



WEATHERIZATION SPECIFICATIONSⁱ
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ⁱ These Site Built and Manufactured Housing Weatherization Specifications were prepared by Bonneville in Cooperation with Regional Utilities, State Energy Organizations, and Product Manufacturers.

A. GENERAL PROGRAM SPECIFICATIONS

1. These specifications are intended to meet or exceed applicable existing codes and regulations. Codes and regulations, however, are updated periodically and are also subject to change through the code processes at State and local jurisdictions. Therefore, the specifications, codes, and regulations shall apply as follows:
 - a. Weatherization Measures shall be installed in accordance with these specifications, all applicable State and local codes, HUD code, and Federal regulations, and the most recent versions of the International Codes and the National Electric Code;
 - b. Where State or local code and specification requirements are in conflict, the most stringent of the requirements shall apply. When State or local codes are less restrictive, Bonneville may approve their use in lieu of these specifications. Such approval must be requested in writing by the Utility and approved in writing by Bonneville prior to installation of the Measure; and
 - c. In cases where a specific application is not addressed in the specification, codes, or regulations, the Utility shall determine the appropriate action consistent with the codes and these specifications. Utility decisions in these instances shall be thoroughly documented in the Residence file.
2. Definitions – For purposes of this specification, the following definitions apply. All other applicable definitions can be found in the main body of this Agreement.
 - a. Permanent Housing. A Building containing Residence(s) which is either constructed on a site or transported to a site and is permanently located on that site designed never to be moved. It is not a Mobile Home.
 - b. Code. The most recent edition of the International Codes written by the International Conference of Building Officials (ICBO) including the International Building Code (IBC), the International Mechanical Code (IMC), International Plumbing Code (IPC), International Fire Code (IFC), International Energy Conservation Code (IECC), and other associated codes and the National Electric Code (NEC) written by the National Fire Protection Association (NFPA) and associated codes.
3. The Utility shall be responsible for determining weatherization Measures eligible to be installed in each Residence per this specification.
4. All weatherization shall be completed in a manner that will provide a safe, permanent, effective, and Workmanlike installation.
5. The Utility shall maintain a copy of an Installer certificate containing the following information where loose fill insulation is installed in ceilings, walls, or floors:
 - a. address of the Residence;
 - b. date of Installation;
 - c. name and Address of Installer;
 - d. the estimated R-value of any existing insulation;
 - e. the amount, R-value, depth and type (including product name) of insulation installed by the Installer;
 - f. final R-value of insulation; and
 - g. area of the space (in square feet) insulated.

6. Insulation shall be installed in areas of the Residence envelope that separate Conditioned Space and unconditioned or outside spaces where none exists or where the R-value is less than that prescribed in the Measure Description of the reporting software.
7. Exhaust fans that terminate in attics, crawl spaces, or other spaces, shall be extended through to the outside and sealed to prevent any exhaust air from entering back into the space.
8. Knob-and-tube wiring shall be treated with special care. Insulation shall be installed such that free air circulation is maintained around all knob-and-tube wiring. (e.g., using tent baffles to maintain a 3-inch clearance, installing insulation under the wiring, etc.) Other methods as adopted at State or local code jurisdictions shall be submitted to the Utility and Bonneville for written approval prior to use. A more stringent local or State fire code may preclude using any one or all of these methods.
9. Accessible gaps (including: HVAC duct, plenum, and register penetrations; electrical penetrations; and plumbing penetrations) in the building envelope component (ex. floors, walls, ceilings) shall be sealed before insulation is added to the component.
10. Site-built additions shall be weatherized at the same time as the Mobile Home, using the Site Built specifications for the component.
11. In manufactured homes, all combustion appliances, except gas cooking appliances and gas clothes dryers, shall have outside combustion air ducted directly to the appliance. Fireplaces and wood-burning stoves shall have tight-fitting glass or metal doors that cover the entire opening of the firebox.

