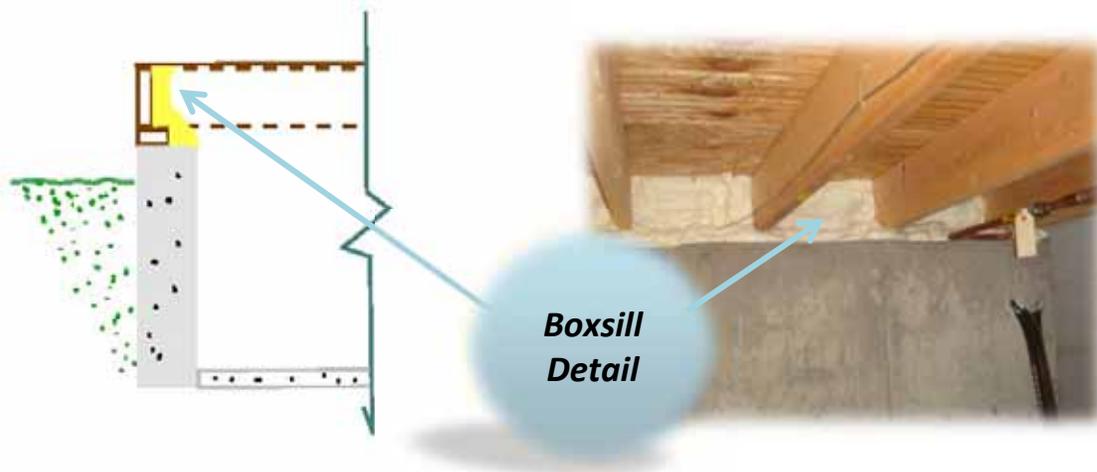


## Section 2: Bottom of Building

### Basement & Crawlspace Boxsills, Bandjoists, & Beams

#### Air Sealing & Insulation Requirements

**Every foundation boxsill/bandjoist/beam shall be thoroughly airsealed & insulated during all Wx projects**



Each bandjoist, boxsill and/or beam shall be airsealed and insulated w/ a minimum of 2" thick Hi-R (polyisocyanurate) or a 3" nominal application of closed-cell spray foam.

#### **Exceptions to the standard installation requirement for boxsills/bandjoists are outlined below:**

- ✓ When the basement is finished and there is no access to the sill area without demolition this measure is not required, but it is allowable and encouraged when cost-effective.
- ✓ When there is a beam serving as the rim/sill with a 6 inches or greater true dimensional thickness this measure is not required, but it is allowable and encouraged when cost-effective.
- ✓ If the floor framing on the gable end doesn't provide enough access to install foam products out at the sill, the outer bay of the floor system shall be densepacked with cellulose or fiberglass.
- ✓ Do not isolate any plumbing/heating piping to the cold side of a foam insulation installation.

#### Preexisting Boxsill Insulation Policy



Fiberglass batting at the sills

Whenever there is preexisting fiberglass batting installed at the boxsill it shall be removed and then the area shall be reinsulated.

