

Installer Badges Verification Criteria

Qualified Supervisor Sign-Off Checklist

(Part 5 of 5)

Acknowledgments

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Note: All elements of the Badges Toolkit are tools designed for use by potential program implementors. They are not “off the shelf” products intended for immediate deployment. Program implementers must review and modify as needed, revise verification criteria to match local requirements, complete worksheets, and otherwise define the parameters of their own badging program.

Unless stated otherwise, all relevant references listed in footnotes throughout the document refer to the Standard Work Specifications (SWS).

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Work Lead-Safe

Desired outcome: Protect workers and occupants from potential lead hazards.¹

The United States (U.S.) Environmental Protection Agency's (EPA's) Lead Renovation, Repair and Painting (RRP) job site requirements²:

- Signs posted clearly define the work area and warn occupants and other persons not involved in renovation activities to remain outside the work area:
 - Signs are in the language of the occupants.
- Work area contained so that no dust or debris leaves the work area while the renovation is being performed; and
- Worker can identify personal protective equipment requirements: P-100 respirator, disposable coveralls, gloves.

Interior job site setup requirements:

- All objects removed from the work area or covered with plastic sheeting with all seams and edges sealed;
- All ducts opening in the work area closed and covered with taped-down plastic sheeting;
- Windows and doors in the work area closed;
- Doors in work area covered with plastic sheeting;
- Floor surface covered with taped-down plastic sheeting in the work area a minimum of six feet beyond the perimeter of surfaces undergoing renovation or a sufficient distance to contain the dust, whichever is greater:
 - Plastic sheeting is 6-mil or two layers of 4-mil.
 - If a vertical containment system is employed, floor covering may stop at the vertical barrier, providing it is impermeable, extends from floor to ceiling, and is tightly sealed at floors, ceilings, and walls.

Exterior job site setup requirements:

- All doors and windows within 20 feet of the renovation are closed.;
- Doors within the work area that will be used while the job is being performed are covered with plastic sheeting in a manner that allows workers to pass through while confining dust and debris;
- Ground covered with plastic sheeting or other disposable impermeable material extending a minimum of 10 feet beyond the perimeter or a sufficient distance to collect falling paint debris, whichever is greater.
 - If a property line prevents 10 feet of such ground covering vertical containment or equivalent extra precautions are in place to prevent contamination of adjacent buildings and property.
- In situations where work areas are in close proximity to other buildings, windy conditions, and so on, extra precautions are taken to contain the work area, like vertical containment.

¹ **Relevant Reference(s):** EPA RRP Standards.

² EPA requirements include additional specifications for cleanup and recordkeeping. Those responsibilities typically fall to a crew leader or the certified renovator, not the entry-level installer this badge is intended for.



Air Seal Attic Floor

Desired outcome: Holes, penetrations, chases, cracks, gaps, and joints sealed to prevent air leakage and moisture movement between the attic and conditioned space.³

- Existing insulation was removed as needed to access air sealing locations;
- All wall cavities are enclosed on all sides (e.g., have top and bottom plates). Additional blocking was installed where necessary;
- The following cracks, penetrations, and chases⁴ are sealed according to the work order to prevent air movement with the appropriate materials based on hole sizes according to the Air Sealing Materials Guidelines table below:
 - Top plates of all walls
 - Tongue + groove ceilings
 - Chases
 - Dropped soffits
 - Insulation contact (IC)-rated can lights
 - Plumbing vent pipes
 - Electrical penetrations
 - Exhaust fans
 - Dropped ceilings
 - Stairwells
 - Chimney/flue
 - Ductwork penetrations into attic
 - Any other holes/penetrations in the attic plane/boundary.
- Work area cleaned.

Air Sealing Materials Guidelines	
Hole/Gap Size	Materials/Notes
¼" or less (small)	caulk
¼" to 2" (medium)	one component foam or mastic
2"–3" (large)	two-component foam
3" or larger (extra-large)	Infill material installed that will not bend, sag, or move Support material (e.g., 2 x 4) installed for spans wider than 24"

³ Relevant Reference(s): 3.0101.1, 3.0102.9, 3.0102.10.

