closing the vents in winter and opening the vents in summer.

e. If excess ventilation is present, it is preferred that it be closed off with removable rigid insulation. Where possible, close off vents on the windward side of the crawl space. Do not close off combustion air vents.

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Section VII: Baseload

A. Energy-Saving Showerheads and Faucet Aerators

1. An energy-saving (low-flow) showerhead may be installed with client permission. The energy-saving showerhead must have a flow rating of 2.5 GPM or less and must cost test with a SIR of 1.0 or greater.

2. Energy-saving (low-flow) faucet aerators may be installed with client permission. Aerator flow rate will be 2.2 GPM or less and must cost test with a SIR of 1.0 or greater.

B. Plug Load

1. Refrigerators/Freezers

a. Only new refrigerators and refrigerator/freezers can be installed in weatherized housing. Stand-alone upright and chest freezers cannot be installed. However, if upright or chest model types are determined to be energy inefficient, agencies may encourage clients to decommission them as part of the refrigerator replacement. Agencies may decommission a combination of stand-alone upright freezers, chest freezers and/or refrigerator/freezers and replace them with a new refrigerator/freezer if the energy savings compared to both the existing units justify the measure. The replacement refrigerator must be an Energy Star-rated energy-efficient refrigerator with an estimated annual consumption of 600 kWh/yr or less. The replacement refrigerators must be equipped with either manual, automatic or partial-automatic defrost. New replacement units may not have through-the-door ice or water service as this feature increases energy use. However, the Department will allow refrigerators to have an automatic icemaker in the freezer if there is an existing water line hook-up for the icemaker in the home.

b. Refrigerator replacements are limited to one per household. Unless there are special conditions, the refrigerator to be replaced must be the primary unit used by the household.

c. Refrigerator replacement must result in a savings-to-investment ratio (SIR) of 1.0 or greater.

d. There are two methods to estimate the savings that result from replacing an existing refrigerator. These methods should be incorporated into the initial energy audit.

(1) Check the data plate on the refrigerator. The Association of Home Appliance Manufactures' database, which is incorporated into computerized audit, may be used to estimate the annual energy use of existing refrigerators.

(2) Use a meter to determine the energy usage of the appliance.

e. In accordance with DOE guidance, the department will require all agencies to meter at least 10% of the units replaced. Prior to metering, the refrigerator coils must be cleaned and the thermostat must be set within the ranges of 36º to 40º F for the refrigerator and 0º to 5º F for the freezer. **If the existing refrigerator is non-functional and unable to be metered, it is ineligible to be replaced.**

f. All refrigerators replaced must be properly decommissioned according to the environmental standards in the Clean Air Act of 1990, section 608, as amended by Final Rule 40 CFR 82, May 14, 1993. The environmental standards set certification requirements for recycling and recovering equipment, technicians and reclaimers. These standards require refrigerants to be recovered to avoid the release of ozone-depleting compounds into the atmosphere. No refrigerator or freezer that is taken out of service should be returned to service by sale, barter or for free. **Written documentation/ certification that the refrigerator has been properly decommissioned must be included in the Client File.**

g. Size of the replacement refrigerator should be comparable to the size of the unit being replaced. The agency may, on a case-by-case basis, provide a refrigerator larger than the unit being replaced. If a larger refrigerator is installed, the refrigerator replacement must still have an SIR of 1.0 or greater. Some conditions where a larger unit may be installed may include but not limited to:

(1) A larger unit costing less than the similar size being replaced, larger unit needed due to size of family.

(2) A larger size needed due to medical condition of family member, decommissioning a combination of refrigerators and/or freezers.

h. Replacement refrigerators must include a warranty that meets or exceeds:

(1) A one year warranty on parts and labor.

i. A completed Baseload Replacement Audit Form must be included with the Client File for each refrigerator to be replaced. (See Attachment 2.6)

2. Lighting Replacement

Most homes have six to twelve lamps that burn for more than two hours per day. These should be considered for retrofit by more-efficient compact fluorescent lamps (CFLs) and/or light emitting diodes (LEDs). This easy retrofit has as good an economic return as any weatherization measure. Explain the benefits to the client and encourage them to purchase additional L bulbs, if possible. Point out that the long life of these lamps makes them economical, despite their higher initial cost.

a. All lighting replacement must have an individual measure SIR of 1.0 or greater.

b. All lighting replacements must be installed by the subgrantee. Lighting replacements cannot be left with the client to install.

c. All replaced lighting must be removed from the property and be properly discarded.

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Section VIII: Mobile Home Requirements

The same general procedures described in all other sections of these WAP Standards shall apply to mobile homes unless otherwise stated or stated more specifically in this section.

A. Inspections and Repairs

1. General Information

a. The structure shall be properly supported, leveled and secured, if required, at the homeowner's expense before weatherization measures are installed.

b. Existing structural problems, which may affect insulation measures, must be completed prior to installing insulation.

c. Belly rodent barrier damages must be repaired if insulation will be installed or if significant air leakage is occurring.

d. Minor skirting repairs may be performed as an incidental repair tied to belly insulation or infiltration reduction if either is occurring in the belly of the mobile home. The minor skirting repairs are limited to a maximum total of $200 labor and materials per home.

2. Moisture Problems

a. If moisture problems are present in the ceiling or sidewalls, insulation should not be added until the moisture source and/or site of penetration, including leaks, is identified and repaired.

b. Exhaust-fan ducts terminating in spaces such as ceiling cavities or crawl spaces shall be extended to terminate directly to the outdoors, and sealed to prevent exhaust air from returning back into the conditioned space.

3. Electrical Inspections

a. In units that are receiving insulation measures, electrical wiring and the electrical circuit breaker/fuse box must be assessed for adequacy as follows: #14 copper wiring must be protected with 15 amp fusing or breakers. If aluminum wiring is present, work on the home will be stopped until the suspect wiring is inspected and determined to be safe by a licensed electrician

b. The client should be asked about any known existing electrical problems.

c. Care must be taken to ensure that electrical wiring is not damaged during insulation work. This can be done by testing electrical outlets and switches following completion of work.

B. Air Leakage Reduction Requirements

1. General Requirements

a. Except for the sealing of ductwork and large holes to prevent insulation from entering the living space, all insulation measures should be completed before additional air sealing work is done, whenever possible.

b. Air sealing activities should comply with the cost-effective air sealing guidelines in Section IV of these standards.

c. Snap fasteners and/or weather-stripping shall be used whenever possible to reduce air leakage and/or to stop water from entering primary windows.

d. Major air leakage problems around single pane windows that cannot be eliminated with sidewall insulation or snap fasteners, should have a storm window installed, or the window replaced, whichever is most cost-effective.

e. It is recommended that caulking be done around all interior casing when there is an interior storm window.

f. When accessible, the joint between the two sections of a doublewide must be filled and sealed from underneath the structure.

g. Large holes in water heater closets with an exterior wall must be sealed, with care taken not to seal off combustion air from the outside if the water heater is a natural draft water heater.

C. Insulation

1. General Information

Insulation shall be installed only in areas of the mobile home envelope that separate conditioned from unconditioned space.

2. Ceiling Insulation

a. Recessed lighting fixtures and fan/light combinations that are Type-IC rated by UL may be covered with insulation.

b. Ventilation fans may be covered with insulation if all holes and penetrations are sealed with a nonflammable sealant.

c. Thermal insulation shall not be installed within 3 inches of fans, lights and heaters that are not Type-IC rated.

d. All combustible insulation materials shall be kept at least 2 inches from metal flues and chimneys.

e. The ceiling and roof condition must be inspected and assessed before installing insulation.

f. If cost-effective, ceilings that appear weak shall be repaired or reinforced, especially in heavy snow load areas, before installing insulation.

g. Combustion appliance vent blocking is required when insulation is installed, except where combustion air is pulled through a combustion air pipe that surrounds the combustion appliance vent pipe (concentric pipe system). Follow the manufacture's recommendation for clearances between vent and combustible insulation.

h. Ceiling insulation must be installed in such a manner that ensures complete coverage over heated areas.

i. Fiberglass insulation material is preferred for use in mobile home ceilings.

j. Average insulation densities for loose fill fiberglass insulation installed in mobile home ceiling cavities shall be 1.25 to 1.75 pounds per cubic foot.

k. Mobile home ceilings shall not be dense-packed or over filled so as to create ceiling structural problems.

l. If an interior drill-and-blow method is used for installing insulation, holes must be plugged and sealed properly. In addition, the whole pattern must be adequate to ensure complete coverage.

m. If an exterior installation method or side-opening method is used, all roof penetrations and areas of potential leakage must be sealed with elastomeric sealant (when compatible with roof materials), or with other equivalent sealant, as necessary. Areas that are to be patched must be cleaned to the metal roof surface before patch is applied.

D. Ductwork

1. General Requirements

Ducts should be well supported in the belly of the mobile home, sealed and insulated.

2. Mobile Home Belly Return Air Systems

Belly-return systems in mobile homes are notoriously leaky. These leaky return systems can significantly increase the space heating costs and lead to thermal discomfort and indoor air quality problems.

a. Existing return air openings will be closed off and sealed with a durable material equivalent in strength to the surrounding material. An alternate return air opening will be provided to the furnace closet (e.g., replace louvered door or install grilles); whenever possible, follow manufacturer specifications for amount needed. A continuous and adequate return air pathway to the air handler will be installed.

b. For duct leakage, ductwork sealing and insulation follow the instructions covering ductwork in Sections IV, V, and VI.

3. Duct Repair and Treatment:

a. Crossover (jumper) ducts shall be installed in a manner that prevents compressions or sharp bends, minimize stress at connections, avoid standing water and avoid excessive length. When skirting is not present, the crossover duct shall be protected against rodents, pets, etc.

b. Flexible crossover ducts shall have a minimum R-8 insulation. They shall be secured with mechanical fasteners (for example, stainless steel worm drive clamps, plastic/nylon straps applied with a tightening tool, etc.) and sealed with mastic or aluminum foil backed butyl or equivalent pressure-sensitive tape.

c. Existing flexible crossover duct with an insulation of R-4 or less, which has been damaged, may be replaced with new flexible duct with R-8 insulation.

d. The crossover must be replaced if the inner lining is brittle or made of mesh. In many cases, a leaky crossover can be repaired by cutting out the section of duct containing the leak. A fabricated sheet metal sleeve can be inserted between the remaining pieces of crossover duct. The metal sleeve must be attached to the flex duct crossover using ratcheting plastic straps.

e. Crossover ductwork must be appropriately secured above the ground. It may be supported by strapping or blocking.

f. Flexible duct shall not be allowed to sag more than 12 inches for a span of eight feet.

g. Fiberglass, with the exception of duct board, shall not be left exposed in ductwork.

h. Any portion of the ductwork that extends beyond the last register or grille should be sealed.

i. Trunk end sweeps are only allowed if it is determined that duct air leakage reduction will result from installation. End sweeps shall be made from sheet metal or aluminum valley flashing. Two-part foam may not be used unless it is adequately protected with a fifteen-minute fire rated material. Any metal sweeps must be mechanically attached to the duct system. Gaps between the sweep and the duct must be sealed with mastic.

E. Floor (Belly) Insulation

1. Floor Insulation Requirements

a. Belly rodent barriers must be inspected for general condition, structural strength, and major air leakage, prior to installing insulation.

b. Necessary belly rodent barrier repairs must be made if additional insulation will be added or if holes in the belly allow significant air movement between the belly cavity and the outside atmosphere.

c. Belly cavities must be inspected to determine the location of the plumbing, any existing plumbing leaks and the R-value of existing insulation. Leaks must be fixed prior to weatherization.

d. Water pipes that have not been covered by under-floor insulation should be insulated to a minimum of R-3.

(1) The piping shall be free from water leaks and properly secured to support the weight of the piping and insulation.

(2) The insulation product may be either; flat and capable of being molded to the outside surface of common pipe size, or preformed to fit standard pipe diameters. If the product is preformed, dimensions shall be appropriate for the pipe size.

(3) If the insulation is exposed to the weather, it shall be resistant to degradation from moisture, ultra-violet light, and extremes in temperature, or a jacket or facing shall be installed that protects the insulation from these conditions.

e. Belly insulation shall be installed only after all repairs have been made, major holes in the rodent barrier and floor have been sealed, and all ductwork has been sealed according to Section V.

f. Belly insulation must be installed in such a manner that ensures complete coverage under heated areas except those areas requiring and receiving a technical waiver. For more detailed instructions on installation of belly insulation, refer to the Missouri Weatherization Field Guide, Chapter 11: Mobile Homes.

g. Holes that have been made in belly rodent barriers for the installation of insulation must be patched and sealed.

h. Rim joists may not be drilled if they are determined to be a structural component of the foundation support system.

i. Fiberglass insulation material is preferred for use in mobile home ceilings.

j. Average insulation densities for loose fill fiberglass insulation installed in mobile home bellies shall be 1.25 to 1.75 pounds per cubic foot

k. Bellies shall not be dense-packed or over filled so as to create undue stress on the belly rodent barrier.

l. Fiberglass is the preferred insulation material for mobile home bellies.

m. Bellies that are 8 inches height and less in the center area shall be filled entirely with insulation blown at the required densities.

n. Bellies that are greater than 8 inches in height at the center area should have the rodent barrier brought closer to the floor above if possible. This must be done with care to avoid damaging the duct trunk line or water lines in the belly.

o. Access through the rim joist and the use of a metal fill tube is preferred for installing mobile home belly insulation whenever possible.

p. If bellies cannot be insulated through the rim joist and must be insulated from underneath, the use of the insulation hose or a large diameter fill tube is preferred; a 90-degree nozzle may not be used.

q. When insulation is to be installed from underneath the belly, a 6 mil vapor barrier should be installed on the ground by the first person to go underneath in order to reduce health risks to the installers from animal feces.

r. The preferred methods of securing belly patches are through the use of adhesives, clinch staples, screws and lath strips whenever possible to provide a lasting patch. Preferred patching materials for large holes in belly rodent barriers include insulated sheathing board, fiberboard, and nylon reinforced belly bottom material specifically manufactured for mobile homes.

s. Ductwork shall be inspected for insulation that might have accidentally entered during insulation work. The furnace is to be cycled to assess proper operation.

t. Upon completion of insulation work, rim joists that have been drilled shall be plugged with a wood plug. The plug shall be sealed in the hole with an adhesive compound.

F. Sidewall Insulation

1. General Requirements

a. The exterior siding and the interior wall materials must be inspected prior to the installing of insulation.

b. Weak or damaged wall materials must be repaired or reinforced prior to installing insulation.

c. Electrical precautions:

(1) Electrical wiring and the electrical circuit breaker/fuse box must be assessed for adequacy. The client should be asked about any existing electrical problems, especially in the wall outlets or switches.

(2) If aluminum wiring is present, extra care must be taken to insure the electrical system is not damaged during insulation work. Each cavity that contains an outlet, switch, or light fixture should be clearly identified and marked on the outside siding prior to the installation of the insulation. These cavities should be carefully tubed rather than stuffed with a batt or, if excessive movement of the wires will still occur, then the cavity should not be insulated. Each outlet, switch or light fixture must be checked for proper operation immediately following the completion of the insulation work with a receptacle tester.

(3) If the above steps cannot be completed, the sidewalls shall not be insulated and documentation stating the reason for omission must be placed in the client file.

d. Installing insulation above windows and doors is usually not feasible or cost-effective and is not required in mobile homes.

e. Mobile home sidewalls should not be dense-packed or over filled so as to create siding or interior wall structural problems. The batt-stuff method is the favored technique for insulating wall cavities. For cavities that cannot or should not be insulated with the batt-stuff technique, the fill-tube method with loose fill fiberglass is recommended.

f. Vinyl faced fiberglass batt insulation and loose fill fiberglass are the preferred insulation materials for mobile home sidewalls.

G. Water Heater Closets

1. General Information

a. At a minimum, water heater closets with an exterior wall must be treated as follows:

(1) The exterior access door and associated exterior walls of closets containing electric or gas water heaters shall be insulated, if possible. If the door and associated wall can be insulated, the water heater shall not be wrapped with insulation.

(a) Cover air vents if they are present in the door or associated exterior wall.

(b) Bring combustion air from underneath the belly or through the skirting by installing an appropriately sized metal chute with a rodent barrier.

(2) If it is not possible to insulate the closet door and associated wall area:

(a) The tank should be wrapped with an insulation blanket. Please refer to Section III for the procedure.

(b) Large holes in the closet walls that allow air leakage into the interior must be sealed.

(c) All plumbing within the closet that is susceptible to freezing must be insulated.

(d) An adequate amount of combustion air must be provided to gas water heaters.

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Section IX: Multi-family Buildings

A. General Requirements/Information

1. Eligibility

a. Multi-family buildings are those buildings which do not fall under the DOE definition of a single family unit. The DOE definition of a single family unit is, “a structure containing no more than one dwelling unit”.

b. Weatherization work shall be performed in the entire building provided the building is qualified based on applications that meet the 66-2/3 percent eligibility guideline (duplexes and four-plexes may use a 50 percent unit eligibility guideline). However, DOE offered flexibility by adding certain eligible types of large multi-family buildings to the list of dwellings that are exempt from the 66-2/3 percent requirement. For these large multi-family buildings exempted from the 66-2/3 percent, department approval must be granted. For further information on multi-family eligibility, refer to the Procedural Manual, Section 2, Subsection VII, Topic A.

Exception: Vertically connected townhouses that are independently deeded, with its own address, not sharing any mechanical systems and is completely thermally separated (i.e. do not share a basement, attic, entrance or other common space) may be individually weatherized as a site built single family home. The department should be contacted prior to evaluating vertically connected row houses for proper procedure on entering the home in the computerized audit.

2. Prior Approval

a. No weatherization may commence on multi-family projects consisting of five or more units without the prior written approval from the department. See Attachment 5.1 for the required information to be submitted to the department for approval of multi-family projects.

b. No weatherization may commence on a shelter, group home or other place of transient residence without the prior written approval from the department, regardless of number of units.

c. Multi-family projects consisting of four or less thermally connected units may commence without the prior written approval from the department, unless the estimated cost of the computerized audit for the building is greater than $15,000.

3. Expenditures/Funding Issues

a. Landlords must contribute at least 25 percent of the cost of the work on multi-family rental units if the building contains 5 or more units.

b. Only ECMs with a SIR of 1.0 or greater may be performed. However, if the SIR is less than 1, the owner has the option to buy down the estimated cost of the measure in order to bring the SIR to 1.0 or greater. Note that the buy down of measures may only be done on multi-family buildings.

4. Building Measures

a. All work must be cost-justified using the EA-QUIP, TREAT analysis tool or an engineering assessment, except when:

(1) Multi-family projects that have between 5 and 25 units in which each unit is individually heated and cooled. The projects may be evaluated using the NEAT analysis tool.

(2) Multi-family projects that have four or less units may be evaluated using the NEAT audit tool.

b. When NEAT is used to evaluate a multi-family project, the entirety of the thermal envelope of the building must be evaluated within a single NEAT audit. The estimated cost and SIR of the measures will be for the entire building.

c. A person certified to use the EA-QUIP or TREAT auditing tool or other approved software must perform the inspection of the building when these analysis tools are used.

d. An agency may replace up to 5 windows per multifamily building without prior approval, given that individually each window is cost effective with a SIR of one or greater. If an agency feels 6 or more windows need to be replaced, a request to replace the windows must be submitted and approved by the department on a case by case basis.

e. All applicable ECMs specified in the audit must be evaluated and performed unless a waiver is approved by the department.

f. All ECMs must be performed in the order of their cost-effectiveness from highest to lowest SIR.

B. Tasks and Analysis for Preparing the Report

1. Energy Consumption and Facility Data

The auditor shall thoroughly evaluate energy, water and sewage costs and consumption, demand and time-of-use data in order to properly evaluate the economics of specific energy efficiency measures and to formulate an accurate energy/demand baseline. The baseline shall be weather-normalized using a heating degree-day adjustment factor and shall be based on at least 12 months, but preferably 24 months of utility data. Exceptions to this rule are multi-family buildings evaluated using NEAT.

2. Inventory Existing Systems and Equipment

The auditor shall compile and deliver an inventory based on a physical inspection of the major electrical, plumbing, HVAC and other mechanical systems, as well as building shell systems including:

a. Cooling and cooling distribution systems and related equipment.

b. Heating and heat distribution systems.

c. Automatic temperature control systems and equipment.

d. Outdoor ventilation systems and equipment.

e. Exhaust systems and equipment.

f. Domestic hot and cold water systems.

g. Electric motors, transmission and drive systems.

h. Interior and exterior lighting.

i. Water usage equipment.

j. Rated and performance insulation values at walls, floors, and attics.

k. Estimated natural infiltration rate for all buildings.

3. Inventory Data

The auditor shall evaluate the following data for performing the inventory:

a. The actual loads, equipment sizing, operating efficiency and hours of operation for each system.

b. A list of major air leakage sites and description of how natural infiltration was estimated.

c. Current operating condition for each system.

d. Remaining useful life of each system (exclusive of premature equipment failure).

e. A catalog of current indoor air quality and comfort problems in the buildings.

f. An evaluation of feasible replacement/upgrades to address the efficiency, indoor air quality and comfort concerns that were identified.

4. Diagnostics

The auditor shall:

a. Perform diagnostic testing on equipment. These tests shall include combustion appliance zone testing for back drafting potential:

(1) Standard and worst-case spillage testing. See Section III for testing information.

(2) Combustion efficiency analysis.

(3) Ambient carbon monoxide and flue-gas testing.

b. Blower door testing needs to be performed on all multi-family units.

(1) When a blower door test is performed on any multi-family building, a guarded blower door test should be performed. If a guarded blower door test cannot be performed, then the unguarded blower door test must be adjusted with a correction factor of 0.85, which would entail multiplying the blower door reading cfm_{50} by 0.85. This corrected blower door number is what should be used in the computerized audit, documented on all associated forms and reported in MoWAP. However, this corrected blower door should not be used in the compliance with ASHRAE 62.2, as outlined in Topic 5 below.

(2) EXCEPTION: Blower door testing may not apply to large multi-family buildings. This exception will need to be discussed with the department prior to performing the initial audit on the large multi-family building.

c. Perform additional diagnostics to help identify potential Energy Efficiency Measures for installation or implementation at the building, including potential solutions for indoor air quality and comfort concerns.

d. Complete all inputs required by the analysis tool used to evaluate the project and otherwise ensure an accurate audit of the multi-family structure.