B. GENERAL MATERIAL SPECIFICATIONS

1. The Utility or Bonneville reserves the right to identify and disapprove for use any weatherization product at any time when it deems the product not satisfactory.
2. Where written acceptance of materials, components, or products is required, the intent is that, unless otherwise stated in the specification or the acceptance, once it is accepted by a Utility or Bonneville for one installation, the material, component, or product shall be acceptable for all other similar installations without resubmittal to the Utility or Bonneville except as noted in Specification B1 above.
3. All materials shall be resistant to corrosion, degradation from ultraviolet light, and be compatible with other elements and materials (will not react chemically, etc.) so as to enhance long life expectancy of installed Measures.
4. Materials damaged in shipment or in assembly shall not be used.
5. Structural members and building components shall be free of decay and structurally sound before the weatherization measure is installed. The structure shall be properly supported, leveled and restrained (if required) before weatherization Measures are installed.
6. Weatherization materials, products and labor shall be warranted by the Installer against failure due to manufacturing and installation defects for a period of at least 2 years, from the installation date, except that sealed, insulated-glass units shall be warranted against failure of the seal for a minimum of 5 years. The Installer shall provide a written warranty, with the installation date, to the Homeowner or Homeowner Designee. Manufacturers' written warranties may be used by Installers to satisfy a part of this requirement where appropriate.
7. The American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals is the accepted standard for R-value/U-value of materials used by Installers. Products that vary from ASHRAE may be acceptable if they comply with current Federal Trade Commission (FTC) certifications, testing and labeling rules, and have independent laboratory testing which indicates the product's R-value/U-value. NFRC rated u-values fulfill this requirement for windows and doors.
8. All materials used for thermal insulation shall meet the requirements of IBC Section 2603 and IBC Section 719 and meet the requirements contained in the applicable material specifications listed below. Certain requirements in these specifications refer to voluntary standards such as ASTM for specific test methods or physical properties. For purposes of compliance with this weatherization specification, the referenced voluntary standard shall be considered as mandatory.

.1	Mineral Fiber Blankets/Batts	ASTM C 665
.2	Mineral Fiber Loose Fill	ASTM C 764
.3	Cellulose Loose Fill	ASTM C-739-97 16 CFR 1209 16 CFR 1404
.4	Perlite	ASTM C-549-95
.5	Vermiculite	ASTM C-516-96e1
.6	Polystyrene Board	ASTM C-578-01

.7 Polyurethane and
Polyisocyanurate Board

ASTM C 591

9. Insulation materials including facings (except foam plastic insulation--Specifications B10 and B11) shall be installed in accordance with installation requirements of the IBC Section 719. Flame spread and smoke developed limitations do not apply to facings, provided that the facing is installed in substantial contact with the unexposed surface of the ceiling, floor or wall finish.
10. When foam plastic insulation is used, a thermal barrier satisfying IBC 2603.4 shall be present between the insulation and the interior of the Building.
11. Foam plastic used in attics or crawl spaces shall be protected against ignition per IBC 2603.4.1.6.
12. All insulation materials installed shall meet the requirements of the Federal Trade Commission Labeling Rule (16 CFR 460). Additional labeling on weatherization materials may be required under the RCS regulations for covered utilities.
13. Caulking shall be one of the following materials conforming to the Federal Specifications listed below or material demonstrating equivalent performance in resiliency and durability. The cartridge or tube containing the caulking material shall be labeled indicating conformance to the applicable Federal Specification:

a.	Silicone Rubber	TT-S-1543A
b.	Polysulfide or Polyurethane (single component)	TT-S-230C
c.	Polysulfide or Polyurethane (multiple component)	TT-S-227E
d.	Acrylic Terpolymer (single component)	TT-S-230C
e.	Butyl Rubber	TT-S-1657
f.	Acrylic Latex	ASTM C834
14. Urea-Formaldehyde foam insulation is not acceptable.