⁴ High-temperature areas and attic hatches are addressed in separate badges.



Seal and Dam High-Temperature Heat Sources in Attic

Desired outcome: Ensure safety from fire and prevent air leakage.⁵

Combustion vents/chimneys/flues:

- Worker can identify difference between high-temperature flues and other vents (e.g., bath ventilation);
- Chases around high-temperature flues are air sealed with approved materials;
- A durable fixed dam of approved materials is constructed around high-temperature flues that:
 - Allows minimum 3” clearance.
 - Stands at least 2” taller than final insulation levels.

Non-IC recessed lights:

- Where non-IC recessed lights will be left in place, enclosures completely surround each fixture.
- Enclosures:
 - Are constructed of fire-rated materials (e.g., 5/8” gypsum wallboard)
 - Maintain 3” clearance between fixture (including wiring, box and ballast) and insulation
 - Are free of insulation on top.
- All edges, gaps, and cracks of enclosure, and between enclosure and floor, are sealed with caulk, mastic, foam, or other approved material.

⁵ Relevant Reference(s): 3.0102.1, 3.0102.2.



Prep Attic Floor for Insulation

Desired outcome: Provide adequate access to the workspace, indicate location of electrical boxes for future servicing, prevent electrical hazards, maintain existing attic ventilation, and generally provide the groundwork for installation of a consistent thermal boundary between conditioned and unconditioned space.⁶

- Stored or miscellaneous materials that would prevent insulation from being installed level and in contact with the attic floor were removed;
- Ventilation fans are ducted to the outside;
- All wiring junction boxes are covered and flagged to be visible above final insulation levels;
- Holes between the attic and the outside are sealed;
- Soffit vent baffles are installed at all vented soffits;
 - Soffit vent baffles are installed to the exterior side of the top plate to allow for the highest possible R-value;
 - Soffit vent baffles maintain a minimum 1” clearance between roof deck and baffle.
- Drywall or subfloor is removed as required to access cavities.
- Insulation rulers are installed—a minimum of 1 per 300 square feet of the work area.
- Dams are installed around attic access, mechanical equipment, and flues/chimneys.

⁶ **Relevant Reference(s):** 4.0103.1, 4.0103.2, 4.0103.3, 4.0103.4, 4.0103.5, 4.0103.6, 4.0103.8.



Treat Attic Hatch

Desired outcome: Attic access door or hatches properly sealed and insulated to minimize heat loss or gain and prevent insulation from falling out of attic when accessed.⁷

- Rigid,⁸ durable attic hatch blocking/dam is installed in a permanent way;
- Dam will remain 2" taller than final attic insulation depth;
- Hatch is insulated to proper R-value (the maximum R-value structurally allowable, up to the final insulation level of surrounding attic);
- Insulation is durably attached to hatch;
- Access is weather-stripped or otherwise treated to prevent air movement when hatch is closed;
- Access closes with a “friction fit” or latch;
- Trim is air sealed with appropriate material; and
- Airtightness of hatch when closed has been verified with blower door and smoke (or infrared (IR), if temperatures permit).

⁷ **Relevant Reference(s):** 3.0103.1.

⁸ When height around access is limited and variance request has been approved, nonrigid materials may be used for damming attics, but to earn this badge, an appropriate attic must be found to display skills in constructing a rigid dam.



Insulate Attic Floor and Pass Inspection First Time

Desired outcome: Consistent thermal boundary between conditioned and unconditioned space controls heat flow.⁹

Pre-installation check:

- Safety protocols (e.g., venting, lighting, protective barriers) implemented prior to beginning work; and
- Worker can determine whether attic is ready for insulation (e.g., check for air sealing, confirm dams around high-temperature items).

Post-installation check:

- Insulation blown to proper depth;
- Level and even coverage reaches to all edges;
- Insulation is not blown onto equipment or between dams and the items dams are protecting;
- No more than five bags overblown according to manufacturers' coverage chart;
- When insulating attic platforms or attics with partial platforms, insulation is in contact with air barrier (under platform) not blown over platform;
- Insulation has no gaps, voids, compression, or misalignment; and
- Applicable sections of house-wide insulation certificate are filled out with¹⁰ insulation type, coverage area, installed thickness, settled thickness, R-value, and number of bags installed.