5. Ventilation

All multi-family units must comply with ASHRAE 62.2, as further outlined in Section II, Subsection C. Additional considerations and requirements apply for multi-family buildings and units when determining the required rate of mechanical ventilation in multi-family units. All multi-family units must have the ASHRAE 62.2 Form (Attachment 2.8) and the ASHRAE 62.2 Multi-Family Infiltration Credit Calculator (Attachment 2.8.2) completed.

a. Blower door results may be used on vertically connected multi-family units to evaluate an infiltration credit in the ASHRAE 62.2 Form. However, the blower door test results

must be adjusted by a correction factor. This correction factor is calculated on the ASHRAE 62.2 Multi-Family Infiltration Credit Calculator (Attachment 2.8.2).

(1) The "Units are only Vertically Connected" box must be checked as yes.

(2) The entire thermal boundary of the unit, including shared walls between units, must be entered into the ASHRAE 62.2 Multi-Family Infiltration Credit Calculator.

(3) The blower door entered into the ASHRAE 62.2 Multi-Family Infiltration Credit Calculator should not be adjusted by the correction factor as outlined in Section IX, Subsection B, Topic 4.

(4) The CFM_{50} calculated in the "CFM_{50} to Enter Into ASRHAE 62.2 Form" is the blower door result to be entered into the "Final Inspection CFM_{50}" box on the ASHRAE 62.2 Form.

b. Blower door results may not be used on multi-family units that are horizontally connected to evaluate an infiltration credit in the ASHRAE 62.2 Form. The "Units are only Vertically Connected" box must be checked as no. Zero (0) will need to be entered into the "Final Inspection CFM_{50}" box on the ASHRAE 62.2 Form.

Section X: Initial Audits and Final Inspections

A. Initial Audit and Final Inspection Requirements

1. Sub-grantee Requirements

All current sub-grantee staff who are performing energy audits must have, at a minimum, one of the following in order to perform WAP energy audits:

- Valid BPI QCI Certification
- Valid BPI EA Certification
- Proof of successful completion of QCI or EA training with Southface, SFCC or other IREC Accredited Training Facility.

Any Sub-grantee who will need to have an audit completed by staff who do not meet any of the requirements above, should contact the department Technical Staff for guidance.

B. Initial Audit

1. General Requirements

a. A field audit of each home must be conducted and documented in the client file. A home must be in progress within six months of the initial audit being performed. A home in progress is a home in which energy conservation measures, health and safety measures or incidental repairs have begun. The starting of work, however, does not include the hanging of smoke or carbon monoxide alarms.

b. If work on the home has not started within six months of the field audit being performed, a follow-up, on-site inspection will be necessary. This follow-up inspection will determine if any conditions have changed at the unit since the initial field audit was performed and that the home is in compliance with all current department requirements. A re-run of the computerized audit to ensure accuracy must be completed after the follow-up inspection. If any conditions have changed on-site, the sub-grantee must make these changes in the computerized audit. A new on-site inspection and a re-run of the computerized audit is necessary after six months due to likely changes in the conditions at the home, changing labor and material costs, and changing fuel prices.

2. Initial Audit Procedures

The initial audit must include:

a. A client interview, to discuss the client's energy use habits, condition of the dwelling, operation of mechanical equipment, health and comfort problems and other information that may be useful to the auditor or the audit process. See Attachment 2.1: Client Interview & Auditor Assessment Form.

b. A health, safety and hazards assessment of the heating unit as well as the combustion appliances.

c. A cost-effective analysis using the approved computerized audit.

d. A blower door test and ventilation assessment. See attachments 2.9: Final Inspection Form, 2.3: Diagnostic Field Form and 2.8: ASHRAE 62.2 Form.

e. A ductwork assessment.

f. An insulation assessment.

g. A general heat waste assessment.

h. A mechanical systems audit and completion of the mechanical systems audit form on each home. See Attachment 2.2 Mechanical Systems Audit Form.

i. The thermal boundary of each dwelling must be determined during the field audit. This includes the identification of each part of the thermal shell or envelope.

j. All building cavities that define the thermal boundary between the conditioned space and unconditioned must be inspected and measured for existing insulation R-values, structural integrity and the need for repairs.

k. The field audit must identify the most appropriate methods for:

(1) Reducing air leakage and convective bypasses, and

(2) Increasing the insulating value of thermal boundary surfaces, when appropriate.

C. Final Inspection / Quality Control

1. General Requirements

a. As of July 1, 2015, all final inspections must be performed by a certified Quality Control Inspector (QCI).

b. Every dwelling must pass a thorough, quality control inspection by the sub-grantee before it can be reported as completed. The final inspection must certify that work was completed in a professional manner and in accordance with the Technical Standards.

c. The quality-control inspection should be conducted by an individual that has no prior involvement in the work on the home either as the initial auditor or as a member of the crew. In this case, the department must perform quality assurance reviews on a minimum of 5 percent of all completed homes. Sub-grantees may choose to have the same individual perform the initial audit and the quality control inspection. In this case, the department must perform quality assurance reviews on a minimum of 10 percent of all completed homes. In addition, the department will review both initial audits and quality control inspections completed by any individual performing both responsibilities in order to ensure that the individual is able to consistently perform both tasks.

d. Repeated attempts must be made by final inspectors to final-inspect homes that have all ECMs completed. Final inspection includes inspection of both the interior and exterior of the dwelling.

(1) The department requires a minimum of three attempts, within a seven- to fourteen-day period with two of the attempts being a minimum of seven days apart, to contact a client in order to arrange a date for final inspection as appropriate. These attempts may take the form of phone calls, on-site visits, or a combination of phone calls and on-site visits. Various attempts made at contacting a client within the same working day would qualify as one attempt only. If the client cannot be reached after three attempts, the agency may choose to proceed without performing a final inspection (refer to subtopic e below). All attempts to contact a homeowner for the final inspection must be documented in the client's file and uploaded into MOWAP.

(2) In certain instances, clients do not have phone service and/or live a significant distance from a sub-grantee’s weatherization office. Under such circumstances, a letter or postcard may be mailed to the client informing of the intent to perform a final inspection, along with a request to contact the sub-grantee to arrange a date to perform the final inspection. If no response is received within seven working days from the date of mailing, the agency may choose to proceed without performing a final inspection (refer to subtopic e below).

(3) A minimum of three attempts, within a seven- to fourteen-day period to contact a client are required in order to arrange a date to complete the department mandated reworks if necessary. Two of the attempts must be made a minimum of seven days

apart. These attempts may take the form of phone calls, letters or on-site visits, or a combination equaling three attempts. Various attempts made at contacting a client within the same working day would qualify as one attempt. These attempts to contact a homeowner for required rework must be documented in the client's files. Sub-grantees should continue to contact the client to arrange for reworks beyond the minimum attempts.

f. Agencies may not submit a home as completed if the home has not passed a thorough on-site quality control inspection. Any home where work has been completed but no quality control inspection is performed must be handled under the guidance given in the Missouri Weatherization Program Operational Manual, Section 3, Subsection VI, Topic D. This includes, but is not limited to on the Quality Control Inspection Form: the Quality Control Inspector not signing the form, noting in the comment section why the final inspection was not performed, and entering the final blower door number as zero.

g. Agencies may not charge the WAP for additional work on homes that have been reported to DOE as completed weatherized units. Performing activities, such as routine maintenance, repairs or warranty-type work is not permitted using DOE funds for work beyond those costs already invoiced. Agencies may use other funds that are not included as part of the DOE WAP budget plans to pay for the costs associated with these activities.

2. Department Criteria to Pass Housing Inspections

A home will require additional action or correction from the department monitoring when any one or more of the following are noted:

a. Significant or recurring incidents of work measures/materials are being billed to the program, but not installed.

b. A recurring item that has been specifically identified in a previous monitoring letter, which formally warned the sub-grantee that failure to perform the item would result in non-passage of the dwelling.

c. A work measure that is significantly below the required work standards or work that is performed substantially below what is considered professional, quality workmanship.

d. Visible or obvious health and safety hazards that were neglected or overlooked, not rectified as allowed under program parameters, or for which required health and safety diagnostic tests were not performed.

e. Energy efficiency measures installed or a total job completed that have an individual and/or cumulative SIR of less than 1.0.

f. Expenses associated with a home that requires additional action from the department inspection may be withheld from the sub-grantee's subsequent reimbursement until the home passes.

Section XI: Computerized Audits

A computerized audit must be performed for every home weatherized using the Weatherization Assistant (WA), which contains both the National Energy Audit Tool (NEAT) and the Manufactured Home Energy Audit (MHEA). For computerized audits for multi-family buildings of 5 units or more, refer to Section IX: Multi-Family Buildings.

A. Computerized Audit Software Selection

1. Software Version

The WA version 8.9.0.5 must be used on all site-built, manufactured homes and multi-family buildings of four (4) or less units.

2. NEAT

NEAT is to be used on all site built homes, modular homes on a permanent foundation and multi-family buildings consisting of 4 or less units.

3. MHEA

MHEA is to be used on all manufactured housing. Manufactured housing is a single family home that contains a permanently affixed chassis, allowing the dwelling to be transported from location to location by road.

B. Weatherization Assistant Setup Library

Within the Weatherization Assistant, the Setup Library contains many settings which affect the accuracy of the computerized audit. Some values and methods used for the computerized audit will need to be periodically updated by either the sub-grantee or statewide WAP committees. Each subtopic below details a different tab in the WA Setup Library and the necessary changes and/or updates associated with that tab.

All values need to be left as defaulted by the program, unless otherwise directed by the department.

1. Key Parameters Tab

a. In the NEAT Key Parameters the following approved values should be in use:

(1) In the Insulation tab, the value of the 'Added Duct Insulation R-value' needs to be 'R-8'.

(2) In the Insulation tab, the value of the ‘Water Heater Wrap Added R-value’ needs to be 'R-11'.

(3) In the Equipment tab, the SEER values for the air conditioners and heat pumps needs to meet Energy Star requirements. For Energy Star Values, see Attachment 3.8: Energy Star Equipment Specifications.

b. In the MHEA Key Parameters, the following approved values should be in use:

In the Base Loads tab, the value of the 'MHEA Water Heater Wrap Added R-value' needs to be 'R-11'.

2. Fuel Costs Tab

Beginning July 1, 2019, all agencies must use the state provided fuel cost library for all homes as given in Table XI-1. This statewide fuel cost library will be updated approximately July 1 each year by the department.

Table XI-1. FY20 WAP Statewide Fuel Prices

Fuel Type	Price	Unit
Natural Gas	$15.52	MCF
Oil	$4.073	Gallon
Electricity	$0.117	kWh
Propane	$2.671	Gallon
Wood	$295.00	Cord
Coal	$135.750	Ton
Kerosene	$5.029	Gallon
Other	$6.250	MMBtu

3. Library Measures Tab

a. Labor and material cost estimations used for the approved computerized audit must be updated at least once each year and procedures used to derive these estimated costs must be documented by the sub-grantee. These updated cost estimations and how they were derived shall be made available to the department upon request. If actual prices from a contractor performing the work are known, then the actual contractor prices for labor and materials need to be entered into the WA for evaluation for the homes that said contractor will be performing work.

b. Sub-grantees must use material and labor costs that will reflect the cost of a measure as close as possible to actual costs when complete.

c. All measure costs when evaluated in the computerized audit (including energy conservation measures, incidental repairs and health and safety) must include both material and labor costs.

d. Insulation cost estimates must be based on at least the manufacturers' recommended minimum installation density.

e. Sub-grantees must follow the guidelines in Table XI-2 for selecting measures that WA will consider for implementation. By checking a measure as active in the NEAT/MHEA Setup Libraries, the WA can evaluate the measure to see if it is cost effective. If a measure is not checked as active, the WA cannot evaluate the measure for cost effectiveness. The life span given in Table XI-2 must be the evaluated life span in the WA for the associated measure. Any alteration of the evaluated life span will cause the measure to be considered a non-allowable measure.

(1) Mandatory measures must be checked and remain checked as active. These measures must be evaluated for installation at every home.

(2) Optional by Agency measures may be checked at the sub-grantee's discretion. However, these measures must remain either checked or unchecked to be either evaluated at every home or not at any home that a subgrantee weatherizes.

(3) Optional by House measures may be evaluated at the subgrantee's discretion on an individual house-by-house basis.

(4) Not Considered measures shall not be checked as active in the setup screen. These measures may not be installed at homes, as these are non-allowable measures.

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Table XI-2. Measure selection for the WA and associated life spans. With prior DE approval

NEAT				MHEA			
	# *	Measure Name	Life Span		# *	Measure Name	Life Span
Mandatory	1	Attic Insulation R-11	20	Mandatory	1	Seal Ducts	10
	2	Attic Insulation R-19	20		2	General Air Sealing	10
	3	Attic Insulation R-30	20		3	Wall Fiberglass Batt Insulation	20
	4	Attic Insulation R-38	20		4	Wall Fiberglass Batt Insulation in Addition	20
	6	Fill Ceiling Cavity	20		7	Wall Fiberglass Loose Insulation	20
	7	Sillbox Insulation	20		8	Wall Fiberglass Loose Insulation in Addition	20
	10	Floor Insulation R-11	20		11	Floor Fiberglass Loose Insulation	20
	11	Floor Insulation R-19	20		12	Floor Fiberglass Loose Insulation in Addition	20
	14	Wall Insulation	20		15	Roof Fiberglass Loose Insulation	20
	15	Kneewall Insulation	20		16	Roof Fiberglass Loose Insulation in Addition	20
	16	Duct Insulation	20		39	Tune Heating System	3
	31	Furnace Tuneup	3		43	Lighting Retrofits	10
	32	Replace Heating System	20		46	Water Heater Pipe Insulation	13
	33	High Efficiency Boiler	20		49	Replace Heating System	20
	34	High Efficiency Furnace	20	Optional by Agency	6	Wall Cellulose Loose Insulation in Addition	20
	39	Install/Replace Heat Pump	15		14	Roof Cellulose Loose Insulation in Addition	20
	40	Lighting Retrofits	10		41	Tune Cooling System	3
	43	Water heater Pipe Insulation	13		42	Replace Dx Cooling Equipment	15
Optional by Agency	5	Attic Insulation R-49	20	Optional by House	19	White Roof Coat	7
	12	Floor insulation R-30	20		20	White Roof Coat in Addition	20
	21	Low E Windows	20		21	Replace Marked Doors	15
	37	Replace AC	15		22	Replace Wooden Doors	15
Optional by House	9	Foundation Wall Insulation	20		23	Replace Wooden Doors in Addition	15
	18	Door Replacement	20		28	Replace Single Paned Windows	15
	19	Storm Windows	15		29	Replace Single Paned Windows in Addition	20
	20	Window Replacement	20		32	Glass Storm Windows	15
	30	Flame Retention Burner	10		33	Glass Storm Windows in Addition	15
	35	Smart Thermostat	15		38	Setback Thermostat	10
	36	Tuneup AC	3		44	Refrigerator Replacement	15
	41	Refrigerator Replacement	15		45	Water Heater Tank Insulation	13
	42	Water Heater Tank Insulation	13		47	Low Flow Showerheads	15
	44	Low Flow Showerheads	15		48	Water Heater Replacement	13
	45	Water Heater Replacement	13	Not Considered	5	Wall Cellulose Loose Insulation	20
Not Considered	8	White Roof Coating	7		9	Floor Cellulose Loose Insulation	20
	13	Floor Insulation R-38	20		10	Floor Cellulose Loose Insulation in Addition	20
	17	Window Sealing	10		13	Roof Cellulose Loose Insulation	20
	22	Window Shading (awning)	10		17	Add Skirting	10
	23	Sun Screen Fabric	10		18	Add Skirting on Addition	10
	24	Sun Screen Louvered	15		24	Storm Doors	10
	25	Window Film	15		25	Storm Doors in Addition	10
	26	Thermal Vent Damper	10		26	Window Sealing	10
	27	Electric Vent Damper	10		27	Window Sealing in Addition	10
	28	IID	10		30	Plastic Storm Windows	5
	29	Electric Vent Damper IID	10		31	Plastic Storm Windows in Addition	5
	38	Evaporative Cooler	15		34	Add Awnings	20
					35	Add Awnings in Addition	10
					36	Add Shade Screens	15
					37	Add Shade Screens in Addition	10
					40	Evaporative Cooling	15

* measure number in assocaited NEAT and MHEA setup library

C. Performing a Computerized Audit on a Home

Within the individual NEAT or MHEA audits, the information from each home is entered. Information entered into NEAT/MHEA needs to be done to accurately reflect the conditions of the home prior to weatherization. Each subtopic below details a different tab in NEAT/MHEA and the necessary requirements associated with that tab.

For any measures that the costs are not calculated by the Setup Library, the costs must include material and labor when being evaluated by the computerized audit.

1. General Information for tabs in NEAT/MHEA

a. General Information

Within NEAT/MHEA the boxes that have a black outline are the minimum boxes that must be completed on each tab in order to move forward and complete the computerized audit. The lone exception is in the 'Ducts/Infiltration' tab. All the information given in Section XI, Subsection C, Topic 6: Ducts/Infiltration Tab must be completed.

b. Help Menu

Within the Weatherization Assistant to pull up a help menu select a box and press F1 on the keyboard, this will bring up a help menu specific to the box that is selected.

c. Added or Additional Installation Cost

The computerized audit allows for the addition or subtraction of additional measure installation costs. The costs are in addition to the base cost of measures that are contained in the setup library. Whenever additional costs are added in the 'Additional Cost' box, a comment must be entered into the comment box on that tab to explain the necessity of the additional cost.

As an example, consider the base cost of attic insulation, calculated at a certain price per square foot, would cost $350 for a particular attic. Additional installation cost might include cutting a new attic access, two vents, tar and nails for a total of $150. When the additional installation costs are entered in the "Additional Cost" box for the measure, the audit internally combines the two costs and cost-tests the attic insulation measure at $500 rather than at $350.

d. Measure Numbers for Walls, Attics and Foundation Spaces

Measure numbers group together building components (walls, attics and foundation spaces) that are to receive the same energy conservation measure or for which a single SIR will be determined. For example, attic components that have the same measure number will receive an SIR and separate ranking from attic components having a

different measure number. Building components having similar construction and existing insulation levels should have the same measure number assigned.

2. Audit Information Tab

a. Weather Data

Sub-grantees must choose the appropriate weather data that most closely matches the weather for the sub-grantee service area.

b. Conditioned Stories

(1) Enter the number of conditioned stories above grade. This is used to compute the stack effect of infiltration in the computerized audit.

(2) Include the basement in the number of conditioned stories if the basement is heated or cooled and the majority of the basement wall area is above grade or the basement is a walk out basement.

c. Floor Area

Enter the number of square feet of floor area that is conditioned. The value entered is the total floor area, not the footprint area (e.g. enter 2400 for a two-story house with 1200 square feet in each story).

3. Shell Tab

Within the 'Shell' tab the existing structural information will be entered. Refer to the help menu within the WA for information regarding the contents of the various boxes. See Section XI, Subsection C, Topic 1: General Information for tabs in NEAT/MHEA, for additional information regarding the help menu.

a. Walls

Enter the structural information for the walls of the house that are part of the thermal boundary. Walls that are not part of the thermal boundary should not be entered (e.g. exterior walls of an attached garage). A comment needs to be included in the wall section stating how/where existing wall insulation was verified.

b. Windows

(1) Enter the structural information for the windows on the thermal boundary. Windows that are not on the thermal boundary should not be entered (e.g. windows on the exterior wall of an attached garage).

(2) The leakiness field allows the user to describe the air leakage characteristics of each window. This leakiness factor describes the condition between the sash and frame of the window. NEAT and MHEA uses this factor to calculate the energy savings due to reduced air infiltration for window considered for replacement. Refer to Attachment 3.7: Window Leakiness Guidelines to ensure that the proper leakiness factor is selected for each window.

(3) Sliding glass doors should be entered into the computerized audit as a window.

(4) The retrofit option of 'Evaluate All' should be used when evaluating window replacement or storm window installation. The options of 'Replace' or 'Add Storm' should not be used unless department approval has been granted.

c. Doors

(1) Enter the structural information for the doors on the thermal boundary. Doors that are not on the thermal boundary should not be entered (e.g. doors on the exterior wall of an attached garage).

(2) The leakiness field allows the user to describe the air leakage characteristics of each door. This leakiness factor describes the condition between the sash and frame of the door. NEAT and MHEA uses this factor to calculate the energy savings due to reduced air infiltration for doors considered for replacement. The leakiness factor selection should be based upon the following criteria:

- Tight: Door is structurally sound, having functional weather stripping and door sweep.
- Medium: Door is in good to decent condition, may or may not have weather stripping or a door sweep, but having limited to no leakage sites surrounding the door perimeter.
- Loose: Door is ill fitted, having noticeable leakage site surround the door perimeter with no weather stripping and possible structural problems.

(3) The evaluation of sliding glass doors for replacement, if necessary, should be done under the window tab and not under the door tab.

(4) The 'Replacement Door Required' box should not be checked when a replacement door is being evaluated. Checking this box moves the measure up the priority list.

(5) In some cases, a door may be replaced as an incidental repair if it is necessary to protect or ensure the efficiency of an installed ECM.

d. Unfinished Attics

Enter the structural information for all unfinished attics. The Added R Value field should only be used with prior department approval. The Max Depth field should only be used if there is limited amount of depth of insulation that can be installed.

e. Finished Attics

Enter the structural information for all sections of finished attics. These sections are the outer ceiling joist, collar beam, knee wall and roof rafter. The outer ceiling joist is the section of the attic that is unfinished over the living space on the floor below. The collar beam is the flat section of the attic that is overhead when in the living space in the finished attic. The knee wall is the wall that separates the living space in the finished attic from the outer ceiling joist section. The roof rafter is the sloped or cathedral ceiling section of the finished attic.

f. Foundations

Enter the structural information for all foundations. This includes all basements and crawlspaces. The most common foundation types in Missouri are conditioned, non-conditioned, vented non-conditioned and uninsulated slab. For additional information regarding the determination of a foundation's thermal boundary, refer to Section IV, Subsection A, Topic 1: Preparation for Blower Door Test.