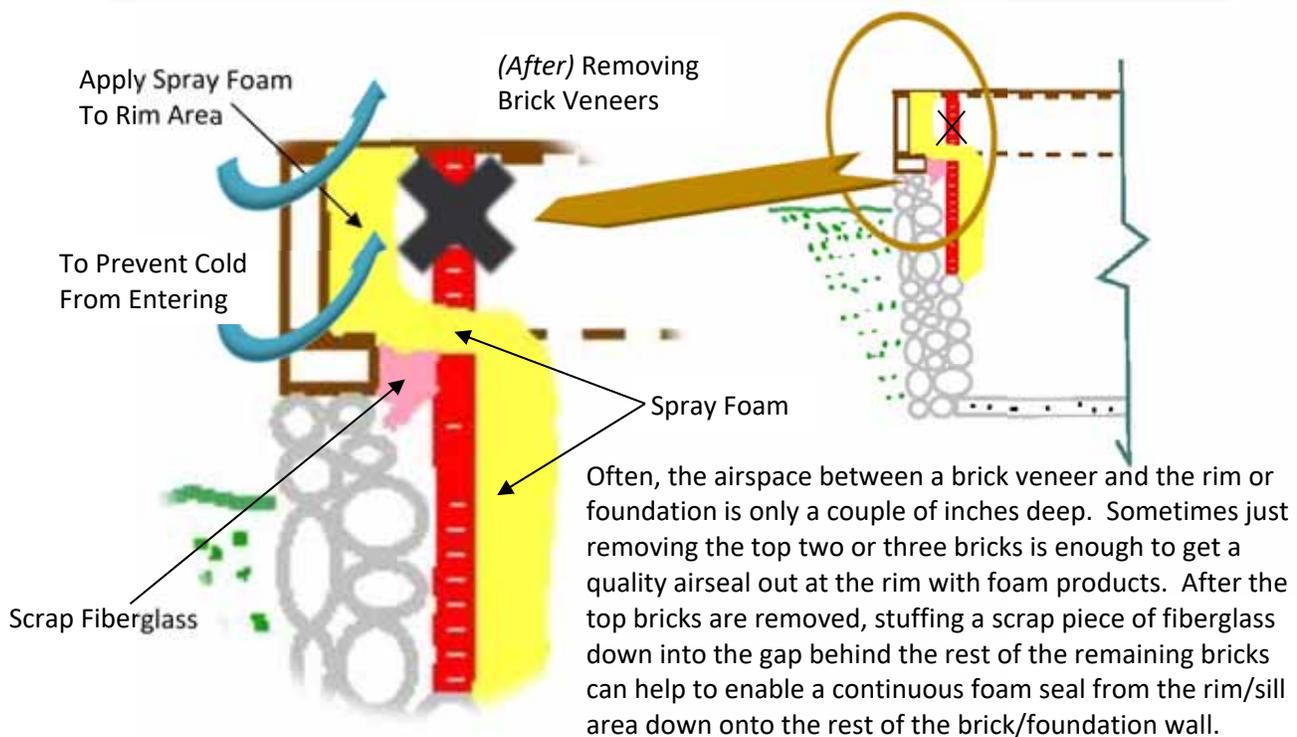
## Section 2: Bottom of Building

### Basement & Crawlpace Boxsills, Bandjoists, & Beams

#### Creating Access to Enable Effective Installations

##### Brick Veneers

If there is a non-structural brick veneer and airspace located in front of the rim and/or foundation, the top rows of brick shall be removed prior to performing any airsealing or insulating measures with foam products.



**\*\*Note that in the image above, if the brick wasn't removed and foam was applied over the brick, the rim and the outer section of the floor above it would be isolated to the cold side of the insulation. This would significantly reduce the effectiveness of the installed weatherization measures.**

##### Alternate Approach

If the airspace behind the brick veneer is a 3 inch cavity or greater then insulating the cavity with blown in fiberglass is an allowable alternative measure.

## Section 2: Bottom of Building

### Basement & Crawlpace Boxsills, Bandjoists, & Beams

#### Creating Access to Enable Effective Installations

##### Suspended Ceiling Tiles

If there is a suspended ceiling with movable tiles, the tiles are to be temporarily removed and the boxesill area shall be addressed during a project.



##### Sheetrocked Ceilings

Cutting out a swath around the basement perimeter when there is a sheetrock (or comparable) ceiling in order to address the boxesill is allowable with client permission and if the measure screens as cost-effective inclusive of all additional ancillary-costs.



**Optional Measure**

**Non-Allowable Practice** | Note that in finished basements it is not allowable practice to drill through the exterior side of the bandjoist to densepack the boxesill area from outside of the home due to the likelihood of drilling into electrical wiring at that location.

#### Thermal Barrier Requirements

If foam materials are applied exclusively to the bandjoist/beam/sill areas and foam does not extend down onto the interior of the foundation wall, then application of a 15-minute fire-retardant-barrier over the foam is not required by WAP\*



*A 15-minute fire retardant barrier is not required by WAP for the foam installation pictured above.*

\*Local codes must still be adhered to\*

## Section 2: Bottom of Building

### Basements & Crawlspaces Large Foundation Openings



#### Foundation/Crawlspace Plugs

##### Vent Grills & Windows

- ✓ All foundation vent grills shall be sealed closed.
- ✓ Foundation windows shall be airsealed at minimum.
- ✓ If a client allows, foundation-window-plugs shall be airsealed into window openings.
- ✓ The installation of smaller, sandwich-door-style hatches is allowable if a durable, energy-efficient, and fully operational access point into a basement or crawlspace area is needed (see pics below). Providing locking mechanisms for crawlspace access points from the exterior is a client responsibility.