⁹ **Relevant Reference(s):** 4.0103.2, 4.0103.4, 4.0103.6.

¹⁰ Underlined details are required on all insulation certificates. Other items are required only when using blown-in insulation.



Insulate the Ceiling of a Manufactured Home

Desired outcome: Consistent, uniform thermal boundary and air barrier between the conditioned space and unconditioned space.¹¹

Ceiling prepared for insulation:

- Any high-temperature issues have been safely addressed;
- Ventilation ductwork terminates to the exterior;
- Plumbing stacks terminate to the exterior;
- Recessed lights are IC-rated, replaced with IC-rated fixtures, or equipped with inserts;
- Roof/ceiling is in good repair;
- Interior ceiling penetrations are sealed; and
- Dust control measures installed as needed.

Insulation:

- Holes drilled or cavities otherwise accessed to allow for consistent, uniform coverage of the proper depth;
- Insulation installed according to manufacturer requirements to reach density of 1.5-1.6 lbs. per cubic foot;
- No more than five bags overblown according to manufacturers' coverage charts;
- Access points/holes repaired in a workmanlike manner; and
- Applicable sections of house-wide insulation certificate are filled out with¹² insulation type, coverage area, installed thickness, settled thickness, R-value, and number of bags installed.

¹¹ **Relevant Reference(s):** 4.0103.9, 4.0103.10, 4.0103.11, 4.0103.12, 4.0103.13.

¹² Underlined details are required on all insulation certificates. Other items are required only when using blown-in insulation.



Seal and Insulate Knee Walls

Desired outcome: Knee walls framed to prevent thermal bypass and sealed to prevent air leakage between conditioned and unconditioned space.¹³

Air sealing (check prior to insulation):

- Existing insulation was removed or adjusted to allow access to top and/or bottom of knee wall;
- Rigid blocking or other durable material installed:
 - Beneath the knee wall (floor running under knee wall) and
 - Above the knee wall (ceiling cavity/ventilation chute/top plate).
- Installed blocking will stop air flow and support insulation; and
- All joints, cracks, and penetrations, including connection between interior surface and framing, are air sealed.

Insulation:

- Fabric or rigid backing material installed to enclose knee wall cavity in a durable, permanent way;
- Insulation installed to manufacturers' specifications/proper density;
- Insulation has no gaps, voids, compression, or misalignment;
- Holes in backing material sealed as needed;
- Applicable sections of house-wide insulation certificate are filled out with coverage area, thickness, R-value; and
- Work area cleaned.

¹³ **Relevant Reference(s):** 4.0104.1, 4.0104.2, 4.0104.4, 4.0104.5.



Install Dense-Pack Sidewall Insulation¹⁴

Desired outcome: Minimize dust and achieve consistent, uniform thermal boundary between conditioned and unconditioned space to prescribed R-value without voids in a manner that will prevent future settling and minimize framing cavity air flows.¹⁵

General:

- Drill patterns reflect knowledge of framing;
- Installer probed to ensure all cavities were accessed;
- All cavities are filled to proper density (Verify before holes are plugged or with blower door and IR scan, if temperature permits.);
- Drill holes are patched as required by standards;
- Applicable sections of house-wide insulation certificate are filled out with coverage area, thickness, R-value; and
- Job site cleaned.

Exterior:

- Proper job site protection measures installed or used (e.g., covering shrubs);
- Siding removed as needed to prevent damage;
- Siding reinstalled in a workmanlike manner.

Interior:

- Proper dust control measures installed or used (e.g., drill shrouds, vertical containment).

¹⁴ To earn badge, at least one of total number of jobs must be blown from exterior and one from interior.

¹⁵ **Relevant Reference(s):** 4.0202.1.



Insulate the Walls of a Manufactured Home

Desired outcome: Consistent thermal boundary and air barrier between the conditioned and unconditioned space.¹⁶

Site prepared for insulation:

- Worker inspected for damage and identified any repairs needed prior to installation;
- Wall hangings removed from any walls to be insulated; and
- Proper job site protection measures installed or used (e.g., covering shrubs).