4. Heating Tab

a. All homes audited must have the heating system data entered into NEAT/MHEA to determine if the heating system can be replaced as an energy efficiency measure. Health and safety heating replacements need to be evaluated in NEAT/MHEA to account for the energy usage differential between the existing system and the replacement system. If a health and safety heating system replacement is determined to be necessary after work has started on the home, a rerun of the computerized audit is not required.

(1) The evaluated cost of replacement heating systems must include all associated costs. These associated costs may range from gas shut off valves to additional ductwork. All of the costs must be included and the cost of the replacement heating system and associated costs must have a SIR of 1.0 or greater for the replacement heating system to be an ECM.

(a) In the replacement system section in NEAT, evaluate all needs to be used for the evaluation of replacement heating systems as a cost effective measure.

(b) 'High Efficiency Replacement Mandatory' or 'Standard Efficiency Replacement Mandatory' should only be selected if the heating system is otherwise required to be replaced due to health and safety reasons. The health and safety reason(s) for replacement must be documented in the client file if a mandatory replacement option is selected in the computerized audit.

(2) There are some instances where, depending on circumstances, the heating system may be replaced as either a health and safety measure or an energy conservation measure. If the heating system has to be replaced as a health and safety measure it should be first evaluated in NEAT/MHEA to see if replacement is cost effective.

(3) When the heating system replacement is cost-effective, the measure will be treated as a weatherization efficiency measure and the 'Include in SIR' box needs to be checked. For cost effective replacements, once the winning bid is received from the installing contractor for the installation of the heating system, the computerized audit must be re-run with the actual price of the bid to ensure the installation of the heating system is cost effective.

(4) The replacement of unvented gas space heaters must be evaluated as a health and safety measure.

b. Required information for the heating system must be entered on the main page of the NEAT heating tab and the Primary and Secondary tab of MHEA. All required information obtained during the combustion analysis test (Section III: Mechanical Systems and Combustion Appliances) must be entered into NEAT/MHEA with the values obtained during the test.

c. For gas and oil combustion heating systems, actual results from the combustion gas analyzer for steady state efficiency (SSE) must be entered into NEAT/MHEA.

Exceptions:

(1) If an atmospherically drafting heating system is non-working or a combustion analysis could not be completed due to high CO, enter a SSE of 66 percent.

(2) If an induced draft heating system is non-working or a combustion analysis could not be completed due to high CO, enter a SSE of 76 percent.

(3) If a Category IV drafting heating system (high efficiency furnace or boiler) is non-working or a combustion analysis could not be completed due to high CO, enter a SSE of 86 percent.

(4) If the heating system is a gravity flow furnace (commonly referred to as octopus furnace) or a gravity flow floor furnace then a SSE of 66 percent may be used to calculate SIR.

(5) If the heating system is a converted from coal to gas/oil boiler system or a gas/oil boiler system that is non-working and was manufactured prior to 1970 a SSE of 57 percent may be used in lieu of the values obtained during the combustion gas analysis or for the non-working values given above.

(6) Existing unvented gas space heaters that are present during the initial audit that are used as a primary heating system will be entered as having a SSE of 100 percent.

(7) A dual fuel heat pump, which is a heat pump with gas or oil auxiliary heat, should be entered as a heat pump with the associated HSPF for the efficiency of the heat pump unit. Note that all required diagnostic testing for combustion appliances are still necessary on the combustion heating system.

d. All electric heating systems will be entered as having a SSE of 100 percent, regardless if the heating system is working or not.

e. Wood stoves and/or fireplaces that are primary heat systems should be entered as having a SSE of 50 percent.

f. The heating efficiency of an air source heat pump, also known as the Heating Seasonal Performance Factor (HSPF), needs to be obtained either from manufacturer inscription on the existing unit or based off of the unit model information.

g. If the HSPF cannot be determined and documented, then the estimated age will need to be determined and the estimated HSPF will need to be entered into NEAT/MHEA. The calculations on how to determine the estimated HSPF based upon the age of the air source heat pump are as follows:

- 1970 and earlier: HSPF = 5.0
- 1971 to 2007: HSPF = 0.06875 x (year manufactured - 1976) + 5.5
- 2008 and later: HSPF = 7.7

h. If the output capacity of electric baseboard heaters cannot be determined, a value of 225 watts per linear foot should be entered in the ‘Output Capacity’ box.

i. If a heating system is only used as a backup heat source, the heating system should not be entered into the WA. Entering a backup heating system into the WA will result in inaccurate energy modeling.

j. If a programmable (smart) thermostat is present, check the 'programmable thermostat' box.

(1) If a programmable thermostat is not present and it is determined by the auditor that a programmable thermostat would not be appropriate at the client/home, check the ‘programmable thermostat’ box and note in the comment box that no programmable thermostat is present and the evaluation would not be appropriate due to onsite conditions.

(3) When evaluating for a programmable thermostat for an electric furnace or heat pump, the programmable thermostat check box is not visible when electricity is the selected fuel type. Therefore, the fuel type needs to be temporarily changed to natural gas or

propane. The ‘programmable thermostat’ box should then be checked or unchecked, depending upon the auditor determination on if a programmable thermostat should be evaluated for installation. The fuel type then needs to be changed back to electricity, and then proceed with the computerized audit.

k. All uninsulated return ducts as well as uninsulated supply ducts located outside of the thermal boundary should be evaluated for insulation in the “Uninsulated Supply Ducts”.

5. Cooling Tab

All homes audited with at least one working air conditioner, either central or window units, must have cooling system data entered into NEAT/MHEA. The evaluated cost of replacement cooling systems must include all associated costs. All of the costs must be included and the cost of the replacement cooling system and associated costs must have a SIR of 1.0 or greater for the replacement cooling system to be an ECM.

a. The 'Replacement Required' box should not be checked unless a package unit heating and cooling system is being replaced as outlined in Section XI, Subsection C, Topic 4, Subtopic a, Detail 1, Part b.

b. Non-working cooling systems should not be entered into the computerized audit. Only working cooling systems may be evaluated for replacement as a cost effective measure.

c. For cost effective replacements, once the winning bid is received from the installing contractor for the installation of the cooling system, the computerized audit must be re-run with the actual price of the bid to ensure the installation of the cooling system is cost effective.

d. The cooling capacity of the cooling system needs to be obtained on-site from the existing unit.

e. The efficiency of the central air conditioner cooling system, also known as the Season Energy Efficiency Ratio (SEER), needs to be obtained either from manufacturer inscription on the existing unit or based off of the unit model information. If the efficiency of the unit cannot be determined and documented then the estimated efficiency of the cooling system shall be entered into the computerized audit. The estimated efficiency to be entered is found in Table XI-2. The SEER ratings in Table XI-2 are degraded based upon the NREL *Building America Home Performance Analysis Procedures for Existing Homes*. SEER is to be used for central systems, as well as room/window units in the computerized audit. If values from Table XI-2 are used, a comment stating that degraded SEER values were used, needs to be included in the cooling tab.

Table XI-2. Estimated SEER by year unit manufactured.

Year Unit Manufactured	SEER	
	Central System	Room/Window Unit
1974 & earlier	4.1	4.1
1975-1980	4.4	4.4
1981-1997	6.0	5.7
1998-2005	8.2	8.0
2006-2015	10.7	8.7
2016 to present	14.0	9.8

f. In NEAT, if "Replacement with Heat Pump Mandatory" is selected for valid reasons in the heating tab, then "Replacement Required" needs to be checked in the cooling tab as well in order for the heat pump to show up on the "Recommended Measures" if the heat pump is not otherwise cost effective.

g. In MHEA, if a heat pump is being evaluated as "Replacement Required" in the heating tab and the home has an existing working AC with a SEER greater than 8.5, then "Replacement Required" needs to be checked in the cooling tab as well.

6. Ducts/Infiltration Tab

When entering information into the Ducts/Infiltration Tab, the auditor must determine a target air infiltration reduction rate that will be achieved on the home. Determining the target air infiltration reduction rate is subjective and comes from experience and trial and error. Along with the target air infiltration reduction rate, the auditor must also determine how much it is going to cost to achieve that infiltration reduction.

a. Once these numbers are determined and the audit is run, the computerized audit returns a SIR for Infiltration Reduction. As long as the SIR is 1.0 or above, the infiltration reduction measure can be included in the work order. If the SIR is less than 1.0, then the auditor has two choices:

(1) Reduce the target air infiltration reduction rate and the cost to do the measure to see if it will cost test.

(2) Do not include infiltration reduction in the work order.

b. The actual initial audit blower door test result must be entered in the 'Before Weatherization (Existing)' column. If a blower door test cannot be performed at a home,

refer to Section IV, Subsection A: Blower Door Testing and Diagnostics for additional information.

c. The target air infiltration reduction rate needs to be entered into the 'After Weatherization (Target or Actual)' column. The sub-grantee is responsible for developing its own cost estimates and infiltration reduction targets based on historical data and on-site conditions to ensure reasonable accuracy of the NEAT/MHEA inputs. The target infiltration reduction and associated cost entered into NEAT/MHEA need to be comparable to the actual infiltration reduction and cost estimate when the home is completed.

d. Since the manometer should be set to read PR/FL@50 during all blower door tests, the "at House Pressure Difference" should always be entered as 50 Pa.

e. Sub-grantee staff needs to analyze actual air leakage reductions and costs to those estimated during the NEAT/MHEA audit runs to see whether significant variations are occurring. This analysis will help identify where adjustments, in the future, may be needed.

7. Baseloads Tab

a. Water Heating

(1) If the home has a functioning water heater, the water heater needs to be entered into NEAT/MHEA.

(a) If the water heater in a home is a tankless on-demand water heater, no water heater should be entered into NEAT/MHEA. A note needs to be entered into the comment box that the home contains a tankless on-demand water heater.

(b) A water heater replacement with a SIR of 1.0 or greater is an allowable measure, but standard water heater replacements are rarely cost effective. Tankless on-demand water heaters and heat pump water heaters may be evaluated for installation; however, the department must be contacted regarding the evaluation of each tankless on-demand water heater or heat pump water heater that is evaluated as a replacement.

(c) If pipe wrap or a water heater blanket is not present but cannot be installed due to on-site conditions or client refusal, the box indicating that a water heater wrap and/or pipe wrap is present should be checked. A comment should be included in the comment box, stating that the tank wrap and/or pipe wrap could not be installed due to the specific circumstances.

(d) If a home has more than one water heater that needs to be evaluated for tank wrap and/or pipe wrap, contact the department for guidance if needed.

(2) Existing showerhead information needs to be entered for evaluation of low flow showerheads. The 'Shower Use (min/day)' is based on an average per shower time. Therefore, if there are two showers and each is used 30 minutes a day, then 30 minutes would be entered into the 'Shower Use (min/day)' box.

b. Refrigerators

Existing refrigerator and replacement refrigerator information needs to be entered for evaluation of refrigerator replacements. Refer to Section VII, Subsection B, Topic 1: Refrigerators/Freezers for additional information on metering refrigerators.

c. Lighting Systems

Existing lighting and lighting retrofit information needs to be entered for evaluation of lighting retrofits. Lighting retrofits should only be evaluated for those lights that are used for an average of two hours a day or more. It is recommended that a burn time of no more than 4 hours be used for lighting replacements when assessed within the computerized audit.

8. Itemized Costs Tab

The following is a list of measures that can be entered into the "Itemized Costs" screen along with an explanation of how they are to be used in the Missouri Weatherization Assistance Program.

a. Health and Safety

Items entered as health and safety do not need to be cost tested and therefore the 'include in SIR' box should not be chosen for the measure within NEAT/MHEA. These items will appear at the bottom of the Recommended Measure List, and their cost will be added to the cumulative cost but not the cumulative SIR.

Measures listed below must be performed as a health and safety measure unless otherwise included in or considered as an energy conservation measure with an SIR of 1.0 or greater. Allowable health and safety measures include:

(1) Cleaning and tuning or replacing the heating system or cooling system when the SIR is less than 1. Repairing or replacing combustion venting, heating equipment, cooling equipment, gas leaks, wiring, dryer vents or ventilation fans.

(2) Alleviating moisture-related problems or installing a vapor barrier.

(3) Installing combustion air, carbon monoxide alarms, heat source barriers, or smoke detectors.

(4) Miscellaneous measures relevant to health and safety as defined in Section I, Subsection A: Important Definitions.

b. Incidental Repairs

(1) If repairs must be done in order to preserve or protect the integrity of an eligible measure, the repair costs including material and labor must be included in the cumulative SIR calculation by checking the 'Include in SIR' box .

(2) No energy savings may be associated with incidental repairs

(3) Repairs are limited to $600 in material per funding source or to the point where NEAT or other approved computerized audit computes a cumulative SIR of not less than one (1), whichever comes first.

(4) Subgrantees may include the repair cost to protect the integrity of an individual measure with that measure's individual SIR calculation.

(5) Refer to Section XII, Subsection D: Incidental Repairs for additional information on incidental repairs.

c. Low Cost/No Cost Activities

Low-cost/no-cost activities must be included in the cumulative SIR of the home. On NEAT/MHEA the items will be entered as an Itemized Cost titled 'LCNC', have no annual energy savings entered onto the computerized audit and the 'Include in SIR' box must be checked.

d. User Defined Measures

This entry is used for an energy conservation weatherization activity that is not addressed within NEAT/MHEA. The energy savings for user-defined measures are entered by the subgrantee. User defined measures can only be used on a case-by-case basis when approval is obtained from the department.

D. Computerized Energy Audit Requirements

1. General Requirements

a. Each client file must have an accurate Recommended Measures generated by the computerized audit. One Recommended Measures with all of the energy efficiency measures installed on the home must be in the client file with the 'Run On' date prior to the passing final inspection date.

b. The Recommended Measures must have been generated within six months of the home being in progress. A home in progress does not include the hanging of smoke or carbon

monoxide detectors. Refer to Section X, Subsection B, Topic 1 General Requirements for additional information regarding this requirement.

c. If the total estimated cost (including incidental repairs, energy conservation measures, health and safety measures, and low-cost no-cost measures) exceeds $15,000, written approval must be obtained from the department prior to work commencing on the home.

2. Savings to Investment Ratio (SIR)

a. Individual measure SIRs must be 1.0 or greater. Energy efficiency measures with a SIR of less than 1.0 are not allowable.

b. Subgrantees will not be reimbursed for any weatherization measure installed on a home that does not have a SIR of 1.0 or greater. If a subgrantee has been reimbursed for a measure that did not have a SIR of 1.0 or greater, the subgrantee will be obligated to reimburse the funds for the measure. Reimbursement cost will include both material and labor.

c. Subgrantees **may** use another funding source to "buy down" the cost of a measure to a point where it has an SIR of 1.0 or greater except for in Multi-family buildings as outlined in Section IX, Subsection A, Topic 3: Expenditures/Funding Issues. The department does not prohibit the installation of an entire weatherization measure with non-department administered funds.

3. Cumulative SIR

a. The cumulative SIR of the measures recommended by NEAT/MHEA must be 1 or greater. The measures should be implemented in a descending order based on the priority of the NEAT/MHEA recommended measures.

b. Should the estimated cumulative SIR compute to less than 1.0, the following options are allowed:

(1) Remove the combination of cost effective weatherization measures and associated incidental repairs with the lowest individual measure SIR and rerun the audit to ensure that the cumulative SIR is 1 or greater. If the incidental repair was deemed necessary for the effective performance of the cost effective weatherization measure, then both the cost effective weatherization measure and the incidental repair must be removed in the attempt to meet the required cumulative SIR. This process would continue until the cumulative SIR of the home is 1.0 or greater.

(2) Reject the home for weatherization.

c. Subgrantees will not be reimbursed for any home that does not have a cumulative SIR of 1.0 or greater. If the subgrantee has already been reimbursed for this home, the

subgrantee will be obligated to reimburse the funds for the home. Reimbursement cost will include both material and labor.

4. Client File Documentation

Client files must contain a physical copy of the NEAT/MHEA Input Report and Recommended Measures. The ‘Run On’ date on the Recommended Measures and the latest date on the ‘Audit Status History’ on the Input Report must correlate.

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Section XII: Miscellaneous

A. Prioritization of Weatherization Measures

1. All 'Mandatory' measures listed in Table XI-2 must be evaluated for installation as outlined in Section XI, Subsection B, Topic 3: Library Measures Tab.

2. Any 'Option by Agency' measure listed in Table XI-2 may be evaluated for installation as outlined in Section XI, Subsection B, Topic 3: Library Measures Tab.

3. Once evaluated measures are determined to be cost-effective by the computerized audit, the measures should be installed based on cost-effective prioritization.

4. Measure skipping of cost-justified major measures is not permitted at any time. A “Major Measure” is defined as follows: A high priority measure, which if skipped, would result in “partial” weatherization of a unit. Major measures are as follows: air sealing, duct sealing of ducts outside the thermal boundary, attic insulation, wall insulation and floor or belly insulation.

5. If it is determined at any time prior to the beginning of work on the home that for legitimate reasons an approved measure cannot be installed, the computerized audit must be re-run to remove the measure which could not be installed. Therefore, it is imperative that the initial auditor correctly evaluate the home so that measures, which cannot be installed for legitimate reasons, are not evaluated for installation.

6. If work has started on the home, and it is determined that a measure is unable to be installed for legitimate reasons, all other weatherization measures should be installed and a comprehensive explanation of why the measure was skipped should be included in the client file. If a client declines a measure based on a legitimate health concern, alternate materials should be researched that can be used to complete the ECM and protect the client's health. If an alternative material cannot be found, the measure may be skipped and measures with a lower SIR may be installed. Be sure to document why the measure was not installed.

7. If subgrantee staff or contractors are not adequately trained or equipped to perform certain measures, the measures cannot be skipped. When priority measures cannot be installed due to lack of trained staff or equipment, standard procedures should be to postpone the job until adequate training and/or equipment are acquired.

8. All Health and Safety measures should be installed prior to installing ECM's. The inability to install health and safety measures will require the deferral of the home since a home cannot be considered complete without having ECM's installed.

9. A signed and dated, agency developed, Change Work Order must be included in the client file whenever:

- An ECM, health and safety measure or incidental repair listed on the Recommended Measures is removed from the work scope.
- A health and safety measure that is not listed on the Recommended Measures is added to the work scope.
- After work commences, an ECM or incidental repair is found to be cost effective on a re-run of the computerized audit and is added to the work scope.

The Change Work Order must be signed by the QCI, Energy Auditor, Weatherization Director or other agency staff member who has authority to approve the change in the work scope. Verbal approval for work changes may be given but must be followed by completion of the change work order.

B. Work Order Review with Client

After the computerized audit has been completed and the work order has been developed, the subgrantee needs to review all measures to be installed with the client prior to any work being performed. This should include all energy efficiency measures, health and safety measures, incidental repairs and low-cost/no-cost activities.

C. Client Refusal of Material Installation

Prioritization of energy saving measures is accomplished using generally accepted engineering methods and determined by the computerized audit. Allowing the refusal of a measure by a building owner or occupant does not comply with these methods.

1. If an ECM is declined, appropriate client education techniques will often eliminate the client's concern.

   a. If the auditor deems the reason for declining the measure(s) as legitimate, the auditor should complete all other weatherization measures and include in the client file a comprehensive explanation of the rationale for skipping the specific measure(s).

   b. If the auditor deems the reason for declining the measure(s) is not a legitimate reason, the situation must be fully documented in the client file. The work would be completed with the installation of only measures having a SIR higher than the declined measure.

2. Health and safety measures cannot be declined or refused by a client. If health and safety measures cannot be performed at the home, then the home needs to be deferred.

3. After the work has started on the home and due to scheduling, measures are installed with a lower priority and during the process of installation, the client declines a higher priority measure, the job would be complete at the time of the client declining the higher priority measure. Only measures having a SIR higher than the declined measure may be installed, unless a lower priority measure has already been installed. Documentation must be provided in the client file, explaining the reasons why a lower priority measure was installed prior to a measure with a higher priority.

D. Incidental Repairs

Incidental repairs are those minor repairs necessary for the effective performance or preservation of energy conservation measures. All work associated with the direct installation of an energy conservation measure (ECM), or required for the ECM measure to comply with code, the SWS or department standards must be included in the cost of the measure and cannot be considered an incidental repair.

Examples:

- Fixing a small roof leak, to protect attic insulation, which is being installed, is eligible since the repair is not completed to comply with code or the SWS, but for the preservation of the attic insulation.
- Minor repairs to a doorjamb that are necessary to allow weather stripping to be installed can be considered an incidental repair tied to the weather stripping. However, repairing the doorjamb without installing weather stripping would need to be an infiltration reduction measure.
- When installing a new furnace, the gas valve, drip leg, electric shutoff are all parts of the furnace installation and must be included for the furnace to comply with code; therefore, these components are **NOT** eligible as incidental repairs.
- When installing spray polyurethane foam (SPF), any thermal or ignition barrier (fire barrier) installed over the SPF to comply with code and/or the SWS, is **NOT** an eligible incidental repair.
- Repairing moderate size holes in the ceiling to keep insulation from falling to the floor while installing blown cellulose can be considered an incidental repair tied to the attic insulation. However, installing a sheetrock ceiling (more than four sheets) to contain or support the insulation being installed, is **NOT** a minor incidental repair. A complete ceiling necessary for the direct installation of the energy conservation measure may be beyond the scope of weatherization.

1. Incidental repairs must be justified in the client file with an explanation for their need and the associated relationship to a specific ECM or group of ECM's. Documentation of the incidental repair justification shall be done using Attachment 2.7: Incidental Repair Justification Form.

2. Incidental repairs shall be limited to $600 in materials per funding source distributed by the department. Any incidental repairs to exceed this limit must have department approval prior to installing the incidental repair.

3. Installing a wall or ceiling surfaces, where there is not an existing surface, is not allowed as a minor incidental repair or ECM. However, if an existing surface has become derelict (i.e. plaster falling off the ceiling, etc.) repairs requiring less than four sheets of drywall, or the equivalent, may be done as an infiltration reduction measure. Needing more than four sheets of drywall may be beyond the scope of weatherization.

4. Removing an overhead garage door and installing a wall is not allowed as an incidental repair.

5. Incidental repairs must be limited to those minor repairs necessary for effective performance or preservation of new energy conservation measures being installed by the subgrantee. Performing repairs that are only necessary to protect materials that existed in the building before weatherization is not allowed.