#### Sandwich Doors

Exterior crawlspace/ basement doors, including those at the base of a bulkhead stairway shall be addressed during each weatherization project. If an existing door cannot be improved in a way that delivers an airtight seal and R-7 to R-10 performance, then a sandwich door shall be built and installed.

#### Extending Functional Measure Life

1. If the door is exposed to the elements, the use of pressure treated CDX is recommended for the outer layer of the door.
2. A durable, high quality gate latch is recommended instead of, or in addition to, barrel bolts on larger door assemblies. (see photo insert)



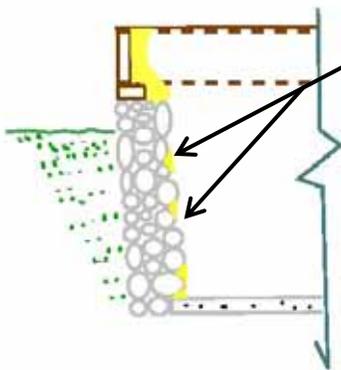
*Note that the measure requirements outlined on this page are only applicable to unfinished basements and crawlspace areas that are inside the thermal envelope/pressure boundary.*

## Section 2: Bottom of Building

### Basements & Crawlspaces

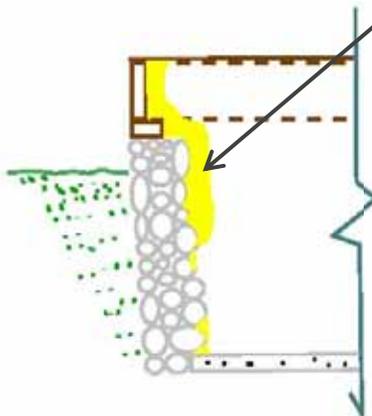
#### Foundations: Rubble & Stone

Blower door assisted airsealing shall be conducted on all rubble and stone foundation walls using the 100 CFM50 reduction per technician-hour rule unless the building is already below 5 ACH50. This applies to surfaces above and below ground level.



#### Required Measures

It is encouraged to airseal **and insulate** rubble and stone foundations with closed cell spray foam to a point at least two feet below grade.



#### Optional Measures

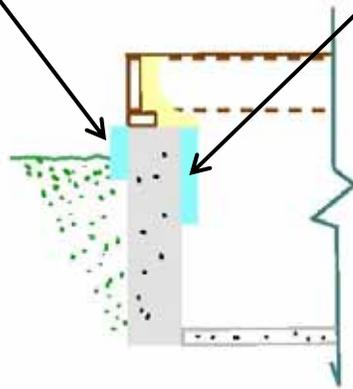


It is also allowable to airseal and insulate an entire rubble or stone foundation wall if the measure is screened and determined to be cost-effective.

## Section 2: Bottom of Building

### Basements & Crawlspaces Foundations: Smooth Surfaces

With smooth foundation surfaces it is encouraged to insulate outside to at least six inches below grade or inside to at least two feet below grade using foam products.



Note that installing foundation insulation is not automatically required if the measure itself is cost-effective. Foundation insulation is always an optional weatherization measure.



**Optional Measures  
Foundation Insulation**



### Considering Multiple Approaches

The pictures above demonstrate two viable approaches for increasing the insulation value of a foundation wall. Both methods shown are allowable and encouraged when cost-effective. In a situation where multiple installation methods are possible, the most cost-effective installation method shall be utilized to insulate foundation walls.

## Section 2: Bottom of Building

### Basements & Crawlspace

#### Foundations: All types

##### Thermal Barrier Requirements

Whenever foam materials extend down onto the interior of the foundation wall, an application of a 15-minute-rated, fire-retardant-barrier is required over the materials used to insulate the foundation walls. This is a WAP requirement.\*

*\*Local codes must still be adhered to regarding installed measures at the boxesill & foundation if they are more stringent than WAP requirements.*



*“Thermax” (pictured above) meets this fire retardant requirement without a separate covering.*

- ✓ **Appendix P of this manual includes more detailed information about thermal barrier requirements.**

## Section 2: Bottom of Building

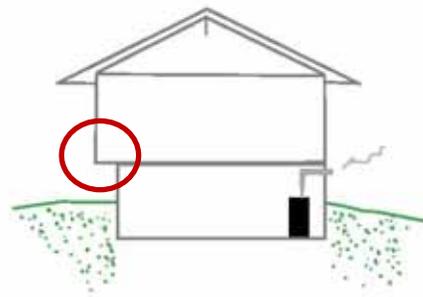
### Basements & Crawlspaces

#### Cantilevered Floors: Closed Cavity

All possible efforts shall be made to ensure cantilevered floor systems that overhang the foundation wall are completely airsealed and insulated to the highest performance value possible to maintain a continuous thermal boundary.