Insulation:

- Cavities accessed to allow for consistent, uniform, and complete coverage;
- Insulation installed to provide consistent, thorough coverage of proper density (blown);
- Insulation has no gaps, voids, compression, or misalignment;
- Access holes are repaired/plugged;
- Any removed siding or skirting is reinstalled;
- Applicable sections of house-wide insulation certificate are filled out with coverage area, thickness, R-value; and
- Job site cleaned.

¹⁶ **Relevant Reference(s):** 4.0202.3, 4.0202.4, 4.0202.5.



Install Weather Stripping and Sweep Set on Exterior Door

Desired outcome: Reduce air infiltration while maintaining or improving proper operation of the door.¹⁷

- Weather stripping and door sweep installed in a durable manner;
- Weather stripping and door sweep prevent air infiltration when the door is closed (Verify with blower door and smoke.);
- Weather stripping and door sweep do not impede door operation; and
- Door adjusted as required to properly fit the jamb and allow for ease of operation.

¹⁷ **Relevant Reference(s):** 3.0202.1.



Air Seal and Insulate Walls of a Conditioned Subspace (Basement or Crawlspace)

Desired outcome: Subspace is air sealed and insulated to achieve best thermal performance possible while preventing moisture condensation on the inside of band joists or other wall cavities.¹⁸

Air sealing:

- Rim joist, sill plate, and adjacent surfaces and any walls to be treated were sufficiently cleaned and free of debris to allow for the proper adhesion of any caulks, adhesives, or spray foam used during installation;
- All penetrations greater than ¼" filled with backing, steel wool, or other pest-proof material before air sealing; and
- Air sealing forms a continuous air barrier on the warm side of the thermal boundary, including floor-to-wall and wall-to-ceiling connections.

Insulation:

- On walls (basements¹⁹ or crawlspaces):
 - Insulation is attached with a durable connector equal to or better than manufacturer specifications.
- On rim joists:
 - Foam-based or vinyl-faced fiberglass batt insulation installed tightly to the cavity and sealed at all edges.
- Fire-rated material is used if the insulation is to be left exposed;
- Insulation has no gaps, voids, compression, or misalignment; and
- Applicable sections of house-wide insulation certificate filled out with coverage area, thickness, R-value.

¹⁸ **Relevant Reference(s):** 3.0104.1, 4.0401.1, 4.0401.2, 4.0401.3, 4.0402.1, 4.0402.2, 4.0402.3, 4.0402.4, 4.0402.5.

¹⁹ Where termite pressure exists, a 3" inspection gap will be maintained from the top of the insulation to the bottom of any wood to allow for termite detection. This varies by region and should be incorporated into the badge inspection criteria where applicable.



Air Seal Floor Above Unconditioned Subspace (Basement or Crawlspace)

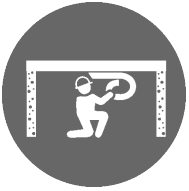
Desired outcome: Consistent pressure boundary between conditioned and unconditioned space.²⁰

- Existing insulation was removed as needed to access air sealing locations;
- All wall cavities are enclosed on all six sides (e.g., have top and bottom plates) Additional blocking was installed where necessary;
- The following cracks, penetrations, and chases are sealed to prevent air movement with the appropriate materials based on hole sizes, according to the Air Sealing Materials Guidelines table below:
 - Chases
 - Plumbing penetrations
 - Electrical penetrations
 - Chimney/flue²¹
 - Ductwork penetrations into subspace
 - Any other holes/penetrations in the floor plane/boundary.
- Work area cleaned.

Air Sealing Materials Guidelines	
Hole/Gap Size	Materials/Notes
¼" or less (small)	caulk
¼" to 2" (medium)	One-component foam or mastic
2"–3" (large)	two-component foam
3" or larger (extra-large)	Infill material installed that will not bend, sag, or move Support material (e.g., 2X4) installed for spans wider than 24"

²⁰ **Relevant Reference(s):** 3.0101.1.

²¹ Materials must be appropriate for high-temperature situations.