6. Additional repairs found to be necessary after the undertaking of a measure has commenced should not be considered incidental repairs. The additional costs should be included as part of the cost of the measure. It would not be practical for a crew or contractor to stop work until the subgrantee has an opportunity to determine if adding the incidental repair costs would cause the home to, cumulatively, fall below cost-effectiveness.

7. See Section XI, Subsection C, Topic 8: Itemized Cost Tab and Attachment 1.4 Incidental Repair Guidance Form for additional information on requirements for incidental repairs.

E. Low-Cost/No-Cost Activities

The installation of low-cost/no-cost (LCNC) weatherization materials are allowable weatherization expenses. LCNC materials are inexpensive weatherization materials, such as water flow controllers, furnace filters or items, which are considered to be cost effective, but are unable to be cost justified using the computerized audit.

1. A maximum of $50 per dwelling unit may be spent on materials to be installed as low-cost/no-cost activities.

2. Low-cost/no-cost weatherization materials may not have any billed labor associated with the installation of the material.

3. Materials installed may only be materials that cannot be evaluated using the computerized audit, but are considered to be cost effective. See Table XI-2 for materials that may be evaluated using the computerized audit.

4 On the computerized audit, low-cost/no-cost activities must be included in the cumulative SIR of the home. Refer to Section XI, Subsection C, Topic 8: Itemized Costs Tab, Subtopic C for information on entering LCNC's into the computerized audit.

5. All low-cost/no-cost materials must be recorded on the Incidental Repair Justification Form (Attachment 2.7). Enter the material name in the ‘Incidental Measure’ box, enter low-cost/no-cost in the ‘Associated ECM(s)’ box and the ‘Justification for Tying to ECM(s)’ box is to be used to explain how the material is cost effective.

6. All low-cost/no-cost materials must be reported on MoWAP with a measure type of Incidental Repair and ‘LCNC’ entered as the component. The cost for the low-cost/no-cost

materials should not be entered as incidental repair costs under the funding source breakdown in MoWAP.

F. Material Standards

1. Only weatherization materials that are listed in the most current Appendix A - Standards for Weatherization Materials in DOE 10 CFR Part 440, or that meet or exceed the standards prescribed in Appendix A, shall be installed as weatherization materials. Materials shall be installed according to state and local codes. Materials shall be installed according to manufacturers' instructions unless specified otherwise.

2. All weatherization measures installed need to be installed in such a fashion to stay in place or remain intact for the duration of the lifespan of the measure, as evaluated in NEAT/MHEA.

3. Surfaces must be appropriately cleaned, prior to installing caulking or adhesive-backed materials.

4. All exposed wood and raw edges, located either within the interior of the home or on the exterior of the home that have been installed or modified by WAP efforts shall have a primer or sealant applied in such a manner that the client can finish the wood to match surrounding wood surfaces. All finish coat paint used to cover primed or sealed surfaces should be supplied by the homeowner.

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Section XIII: Section 106 Requirements

Section 106 of the National Historic Preservation Act of 1966 stipulates that all federally funded projects be reviewed to determine if the effect the proposed project will have on any property that is included in, or eligible for inclusion in the National Register of Historic Places will require review. The department has signed an Interagency Agreement with the Missouri State Historic Preservation Office ("SHPO") (See Attachment 6.1). This policy will address operational changes to the Low-Income Weatherization Assistance Program that resulted from the agreement. Subgrantees are responsible for compliance with 36 CFR 800. Subgrantees may request advice, counsel or assistance from the State Historic Preservation Office or Division of Energy.

This policy is effective for all homes audited since February 11th, 2010.

Contact Information:
Missouri Department of Natural Resources
State Historical Preservation Office
800-361-4827 / 573-751-7858

A. Programmatic Agreement Implementation

1. Training

At least one person employed with each weatherization agency must be trained and designated to carry out the stipulations of the Section 106 review process. This person must meet the Secretary of the Interior's *Professional Qualifications Standards* (https://www.nps.gov/subjects/historicpreservation/laws.htm) outlined in 36 CFR Part 61, Appendix A, or attend a minimum of one (1) Section 106 training session, provided by the State Historic Preservation Office. It is highly recommended that all weatherization auditors attend this training. If a Weatherization agency does not have an employee who meets the Secretary of the Interior's *Professional Qualification Standards*, or has attended a Section 106 training session, then all homes must be submitted to the SHPO for Section 106 review.

2. Client File Requirements

The following is required to be included in all client files regardless of age of the home:

- Age of the home must be included on the client application for Weatherization Assistance Program services.
- Photos of the home, including a streetscape photo. (See Attached 3-6.2)
- A map identifying the location of the property.
    - If the project involves ground-disturbing activity, the map must be a current USGS 7.5 minute topographical map. Free topographical maps can be printed from the website: http://www.webgis.com/terraserver.html
    - If the project does not involve ground-disturbing activity, SHPO will allow the use of simple location maps, (such as Google maps,) provided that the map shows cross streets, and the location of the property is marked.

Projects that require the Section 106 review must have a completed Section 106 Project Information Form and all related applicable documents uploaded to the MoWAP client file.

3. Energy Audit Procedures

When performing an initial energy audit on a client's home, the auditor must verify the estimated age of the home. Clear photos of the home, including a streetscape photo, must also be taken at this time. The age of the home and the photos must be included in the client files. While performing the initial energy audit, the auditor shall review the list of Measures Exempt from Further Review. (See Attachment 6.3) If the proposed activities are included on the list, no further action is necessary. If a proposed activity is not included on the list, the Subgrantee shall submit a completed Section 106 Project Information Form and all applicable documents to the SHPO for review. (See Attachment 6.4) The Section 106 review must be completed by the SHPO prior to the start of work on a project.

4. Emergency Situation Undertakings

All projects that require non-exempt energy efficient measures and involve health and safety emergencies as defined in Section II, Subsection B, Topics 4-6, can be completed in two phases. The Subgrantee may elect to perform individual emergency health and safety measures that are listed in Section XIII, Subsection C: Undertakings Exempt From Further Review in the initial phase of the project prior to approval from the SHPO. Prior to performing the second phase of the project, the Subgrantee must submit a Project Information Form and all applicable documents for the entire project, and await approval from the SHPO before commencing work.

B. Undertakings that Require Further Review

If a proposed activity is not included on the list of Measures Exempt from Further Review, or for projects involving ground disturbing activities, the Subgrantee shall submit a completed Section 106 Project Information Form and all applicable documents to the SHPO for review before commencing work. (See Attachment 6.4)

When a project is determined by the SHPO to have an adverse effect on a historic property, and a resolution of the adverse effect is not readily achievable, the Subgrantee is responsible for issuing a public notice regarding the proposed project, in order to seek public comment. The public notice can be in any form of mass media; however, they shall not include the names of the property owners, and/or tenants. When requested, the department and/or the SHPO shall assist the Subgrantee in identifying organizations interested in historic preservation in the local community, to seek input from the public on the proposed project to the extent possible. The Subgrantees shall notify the department and the SHPO of members of the public or Tribes who have expressed interest in a project.

At any time during the implementation of a project, should an objection be raised by a member of the public, the Subgrantee shall take the objection into account and consult as needed with the objecting party, the department, the SHPO, or the ACHP to resolve the objection.

In addition, when conditions dictate (for example, when writing a recordation report), Subgrantees must employ or contract with qualified professionals who at minimum meet the Secretary of the Interior's Professional Qualifications Standards at 36 CFR Part 61 in the field of archaeology, history, architectural history, or other qualified preservation professional. The Subgrantee will make the professional's resume and contract information available to the department or the SHPO upon request.

C. Undertakings Exempt from Further Review

1. Categorical Exemptions

If the estimated age of the home is less than forty-five (45) years old, and does not meet the criteria established in the National Register Bulletin 22, *Guidelines for Evaluating and Nominating Properties that Have Achieved Significance within the Past Fifty Years*, no further action is necessary regarding the Section 106 review process. As required in A2, Client File Requirements, the estimated age of the structure, photographs, and a location map must be placed in the client file.

If the property is older than 45 years old, an alternative option for exemption is to conduct research at the SHPO to determine if the property has recently been reviewed. If the property has been reviewed by the SHPO within the last five (5) years from the date of application, and has been determined to be ineligible for inclusion in the National Register of Historic Places, the project may proceed without further review or consultation.

All weatherization materials included in Appendix A of 10 CFR 440, *Standards For Weatherization Materials*, **excluding** all windows and doors, are considered appropriate for use on historic properties, and do not require further review or consultation from the State Historic Preservation Office.

a. Specific Activities Exempt from Further Review

"Like-kind" replacement/repair is defined as a replacement action or repair that uses materials that match the original material in terms of composition, appearance, dimension, detailing and durability. To the extent practicable, original materials will be preserved and reused for like-kind replacement/repair.

(1) Exterior Rehabilitation

(a) Installation of scaffolding and other temporary construction-related structures including barriers, screening, fences, protective walkways, signage, office trailers and restrooms.

(b) Application of exterior paint on previously painted surfaces, including masonry.

(c) All lead paint abatement, which does not involve removal or alteration of exterior features and/or a window's surrounding casings sash components, trim and sills.

(d) Like-kind replacement/repair of:

- masonry foundations, floor joists, and ceiling joists
- basement bulkhead doors
- wood siding and trim
- porch elements such as columns, flooring, floor joists, ceilings, railing, balusters and balustrades, and lattice
- roof cladding, flashing, gutters, soffits, and downspouts and with no change in roof pitch or configuration
- doors and door frames
- window sash, frames, glazing and weather stripping (Replacement of existing clear glass with new clear glass is allowed)
- exterior vents

(e) Replacement/repair of:

- concrete foundations
- exterior heating, ventilation, and air conditioning (HVAC) mechanical units that do not require any new venting or a new location, or venting is on the rear of the structure, not viewable from any public right of way

(f) Installation of:

- dryer vents, air intakes, and outlets on secondary facades
- storm windows where the finish on the new storm window matches the finish of the existing window in color.
- caulk and expandable foam to prevent air infiltration so long as it is clear, painted or colored to match the existing exterior materials
- insulation on the underbelly of Mobile Homes
- removable film on windows if the film is transparent
- blown in insulation where no holes are drilled through exterior siding

(2) Interior Rehabilitation

(a) Interior improvements and rehabilitation where no structural alterations are made, where no demolition of walls, ceilings and/or floors occurs, and where no drop ceilings are added or walls are furred out or moved, and consisting of:

- plumbing work, including installation of water heaters
- electrical work, including improving lamp efficiency

- heating, ventilation, and air conditioning (HVAC) systems and their components
- insulation installation in attics and crawl spaces
- blown in insulation where no decorative plaster is damaged
- replacement of interior doors where the size of the opening is not altered
- replacement or repair of door knobs and other door hardware.

(b) Like-kind replacement/repair of:

- plaster walls and ceilings
- floors, including refinishing

(c) Installation of drywall where original plaster wall surfaces are missing, and which will not appreciably change the trim profile. No decorative plaster or other decorative features shall be covered.

(d) All painting and carpeting, provided that carpeting installation damages no underlying wood or masonry floor surfaces.

(e) All kitchen and bathroom remodeling provided no walls, windows, or doors are altered.

(f) All lead paint abatement, which does not involve removal or alteration of interior features.

(g) All asbestos abatement, which does not involve removal or alteration of interior features.

(3) Equipment

Standard energy efficiency measures that do not require ground disturbance, or relocation or removal of walls, ceilings or floors. This equipment may include but is not limited to the installation or replacement of motors, lighting, blowers, pumps, heating, ventilation, and air conditioning (HVAC) systems that do not require any new venting or a new location, or venting is on the rear of the structure, not viewable from any public right of way.

D. Section 106 Compliance under Extraordinary Circumstances

Unanticipated Discoveries -If previously unidentified archaeological sites or historic properties are discovered unexpectedly as a result of construction activities, the construction contractor will immediately halt all construction activity within a one-hundred (100) foot radius of the discovery, notify the Subgrantee of the discovery and implement interim measures to protect the discovery from looting and vandalism. Within forty-eight (48) hours of receipt of this notification of the discovery, the Subgrantee shall:

a. inspect the work site to determine the extent of the discovery and ensure that construction activities have halted;

b. clearly mark the area of the discovery;

c. implement additional measures, as appropriate, to protect the discovery from looting and vandalism; and

d. notify the SHPO, the department and interested Indian Tribes or other parties of the discovery.

The Subgrantee will have seven (7) calendar days following notification to determine the National Register eligibility of the discovery after considering the timely filed views of the SHPO and interested Indian Tribes or other parties. The Subgrantee may assume the newly discovered property to be eligible for the National Register for the purposes of Section 106 pursuant to 36 CFR § 800.13(c).

For properties determined eligible, the Subgrantee will notify the SHPO, the department and interested Indian Tribes or other parties of those actions that it proposes to resolve adverse effects in a mitigation plan.

- Consulting parties will have seven (7) calendar days to provide their views on the proposed mitigation plan.
- The Subgrantee will ensure that the recommendations of consulting parties are taken into account to resolve adverse effects.
- The Subgrantee will carry out the approved mitigation plan.

The construction contractor will resume construction activities in the area of the discovery upon receipt of written authorization from the SHPO.

e. Discovery of Human remains - When an unmarked human burial or skeletal remains are encountered during construction activities, the Subgrantee will comply with Missouri Rev. Stat. § 194.400, et seq. (Unmarked Human Burial Law).

Upon encountering unmarked human burials or skeletal remains during ground disturbing construction activities, the construction contractor will immediately stop work within a one-hundred (100) foot radius from the point of discovery and notify the Subgrantee. The construction contractor will implement interim measures to protect the discovery from vandalism and looting, but must not remove or otherwise disturb any human remains or other items in the immediate vicinity of the discovery.

Immediately following receipt of such notification, the Subgrantee will:

(1) Ensure that construction activities have halted within a one-hundred (100) foot radius from the point of discovery.

(2) Implement additional measures, as appropriate, to protect the discovery from looting and vandalism until the requirements of state law have been completed.

(3) Notify the local law enforcement officer, the SHPO, the department and interested Indian Tribes or other parties, of the discovery.

The investigation by the local law enforcement officer will establish jurisdiction over the remains. The Subgrantee will notify the SHPO when local law enforcement determines that the SHPO has jurisdiction. Within seven (7) days of receipt of such notification, the SHPO will determine the treatment to be implemented. If the human remains are Native American, the SHPO in consultation with interested Indian Tribes will determine the treatment to be implemented.

The construction contractor will resume construction activities in the area of the discovery upon receipt of written authorization from either local law enforcement or the SHPO, whoever has jurisdiction under state law.

THE REMAINDER OF THIS PAGE IS INTENTIONALLY LEFT BLANK FOR FUTURE EXPANSION

Attachment 2.6

Missouri Weatherization Assistance Program

Daily Combustion Appliance Zone (CAZ) Test Form

Client Name:	Job #:	Date:

General Information

This Daily CAZ Test Form must be completed at the end of each day, regardless of the type of work performed, at all homes where a CAZ test is required. All electric homes or homes with combustion appliances that do not require a CAZ test must have this form completed the first day of work only.

Appliances in the home: ___ All Electric Combustion Appliances that do not require a CAZ test ☐ One or more Combustion Appliances that require CAZ Testing

If there are one or more combustion appliances in the home that require a CAZ test, proceed with the form.

List all Work performed at the home today _____

Test Steps (refer to Technical Operation Manual for details)		Test Results
1. Was work performed on the home today that could potentially affect the drafting appliances?		YES / NO
• If YES, Proceed to the test Steps below, If NO, Proceed to Signature at bottom of page.		
2. Visually inspect combustion appliances and venting before proceeding.		
3. Are any combustion appliances natural draft or mechanically assisted draft? If YES, proceed with Daily CAZ Test Step 4. If NO, no spillage testing is necessary.		YES / NO
4. Close all exterior doors and windows. Close all interior doors to rooms without exhaust fans or forced air returns. Close all CAZ doors.		
5. Set combustion water heaters to pilot and turn off heating/cooling systems. Turn off all exhaust fans and dryers. Extinguish all fires and close fireplace dampers. Outdoor openings for combusiton air should remain open.		
6. Measure and record baseline pressure of CAZ with reference to (WRT) outdoors.		Pa
7. Turn on all exhaust fans and clothes dryers. Measure and record the pressure of CAZ WRT outdoors.		Pa
8. Turn on air handler(s). Measure and record the pressure of the CAZ WRT outdoors.		Pa
9. With the air handler on, is the pressure in the CAZ more negative WRT outdoors than in step #6 and #7? If YES, the air handler is to remain on. If NO, the air handler is to be turned off.		YES / NO
• Is the air handler on or off?		ON / OFF
10. Open interior doors to the CAZ. Is the pressure in the CAZ more negative WRT outdoors? If YES, the CAZ doors remain open. If NO, the CAZ doors are to be closed.		YES / NO
• Are the interior CAZ doors open or closed?		OPEN / CLOSED
11. Measure and record pressure of CAZ with reference to (WRT) outdoors. **This is the greatest depressurization achieved.**		Pa
12. What are the dominant forces causing depressurization?		
13. Fire the appliances, check ambient CO and test for spillage, starting with the appliance with the smallest BTU. Does the appliance spill after 2 minutes?		
a. Appliance 1 description:	Ambient CO:	YES / NO
b. Appliance 2 description:	Ambient CO:	YES / NO
c. Appliance 3 description:	Ambient CO:	YES / NO
14. If appliance spills after 2-minutes during Step 13, re-test under natural conditions. Does the appliance spill after 2 minutes under natural conditions?		
a. Appliance 1 description:	Ambient CO:	YES / NO
b. Appliance 2 description:	Ambient CO:	YES / NO
c. Appliance 3 description:	Ambient CO:	YES / NO
15. If dwelling has other combustion appliance zones, repeat steps 1-14 and complete an additional CAZ form for each location.		
16. Return dwelling, exhaust fans, and combustion appliances to normal settings.		
17. Before a home can be left for the day, all appliances must pass the Daily CAZ Test or actions must be taken to make the appliances safe until further action can be taken. Do all appliances pass spillage under greatest depressurization achieved? If NO, complete the Additional Actions Taken section below.		YES / NO

Adtional Actions Taken: *These are the actions taken if an appliance does not pass spillage under the greatest depressurization (step 13).*

Signature of Tester:		**Affiliation of Tester:**	
Printed Name of Tester:		**Client Signature*:**	

** Client signautre is not required, but is highly recommended when any additional actions are taken.*

August 2023

Attachment 3.1

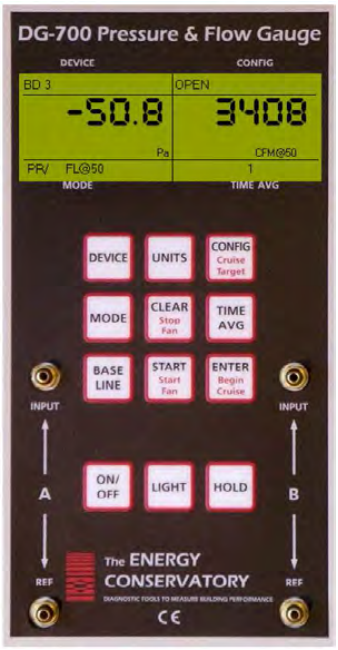
Depressurization Blower Door Test Procedures

Below is a step by step guide on the proper procedure when performing a depressurization blower door test. This step by step guidance is based upon using the DG 700 and the Minneapolis Blower Door.

1. Perform a visual inspection of the attic and home. Inspect for vermiculite insulation in the attic. If vermiculite is present, do not perform a blower door test unless the vermiculate has been tested and the results were negative for asbestos. Do not conduct a blower door test while a wood stove, fireplace or vented space heater is operating.
2. Turn water heater to pilot.
    - Record water heater temperature setting from the thermostat control knob. _____ ºF
3. Turn the furnace and/or air conditioner off.
    - Record temperature setting from thermostat. _____ ºF
4. Set house up in winter conditions. Close all windows and exterior doors. Open all interior doors, including closet doors.
5. Setup the blower door in an appropriate exterior door.
    - The blower door should not be setup in a door located within an enclosed porch.
    - Run a hose outside the door at with the end terminating at least five feet from the blower door and not directly in the path of exhaust of the blower door. The other end of the hose needs to be run through the door cover as it will be connected to the DG 700.
    - Examine the blower door fan to ensure that the fan flow direction is setup for a depressurization blower door test.
6. Connect the hose ran to outside (as described in step 5) to the Channel A reference port of the DG700.
7. Connect another hose to the Channel B input port and to the single pressure tap (metal nipple) on the blower door fan.
8. At this time make sure that all of the flow rings are installed in the blower door fan.
9. Turn on the DG 700 then in the following order:
    - Press the ‘Mode’ twice until the mode reads PR/FL@50.
    - Press the ‘Base Line’ button.
    - Press the ‘Start’ button and wait 20 seconds (if windy wait 60 to 120 seconds).
    - Press the ‘Enter’ button.
10. On the blower door fan, take off appropriate flow ring. If not sure what flow ring(s) to take off, then take off all of the flow rings to have the fan in the Open configuration.
11. On the DG 700 press the ‘Config’ button until the appropriate flow ring is selected.

12. On the gauge mounting board, turn the fan controller switch to turn on the fan. Continue to slowly adjust the fan speed until the DG 700 reaches between -45 and -55 pascals.
13. If the DG 700 continually flashes “LO”, then a fan flow ring needs to be installed in the blower door fan. If it is not flashing “LO”, move onto step 14.
    - Install a fan flow ring, if the blower door fan was in the open configuration install the A ring. If the blower door fan was in the A ring configuration, install the B ring and so on.
    - Make sure that if a fan flow ring is installed that the appropriate flow ring is selected on the DG 700 (see step 11).
14. With this configuration the blower door is taking a single point test at -50 pascals, as the DG 700 is converting all figures and showing what the results of the blower door at -50 pascals.
15. Record CFM_{50} as shown on the DG 700. **This is the blower door test results for the home. _____ CFM_{50}**
16. Turn the fan down from between -45 and -55 pascals to approximately -30 pascals. Leave the blower door running and check for air leaks throughout the home (duck work, attic hatches, plumbing bypasses, windows, around doors, door latches, etc.).
17. Look for biggest leak by room. Use the DG 700 with a hose to the Channel A input port and place the hose into a room. If the DG 700 reads more than 5 pa, then there is a connection between the room and to outside the pressure boundary of the home. Use this information to determine where air sealing should be prioritized.
18. Re-set furnace temperature and pilot lights to original state (see steps 1 and 2).