#### Raised Ranches

If there is access to the sills, any pre-existing fiberglass batting in the cantilevered floor section should be removed. HI-R shall be installed at the boxesill area atop the foundation wall and the cantilevered floor system shall be densepacked with cellulose insulation through the HI-R as shown in the images below.



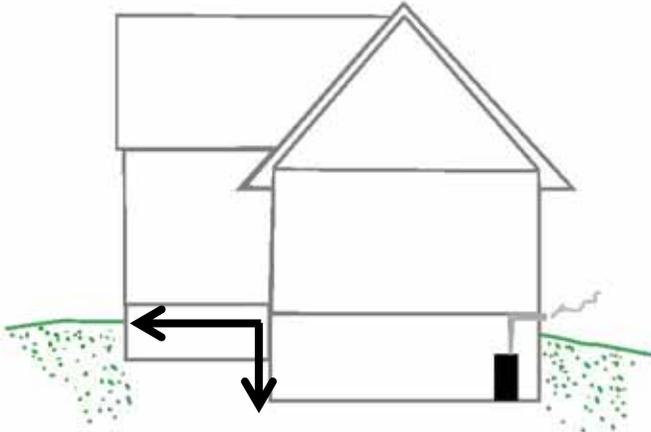
#### Alternate Approaches

If the basement is finished and there is no access to the sill without demolition then the installation of densepacked cellulose from the exterior is encouraged.



## Section 2: Bottom of Building

### Basements & Crawlspaces Placing the Thermal Boundary



The diagram above shows a full basement with a boiler located adjacent to a crawlspace that has no mechanical systems or plumbing lines. The arrows represent the surfaces that would need to be completely airsealed and insulated in order to place the crawlspace outside of the thermal envelope.



*A weatherization technician installs blown in insulation into the floor system pictured above.*

#### Floor v. Foundation

Whenever a basement/crawlspace houses a heating system or water heater it shall be considered inside the thermal boundary and the foundation must be thoroughly airsealed.

If the crawlspace/basement has no heating system or water heater then it can be considered inside or outside of the thermal boundary. Wherever the boundary is established it must be completely airsealed & adequately insulated by the end of a Wx project.

#### Multiple Basement Zones

Basement/crawlspaces must be completely airsealed from each other whenever (a) there are multiple basement/crawlspace zones and (b) the thermal boundary location changes from one zone to the next, e.g. the perimeter of one zone is the thermal boundary and in the next zone over, the ceiling is the thermal boundary.

Each floor system over a crawlspace must be sealed and insulated whenever a crawlspace zone is located outside of the thermal envelope.

## Section 2: Bottom of Building

### Basements & Crawlspaces

#### Moisture Issues: Impact on Weatherization Project Approaches

Prior to weatherizing a home it is important to evaluate whether the basement/crawlspace is dry, damp or wet.

The following are incidental repair measures that are allowable in order to alleviate moisture issues and maximize weatherization project outcomes.

Wet



Install new or improve existing gutters, extend downspouts away from buildings, install covers on sump pits, upgrade existing sump pumps, install new sump pits and/or sump pumps if none exists.

Damp



Install 6 mil or thicker poly over the ground, exposed ledge, onto rubble or stone walls, etc. to reduce the amount of moisture evaporated into the indoor air. This helps control humidity levels throughout the home and reduces the likelihood for moisture and mold problems after a weatherization project.

Dry

Standard weatherization work should proceed if there are no preexisting bulk water intrusion problems or ground-sourced moisture issues. If identified issues can be effectively improved (before or as part of the WAP project) and the *project-level savings-to-investment-ratios* exceed cost-effectiveness screening thresholds then weatherization work can proceed.