Insulate the Floor Above an Unconditioned Subspace (Site Built Single Family)

Desired outcome: Consistent thermal boundary between conditioned and unconditioned space to the prescribed R-value.²²

General:

- Worker-verified air sealing of the floor system was completed before installing insulation;
- Insulation installed to the prescribed R-value;
- Insulation installed correctly for climate (e.g., vapor retarder layer toward the “warm” side);
- Insulation is secure such that it will remain in contact with the subfloor;
- Insulation has no gaps, voids or compressions, misalignments, or potential for wind intrusion; and
- Applicable sections of house-wide insulation certificate are filled out with²³ insulation type, coverage area, installed thickness, settled thickness, R-value, and number of bags installed.

Batts:

- Batts are secured with physical fasteners.

Blown-in:

- Where netting or rigid backing was installed to accommodate blown-in insulation, backing is:
 - Mechanically fastened to underside of floor assembly according to manufacturer specifications or better
 - Providing 100% coverage of the floor assembly.
- Insulation is installed to the correct density.

²² **Relevant Reference(s):** 4.0301.1, 4.0301.2, 4.0301.3, 4.0301.4, 4.0301.5, 4.0301.6, 4.0302.1, 4.0302.2, 4.0302.3, 4.0302.4.

²³ Underlined details are required on all insulation certificates. Other items are required only when using blown-in insulation.



Insulate the Belly of a Manufactured Home

Desired outcome: Consistent thermal boundary between conditioned and unconditioned space to the prescribed R-value.²⁴

Site prepared for insulation:

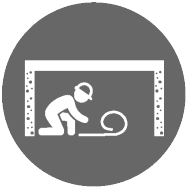
- Worker-inspected to ensure belly was prepared for insulation:
 - Duct sealing from exterior is complete
 - Gas, water, waste, and electrical lines are safe, leak-free, and supported at least every 4' to a floor joist or framing member
 - Water lines are insulated if needed; and
 - Bottom board/belly fabric/rodent barrier is complete and sound enough to support insulation.

Insulation:

- Cavities accessed to allow for consistent, uniform, and complete coverage;
- Insulation installed to provide consistent, thorough coverage to specified R-value;
- No more than five bags overblown according to manufacturers' coverage charts;
- Insulation has no gaps, voids, compression, or misalignment;
- All openings made to install insulation or other seams or gaps in the air barrier are sealed in a durable, weather-tight manner;
- Any removed skirting is reinstalled;
- Job site cleaned; and
- Applicable sections of house-wide insulation certificate filled out with²⁵ insulation type, coverage area, installed thickness, settled thickness, R-value, and number of bags installed.

²⁴ **Relevant Reference(s):** 4.0302.1, 4.0302.9.

²⁵ Underlined details are required on all insulation certificates. Other items are required only when using blown-in insulation.



Install or Repair Vapor Retarder in a Subspace

Desired outcome: Durable, effective ground vapor retarder provides long-lasting access and minimizes ground vapor beneath home.²⁶

- Appropriate material (minimum 6 mil thickness) used;
- Coverage is 100% (or as close as is reasonably possible);
- Vapor retarder extends at least 6” up walls, columns, and footings;
- Physical attachments are used where practical and necessary for long-term adhesion of vapor barrier to vertical surfaces;
- All seams overlap at least 12” using a reverse or upslope lapping technique;
- For wall to floor connection, the wall vapor retarder is installed under the ground moisture barrier;
- Material is fastened to ground as needed to prevent movement where ground is sloping, area is accessed, or area is subject to wind/air movement that may disturb the material;
- Seams and penetrations are sealed with a durable sealant compatible with the vapor retarder (unvented crawlspaces only); and
- Vapor retarder does not interfere with established drainage patterns.

²⁶ **Relevant Reference(s):** 2.0202.1, 2.0202.2, 2.0202.3, 3.0104.1.