DG-700 Pressure and Flow Gauge



Appendix E. Window Leakiness

E.1 Introduction

The "Leakiness" data field in the Weatherization Assistant is found under the "Windows" tab of both NEAT and MHEA. The "Leakiness" field allows the user to describe the existing air leakage characteristics of each window entered. This input is used to calculate the energy savings due to reduced air infiltration for three window retrofit measures: window replacement, storms windows, and window weatherization (i.e., sealing). For each window retrofit measure, NEAT and MHEA add the energy savings due to reduced air infiltration to other energy savings associated with the measure to obtain the total energy savings.

Five options are allowed under the "Leakiness" data field: Very Tight, Tight, Medium, Loose, and Very Loose. Guidance on the applicability of these options is provided below for each of the various window types that can be specified in NEAT and MHEA: Jalousie, Awning, Slider, Fixed, Door Window, Sliding Glass Door, and Skylight. The options that are typical for windows encountered in homes served by the Weatherization Assistance Program are also identified.

The guidance provided below is based primarily on the condition of the frame, sashes, and weatherstripping. Once a leakiness level is selected using the guidance below, it should be modified as follows to take into account the condition of the window panes and the presence of a storm window:

- Condition of window panes
    - No adjustment should be made if the window pane is cracked or if less than 2 sq. in. of glass is missing in the window (e.g., up to about a 1.5 in. diameter hole or a 1.5 in. × 1.5 in. glass section).
    - Degrade the leakiness one level if 2 to 9 sq. in. of glass is missing in the window (e.g., about a 1.5 in. to 3.5 in. diameter hole or a 1.5 in. × 1.5 in. to 3 in. × 3 in. glass section).
    - Degrade the leakiness two levels if 9 to 25 sq. in. of glass is missing in the window (e.g., about a 3.5 in. to 5.5 in. diameter hole or a 3 in. × 3 in. to 5 in. × 5 in. glass section).

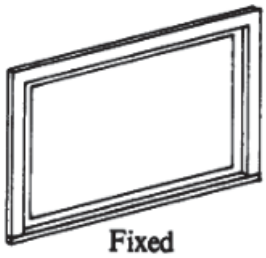
Appendix E: Window Leakiness

- Specify the window to be **Very Loose** if more than 25 sq. in. of glass is missing in the window (e.g., a hole bigger than about a 5.5 in. diameter or a 5 in. × 5 in. square).

- **Presence of storm window** – Upgrade the leakiness one level if a storm window in average or better condition is installed.

E.2 Fixed Window, Door Window, and Skylight

Fixed-type windows are sealed in their frames and cannot be opened. Fixed-type windows include large picture windows, decorative windows in doors, and most skylights (i.e., windows in the ceiling). *The leakiness of a typical fixed window, door window, or skylight is* ***Very Tight****.*

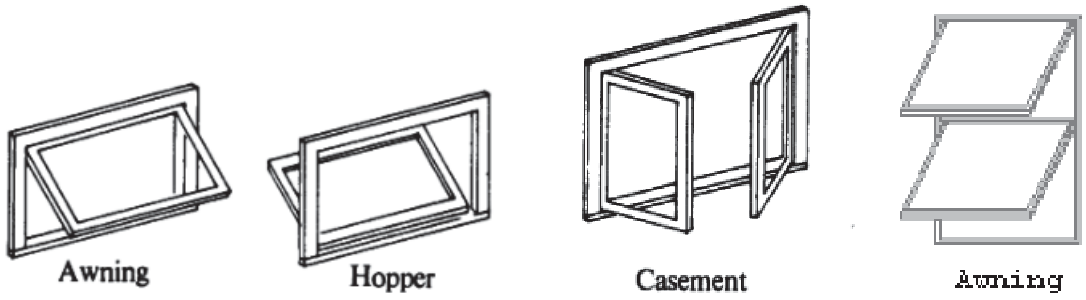

Fixed

E.3 Awning Window (Including Hopper and Casement Window)

The awning window type used in NEAT and MHEA includes hopper and casement windows. Most awning, hopper, and casement windows have just a single sash, although casement windows can have two sashes and awning windows can have two or three sashes. The sash of an awning window is hinged at the top of the window frame and opens outward and upward. The sash of a hopper window is hinged at the bottom of the window frame so that the window tilts open at the top. The sash of a casement window is hinged on the side of the window frame and swings out right or left. On a casement window with two sashes, a vertical framing member is often present in the middle of the window that houses a locking mechanism (not shown in the figure below).

These types of windows are often operated by a cranking mechanism. In awning and hopper windows with two or three sashes, a common crank is usually present so that the sashes open and close together at the same angle. When closed, the sashes press against the window frame and any installed weatherstripping to form a seal. In windows with multiple sashes, the sashes are usually designed to fit together at their interface when closed to form a tight seal. A lock or latch is usually present that further helps seal the window by drawing the sashes tightly against the frame, each other, and/or any installed weatherstripping.

Appendix E: Window Leakiness



Awning, hopper, and casement windows with a single sash are generally tighter than other types of moveable windows. *The leakiness of a typical single-sash awning, hopper, or casement window is **Tight**, while the leakiness of a typical multiple-sash awning, hopper, or casement window is **Medium***.

- Very Tight – The sashes and window frame fit together snuggly to form a complete seal when the window is closed. The sashes and frame are in excellent condition, or they can be in average condition if weatherstripping in good condition is also present. The cranking and locking mechanisms are typically operable and assist in securely pulling the sashes and window frame together. Typical of a new window.

- **Tight (typical of a window with a single sash) — No visible gaps are observed between the sashes or between the sashes and the window frame when the window is closed. The sashes and frame are in average condition. Weatherstripping can be absent or deteriorated. The cranking and locking mechanisms are typically operable and assist in securely pulling the sashes and window frame together.**

- **Medium (typical of a window with multiple sashes) — Small gaps up to 1/8 in. are observable between the sashes and/or between the sashes and the window frame when the window is closed, even with the aid of a locking mechanism. The sashes and frame are in average to poor condition. Weatherstripping is usually absent or deteriorated.**

- Loose — Gaps up to 1/4 in. are observable between the sashes at their interface when the window is closed as much as the cranking and locking mechanism allow, and/or gaps up to 1/2 in. are observable between the sashes and the window frame when the window is closed. The sashes and frame are in poor

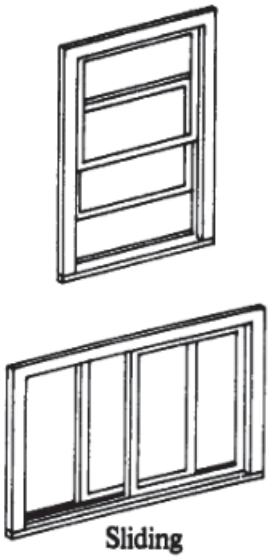
Appendix E: Window Leakiness

condition, and may be warped or not square. Weatherstripping is absent or ineffective.

- Very Loose — Gaps 1/4 in. or greater are observable between the sashes at their interface when the window is closed, and/or gaps 1/2 in. or more are observable between the sashes and the window frame when the window is closes. The sashes and frame are in very poor condition and are likely warped or not square. Weatherstripping is absent or ineffective. The locking mechanism may not be able to be engaged.

E.4 Slider Window and Sliding Glass Door

A vertical slider window has at least one sash that slides up and down within the window frame. In a double-hung slider window, both sashes slide vertically past one another. Only the bottom sash slides up and down in a single-hung slider window. A horizontal slider window (designated as "Sliding" in the figures) or sliding glass door has at least one sash that slides horizontally within the window or door frame. A locking mechanism is often present on a slider window that draws the two sashes together at their interface and helps press each moveable sash into the window frame.


Sliding

Horizontal slider windows and sliding glass doors are usually in poorer condition and, thus, leakier than comparable vertical slider windows. *The typical leakiness of an original double- or single-hung vertical slider window is **Medium** if installed in a house built in the 1960s and before, and **Tight** if installed in a house built in the 1970s and after. The leakiness of a typical horizontal slider window or sliding glass door is **Medium**.*

- Very Tight — The moveable sashes and window frame fit together tightly as designed when the window is closed such that no gaps are present. The sashes and frame are in excellent condition. Each moveable sash is secure and tight in its track. The moveable sashes are able to be closed such that the window locking mechanism can be fully engaged. Weatherstripping is present and in good condition. Typical of a new window.

Appendix E: Window Leakiness

- **Tight (typical of an original double- or single-hung vertical slider window installed in a home built in the 1970s or later) — No visible gaps are observed between the sashes or between the moveable sashes and the window frame when the window is closed. The sashes and frame are in average condition. Each moveable sash is secure in its track although some play may be present. The moveable sashes are able to be closed such that the window locking mechanism can be engaged, although perhaps not fully. Weatherstripping is present and in good to fair condition.**

- **Medium (typical of an original double- or single-hung vertical slider window installed in a home built in the 1960s or earlier, a horizontal slider window, or a sliding glass door) — Small gaps up to 1/8 in. are observable between the sashes at their interface and/or between the moveable sashes and the window frame when the window is closed. The sashes and frame are in average condition. Each moveable sash is operable in its track although some play is likely. The moveable sashes may not sit perfectly horizontal or vertical when closed. The locking mechanism may not be able to be engaged. Weatherstripping is absent or deteriorated.**

- Loose — Gaps up to 1/4 in. are observable between the sashes at their interface when the window is closed, and/or gaps up to 1/2 in. are observable between the moveable sashes and the window frame. The sashes and frame are in poor condition. Each moveable sash may be loose in its track. The moveable sashes likely do not sit horizontal or vertical when closed. The locking mechanism may not be able to be engaged. Weatherstripping is absent or ineffective.

- Very Loose — Gaps 1/4 in. or greater are observable between the sashes at their interface when the window is closed, and/or gaps 1/2 in. or more are observable between the moveable sashes and the window frame. The sashes and frame are in poor condition. Each moveable sash may no longer fit in its track. The moveable sashes likely do not sit horizontal or vertical when closed. There may be considerable movement (rattling) between sashes. The locking mechanism is likely to be inoperative. Weatherstripping is absent or ineffective.

Appendix E: Window Leakiness

E.5 Jalousie Window

A jalousie window is made up of multiple horizontally-mounted glass louvers or slats. The glass louvers are usually 3 in. to 5 in. wide and are mounted in a metal panel. A crank typically rotates the glass louvers outward like a shutter when open. The glass louvers overlap each other slightly when closed. *The leakiness of a typical jalousie window is* ***Loose****.*


Jalousie

- Very Tight — Generally not applicable to jalousie windows.
- Tight — Generally not applicable to jalousie windows.
- Medium — A tight glass-to-glass seal is visually obtained at the overlap of all the glass louvers when the window is closed. The cranking mechanism is in good working order. All window panes are securely attached to the cranking mechanism. Typical of a new window.
- **Loose (typical) — Small gaps up to 1/8 in. are observable between the glass louvers when the window is closed. One or two of the glass louvers may not be securely attached to the cranking mechanism. The cranking mechanism may not be able to fully rotate the glass louvers to their fully closed position.**
- Very Loose — Gaps 1/8 in. or greater are observable between the glass louvers when the window is closed. Multiple glass louvers may not be securely attached to the cranking mechanism. The cranking mechanism is likely not able to fully rotate the glass louvers to their fully closed position.

ATTACHMENT E TO WEATHERIZATION PROGRAM CONTRACT
NO. UC: PY26/27
BID FORM - TO BE COMPLETED BY CONTRACTOR
INVITATION FOR BID

BUYER: CAASTLC, Inc.
ADDRESS: 2709 Woodson Road
Overland, MO. 63114

CONTRACTOR: _____
ADDRESS: _____
_____

TELEPHONE: (314) 863-0015

Keith Robinson (314) 446-4417
TELEPHONE: Dale Hickman (314) 446-4442

DATE: June 1, 2026
DATE & TIME OF BID CLOSING: **Monday, June 15, 2026, 5:00 p.m.**
IMPORTANT: NOTE MINIMUM MATERIAL SPECIFICATIONS ON ATTACHMENT C. WORKMANSHIP MUST CONFORM TO STANDARDS IN ATTACHMENT D.

The Quantity shown in each bid line is based on the work to complete one (1) home for the twelve (12) month period of July 1, 2026, through June 30, 2027. It is anticipated that approximately 170 homes will be completed during the contract period of July 1, 2026, through June 30, 2027.

Please break down each line item by material and labor and use the indicated quantity to establish a line item price to be in effect for the twelve (12) month period of July 1, 2026, through June 30, 2027.

CAASTLC, Inc. reserves the right to choose more than one Contractor to perform the work under this contract.

Products used most frequently (estimate)

- Window and door weather-stripping and door sweeps
- Blown Cellulose and/or Fiberglass-Batt insulation
- Caulk and spray type foam
- Smoke Detector(s)
- CO Detector(s)
- Water heater blanket
- Pipe wrap
- CFL light bulbs

CONTRACTOR NAME: _____ AUTHORIZED SIGNATURE: _____

IFB No. UC: PY26/27 Invitation for Bid Date: 06/01/26	CAASTLC USE ONLY

Specifications for each measure can be found in Attachment C and the Standard Work Specifications (SWS). Photos of each completed item are required to be submitted at job completion - email attachment okay. Blower door testing required in & out for every job - Record & Report before & after #'s. Blower door TESTING will not have its own designated line item. Daily CAZ testing is also required at the end of each work day when work was done that could potentially affect any drafting appliances. Daily CAZ testing will not have a designated line item.

Item #	Description	Material Price	Labor Price	Quantity (units)	Total Price	Frequency multiplier	**Weighted Total**
1	Cut in accessible horizontal access hatch. Include trim, lid with weather-stripping.			each	$0.00	40	$0.00
2	Cut in accessible vertical access hatch. Includes hinged door weather-stripped with door type weather-stripping and barrell bolt latches. Exterior crawlspace doors require a lockable latch			each	$0.00	50	$0.00
3	Weather-strip hatch - to create air-tight seal between conditioned space and attic. Foam self adhesive type			each	$0.00	150	$0.00
4	Weather-strip hatch - to create air-tight seal between conditioned space and attic. Door type weather-stripping			each	$0.00	150	$0.00
5	Install Non-Compressible Insulation on hatch lid/door. Match surrounding R-Value or minimum per SWS. Mechanically fasten insulation to lid/door.			each	$0.00	200	$0.00
6	Block attic hatch with rigid material exceeding the height of installed insulation. Must be strong enough to hold the weight of a person entering or exiting the attic			each	$0.00	150	$0.00
7	Replace hatch lid with minimum 3/4" plywood - primed on all 6 sides			each	$0.00	75	$0.00

Company Name:

Authorized Signature:

IFB No. UC: PY26/27 Invitation for Bid Date: 06/01/26	CAASTLC USE ONLY

Specifications for each measure can be found in Attachment C and the Standard Work Specifications (SWS). Photos of each completed item are required to be submitted at job completion - email attachment okay. Blower door testing required in & out for every job - Record & Report before & after #'s. Blower door TESTING will not have its own designated line item. Daily CAZ testing is also required at the end of each work day when work was done that could potentially affect any drafting appliances. Daily CAZ testing will not have a designated line item.

Item #	Description	Material Price	Labor Price	Quantity (units)	Total Price	Frequency multiplier	**Weighted Total**
8	Install new trim around hatch. Casing type trim fastened & caulked to ceiling or wall surface			each	$0.00	20	$0.00
9	Install Barrell Latch (bolt). Typically used on kneewall access doors and plumbing access panels			each	$0.00	50	$0.00
10	General blocking in attic with plywood or other rigid material higher than installed insulation. To hold insulation back. Mechanically fastened			per square foot	$0.00	40	$0.00
11	Block attic fan with rigid material exceeding the height of installed insulation. Fasteners must be used at corners			each	$0.00	100	$0.00
12	Attic fan cover - white on house side, reflective foil type facing on attic side. Cut to fit. Removable, velcro type. Velco mechanically fastened to fan & cover. Clean fan housing surface with acetone or equivalent before applying velcro.			each	$0.00	50	$0.00
13	Replacement ceiling fan shutters - Universal type attic fan louvers - Actual fan housing stays in place, new shutters screw on at ceiling - 24" or 30" to be specified on work order.			each	$0.00	10	$0.00

Company Name:

Authorized Signature:

IFB No. UC: PY26/27 Invitation for Bid Date: 06/01/26	CAASTLC USE ONLY

Specifications for each measure can be found in Attachment C and the Standard Work Specifications (SWS). Photos of each completed item are required to be submitted at job completion - email attachment okay. Blower door testing required in & out for every job - Record & Report before & after #'s. Blower door TESTING will not have its own designated line item. Daily CAZ testing is also required at the end of each work day when work was done that could potentially affect any drafting appliances. Daily CAZ testing will not have a designated line item.

Item #	Description	Material Price	Labor Price	Quantity (units)	Total Price	Frequency multiplier	**Weighted Total**
14	Air-seal attic. Includes plumbing penetrations, open soffits, top plates, electrical penetrations, any other bypasses between attic and interstitial/conditioned spaces. Up to 1000 Square feet			per home	$0.00	150	$0.00
15	Air-seal attic. Includes plumbing penetrations, open soffits, top plates, electrical penetrations, any other bypasses between attic and interstitial/conditioned spaces. 1001 - 1500 Square feet			per home	$0.00	100	$0.00
16	Air-seal attic. Includes plumbing penetrations, open soffits, top plates, electrical penetrations, any other bypasses between attic and interstitial/conditioned spaces. More than 1500 Square feet			per home	$0.00	50	$0.00
17	Air-seal all top plates in attic with 1" of spray foam (assumes no insulation or insulation removal is part of work scope)			per home	$0.00	20	$0.00
18	Vacuum out existing loose fill insulation in attic - includes removal & disposal			per square foot	$0.00	20	$0.00

Company Name:

Authorized Signature:

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Item #	Description	Material Price	Labor Price	Quantity (units)	Total Price	Frequency multiplier	**Weighted Total**
19	Air-seal can lights in attic to twice the can height with fire-rated boxes -sealed to the attic floor			each	$0.00	50	$0.00
20	Blank Junction box covers - may be single or double to cover exposed wiring already in a junction box without a cover			each	$0.00	20	$0.00
21	Build cover for pull down attic stairs using appropriate lumber to box around perimeter, minimum 3/4" plywood for lid. Must be insulated to same R-value as installed insulation. Min. R30 non compressible			each	$0.00	20	$0.00
22	Replace pull down attic stairs springs and/or closing mechanism.			each	$0.00	20	$0.00
23	Install ventilation baffles for blown attic insulation - 16" centers			each	$0.00	50	$0.00
24	Install ventilation baffles for blown attic insulation - 24" centers			each	$0.00	50	$0.00
25	Gable vent with insect screen - 2 square feet net free area			each	$0.00	20	$0.00

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Item #	Description	Material Price	Labor Price	Quantity (units)	Total Price	Frequency multiplier	**Weighted Total**
26	Gable vent with insect screen - Over 2 square feet net free area			each	$0.00	20	$0.00
27	Hooded roof vent - minimum 50 square inch net free area - closed slanted back			each	$0.00	20	$0.00
28	Turbine vent - minimum 12" base, internally braced			each	$0.00	20	$0.00
29	Soffit Vents - 8"x 16" or appropriate per application			each	$0.00	20	$0.00
Attic Insulation - per Attachment C and SWS, includes blocking or shielding all heat sources with a minimum of 3" clearance - max clearance - 6". Blocking must be slightly higher than the finished insulation height. A fire rated material such as 26 gauge galvanized tin, must be used to seal gaps around heat sources such as masonry or metal chimneys. Air-sealing is required prior to adding insulation to ensure maximum R-value. Rigid permanent blocking is required around the attic hatch if hatch opens into a living area and adequate clearance exists. All visible electrical junctions must be flagged so location is visible after insulation is installed. HVAC & ventilation fans should be turned off while blowing insulation.							
30	R-19 Blown Cellulose insulation			per sq foot	$0.00	100	$0.00
31	R-30 Blown Cellulose insulation			per sq foot	$0.00	100	$0.00
32	R-38 Blown Cellulose insulation			per sq foot	$0.00	100	$0.00

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Item #	Description	Material Price	Labor Price	Quantity (units)	Total Price	Frequency multiplier	**Weighted Total**
33	R-49 Blown Cellulose insulation			per sq foot	$0.00	100	$0.00
34	R-19 Blown Fiberglass insulation			per sq foot	$0.00	50	$0.00
35	R-30 Blown Fiberglass insulation			per sq foot	$0.00	30	$0.00
36	R-38 Blown Fiberglass insulation			per sq foot	$0.00	30	$0.00
37	R-49 Blown Fiberglass insulation			per sq foot	$0.00	30	$0.00
38	Open cell spray foam - R-19			per square foot	$0.00	30	$0.00
39	Open cell spray foam - R-30			per square foot	$0.00	30	$0.00
40	Open cell spray foam - R-38			per square foot	$0.00	30	$0.00
41	Open cell spray foam - R-49			per square foot	$0.00	30	$0.00
42	Ignition barrier for open cell spray foam - spray on type recommended by manufacturer. Attic space used only for repairs or maintenance. Spaces used for storage or occupancy require a thermal barrier			per square foot	$0.00	30	$0.00

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Item #	Description	Material Price	Labor Price	Quantity (units)	Total Price	Frequency multiplier	**Weighted Total**
43	Drill and plug floored attic - dense pack 2" x 6" ceiling joist cavities			per square foot	$0.00	100	$0.00
44	Install R-19 Unfaced Fiberglass batts in attic floor			per square foot	$0.00	20	$0.00
45	Install R-30 Unfaced Fiberglass batts in attic floor			per square foot	$0.00	20	$0.00
46	Labor only to evenly distribute existing insulation in attic			per hour	$0.00	20	$0.00
47	Interior caulking - color to match existing materials or be paintable. 1 tube = 40 linear feet			per tube	$0.00	100	$0.00
48	Exterior caulking - clear or color to match existing materials or be paintable. 1 tube = 40 linear feet			per tube	$0.00	100	$0.00
49	Air-sealing with spray foam - gaps and cracks larger than 1/4". Can type spray foam okay			per linear foot	$0.00	100	$0.00
50	Backer Rod			per linear foot	$0.00	20	$0.00
51	1" rigid foam board - sealed with caulk or spray foam - Extruded polystyrene or urethane			per square foot	$0.00	200	$0.00