C. SITE BUILT - ATTIC INSULATION

1. General Program and General Material Specifications (sections A and B) shall be followed, in addition to the following Section C.
2. Ceilings shall be insulated to a minimum of R-38 or the highest R-value approaching R-38 which is practical.
3. Uninsulated sloped ceilings between ventilated attics shall be insulated where practical. Airflow may be maintained over the sloped-ceiling insulation by tubes, baffles, or by using rigid insulation; or the sloped-ceiling area may be insulated to the full cavity depth where local codes allow, provided containment materials used at the lower and upper cavity openings allow for rapid vapor diffusion.
4. Uninsulated knee walls adjoining attic spaces shall be insulated to the highest R-value which is practical or minimum of R-11, in accordance with Specification H.2 “Unfinished Walls”, as part of attic insulation.
5. All exposed ducts located in the attic space which will extend above the level of the finish attic insulation shall be insulated as specified in Section I “SITE BUILT – HVAC DUCT INSULATION”.
6. Attic access doors which are adjacent to Conditioned Spaces shall be insulated to at least R-30 for horizontal openings and to at least R-11 for vertical openings and weatherstripped.
7. If water pipes are located in the attic space, water pipe insulation shall be included with ceiling insulation, for freeze protection as per Section J “ALL HOMES – HYDRONIC AND WATER PIPE INSULATION”.
8. If vapor barriers are installed with ceiling insulation, the barrier shall be placed between the insulation material and the Conditioned Space adjacent to the ceiling.
9. Enclosed attics and enclosed rafter spaces shall have cross ventilation for each separate space. Ventilating openings shall be protected against the entrance of rain and snow.
 - a. The net free-ventilating area shall be not less than 1/150 of the area of the space ventilated, except that the area may be 1/300, provided 50 to 60 percent of the required ventilating area is provided by ventilators located in the upper portion of the space to be ventilated at least three feet above eave or cornice vents with the balance of the ventilation provided by eave or cornice vents or provided a vapor barrier is present between the insulation and the ceiling. (IBC 1203.2)
 - b. Other configurations of vent placement that provide equivalent performance may also be accepted with written Utility approval or as approved by local code.
 - c. Vent openings shall be covered with corrosion-resistant metal mesh with mesh openings of maximum 1/4 inch in dimension.
 - d. Air turbines shall not be installed under these specifications, however, ventilating area of existing air turbines may be included by estimating the net free ventilating area of the air turbine in a locked, nonrotating position.
10. The UL label or equivalent label shall appear on every bag of loose fill cellulose material. It shall include the file number (R-number) of the manufacturer and the issue number for labels

purchased. This ensures adherence to the requirements of CPSC cellulose regulation 16 CFR 1209 (i.e., critical radiant flux, smoldering combustion, settled density, and corrosiveness).

11. Recessed lighting fixtures and fan/light combinations that are Type-IC rated by UL may be covered with insulation. Fan/heater, fan/light/heater, and light/heater combinations may be covered with insulation IF they are rated "Heater" or "Air Heater."
12. Ventilation fans may be covered with insulation IF all holes and penetrations are sealed with a nonflammable sealant.
13. Only fluorescent fixtures with appropriate thermal protection shall be covered with insulation.
14. Thermal insulation shall not be installed within 3 inches of fans, lights, and heaters that do not meet the requirements of C.11 through C.13 and other heat producing fixtures, and shall not be installed so as to entrap heat and prevent the free circulation of air (NEC 410.66 and IECC 502.1.3). Solid, flame resistant baffles attached to the ceiling structure shall be used to maintain required clearances.
15. All combustible insulation materials, including existing insulation, shall be kept a minimum of 2 inches from metal flues and masonry chimneys. Noncombustible insulation may be installed with no clearance around flues and chimneys if permitted by local or State fire code. However, if the flue is a single wall type (i.e., made from a single thickness of rolled sheet metal) then, a 2-inch air clearance to all insulating materials shall be maintained. Noncombustible insulation is insulation material which conforms to the standard test method ASTM E-136.
16. Kitchen range exhaust fans vented through the ceiling shall be connected to a duct made of galvanized steel, stainless steel, aluminum, or copper (IMC 505.1) which is substantially airtight throughout and which terminates directly to the outside in a vent cap. Backdraft dampers are recommended. Existing installations that substantially meet these requirements are acceptable.