Vent Clothes Dryer to the Exterior

Desired outcome: Dryer air exhausted efficiently and safely without condensing in vent.²⁷

- Duct material is rigid or semirigid sheet-metal venting material;
- Duct run is as short and straight as is practical;
- Duct run is supported as needed to prevent bending or sagging:
 - Support materials do not cause the interior dimensions of the ductwork to be less than specified.
- Dryer is ducted to exterior (This does not include unconditioned attics, crawlspaces, and other areas that are ventilated with the outdoors.);
- Duct connections are sealed as follows:
 - Underwriters Laboratories (UL)-listed foil type duct or semirigid sheet metal to rigid metal is fastened with clamp;
 - Other specialized duct fittings are fastened in accordance with manufacturer specifications; and
 - In addition to mechanical fasteners, duct connections are sealed with UL 181B or 181B-M listed material.
- Duct connectors or other fasteners will not obstruct exhaust flow;
- Where they run through unconditioned space, ducts are insulated (as required by the Authority Having Jurisdiction (AHJ));
- Termination fitting is appropriate for dryer and includes a backdraft damper; and
- Termination fitting does not include grille/cage/screen (International Residential Code (IRC) 1502.3).

²⁷ **Relevant Reference(s):** 6.0202.1.



Install Ducting for Bath or Kitchen Range Fan

Desired outcome: Installed ducts effectively move the required volume of air and prevent condensation.²⁸

- Duct run is as short, straight, and smooth as possible;
- Ducts are at least as large as the connections they are attached to;
- Ducts are supported as needed to prevent bending and sagging:
 - Flexible and duct board ducts and plenums are supported every 4' using a minimum of 1½" wide material;
 - Metal ducts are supported by 1/2" or wider 18-gauge strapping or 12-gauge or thicker galvanized wire no more than 10' apart; and
 - Support materials do not cause the interior dimensions of the ductwork to be less than specified.
- All connections are sealed and fastened according to the Exhaust Fan Duct Connections table below:
 - In addition to mechanical fasteners, duct connections are sealed with UL 181B or 181B-M listed material.
- Fan is ducted to exterior (This does not include unconditioned attics, crawlspaces and other areas that are ventilated with the outdoors.);
- Duct connectors or other fasteners will not obstruct exhaust flow;
- Where they run through unconditioned space, ducts are insulated to at least R-8 (as required by the AHJ) (bath fans only); and
- Work area cleaned.

Exhaust Fan Duct Connections	
Connecting Ducts	Approved Materials/Techniques
Metal-to-metal (round) Metal-to-Polyvinyl Chloride (PVC) (round)	Minimum of three equally spaced screws
Other metal-to-metal connections	Fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems, or tapes
PVC-to-PVC connections	Approved PVC cement
Flexible duct-to-metal or Flexible duct-to-PVC	Tie bands, using a tie band tensioning tool
Other specialized duct fittings	In accordance with manufacturer specifications

²⁸ **Relevant Reference(s):** 6.0101.1, 6.0201.1, 6.0101.2, 6.0201.2, 6.0201.3.



Air Seal Ducted Distribution System

Desired outcome: Duct leakage and connections between conditioned/unconditioned space is reduced, air is efficiently delivered from appliance to home and back.²⁹

Preparing for the work:

- Existing insulation cleared away as needed.
- Ducts are connected for durability according to the Duct Connections table below.
- Ducts are supported for durability according to relevant SWS:
 - Flex duct and duct boards are supported every 4' using 1 ½" wide material;
 - Metal ducts are supported every 10' or less using ½" wide 18-gauge metal straps or 12-gauge galvanized wire (or other approved means);
 - Support materials do not cause the interior dimensions of the ductwork to be less than specified.
- Holes are patched;
- If flex duct, damaged section removed, replaced with sealed spliced collar.
- Duct surfaces to receive applied sealant are clean; and
- Supply boots are fastened to subfloor with mechanical fasteners.

Duct sealing³⁰:

- Site and ducts adequately prepared for the work;
- Seams of each supply boot sealed;
- Gaps between the subfloor or ceiling and the supply boot sealed;
- Seams of each return box sealed;
- All gaps between the subfloor, wall, or ceiling and the return box sealed;
- Panned returns sealed;
- Air handler panels taped or gasketed;
- Air handler penetrations sealed or gasketed;
- The following connections are mechanically fastened and sealed:
 - Connections between the air handler and the plenums
 - Supply plenum seams and end caps
 - Inner liner of all supply ducts to supply take-off collars/supply boots
 - Connection between supply take-off collars and plenums
 - All sectioned metal elbows to supply ducts and take-off collars.
- Connection between supply take-off collars and plenums sealed.