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Item #	Description	Material Price	Labor Price	Quantity (units)	Total Price	Frequency multiplier	**Weighted Total**
52	2" rigid foam board - sealed with caulk or spray foam - Extruded polystyrene or urethane			per square foot	$0.00	100	$0.00
53	Air-seal subfloor penetrations with galvanized tin and fire rated caulk - in accordance with applicable fire code			per home	$0.00	100	$0.00
54	Drywall Patch : 0-2 Square feet - 2 coats of joint compound - finish sanded			each	$0.00	150	$0.00
55	Drywall Patch : 3-10 Square feet - 2 coats of joint compound - finish sanded			each	$0.00	100	$0.00
56	Drywall Repair : Over 10 Square feet - 2 coats of joint compound - finish sanded. *1/2" drywall may be used as a thermal barrier for spray foam insulation in living/storage areas			per square foot	$0.00	50	$0.00
57	Drywall Repair - moisture resistant drywall: - 2 coats of joint compound - finish sanded			per square foot	$0.00	25	$0.00
58	Drywall Repair - Firecode 5/8" drywall: - 2 coats of joint compound - Sanded - Interior; 1 coat not sanded - garage			per square foot	$0.00	25	$0.00
59	Mortar patch			per square foot	$0.00	50	$0.00
60	Minor Tuck-pointing - up to 10 square feet. Remove loose & match surrounding			each	$0.00	10	$0.00

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Item #	Description	Material Price	Labor Price	Quantity (units)	Total Price	Frequency multiplier	**Weighted Total**
61	Door sweep - Aluminum with triple vinyl			each	$0.00	100	$0.00
62	Door sweep - door bottom (U-type)			each	$0.00	25	$0.00
63	Door Weather-strip - Aluminum with 3/8" vinyl or equivalent (heavy duty). Color to match door or jamb as close as possible.			per door	$0.00	100	$0.00
64	Aluminum threshold with vinyl stop			each	$0.00	20	$0.00
65	Wood threshold with vinyl stop			each	$0.00	20	$0.00
66	Labor only to cut down & rehang existing door slab			each	$0.00	20	$0.00
67	Door jamb repair - may include repairing or replacing stops, strike-plates, and hinges			each	$0.00	50	$0.00
68	Door Reinforcer (mod kit) to accommodate keyed entry or deadbolt. Finish to be specified			each	$0.00	20	$0.00
69	Replace keyed entry lockset - match finish to other doors hardware			each	$0.00	50	$0.00
70	Install dead bolt lock (drill hole) Match finish of keyed lockset			each	$0.00	50	$0.00

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Item #	Description	Material Price	Labor Price	Quantity (units)	Total Price	Frequency multiplier	**Weighted Total**
71	Replace existing dead bolt lock. Match finish of keyed lockset.			each	$0.00	50	$0.00
72	Exterior Solid wood core door, blank, 1 3/4" thick, 32" - 36" x 80" with hardware. Sealed with exterior grade paint or sealer on all 6 sides			each	$0.00	50	$0.00
73	Same as #68 - any other size			each	$0.00	10	$0.00
74	Steel insulated door (slab only). 32" - 36" x 80" - blank. With hardware			each	$0.00	50	$0.00
75	Steel insulated pre-hung door and frame. 32" - 36" x 80" - blank. With hardware			each	$0.00	50	$0.00
76	Steel insulated pre-hung door and frame. 32" - 36" x 80" - with single lite. With hardware			each	$0.00	25	$0.00
77	Remove and re-install storm door			each	$0.00	20	$0.00

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Item #	Description	Material Price	Labor Price	Quantity (units)	Total Price	Frequency multiplier	**Weighted Total**
78	Install peep-site in door			each	$0.00	50	$0.00
79	Glass, up to 12"x12" for door slab replacement - Thermal. Needs to be at least 20" away from deadbolt			each	$0.00	20	$0.00
80	5x6'8 Patio Door			each	$0.00	2	$0.00
81	6x6'8 Patio Door			each	$0.00	4	$0.00
82	Over 6x6'8 Patio Door			each	$0.00	1	$0.00
Lead-safe Weatherization - needed on all homes built before 1978 that have not been certified as free from lead based paint when the total amount of disturbed lead-based painted surface exceeds six square feet per room of interior surface, twenty square feet of exterior surface or a window or door will be replaced.							
83	Lead-safe setup and cleanup - as specified by EPA's RRP Rule 40 CFR Part 745			per setup	$0.00	75	$0.00

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Item #	Description	Material Price	Labor Price	Quantity (units)	Total Price	Frequency multiplier	**Weighted Total**
84	Door type weather-strip (same as item #59) Used on casement or awning type windows or vertical attic hatches.			per linear foot	$0.00	50	$0.00
85	Install/Replace interior window or door casing trim. Match other windows/doors			per linear foot	$0.00	25	$0.00
86	Install/Replace Exterior window or door casing trim. Match other windows/doors			per linear foot	$0.00	10	$0.00
87	V-bronze for window or door weather-stripping			per linear foot	$0.00	50	$0.00
88	Self adhesive foam weather-stripping			per linear foot	$0.00	50	$0.00
89	Box in window A/C unit. (Only when A/C stays in window) Rigid foam and plywood on each side - caulked & sealed between sashes. May also be called for on wall units.			each	$0.00	50	$0.00
90	Exterior cover for window a/c unit			each	$0.00	20	$0.00
91	Window glass replacement, single strength, clear. 0 - 40 ui			each	$0.00	100	$0.00
92	Window glass replacement, single strength, clear. 41 - 80 ui			each	$0.00	100	$0.00
93	Window glass replacement, single strength, obscure. 0 - 40 ui			each	$0.00	20	$0.00

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Item #	Description	Material Price	Labor Price	Quantity (units)	Total Price	Frequency multiplier	**Weighted Total**
94	Window glass replacement, single strength, obscure. 41 - 80 ui			each	$0.00	20	$0.00
95	Window glass replacement, double strength, clear. 81 - 100 ui			each	$0.00	50	$0.00
96	Plexi-glass - 0-50 ui			each	$0.00	20	$0.00
97	Plexi-glass - 51 + ui			each	$0.00	10	$0.00
98	Window glass replacement - thermal unit. 0 - 50 ui			each	$0.00	20	$0.00
99	Window glass replacement - thermal unit. 51 - 90 ui			each	$0.00	20	$0.00
100	Window glass replacement - thermal unit. Over 90 ui			each	$0.00	1	$0.00
101	Tempered glass replacement 0 - 50 ui			each	$0.00	1	$0.00
102	Tempered glass replacement 51 - 90 ui			each	$0.00	1	$0.00
103	Pulley Seals - mechanically fastened			pair	$0.00	50	$0.00
104	Sash Lock - cam locking style			each	$0.00	50	$0.00
105	Plastic shims for sash locks			each	$0.00	20	$0.00
106	Re-putty existing window sash - Single Pane sash. Remove loose, replace points as needed, glazing not caulk			each	$0.00	100	$0.00
107	Re-putty existing window sash - Multi - Pane sash. Remove loose, replace points as needed, glazing not caulk			each	$0.00	100	$0.00
108	Align meeting rails of a window - labor only			each	$0.00	50	$0.00

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Item #	Description	Material Price	Labor Price	Quantity (units)	Total Price	Frequency multiplier	**Weighted Total**
109	Board up window - minimum 1/2" plywood - painted all 6 sides and caulked in			per square foot	$0.00	50	$0.00
110	Labor to remove window sash, plane to fit, and reinstall			each	$0.00	20	$0.00
111	Replace window sill, 2"x6" or appropriate lumber - primed and painted			each	$0.00	20	$0.00
112	Replace window stops - will specify sides or top			each	$0.00	1	$0.00
113	Repair window sash - includes removal of sash and associated repairs as needed to ensure sash functions properly and seals tight			each	$0.00	1	$0.00
Storm Windows - Per Section 3 and Standard Work Specifications (SWS)							
114	Aluminum combination, vertical or horizontal operation. 0 - 100 ui			each	$0.00	20	$0.00
115	Aluminum combination, vertical or horizontal operation. Over 100 ui			each	$0.00	20	$0.00
116	Aluminum Picture window with removable inserts. 0 - 80 ui			each	$0.00	20	$0.00

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Item #	Description	Material Price	Labor Price	Quantity (units)	Total Price	Frequency multiplier	**Weighted Total**
117	Aluminum Picture window with removable inserts. 81 - 100 ui			each	$0.00	20	$0.00
118	Aluminum Picture window with removable inserts. Over 100 ui			each	$0.00	20	$0.00
Primary Window Replacement - All primary windows to include complete installation - caulk, hardware, trim, etc. Aluminum flashing/trim when needed. Lead Safe - RRP - is required on any pre 1978 home.							
119	Vinyl replacement window, slider (direction to be specified), thermal glass: minimum U-value 0.46; minimum SHGC 0.62. with screens. 0 - 70 ui			each	$0.00	20	$0.00
120	Vinyl replacement window, slider (direction to be specified), thermal glass: minimum U-value 0.46; minimum SHGC 0.62. with screens. 71 - 90 ui			each	$0.00	20	$0.00
121	Vinyl replacement window, slider (direction to be specified), thermal glass: minimum U-value 0.46; minimum SHGC 0.62. with screens. 91 - 100 ui			each	$0.00	20	$0.00
122	Vinyl replacement window, slider (direction to be specified), thermal glass: minimum U-value 0.46; minimum SHGC 0.62. with screens. Over 100 ui			each	$0.00	20	$0.00

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Item #	Description	Material Price	Labor Price	Quantity (units)	Total Price	Frequency multiplier	**Weighted Total**
123	Vinyl replacement window, 3-lite Slider (fixed center), thermal glass: minimum U-value 0.46; minimum SHGC 0.62. with screens. Over 100 ui			each	$0.00	1	$0.00
124	Vinyl replacement window, Fixed, thermal glass: minimum U-value 0.46; minimum SHGC 0.62. 0 - 70 ui			each	$0.00	20	$0.00
125	Vinyl replacement window, Fixed, thermal glass: minimum U-value 0.46; minimum SHGC 0.62. 71 - 90 ui			each	$0.00	20	$0.00
126	Vinyl replacement window, Fixed, thermal glass: minimum U-value 0.46; minimum SHGC 0.62. 91 -100 ui			each	$0.00	20	$0.00
127	Vinyl replacement window, Fixed, thermal glass: minimum U-value 0.46; minimum SHGC 0.62. Over 100 ui			each	$0.00	20	$0.00
128	Aluminum window wrap for window replacement. 2 color options white or brown to be specified			per linear foot	$0.00	10	$0.00
129	Sliding patio door, thermal glass, vinyl, 5' x 6'8"			each	$0.00	20	$0.00
130	Sliding patio door, thermal glass, vinyl, 6' x 6'8"			each	$0.00	20	$0.00
131	Sliding patio door, thermal glass, vinyl, larger than 6' x 6'8"			each	$0.00	1	$0.00

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Item #	Description	Material Price	Labor Price	Quantity (units)	Total Price	Frequency multiplier	**Weighted Total**
132	Replace/Install sliding glass door hardware			each	$0.00	5	$0.00
133	Clear plastic window well cover - sealed to house			each	$0.00	10	$0.00
134	Install removable, inflatable fireplace plug - rectangular			each	$0.00	20	$0.00
135	Install removable, inflatable fireplace plug - round			each	$0.00	20	$0.00
136	Tar around flues,chimneys, or other roof penetrations			per linear foot	$0.00	20	$0.00
137	Switch plate and outlet gaskets			each	$0.00	100	$0.00
138	Single switch plate cover - color to be specified			each	$0.00	50	$0.00
139	Double switch plate cover - color to be specified			each	$0.00	50	$0.00
140	Single outlet cover - color to be specified			each	$0.00	50	$0.00
141	Double outlet cover - color to be specified			each	$0.00	50	$0.00

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Item #	Description	Material Price	Labor Price	Quantity (units)	Total Price	Frequency multiplier	**Weighted Total**
Band-sill or Rim joist insulation square footage will be calculated by multiplying the linear feet desired by (joist height / 12) - Although sill plate is expected to be insulated down to the foundation. Closed cell 2-part foam is the preferred method for insulating and air-sealing band-sills or rim joists. Area should be thoroughly cleaned before applying spray foam.							
142	Insulate Band-sill with R-19 Fiberglass batts - includes air-sealing with caulk or foam behind insulation			per square foot	$0.00	50	$0.00
143	Insulate Band-sill with 2" of closed cell 2-part foam			per square foot	$0.00	100	$0.00
144	Remove & dispose of batt insulation			per square foot	$0.00	50	$0.00
Sidewall Insulation - Dense Packing - minimum pounds per cubic foot per manufacturers specifications. Sidewall insulation should not be added if electrical issues exist in the home, including unsafe wiring, uncovered junction boxes, and knob & tube wiring. Plugs must be sealed tightly and glued. Finish insulation must be guaranteed not to settle or contain voids greater than 5% for at least 1 year from installation. Tubing method is preferred - drilling one hole per cavity per story. Infrared scanning may be used for quality assurance.							
145	Dense pack Cellose 2"x4" framed walls from exterior. Removal of siding. Net wall area			per square foot	$0.00	100	$0.00
146	Dense pack Cellulose 2"x4" framed walls from interior. Interior plugs must be covered to match surrounding wall texture. Net wall area			per square foot	$0.00	100	$0.00

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Item #	Description	Material Price	Labor Price	Quantity (units)	Total Price	Frequency multiplier	**Weighted Total**
147	Dense pack Cellulose 2" x 6" framed walls from the exterior. Removal of siding. Net wall area			per square foot	$0.00	50	$0.00
148	Dense pack Cellulose 2"x 6" framed walls from interior. Interior plugs must be covered to match surrounding wall texture. Net wall area			per square foot	$0.00	50	$0.00
149	Dense pack fiberglass 2"x4" framed walls from exterior. Removal of siding. Net wall area			per square foot	$0.00	20	$0.00
150	Dense pack fiberglass 2"x 4" framed walls from interior. Interior plugs must be covered to match surrounding wall texture. Net wall area			per square foot	$0.00	20	$0.00
151	Dense pack fiberglass 2"x6" framed walls from exterior. Removal of siding. Net wall area			per square foot	$0.00	20	$0.00
152	Dense pack fiberglass 2"x 6" framed walls from interior. Interior plugs must be covered to match surrounding wall texture. Net wall area			per square foot	$0.00	20	$0.00
153	Dense pack fiberglass - cavities greater than 2x6". Interior plugs must be covered to match surrounding wall texture. Net wall area.			per square foot	$0.00	20	$0.00

Company Name:

Authorized Signature:

IFB No. UC: PY26/27 Invitation for Bid Date: 06/01/26						CAASTLC USE ONLY	
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Item #	Description	Material Price	Labor Price	Quantity (units)	Total Price	Frequency multiplier	**Weighted Total**
154	Build framed wall to enclose drive under garage. Includes framing, exterior sheeting & house wrap, vinyl siding,R13 batt insulation & air-sealing			per linear foot	$0.00	20	$0.00
155	Build interior framed wall to separate drive under garage from basement - Include framing and fire code drywall - 1 coat			per linear foot	$0.00	10	$0.00
156	Dense pack cellulose garage or other ceiling - 2" x 8" framing. Drywall patch holes			per square foot	$0.00	50	$0.00
157	Dense pack cellulose garage or other ceiling - 2" x 10" framing. Drywall patch holes			per square foot	$0.00	20	$0.00
158	Dense pack cellulose bag method - seals & insulates open cavities under kneewalls and between floors			per cavity	$0.00	20	$0.00
Fiberglass batt insulation - must be properly secured with ties or other approved fastener. Cannot be friction fit. Facing if present must face the conditioned side. Fiberglass can never be left exposed in a living space or space used for storage.							
159	Install R-13 Fiberglass batts in 2" x 4" wall cavity. May be partition wall between conditioned space and garage, knee wall, etc			per square foot	$0.00	100	$0.00

Company Name:

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Item #	Description	Material Price	Labor Price	Quantity (units)	Total Price	Frequency multiplier	**Weighted Total**
160	Install R-19 Fiberglass batts in 2" x 6" wall or floor cavity			per square foot	$0.00	100	$0.00
161	Install R-30 Fiberglass batts in 2" x 10" or deeper floor cavity			per square foot	$0.00	50	$0.00
162	Cover exposed Fiberglass in living area with house wrap			per square foot	$0.00	20	$0.00
163	Insulate crawlspace foundation walls with 2" of closed cell 2-part foam. To include crawlspace in thermal boundary - must be floored or have vapor barrier installed. Band-sill must also be insulated. Must be dry			per square foot	$0.00	20	$0.00
164	Removal and disposal of debris in attic or crawlspace			per hour	$0.00	20	$0.00
165	Install vapor barrier - minimum 6 mil plastic - sealed 6" up around entire perimeter. Seems overlapped 12" and sealed			per square foot	$0.00	100	$0.00
166	Walk path (rolled roofing or SWS approved material) over vapor barrier to get to mechancals in crawlspace			per linear foot	$0.00	20	$0.00

Company Name:

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Item #	Description	Material Price	Labor Price	Quantity (units)	Total Price	Frequency multiplier	**Weighted Total**
167	Install vent in crawlspace - must be closeable. Up to 2 square foot net free area			each	$0.00	1	$0.00
168	Install vent in crawlspace - must be closeable. More than 2 square feet net free area			each	$0.00	1	$0.00
169	Insulate 6" round ductwork in un-heated space with foil-faced fiberglass duct wrap. Minimum R8. Secured with ties.			per linear foot	$0.00	20	$0.00
170	Insulate 8" - 10" round ductwork in un-heated space with foil-faced fiberglass duct wrap. Minimum R8. Secured with ties			per linear foot	$0.00	20	$0.00
171	Insulate ductwork in un-heated space with 2" of closed cell 2-part foam. Square footage as calculated by NEAT based on LxWxH or Circumference x length			per square foot	$0.00	100	$0.00
172	Air-seal ductwork with mesh tape & mastic			per joint	$0.00	50	$0.00
173	Air-seal ductwork with mesh tape & mastic - all connections, joints, turns, etc. Return and Supply. UL rated			per home	$0.00	50	$0.00
174	Reconnect misaligned ductwork - tape/seal connection			each	$0.00	50	$0.00
175	Cork tape - seal penetrations in ductwork, typically where a/c line-set enters coil cabinet			each	$0.00	20	$0.00

Company Name:

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Item #	Description	Material Price	Labor Price	Quantity (units)	Total Price	Frequency multiplier	**Weighted Total**
176	Supply register - standard sizes - Repace existing or install where existing hole is present			each	$0.00	50	$0.00
177	Supply register - standard sizes - Install new (cut hole in duct)			each	$0.00	20	$0.00
178	Return air grate - standard sizes - Replace existing or install where hole is present			each	$0.00	50	$0.00
179	Install passive air grilles in wall or duct - standard sizes to be specified on work order			each	$0.00	50	$0.00
180	Vent Dryer to exterior of home - includes 10' of rigid vent pipe and termination cap - Drill thru wood			each	$0.00	100	$0.00
181	Vent Dryer to exterior of home - includes 10' of rigid vent pipe and termination cap - Drill thru masonry			each	$0.00	100	$0.00
182	Dryer vent pipe - 4" rigid. Install/Replace as specified on work order			per linear foot	$0.00	50	$0.00
183	Dryer vent - exterior termination cap only - Replace existing			each	$0.00	50	$0.00
184	Vent existing exhaust fan through the roof - hooded roof termination with damper, rigid vent pipe insulated to minimum of R7 to prevent condensation			each	$0.00	100	$0.00

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Item #	Description	Material Price	Labor Price	Quantity (units)	Total Price	Frequency multiplier	**Weighted Total**
185	Vent existing exhaust fan through the gable - termination cap with damper, rigid vent pipe insulated to minimum of R7			each	$0.00	50	$0.00
186	Replace existing exhaust fan with new variable speed continuous < 1.0 sone, ASHRAE 62.2 compliant with on/off switch. Panasonic whisper green, Delta GBR, or approved equilavent. Includes all controls, wiring, ducting and installation per SWS and local building codes.			each	$0.00	100	$0.00
187	Install exhaust fan with new variable speed continuous < 1.0 sone, ASHRAE 62.2 compliant with on/off switch. Panasonic whisper green, Delta GBR, or approved equilavent. Includes all controls, wiring, ducting and installation per SWS and local building codes.			each	$0.00	100	$0.00
188	Add charge for integrated light in fan listed in measure # 183, 184			each	$0.00	30	$0.00
189	Water heater blanket - up to 50 gallon unit - must bring overall R-value to 11 or greater. No fiberglass may be exposed. Top of electric water heater must be insulated			each	$0.00	200	$0.00

Company Name:

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Item #	Description	Material Price	Labor Price	Quantity (units)	Total Price	Frequency multiplier	**Weighted Total**
190	Pipe insulation - closed cell foam tubes - size to be specified; typically 3/4" internal diameter. Continuous coverage with no thermal breaks, fastened with aluminum tape and ties			per linear foot	$0.00	200	$0.00
191	LED light bulb installed - 60 watt incandescent replacement			each	$0.00	200	$0.00
192	LED light bulb installed - 75-100 watt incandescent replacement			each	$0.00	100	$0.00
193	13-watt LED light bulb installed			each	$0.00	100	$0.00
194	18-watt LED light bulb installed			each	$0.00	100	$0.00
195	Install Smoke Alarm - battery type			each	$0.00	200	$0.00
196	Install CO Alarm - 10 year sealed lithium battery. Alarms at 35 ppm or less			each	$0.00	100	$0.00
197	Install Fire Extinguisher			each	$0.00	20	$0.00
198	12 ft. Handrail			each	$0.00	2	$0.00
199	Install drain tile (4" drainage pipe) on existing gutter down spout to take water away from foundation. Up to 10' Corrugated or Non to be specified. Above grade. Includes adapter if needed.			each	$0.00	20	$0.00

Company Name:

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Item #	Description	Material Price	Labor Price	Quantity (units)	Total Price	Frequency multiplier	Weighted Total
200	Install down spout on existing gutter - match existing color as close as possible. Typ 2" x 3" with elbow on bottom			each	$0.00	20	$0.00
201	Minor labor - general			per hour	$0.00	100	$0.00
202	Minor labor - skilled carpentry			per hour	$0.00	100	$0.00
203	Minor labor - skilled MEP (Mechanical, electrical, plumbing)			per hour	$0.00	100	$0.00
Blower door guided air-sealing includes general air-sealing materials such as caulk, foam, and foam board. Target # will be provided, results to be verified at final inspection. Blower door guided air-sealing form will be included with work order and must be completed and submitted with invoice.							
204	Blower door guided air-sealing to achieve target infiltration rate. Up to 2 hours			each	$0.00	100	$0.00
205	Additional 1/2 hour of blower door guided air-sealing. Beyond 2 hour initial - Must be approved			per 1/2 hour	$0.00	20	$0.00

	Contractor Total	**$0.00**	

Frequency multiplier is an arbitrary number based on each measure's estimated frequency relative to all other measures with the intent of eliminating the intentional under-pricing of measures that are rarely needed, and the over-pricing of the most frequently needed measures. Frequency multipliers are in no way guarantees of quantity to be ordered from the contract once awarded. All pricing will be compared to market rate and any unreasonable under/over bidding will result in disqualification of bid.