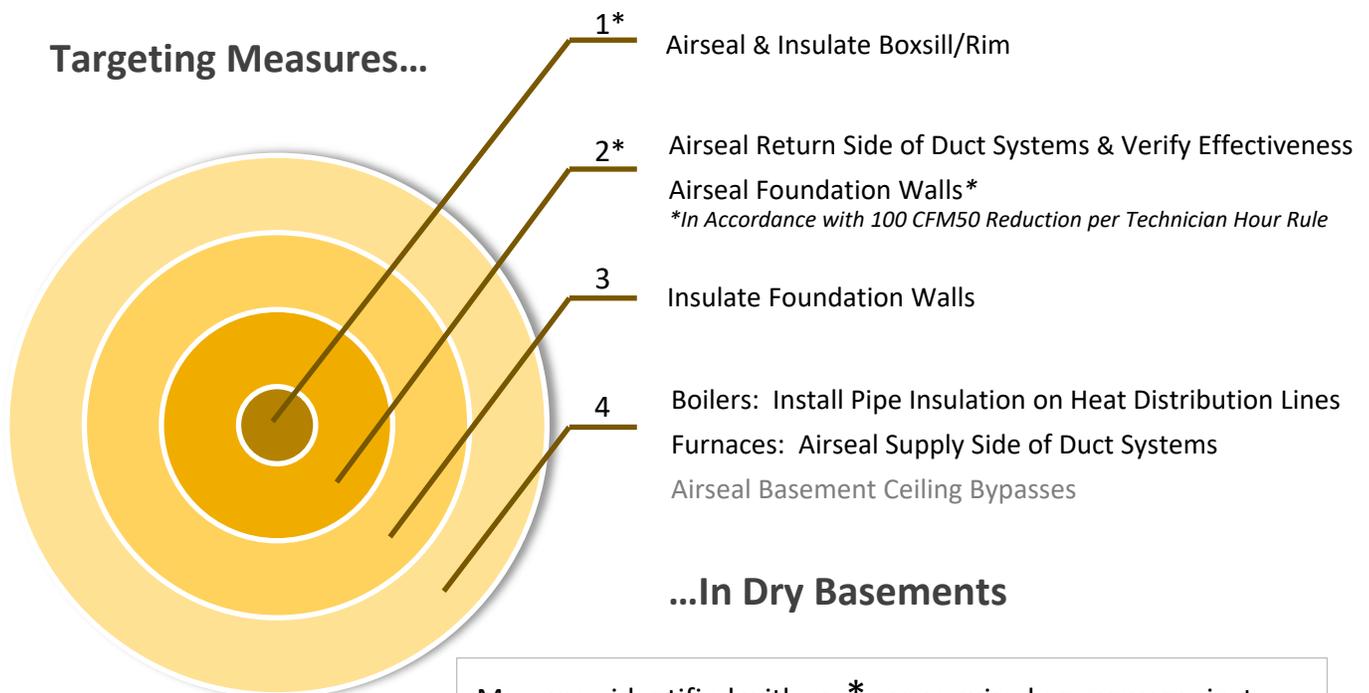
## Section 2: Bottom of Building

### Basements & Crawlspaces

#### Typical Measure Selection Guide: Summary

The following is a quick reference guide to summarize measure prioritization when the basement perimeter is the thermal boundary.

#### Targeting Measures...



#### ...In Dry Basements

Measures identified with an \* are required on every project.

The content illustrated on this page shall be followed as a measure prioritization guide if the basement/crawlspace is dry or preexisting moisture issues will be addressed before or during the WAP project in accordance with Incidental Repair and Health and Safety policies.

**Basement ceilings** become an interior surface whenever the thermal boundary is established out at the basement perimeter. In these cases, blower door readings shall be taken with any interior doors leading down into the basement opened. Measures to airseal basement ceiling bypasses should be the lowest priority tasks pursued in homes meeting the criteria outlined on this page.



**A Low Priority Measure**

## Section 2: Bottom of Building

### Basements & Crawlspaces

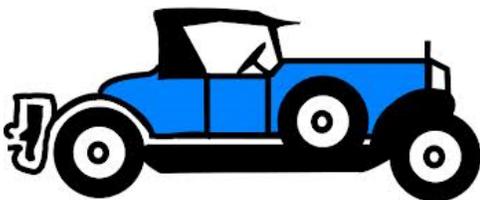
#### Tuck Under Garages

## Put the Garage Outside



Or...

## Put the Car Outside



**Allowable measures that place the garage outdoors to optimize client safety and ensure a complete thermal envelope include:**

- Airseal and insulate garage ceiling
- Airseal and insulate garage wall(s) bordering the basement
- Build Partition(s) as needed
- Airseal any door(s) separating the garage from the basement
- Airseal, insulate and/or reroute any return-ductwork in garage
- Insulate any plumbing and/or heat distribution lines in garage.