Heating, Ventilation, and Air Conditioning (HVAC) Duct Connections	
Duct Types	Connection Requirements
Metal-to-metal	Round ducts mechanically fastened to maintain alignment Other shaped ducts securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems, or tapes
Flex-to-metal	Tie bands using a tie band tensioning tool
Duct board-to-duct board	Clinch stapler/staples
Flex duct-to-duct board	Metal take-off collar attached in accordance with IRC

²⁹ **Relevant Reference(s):** 5.0105.1, 5.0105.2, 5.0105.3., 5.0106.1.

³⁰ This checklist assumes ducts are in unconditioned space.



Insulate Ducted Distribution System

Desired outcome: Lowered conductive heat transfer of duct system and minimized condensation on the duct system.³¹

Preparing for the work:

- Ducts are prepared and sealed according to “Air seal ducted distribution system” guidelines.

General:

- Duct insulation has an attached and continuous vapor barrier;
- Duct insulation is mechanically fastened and sealed with no exposed ducts;
- All insulation seams are sealed;
- Ducts are adequately supported:
 - Support materials do not cause the interior dimensions of the ductwork to be less than specified.

Metal ducts:

- Insulation is securely attached to the ducts with metal wire or rot-proof nylon twine;
- Pattern of wire or twine is sufficient to securely hold the duct insulation tight to the duct;
- Duct insulation vapor barrier seams are sealed with manufacturer approved tape; and
- Duct insulation is minimum R-8.³²

Flex Ducts:

- All metal fittings, including boots, elbows, and take-offs, are insulated separately using a duct wrap of the minimum acceptable R-value with vapor retarder;
- Insulation on metal fittings, boots, elbows, and take-offs is mechanically fastened (e.g., stitch staples, tie bands) and sealed with no exposed metal;
- Any replacement flex duct is sized accordingly;
- Interior liner of flex-to-metal connections are fastened with tie bands using tie band tensioning tool³³;
- Interior liner of flex-to-metal connections are sealed with UL181 B-M listed mastic;
- The exterior liner of the flex duct is fastened with tie bands using a tie band tensioning tool; and
- Exterior liner connections are sealed with UL181 B-M listed mastic.

³¹ **Relevant Reference(s):** 5.0107.1, 5.0107.2.

³² If variance request has been approved, replace this with approved figure.

³³ Or other appropriate mechanical fasteners, as necessary.



Install Window or Exterior Door

Desired outcome: Replacement window or door provides weather-tight fit; improved energy efficiency performance of fenestration.³⁴

- Window or door installed to meet all local building and safety codes;
- Window or door is fully operational; and
- Installation prevents water and air infiltration. (Verify with blower door and smoke or IR scan if temperatures permit.)

³⁴ **Relevant Reference(s):** 3.0201.9, 3.0202.2.



Repair/Replace Cracked or Broken Glass

Desired outcome: Glass complete and intact; improved energy efficiency performance of fenestration.³⁵

- In pre-1978 windows, presence of lead is assumed unless testing proved otherwise and work was completed accordingly;
- Replacement glass is sized correctly for the opening;
- Replacement glass selected matches original in color and look;
- Replacement glass meets local code requirements (e.g., tempered glass, safety glass);
- Glass is durably fastened to frame (stops or push points);
- Opening was cleaned adequately to allow adhesion of sealant; and
- Glass is sealed according to design (e.g., glazing, glazing tape, or other) to prevent air movement.

³⁵ **Relevant Reference(s):** 3.0201.1, 3.0201.4, 3.0202.1.



Insulate a Water Heater Tank and First Six Feet of Pipes

Desired outcome: Improved thermal performance of the water heating and delivery system.³⁶

- Water heater storage tank is insulated to achieve overall tank R-24³⁷;
- Added insulation does not obstruct the unit's:
 - Draft diverter.
 - Pressure relief valve.
 - Thermostats or other controls.
 - Access plates.
- The first 6' of accessible inlet and outlet pipes are insulated so that coverage is complete and secure;
- Pipe insulation is correct size for pipes; and
- Pipe insulation seams are sealed.