Company Name:

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IFB No. UC: PY26/27 Invitation for Bid Date: 06/01/26	CAASTLC USE ONLY

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Item #	Description	Material Price	Labor Price	Quantity (units)	Total Price	Frequency multiplier	**Weighted Total**

CAASTLC USE ONLY

Weighted Grand Total	**$0.00**

Company Name:

Authorized Signature:

CAASTLC
Community Action Agency of St. Louis County, Inc.

CONTRACTUAL REQUIREMENTS PURSUANT TO THE WEATHERIZATION PROGRAM
CONTRACT NO. UC: PY26/27

ARTICLE I: GENERAL

These Contractual Requirements and Attachments A, B, C, D, & E shall together constitute the "Contract".

AWARD - The right is reserved, as the interest of Community Action Agency of St. Louis County, Inc. (hereinafter "CAASTLC") may require, to reject any or all bids. This Contract shall be awarded to that responsive and responsible bidder whose bid conforming to the provisions outlined herein will be most advantageous to CAASTLC, as determined by firm fixed price. (See Attachment A).

BOND - A Performance Bond or Irrevocable Letter of Credit will be required of the winning bidder prior to the signing of this Contract. (See Attachment A.)

The Contractor shall perform Weatherization services in the homes of CAASTLC customers (hereinafter "customers") as outlined in the attached PY26/27 Missouri Weatherization Work Standards (hereinafter "Attachment D"). The estimated number of homes to be weatherized under this Contract shall be 125 for a total estimated sum of $650,000 dollars. CAASTLC shall have the Contractor perform Weatherization services on an as-needed basis only and makes no promises or guarantees as to the number of homes to be weatherized or the amount to be paid under this Contract.

The Contractor agrees that CAASTLC and/or CAASTLC customers shall not be liable for the debts of the Contractor, or any other firm or organization affiliated with the Contractor in the fulfillment of the terms of this Contract.

The term of this Contract runs from July 1, 2026, through June 30, 2027. All homes must be completed by the end of the contract period. The Contractor assures, promises, and guarantees that all jobs will be completed to the satisfaction of CAASTLC and State of Missouri, Department of Natural Resources, Division of Energy (hereinafter "DNR/DE") within the terms and obligations of this Contract.

The Contractor agrees to perform weatherization measures and understands final inspection must be performed by CAASTLC personnel during established CAASTLC working hours, Monday through Friday.

_____ _____
Company Name Authorized Signature

DNR/DE's Weatherization Assistance Program is not a party to the bid or this Contract and shall be held harmless in any dispute arising from the bid or this Contract.

INSURANCE REQUIREMENTS - The successful bidder (hereinafter "Contractor") agrees to carry appropriate insurance as required in Attachment A during the period of this Contract and will provide CAASTLC with a Certificate of Insurance on all required coverage prior to signing of this Contract. The Contractor agrees to save and hold harmless CAASTLC and its employees, elected and non-elected officials.

Any notice to any Contractor from CAASTLC relative to any part of this Contract will be in writing and considered delivered when said notice is mailed at any level, regular or certified, or, if delivered in person, upon receipt of said notice. Any notice to Contractor shall be sent to:

Contractor's name: _____
Attn: Contractor's Contact Name & Title

_____
Contractor's address & zip code:

_____

_____

Any notice to CAASTLC shall be sent to:

CAASTLC, Inc.
Attn: Keith Robinson, Director of Weatherization & Support Services
2709 Woodson Road
St. Louis, MO 63114

PRIMARY, SECONDARY, TERTIARY, ETC. CONTRACTORS

The Contractor agrees that CAASTLC may choose to award the Weatherization services to primary, secondary, tertiary, etc., contractors. The lowest bidder will be the primary contractor, the second lowest bidder will be the secondary contractor, the third lowest bidder will be the tertiary contractor, etc. CAASTLC will always go to the primary contractor each time Weatherization services are needed and will utilize the primary, secondary, tertiary, etc. contractor in that order unless one of the following conditions applies:

a. The primary contractor cannot provide the services in the time frame requested by CAASTLC. In such an event, CAASTLC may award the work to the next lowest bidder

(secondary contract). If the next lowest bidder (secondary contract) cannot provide the services in the time frame requested by CAASTLC, CAASTLC may award the work to the third lowest bidder (tertiary contract).

b. CAASTLC has been receiving unsatisfactory services applicable to the primary (or secondary, tertiary, etc.) contractor's work performance. In such an instance, CAASTLC will identify the problem(s) and give the contractor a period of no longer than twenty (20) calendar days for such contractor to correct the identified problem(s). After an attempt has been made to do this and the problem(s) have not been corrected, the contract will be terminated.

c. If in the opinion of CAASTLC a potential conflict of interest exists with the primary contractor (or secondary, tertiary, etc.) on a given project, CAASTLC may award the contract to the next lowest bidder (secondary contractor).

The Contractor recognizes that circumstances may arise in which CAASTLC discovers, after award of the primary contract, that the primary contractor cannot provide services in the requested time frame, performs in an unsatisfactory manner or has a conflict of interest. In these situations, CAASTLC may cancel the contract with the primary contractor and may award a contract to the second-lowest bidder (secondary contract). If CAASTLC discovers these kinds of issues with the secondary contractor, CAASTLC shall cancel the contract with the secondary contractor and may award a tertiary contract.

ARTICLE II: RESPONSIBILITY FOR MATERIALS AND SUPPLIES

Except as otherwise provided in this Contract, the Contractor shall be responsible and bear all risks for loss and damage to materials and supplies required by this Contract. The Contractor shall also be responsible for removing from the worksite any material and/or supplies and/or articles to be furnished under this Contract that have been rejected due to non-conformity or lack of adherence to bid specifications.

Except as otherwise specifically stated in this Contract, or any Amendments to this Contract, the Contractor shall provide and pay for all materials, labor, and all other expenses necessary for the complete performance of the work to be done under this Contract.

(1) The Contractor shall have a competent superintendent to supervise the work at all times during the progress of this Contract. The Contractor shall also provide a staff adequate to coordinate and expedite the work and to ensure compliance with all Contract requirements.

(2) The Contractor shall lay out the work and be responsible for all measurements, quantity estimates and site-specific ordering of the work executed under this Contract. The Contractor shall be responsible for any errors resulting from its work. The customers are to be contacted before work begins on their homes. No work is to be performed unless the client or his/her adult representative is on the

premises.

The activities of the Contractor's staff and associates shall be fully coordinated with the activities of CAASTLC. As the work of the Contractor's staff and associates progresses, advice on matters of immediate concern to CAASTLC and related to the specific scope of work covered by this Contract, shall be made available to CAASTLC during the period of this Contract.

The Contractor agrees to protect, indemnify and save harmless CAASTLC from all liabilities, attorneys' fees, costs, expenses and damages arising out of:

(1) Failure by the Contractor to comply with all applicable Federal, State and local laws and regulations pertaining to the services, materials and/or supplies and/or articles ordered, and labor expended pursuant to this Contract.

(2) All claims, suits, actions, costs, counsel fees, damages, judgments or decrees by reason of any person or persons being injured or property being damaged or destroyed by any fault, negligence or defect, latent, or otherwise, in the material or articles purchased or their design, or during or as a result of the work or services to be performed pursuant to this Contract.

ARTICLE III: MATERIALS INSPECTION, ACCEPTANCE AND APPROVALS

CAASTLC shall furnish work orders to the Contractor for homes approved and appraised for weatherization services with address and directions to said homes. Included with each work order will be instructions for work to be performed on the home as well 'as estimated material and labor costs. Any materials *not* bid in the Invitation For Bid must be approved in writing prior to installation by authorized Weatherization Personnel.

MATERIALS AND WORKMANSHIP - All materials used shall conform to the standards in the Material Specifications specified in Attachment C. Prior to signing of this Contract, current test data from certified independent testing laboratories must be submitted showing compliance with certain of these standards, as required in Attachment A. All workmanship must comply with the Standards and Guidelines as required in Attachment D.

All materials shall be installed in the quantities ordered, per the job specification sheet provided by CAASTLC on each job. All materials must be new and approved by CAASTLC prior to their use. Preference will be shown for recycled building insulation materials (see federal specifications).

Substitution is defined as an item that materially conforms to the specifications listed but is physically or technically different from the item bid. Substitution shall only be made with the

advanced written consent of CAASTLC. Any product provided that does not meet the listed specifications shall be replaced by the Contractor at no expense to CAASTLC. If the Contractor is unable to make an acceptable adjustment or replacement, CAASTLC shall interpret this as a breach of contract and may seek damages for default.

Approval of any materials and supplies shall not constitute a waiver of CAASTLC's right to demand full compliance with this Contract. Materials, supplies and accessories may be rejected for cause even though such articles have been given prior approval. CAASTLC has the option to use materials in inventory. The Contractor will be paid the line-item labor cost of bid material.

Any material, other than unusable material, removed from the house must be reinstalled in or on the house at no cost to the client or CAASTLC unless replaced with equal or better-quality material by order of CAASTLC. *Any material that is removed from the house and not reinstalled shall* be *left with the client with the exception of lead paint materials that must be removed to comply with lead-safe work practices.* New materials listed on a job order that are not installed at the client's request or for acceptable reasons provided by the Contractor will be removed from the premises and the cost of that material and its installation will be subtracted from the total job cost.

The Contractor has the right to accept, or re-measure all work orders; however, CAASTLC will not be liable for mismeasurements by the Contractor.

All work performed with funding administered by the Missouri Department of Natural Resources' Low-Income Weatherization Assistance Program must meet the objectives and specifications outlined in the Standard Work Specifications for Home Energy Upgrades, and the Missouri Weatherization Program Technical Manual. These specifications can be found at: https://sws.nrel.gov/ and https://energy.mo.gov/sites/energy/files/Technical%20Manual%202017%20%28Final%20with%20attachments-A%29.pdf. All work will be inspected and validated by a certified CAASTLC Quality Control Inspector before being submitted for reimbursement.

CAASTLC shall also have access to all areas of the Contractor's business premises during regular business hours as well as the business premises of subcontractor(s), if any, for the purpose(s) of ensuring compliance with any and all relevant Federal and/or State laws and/or regulations.

Contractor shall inform CAASTLC when work cannot be performed as indicated, when the homeowner refuses the work, or the service called for does not match the job site.

COMPLETION AND FINAL INSPECTION - The Contractor shall notify CAASTLC in writing, or verbally as to the date when work will be completed and ready for inspection of work by returning the completed work order and invoice within five (5) calendar days of completion of the work. Should CAASTLC, upon final inspection, find that deficient materials were used and/or improperly completed work by the Contractor, the Contractor must correct any and all such

deficiencies from the date of issuance of the re-work order within three (3) business days. The Contractor shall notify CAASTLC in writing of the completion of any rework in order to arrange for a CAASTLC inspector to make a timely re-inspection. Further, the Contractor shall make all necessary corrections in materials and/or workmanship that may be required by the Missouri Department of Economic Development. The final inspection report of CAASTLC shall not be deemed to be a warranty or representation that all such laws, ordinances, rules and regulations have been complied with by the Contractor.

The Contractor agrees to inspection of work by DNR/DE monitors in order to establish inspection standards set by Federal and State Regulations. The Contractor also agrees to correct any deficiencies at no extra cost on a client's home deemed sub-standard during DNR/DE monitor periodic inspection visits.

Further, CAASTLC will require prompt replacement or correction of rejected items or deficient workmanship.

WAIVER OF LIENS - The Contractor does hereby waive and release any and all liens and claims or rights to liens on all work performed pursuant to this Contract, under the Statutes of the State of Missouri relating to Mechanic's Liens, on account of materials and labor heretofore furnished by the undersigned for buildings and real estate to receive work under this Contract. CAASTLC may require the Contractor to supply signed lien waivers from any of its suppliers to CAASTLC prior to beginning the work for any job under this Contract. Under no circumstance will any lien ever be placed on any client home.

ACCIDENT PREVENTION AND CLEAN-UP - The Contractor shall exercise proper precaution at all times for the protection of persons and property. The safety provisions of all applicable laws, building and construction codes shall be observed. During the installation, the Contractor shall keep all work clean and safe. Upon completion of work under this Contract, all areas will be cleaned appropriately and made ready for use by the dweller and all unused materials and waste will be removed by the Contractor.

All work shall be done to the satisfaction of CAASTLC. No trash shall be left on the premises, and the work shall be done in a neat manner and shall show the workmanship expected of a professional contractor. The work shall fulfill all requirements of this Contract to be acceptable.

WARRANTY - The Contractor warrants that items ordered to specifications will conform to any drawings, samples or other descriptions furnished or adopted by CAASTLC. The Contractor also warrants that items not covered by specifications (see Attachment C) will be fit and sufficient for the purpose intended, and that all items will be new, merchantable, of good quality and workmanship, free from defect, and in conformance with this Contract and all Attachments hereto.

Except for latent defects, notice of any defects or non-conformity to the Material Specifications or Work Standards must be given by CAASTLC to the Contractor within one (1) year after acceptance. Contractor shall correct or replace the defective workmanship or non-conforming

item(s), at the Contractor's expense. Any and all items required to be corrected or replaced shall be subject to the provisions of this Article.

The Contractor will guarantee Workmanship and Materials for one (1) year upon completion and approval from CAASTLC. The Contractor agrees no additional material or labor costs will be charged to CAASTLC thereof.

ARTICLE IV: NON-COMPLIANCE WITH MATERIAL SPECIFICATIONS AND/OR WORK STANDARD

Should the Contractor fail to perform in compliance with Article III, CAASTLC may terminate this Contract, in whole or in part, in accordance with the "Termination" clause of this Contract as specified in Article VI.

Should the Contractor determine that a material and/or supply change is necessary for the completion of the work performed pursuant to this Contract, and such change is mutually agreed upon by the Contractor and CAASTLC, Article V shall prevail.

CAASTLC expressly retains all other rights or remedies provided by law for any violation of this clause, and no action by CAASTLC shall constitute a waiver of any rights or remedy.

ARTICLE V: AMENDMENTS, ASSIGNMENTS AND WAIVER(S)

AMENDMENTS: The scope of work to be done under this Contract shall be subject to modifications and supplementation upon the written Amendment to this Contract by the duly authorized representatives of the contracting parties with or without out notice to sureties. If such an AMENDMENT causes an increase or decrease in the cost of or the time required for the performance or any part of the work under this Contract, or affects any other provision of this Contract, Contractor may request an equitable adjustment be made in the price, not to exceed the general cost limitations as specified by DNR/DE for PY26/27.

Further, CAASTLC shall make the necessary changes for any other provisions in this Contract as may be affected. Any and all changes shall serve as a written AMENDMENT to this Contract. No AMENDMENT shall proceed without notice to the Contractor or its designee.

Any claim by the Contractor for adjustments under this clause shall be asserted in written form within fifteen (15) calendar days from the date of receipt of the written AMENDMENT provided, however:

That CAASTLC, if it decides that the facts justify such action, may receive and act upon such claim asserted at any time prior to payment under this Contract.

Company Name	Authorized Signature

Any action taken by the Contractor which affects any provision of this Contract, including price, whether or not accomplished with the concurrence of CAASTLC, shall not entitle the Contractor to any equitable adjustment in accordance with this clause unless such action has been specifically directed by a written AMENDMENT issued by CAASTLC or its designated and duly authorized representative. Nothing in this provision shall excuse the Contractor from proceeding with this Contract as amended.

The Contractor shall maintain such records and accounts, including property, personnel, and financial records as are deemed necessary by CAASTLC or the Director of DNR/DE to assure a proper accounting for all project funds, both federal and non-federal shares. These records will be made available for audit purposes to CAASTLC, DNR/DE, or the Comptroller General of the United States and/or authorized representative(s) and will be retained for three (3) years after the expiration of this Contract unless permission in writing to destroy them is granted by both CAASTLC and the Director of DNR/DE.

The Contractor agrees to display on business vehicles magnetic signs that read: “Weatherization Work funded by the Missouri Department of Economic Development, Division of Energy".

ASSIGNMENT OF CONTRACT: The Contractor shall not assign or any interest in the Contract and shall not transfer any interest, whatsoever, in the same (whether by assignment or novation/substitution), without the written consent of CAASTLC.

WAIVER(S): Failure of CAASTLC to insist on performance of any of the Contract requirements and/or Attachments hereto shall not be construed as a waiver of such Contract requirements, and/or Attachments and the same shall remain in full force and effect for the duration of this Contract.

Non-fulfillment of any terms of this Contract, including those by attachment or reference, shall be deemed a breach of Contract, and CAASTLC shall seek full remedies as the law and this Contract provide, including forfeiture of performance bond or other assurance of performance. A written warning shall first be given to the Contractor stating the grounds for possible termination and the date this Contract will be terminated if problems are not corrected, with such date being no longer than twenty (20) calendar days from the date of the written warning. If a correction is not then affected by such date, this Contract will be terminated with a written notice to the Contractor stating the effective date and the reason for the termination.

Repair Damage: Any and all damage to a home during the weatherization process shall be repaired within five (5) calendar days of the damage occurring and at no expense to CAASTLC or client. The Contractor further agrees and assures that CAASTLC and DNR/DE shall be "Held Harmless" for any and all acts or damage caused by the activities of the Contractor.

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Company Name Authorized Signature

Contractor shall obtain a signed release from homeowner stating all repairs have been completed and further agree that CAASTLC and DNR/DE shall be “Held Harmless” for any and all repair work performed by the Contractor.

Incidents of property damage, as a result of the Contractor's methods of operation and/or negligence may result in disqualification of the Contractor for future bids and termination of this Contract at the discretion of CAASTLC.

In the event of the institution of any bankruptcy proceedings by or against the Contractor or under any provision of the U.S. Bankruptcy Act or for the appointment of a receiver, trustee or a general assignment for the benefit of creditors of either party, CAASTLC shall be entitled to terminate this Contract without further cost or penalty. Furthermore, CAASTLC shall in no way waive any rights it may have as a potential creditor in bankruptcy should Contractor owe any obligation under this Contract at the time of such filing.

Failure by the Contractor to pay suppliers of material and/or labor will be reason to terminate this Contract.

Any breach of Contract by Contractor will result in loss of standing to bid on future CAASTLC contracts for a period of two (2) years. If CAASTLC must seek a new contract following default or termination of this Contract, the original Contractor shall be responsible for the cost of re-bid and any and all additionally incurred costs which are above the original Contract prices.

The bid/Contract may be invalidated by CAASTLC and/or DNR/DE. The Contractor acknowledges that funds expended for the purposes of this Contract are appropriated by State and/or Federal sources and, therefore, this Contract shall automatically terminate without penalty or termination costs if such funds are not appropriated. In the event that funds are not appropriated for this Contract, the Contractor shall not prohibit or otherwise limit CAASTLC's right to pursue and contract for alternate solutions and remedies as deemed necessary by the State and/or Federal agency for the conduct of its affairs. The requirements stated in this paragraph shall apply to any amendment or the execution of any option to extend this Contract.

The Contractor warrants that no person, selling agency, or other organization has been employed or retained to solicit or secure this contract upon an agreement or understanding for a commission, percentage, brokerage, or contingent fee. For breach or violation of this warrant, CAASTLC shall have the right to annul this contract without liability or, in its discretion, to deduct from the compensation, or otherwise recover the full amount of such commissions, percentage, brokerage, or contingent fees.

If the Contractor is unable or unwilling to comply with any additional conditions as may be lawfully imposed by DNR/DE on the grant of Contract under which CAASTLC is performing the program for which the Contractor’s work is rendered, the Contractor shall have the right to terminate this Contract by giving at least twenty (20) calendar days written notice to CAASTLC. This paragraph does not release the Contractor from completing work already assigned and

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Company Name Authorized Signature

accepted before the additional conditions were imposed. If the Contractor terminates this Contract for any reason other than that stated in this paragraph, it shall be considered a breach of Contract.

Notwithstanding the above, the Contractor shall not be relieved of liability to CAASTLC for damages sustained by CAASTLC by virtue of any breach of this Contract by the Contractor, and CAASTLC may withhold any reimbursement to the Contractor for the purpose of set-off until such time as the exact amount of damages due CAASTLC from the Contractor is agreed upon or otherwise determined.

However, the Contractor shall not be liable for such excess cost where the failure upon which the termination is based has arisen out of causes beyond the control of the Contractor and without the fault or negligence of the Contractor.

Neither party shall be liable for delays or defaults during the performance of this Contract due to Acts of God, the public enemy, riots, strikes, fires, explosions, accidents, governmental actions of any kind or any other causes of a similar nature beyond the control of and without the fault of the Contractor.

The rights of and the authority of CAASTLC provided in this Article shall be in addition to and in accordance with any other rights, provided by law or as specified herein.

Disputes on Quality and Quantity of Work: In the event of a dispute between CAASTLC and Contractor over quality and quantity of materials and work performed, the Contractor understands he is responsible for replacing materials at no additional cost or additional labor cost. If Contractor does not agree to these terms, he will relinquish payment for disputed materials and labor.

The Contractor may appeal to CAASTLC's Executive Director for a final determination of CAASTLC's position regarding work and acceptable corrections to be made.

ARTICLE VI: TERMINATION

General - The performance of work pursuant to this Contract may be terminated by CAASTLC in whole or in part, whenever CAASTLC determines in its sole discretion that such termination is in the best interest of the program or CAASTLC.