If either of these approaches is viable for the Wx provider and acceptable to the client then the most cost-effective work order shall be performed. If neither approach is viable for the Wx provider, or acceptable to the client, then Wx services are to be deferred.

**Allowable measures that place the garage inside the thermal- boundary after permanently disabling the garage doors include:**

- Frame a new wall system into the rough opening for a garage door. *A new wall may or may not include installation of a smaller door.*
- Airseal and insulate the exterior surfaces of the former garage in accordance with the policies outlined in this manual. *To prolong measure life, new building shell components that will be exposed to the elements must be constructed of exterior grade materials or paints/sealants must be applied after installation to prolong measure life.*

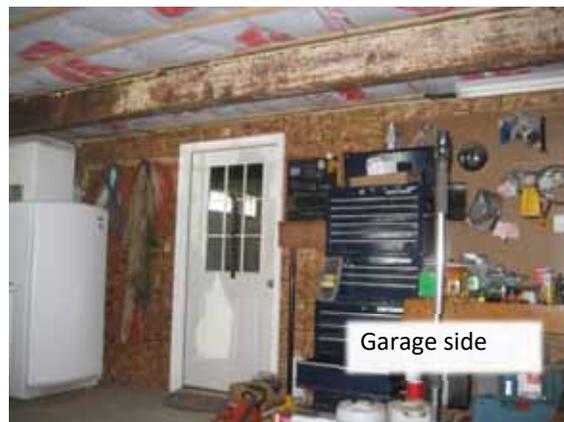
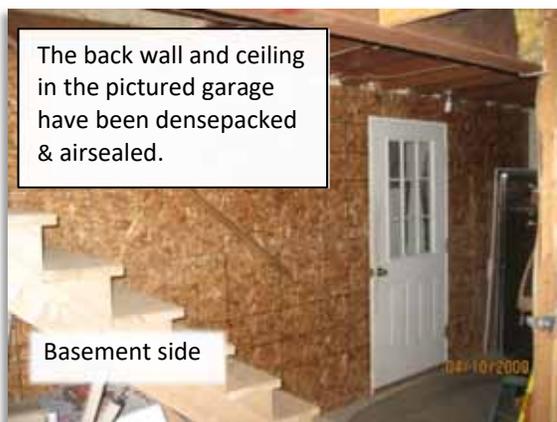
## Section 2: Bottom of Building

### Basements & Crawlspaces Tuck Under Garages



**Tuck under garages must be isolated from the living space for health and safety purposes unless garage doors are permanently disabled.**

*This separation must be verified with smoke testing or series leakage testing.*



## Section 2: Bottom of Building

### Basements & Crawlspaces

#### Tuck Under Garages: Protocol Summary

##### Measure Screening Requirements

All “Garage Isolation” measures must be screened for cost-effectiveness. But even if “Garage Isolation” measures do not screen as cost effective for energy saving benefits alone, they can—and must—be completed for health, safety and indoor air quality purposes or weatherization is to be deferred.

##### How to Proceed if this Type of Measure Fails to Screen

In the event a “Garage Isolation” measure does not screen, in whole or in part, as an energy saving measure, then the entire measure—or portions of the measure—can be considered as an incidental repair cost. The portion of the project costs classified as incidental repairs must be included in the project-level SIR calculation. The project as-a-whole must screen as cost-effective inclusive of these incidental repair(s).

##### How to Proceed if Project Fails to Screen Due to Incidental Costs

If the project cannot absorb the needed incidental repairs without becoming non-cost-effective then weatherization shall be deferred and the client referred to alternate housing repair programs.

##### How to Proceed if Client Will Not Allow Garage Modifications

If none of the potential options for modifying tuck under garages (as outlined on page 12 in this section of the policy manual) is acceptable to the client then weatherization is to be deferred. A client cannot opt out of this requirement for their project.

##### Verification of Measure Effectiveness

All “Garage Isolation” airsealing measures shall be verified for effectiveness using smoke sticks/pencils in tandem with a blower door (or alternately by conducting series leakage testing) prior to project closeout.

- ✓ Note that the use of alternative pressure diagnostics and/or infrared cameras to verify the successful completion of airsealing measures is also encouraged. However, these techniques must be utilized in addition to, not instead of, the required use of blower door assisted smoke testing or series leakage testing.