³⁶ **Relevant Reference(s):** 7.0302.1, 7.0302.2, 7.0302.3.

³⁷ If variance request has been approved, replace this with approved figure.



Install Low-Flow Faucet Aerators or Showerhead

Desired outcome: Energy and water use reduced while occupant needs for water flow maintained.³⁸

- Equipment is installed in accordance with manufacturer instructions and applicable building codes;
- Rated flows of new fixtures will be no more than:
 - Showerheads: 2.5 gallons per minute (gpm)
 - Faucet aerators: 2.2 gpm.
- Faucet aerator/showerhead is installed so that:
 - There is no water leakage upon completion;
 - Fixtures are undamaged; and
 - Fixtures are fully functional (Verify by testing).

³⁸ **Relevant Reference(s):** 7.0201.1.



Install Exterior Roof Penetration (e.g., roof vents or bath fan termination)













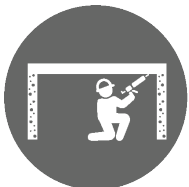


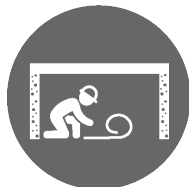




Desired outcome: Securely installed weatherproof termination fittings with unrestricted air flow.³⁹

- Hole through building shell is no greater than ¼” larger than the termination fitting;
- Termination fitting is galvanized or stainless steel or copper (kitchen range only);
- Termination fitting includes an integrated collar/flashing;
- Collar is same diameter as exhaust fan outlet or if collar is larger than exhaust fan outlet, rigid metal transition of appropriate size is used;
- Fittings are appropriate for regional weather conditions;
- Duct to terminations connections align with Termination Fittings table below;
- Duct connections are sealed with UL 181B or 181B-M-listed materials, in addition to mechanical fasteners listed in the table below;
- Fasteners do not inhibit damper operation;
- Exterior terminations are flashed/weather sealed and direct water away from penetration;
- Exterior termination is covered with pest exclusion screen material with holes between ¼” and ½”;
- Exterior termination is located:
 - At least 3’ away from property lines.
 - At least 3’ away from operable openings in the home.
 - At least 10’ away from mechanical intake.
 - Otherwise sited as required by authority having jurisdiction.

Termination Fitting to Duct Connections		
Duct-to-termination connection type		Acceptable Mechanical Fasteners
Metal-to-metal or Metal-to-PVC	Round	Three equally spaced screws
	Other	Sealed welds, gaskets, mastic, mastic-plus-embedded-fabric, tapes
Flexible duct-to-metal or Flexible duct-to-PVC		Tie bands, using tie-band tensioning tool
PVC-to-PVC		Approved PVC cement
Other specialized fittings		According to manufacturer specifications

³⁹ Relevant Reference(s): 6.0101.2.

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Work Lead-Safe	Air Seal Attic Floor	Seal and Dam High-Temperature Heat Sources in Attic	Prep Attic Floor for Insulation	Treat Attic Hatch
				
Insulate Attic Floor and Pass Inspection First Time	Insulate the Ceiling of a Manufactured Home	Seal and Insulate Knee Walls	Install Dense-Pack Sidewall Insulation	Insulate the Walls of a Manufactured Home
				
Install Weather Stripping and Sweep Set on Exterior Door	Air Seal and Insulate Walls of a Conditioned Subspace	Air Seal Floor Above Unconditioned Subspace	Insulate the Floor Above an Unconditioned Subspace	Insulate the Belly of a Manufactured Home
				
Install or Repair Vapor Retarder in a Subspace	Vent Clothes Dryer to the Exterior	Install Ducting for Bath or Kitchen Range Fan	Air Seal Ducted Distribution System	Insulate Ducted Distribution System
				
Install Window or Exterior Door	Repair/Replace Cracked or Broken Glass	Insulate a Water Heater Tank and First Six Feet of Pipes	Install Low-Flow Faucet Aerators or Showerhead	Install Exterior Roof Penetration