ARTICLE VII: EQUAL EMPLOYMENT OPPORTUNITY

Discrimination in Employment Prohibited. The Contractor will not discriminate against any employee employed in the performance of this Contract, or against any applicant for employment in the performance of this Contract because of race, creed,

color, sex, age, handicap, or national origin. The Contractor will take affirmative action to ensure that applicants are employed and that employees are treated during employment without regard to their race, creed, color, sex, age, handicap, or national origin. This requirement shall apply to, but not be limited to, the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination, rates of pay or other forms of compensation; and the selection for training, including apprenticeship. CAASTLC and Contractor shall abide by the requirements of 41 CFR §§ 60-300.5(a) and 60-741.5(a). These regulations prohibit discrimination against qualified individuals on the basis of protected veteran status or disability and require affirmative action by covered prime contractors and subcontractors to employ and advance in employment qualified protected veterans and individuals with disabilities. In the event that the Contractor signs any Contract which would be covered by Executive Order 10925 (March 6, 1961) or Executive Order 11114 (June 22, 1963), the Contractor shall include the Equal Employment Opportunity clause specified in Section 301 of Executive Order 10925, as amended.

1 **Executive Order 11246.** The Contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 and supplemented by Department of Labor regulations (41 CFR, Part 60), and of the rules, regulations and relevant orders of the Secretary of Labor.

2. **Requested Information.** The Contractor will furnish all information and any reports pertaining to employment as requested by CAASTLC.

3. **Non-Compliance.** In the event of the Contractor's non-compliance with the Equal Employment Opportunity clause of this Contract or with any such laws, regulations, or orders, this Contract may be canceled, terminated or suspended in whole or in part in accordance with Article VI entitled "**TERMINATION**".

ARTICLE VIII: COPELAND ANTI-KICKBACK ACT AND CONFLICT OF INTEREST

The Contractor must provide assurance of compliance with the Copeland Anti-Kickback Act (18 USC 874) and 29 CFR, Part 3.

No official or employee of CAASTLC, or official or employee of the Contractor or its governing body, or any public official of the State of Missouri who exercises any functions or responsibilities in the review or approval of the undertaking or in the fulfillment of the obligations of the terms and conditions of this Contract shall, prior to the completion of the term of this Contract, voluntarily acquire any personal interest, direct or indirect, in this Contract, proposed Contract, or Contract Subject.

Conflict of Interest: The Contractor shall in no manner contract or solicit monies or services from customers assisted under this program while performing services, during the one-year warranty of services, or as a result of performing services for CAASTLC. The Contractor

will not represent his company as directly affiliated with CAASTLC other than as a hired contractor independent from CAASTLC. The Contractor agrees to abide by CAASTLC's conflict of interest policy, and will make CAASTLC aware of any relationship which exists between the Contractor and any household member of a home which has been awarded to the Contractor.

Client Relations: The Contractor may not in any way allow employees of the company to engage in activities or make statements that would be, or might become uncomplimentary to CAASTLC, DNR/DE, or infringe upon the rights of the customers.

The Contractor covenants that it has no interest and shall not acquire any interest, direct or indirect, which would conflict in any manner or degree with the performance of the specified services. The Contractor further covenants that in the performance of this Contract, no person having any such known interest shall be employed.

ARTICLE IX: REGULATIONS CONCERNING SUBCONTRACTORS

None of the work or services specified in this Contract shall be subcontracted by the Contractor without the prior written consent of CAASTLC and DNR/DE. Approval to subcontract shall in no way release the Contractor of its responsibility to fulfill all terms and obligations under this Contract. The Contractor shall be as fully responsible for the acts and omissions of its subcontractors and of persons directly or indirectly employed by them, as the Contractor is for the acts and omissions of persons directly employed by it.

Contractor shall provide and shall ensure any subcontractor(s) used in the completion of this Contract shall provide the following:

A. The availability of group-rate health insurance. The Contractor/subcontractor(s) does not have to pay for employee health insurance coverage but must make available a policy from which an employee may select health insurance coverage.

B. Compliance with all applicable Missouri 'Wage and Hour regulations. Contractor/subcontractor(s) must submit a self-attestation letter to CAASTLC which states the Contractor/subcontractor shall remain in compliance with all aspects of Missouri's Wage and Hour rules and regulations.

C. Occupational Health and Safety Administration (OSHA) 10-Hour construction safety course training. All Contractor/subcontractor(s) weatherization workers, supervisors, and other personnel responsible for on-site weatherization activities must be certified as having completed OSHA 10-Hour construction safety course training. Contractor/subcontractor(s) shall provide a self attestation that all such weatherization workers, supervisors, and other personnel have completed the training. Further, Contractor/subcontractor(s) shall provide a copy of each worker's OSHA card or certification of completion for the 10-hour training to the sub-grantee.

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Company Name Authorized Signature

D. Workers' Compensation and Unemployment Insurance. Contractor/subcontractor(s) must provide all employees with workers' compensation and unemployment insurance as applicable under state and federal laws and regulations. Contractor/subcontractor(s) must provide CAASTLC with documentation proving a past record of compliance with federal or state employment requirements.

ARTICLE X:

The Contractor will comply with standards that may be prescribed pursuant to the following:

1. State and Federal Environmental Laws:

    a. The Federal Clean Air Act, 42 U.S.C. 7606, as amended, prohibiting award of assistance by way of grant, loan, or contract to non-complying facilities.

    b. The Federal Water Pollution Control Act, 33 U.S.C. 1368. as amended, prohibiting award of assistance by way of grant, loan, or contract to non-complying facilities.

    c. The National Environmental Policy Act of 1969, 42 U.S.C. 4321, et seq., as amended, particularly as it relates to the assessment of the environmental impact of federally assisted projects.

    d. The National Historic Preservation Act of 1966, 16 U.S.C. 470 et seq., as amended, relating to the preservation of historic landmarks.

    e. Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, 42 U.S.C. 4601 et seq., 4651 et seq., relating to acquisition of interest in real property or any displacement of persons, businesses, or farm operations.

    f. The Hatch Act, 5 U.S.C. 1501 et seq., as amended, relating to certain political activities of certain state and local employees.

    g. The Archeological and Historic Preservation Act of 1974 (Public Law 93-291) relating to potential loss or destruction of significant scientific, historical, or archaeological data in connection with federally assisted activities.

    h. The Wild and Scenic Rivers Act of 1968 (16 U.S.C. 1271 et seq.) related to protecting components or potential components of the national wild and scenic rivers system.

    i. The flood insurance purchase requirements of Sec. 102(a) of the Flood Disaster Protection Act of 1973 (Public Law 93-234) which requires Subgrantees in a special flood hazard area to participate in the program and to purchase flood

insurance if the total cost of insurable construction and acquisition is $10,000 or more.

j. The Privacy Act of 1974, P.L. 93-579, as amended, prohibiting the maintenance of information about any individual in a manner which would violate the provision of the Act.

k. The Missouri Clean Water Law, Sections 644.006 to 644.141, RSMo.

l. The Missouri Hazardous Waste Management Law, Section, 260.350 to 260.430, RSMo.

m. The Missouri Solid Waste Management Law, Sections 260.200 to 260.245, RSMo.

n. The Missouri Air Conservation Law, Sections 643.101 to 643.190, RSMo.

o. Public Law 93-348 regarding the protection of human subjects involved in research, development and related activities supported by this award of assistance.

p. Earthquakes – Seismic Building and Construction Ordinances, Sections 319.200 – 319.207. RSMo (Cum. Supp. 1990), relating to the adoption of seismic design and construction ordinances by certain cities, towns, villages and counties.

q. The Laboratory Animal Welfare Act of 1966 (P.L. 89-544), 7 U.S.C. Section 2131 et seq., pertaining to care, handling, and treatment of warm-blooded animals held for research, teaching, or other activities supported by this award of assistance.

r. The Lead-Based, Paint Poisoning Prevention Act (42 U.S.C. 4801 et seq.) which prohibits the use of lead paint in construction or rehabilitation of residence structures.

s. The Contractor understands it must follow lead safe practices introduced by DNR/DE, HUD, and the EPA. This regulation applies when the following conditions exist in a home:

- Built before 1978.
- Dwelling has not been certified as lead-based paint free.
- Amount of disturbed lead-based painted surfaces exceeds two square feet per room of interior surfaces or twenty square feet of exterior surface or 10% of a small component, e.g., door or window.

_____ _____

Company Name Authorized Signature

2. Laws and regulations related to nondiscrimination:

a. Title VI of the Civil Rights Act of 1964 (P.L. 88-352) which prohibits discrimination on the basis of race, color or national origin.

b. Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C Section 794), which prohibits discrimination on the basis of disability.

c. Drug Abuse Office and Treatment Act of 1972 (P.L. 92-255), as amended, relating to nondiscrimination on the basis of drug abuse.

d. Comprehensive Alcohol Abuse and Alcoholism Prevention, Treatment and Rehabilitation Act of 1970 (P.L. 91- 616), as amended, relating to nondiscrimination on the basis of alcohol abuse or alcoholism.

e. Section 523 and 527 of the Public Health Service Act of 1912 (42 U.S.C. Sections 290 dd-3 and 290 ee-3), as amended, relating to confidentiality of alcohol and drug abuse patient records.

f. Age Discrimination Act of l975, as amended (42 U.S.C. §§ 621-634), which prohibits discrimination on the basis of age;

g. Title VII of the Civil Rights Act of 1964 found at 42 U.S.C. §2000(e) et.seq. which prohibits discrimination on the basis of race, color, religion, national origin, or sex.

h. Title VIII of the Civil Rights Act of 1968 (42 U.S.C, § 3601 et seq.), as amended, relating to nondiscrimination in the sale, rental or financing of housing.

i. Chapter 213 of the Missouri Revised Statutes which prohibits discrimination on the basis of race, color, religion, national origin, sex, age, and disability.

j. The Americans with Disabilities Act (P.L. 101-336) 42 U.S.C. Section 12101 et seq., relating to nondiscrimination with respect to employment, public services, public accommodations and telecommunications.

k. Any other nondiscrimination provisions in the specific statute(s) under which application for federal assistance is being made.

l. The requirements of any other nondiscrimination statute(s) which may apply to the application.

m. Title IX of the Education Amendments of 1972, as amended (U.S.C §§ 1681-1683 and 1685-1686) which prohibits discrimination on the basis of sex.

3. The following additional requirements apply to projects that involve construction:

_____ _____

Company Name Authorized Signature

a. The Davis-Bacon Act, as amended, 40 U.S.C. Section 276a et seq., respecting wage rates for federally assisted construction contracts in excess of $2,000.

b. The Copeland (Anti-Kickback) Act, 18 *U.S.C.* § 874,40 U.S.C. § 276c.

c. The Contract Work Hours and Safety Standards Act, 40 U.S.C. Section 327 et seq.

d. Convict labor shall not be used on construction projects unless by convicts who are on work release, parole, or probation.

e. The Lead-Based Paint Poisoning Prevention Act (42 U. S. C. § 4801 et seq.) which prohibits the use of lead paint in construction or rehabilitation of residence structures.

f. Trafficking Victims Protection Act of 2000, Section 106, as amended (22 U.S.C. 7104(g) relating to termination of contract award based should any employee of the department, recipient or Sub-recipient violate this act.

g. Missouri House Bill 1549, 1771, 1395 & 2366 -Illegal Aliens and Immigration Status Verification -This bill changes the laws regarding illegal aliens and immigration status verification. Effective January I, 2009, no business entity or employer shall knowingly employ, hire for employment, or continue to employ an unauthorized alien to perform work within the state of Missouri.

h. Federal Funding Accountability and Transparency Act of 2006 (S. 2590) - Requires information on federal awards be made available to the public via a single searchable website. Federal awards include grants, sub-grants, loans, awards, cooperative agreements and other forms of financial assistance. House Resolution 2646, Amended 09/30/2008.

i. Illegal Immigration - Missouri Statutes - As per HB 1549, 1771, 19395 & 2366 - Section 67.307 2. Any municipality that enacts or adopts a sanctuary policy will be ineligible for monies provided through grants administered by any state agency or department until the policy is repealed or is no longer in effect.

j. Unauthorized Aliens – Missouri Statutes – RSMo 285.525 – 285.550 Effective January 1, 2009- Effective January 1, 2009, and pursuant to RSMo 285.530 (1) no business entity or employer shall knowingly employ, hire for employment, or continue to employ an unauthorized alien to perform working within the state of Missouri.

k. The Byrd Anti-Lobbying Amendment (31 U.S.C. 1352).

l. Human Trafficking. No business entity or employer may engage in severe forms of trafficking in persons during the period of time that this award is in effect; procure a commercial sex act during the period of time that this award is in effect; or use forced

labor in the performance of this award or subawards under this award. The department has the right to terminate unilaterally: (1) implement section 106(g) of the Trafficking Victims Protection Act of 2000 (TVPA), noncompliance that is available to the subgrantee under this award.

3. Information on Statutory Authorization

Public Improvement, Recreation/Education, Bruce Watkins, RSMO. 253.220
http://www.moga.mo.gov/statutesIC200-29912530000220.HTM

Soil Conservation Research, RSMO. 278.080
http://www.moga.mo.gov/statutes/C200-299/2780000080.HTM

Cost Share Program, RSMO. 278.080
http://www.moga.mo.gov/statutesIC200-299/2780000080.HTM

Disbursements to Soil Districts, RSMO. 278.080, 278.120
http://www.moga.mo.gov/statutes/C200-299/2780000080.HTM
http://www.moga.mo.gov/statutes/C200-299/2780000120.HTM

Soil Conservation Expenditure Loans, RSMO. 278.080
http://www.moga.mo.gov/statutes/C200-299/2780000080.HTM

Soil Conservation Demonstrations, RSMO. 278.080
http://www.moga.mo.gov/statutes/C200-299/2780000080.HTM

Recovered Materials Market Development, RSMO. 260.335
http://www.moga.mo.gov/statutes/C200-299/2600000335.HTM

Water Pollution Control Loans, RSMO. 644.122
http://www.moga.mo.gov/statutesIC600-699/6440000122.HTM

Energy Set-Aside Program, RSMO. 640.665
http://www.moga.mo.gov/statutesIC600-699/6400000665.HTM

Public Improvement Expenditures, MO Botanical Garden & Jefferson Landing, RSMO.253.220
http://www.moga.mo.gov/statutes/C200-299/2530000220.HTM

Storm Water Grants, RSMO. 644.031
http://www.moga.mo.gov/statutesIC600-699/6440000031.HTM

Wastewater Treatment Grants, RSMO. 644.026
http://www.moga.mo.gov/statutes/C600-699/6440000026.HTM

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Rural Water and Sewer Grants, RSMO. 644.026
http://www.moga.state.mo.us/statutes/C600-699/6440026.HTM

Outdoor Recreation Sub-Grants, RSMO. 258.083
http://www.moga.mo.gov/statutes/C200-299/2580000083.HTM

Information on Statutory Authorization Energy Conservation - Schools/Hospitals, RSMO. 640.653
http://www.moga.mo.gov/statutes/C600-699/6400000653.HTM

Energy Conservation - Local Governments/Non-Profit, RSMO. 640.653
http://www.moga.mo.gov/statuteslC600-699/6400000653.HTM

Waste Management Grants, RSMO. 260.335
http://www.moga.mo.gov/statutes/C200-29912600000335.HTM

Environmental Grants, RSMO. 260.273-342
http://www.moga.mo.gov/STATUTES/C260.HTM

Historic Preservation Sub-Grants, RSMO. 253.408-415
http://www.moga.mo.gov/STATUTES/C253.HTM

Clean Air Act Grants and Sub-Grants, RSMO. 643.010-190
http://www.moga.mo.gov/STATUTES/C643.HTM

The Contractor will comply with the requirements of the Occupational Safety and Health Act of 1970 (29 CFR 1900-1999 et seq.), which provides job safety and health protection for workers by promoting safe and healthful working conditions, in all work performed by its staff and associates under the Contract.

MONITORING - CAASTLC or DNR/DE, may monitor all work in progress.

REGISTRATION – The Contractor must be registered and maintain good standing with the Missouri Secretary of State's Office and other regulatory agencies, as may be required by law or regulations.

ARTICLE XI: DURATION

This Contract shall commence on July 1, 2026, and be in full force and effect until June 30, 2027, provided, however, that termination proceedings may be initiated according to Article VI.

_____ _____

Company Name Authorized Signature

If appropriate and cost effective, this Contract period may be extended for one (1) year. The Contractor must have met all performance standards, as determined by CAASTLC, for this Contract to be renewed. Any such renewal will be on a percentage-type basis and must be mutually agreed to in writing and signed and dated by both parties.

ARTICLE XII: PAYMENTS

Payments under this Contract shall be made in accordance with the firm prices stated in Attachment E.

Credit for the completed work shall be provided when all weatherization work (including any rework) for the job has passed final inspection by CAASTLC. Upon passing final inspection, CAASTLC shall make every reasonable effort to provide payment for completed work within forty-five (45) days, however, contractor is advised that payment may take up to ninety (90) days pending release of funds from DNR/DE.

No interest shall be paid from funds administered by DNR/DE for any reason.

A written invoice for each job completed must be submitted for payment on the Contractor's letterhead. The invoice must include the following information: company name, contact information, dates of service, job number and/or client's name, quantity of material and labor by unit, description of service with individual measures documented (as defined by NEAT/MHEA), and costs broken out by material and labor. In addition, for all HVAC equipment, hot water heaters, and refrigerators, invoices must include the make, model number and serial number of the equipment. No "miscellaneous" amounts will be paid. If insulation was included, R-factor of insulation installed must be shown.

ARTICLE XIII ENTIRE AGREEMENT

This Contract constitutes and represents the complete and entire agreement between CAASTLC and the Contractor and supersedes all previous communications and representations.

Any modifications of this Contract shall not be binding unto CAASTLC, unless made in writing and in accordance with Article V entitled "**AMENDMENTS, ASSIGNMENTS AND WAIVER(S)**".

1. **Choice of Law**. This Contract shall be construed according to the laws of the State of Missouri.

2. **Compliance with Applicable Laws**. The Contractor agrees that all work shall be performed in strict compliance with all applicable laws, ordinances, OSHA guidelines, EPA's Lead, Renovation, Repair, and

Painting Final Rule (RRP), rules and regulations, of federal, state, county or municipal governments or agencies, now in force or that may be enacted hereafter. The final inspection report of CAASTLC shall not be deemed to be a warranty or representation that all such laws, ordinances, rules, and regulations have been complied with by the Contractor.

Section two (2) of this Article includes but does not limit the specific provisions of the Fair Labor Standards Act of 1938, as amended.

SIGNATURE OF BIDDER - The signature of Contractor indicates that it understands and will comply with these Contractual Requirements and with all provisions of the entire bid package, including the cover letter and all Attachment. Further, in compliance with the above, the undersigned offers and agrees that if its bid is accepted by CAASTLC, to furnish any or all of the materials, supplies, and services under this Contract as well as complete the work within the time specified.

STATE PLAN - The Missouri State Weatherization Plan, Program Year 2026, shall be adhered to in its entirety. Contractor's bid may be invalidated by CAASTLC and/or DNR/DE.

THEREFORE, IN WITNESS WHEREOF, the parties hereto, have caused this Contract to be duly executed this _____ day of _____, 2026.

_____	CAASTLC, Inc.
(Contractor Name)	
By: _____	By: _____
(Signature)	
Title: _____	Title: CEO

_____ _____

Company Name Authorized Signature

Name of prospective supplier_____

CAASTLC

Community Action Agency of St. Louis County, Inc.

CERTIFICATION REGARDING DEBARMENT, SUSPENSION AND OTHER RESPONSIBILITY MATTERS

The prospective supplier certifies to the best of its knowledge and belief that it and its principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;

(b) Have not within a three year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or falsification or destruction of records making false statements or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (b) of this certification; and

(d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

(e) Are current on all taxes due and owing to the State of Missouri; and

(f) Are in compliance with all state and federal environmental laws and court orders issued pursuant to those laws, and that all environmental violations have been resolved.

I understand that a false statement on this certification may be grounds for rejection of this proposal, or termination of the award or contract. In addition, under 18 USC Sec. 1001, a false statement may result in a fine of up to $10,000 or imprisonment for up to five years, or both.

Printed or typed name and Title of Authorized Representative

Signature of Authorized Representative Date

_____ I am unable to certify to the above statements. My explanation is attached.

CAASTLC

Community Action Agency of St. Louis County, Inc.

Contractor Self-Attestation

Contractor Name: _____
Contractor Address: _____
City, State, Zip Code: _____

_____ hereby attests that it is in compliance with
(Contractor Name)
all aspects of Missouri's Wage and Hour rules and regulations and that all such weatherization workers, supervisors, and other personnel have completed the OSHA 10-Hour construction safety course training.

Signature: _____

Title: _____

Date: _____

CAASTLC

Community Action Agency of St. Louis County, Inc.

CAASTLC WEATHERIZATION IFB: 6/09/2026 PRE-BID CONFERENCE

The meeting link for this Conference will be available on CAASTLC's homepage (https://www.caastlc.org/) the day of the Conference and the login attendee ID and password for this Conference are as follows:

Topic: Pre-Bid Conference
Time: June 9, 2026, 2:00 PM Central Time (US and Canada)

Join Zoom Meeting

https://us02web.zoom.us/j/86441723561?pwd=NEfN0Bz6pwV2oVOcx8drQllCE0lf2T.1&jst=1

Meeting chat link

https://us02web.zoom.us/launch/jc/86441723561

Meeting ID: 864 4172 3561

Passcode: w4bZg0z!

One tap mobile

+13126266799,,86441723561#,,,,*76771506# US (Chicago)

+13092053325,,86441723561#,,,,*76771506# US

Join by SIP

• 86441723561@zoomcrc.com

Bid explanation and questions answered.

CAASTLC

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INVITATION FOR BID – IFB No. UC: PY26/27
Recycled Products in Insulation Requirement

Attention all bidders:

Insulation products containing recycled materials are being targeted under this IFB. All bidders are required to provide estimates of the percentage of recycled products in the insulation products they are bidding. The winning bidder(s) will be required to provide certification of the recycled content prior to the contract award.

CAASTLC will verify the percentage of recycled materials contained in the insulation provided by the contractor. This verification may be done by contacting the manufacturer and providing the manufacturer with batch numbers. If the insulation provided by the contractor does not meet the requirements stated in this IFB the contractor will be considered in violation of their contract.