D. SITE BUILT - EXTERIOR ROOF INSULATION

1. General Program and General Material Specifications (sections A and B) shall be followed, in addition to the following Section D.
2. Roofs shall be insulated to a minimum of R-20 or the highest R-value approaching R-20 which is practical.
3. Insulation shall not be applied to roofs over ventilated cavities. (e.g., vaulted ceilings with ventilated spaces, attics, sloped ceilings connected to attics and/or knee wall spaces, etc.)
Ventilated cavities of flat or sloping roofs shall not be blocked.
4. Insulation shall be in a rigid board form.
5. A vapor barrier of 1.0 perm or less shall be in place between the insulation and the roof deck. However, if insulation is already present in the roof system, then a vapor barrier shall not be installed.
6. Roof drainage systems shall function properly after insulation is installed (IPC Chapter 11).
7. Roof coverings shall be applied directly over the insulation per Section 1507 of the IBC.
8. All penetrations through the roof covering and all joints between the roof covering and vertical surfaces (e.g., walls, chimneys, etc.) shall be flashed according to the requirements of the IBC 1507.
9. Utility shall perform an “in-progress” inspection during the installation. The in-progress inspection shall be documented in the Residence permanent file.

E. SITE BUILT - INTERIOR ROOF INSULATION

1. General Program and General Material Specifications (sections A and B) shall be followed, in addition to the following Section E.
2. Roofs shall be insulated to a minimum of R-24 or the highest R-value approaching R-24 which is practical.
3. Insulation shall be in a rigid board form. Rigid board insulation shall be cut to fit, minimizing openings and gaps between beams that support the roof structure, other necessary protrusions (light fixtures, electrical boxes, etc.) and the insulation itself.
4. Lighting fixtures or similar items shall be extended to accommodate the lower ceiling level.
5. All air by-passes shall be sealed to minimize heat loss and moisture damage potential.
6. Beam pockets and end-wall grooves created by tongue-and-groove ceiling construction shall be sealed with caulk or with foam tape covered by trim board.
7. Gaps between insulation boards and fixtures (e.g., ceiling lights, fans, etc.) when greater than 1/8 inch in width shall be filled with self expanding foam, chemically compatible with the insulation material. Gaps less than 1/8 inch in width shall be caulked.
8. An in-progress inspection shall be performed by the Utility after the rigid board has been installed and prior to covering the insulation with a fire rated barrier to verify the insulation board is properly installed and sealed. The in-progress inspection shall be documented in the Residence permanent file.
9. The fire-rated barrier shall be taped at all joints and sealed at all edges to ensure air/moisture infiltration paths have been eliminated.

F. SITE BUILT - UNDERFLOOR INSULATION

1. General Program and General Material Specifications (sections A and B) shall be followed, in addition to the following Section F.
2. Underfloors shall be insulated to a minimum of either R-30 or to the level needed to fill the joist cavities, whichever is less.
3. Any crawlspace access door adjacent to a Conditioned Space shall be insulated to at least R-19 for horizontal openings and to at least R-11 for vertical openings and shall be weatherstripped with appropriate materials.
4. All exposed uninsulated ducts located in the crawlspace shall be insulated as specified in Section I "SITE BUILT - HVAC DUCT INSULATION".
5. Uninsulated walls separating the crawlspace from Conditioned Space shall be insulated to the highest R-value which is practical or minimum R-11 in accordance with Section H "SITE BUILT - WALL INSULATION".
6. If water pipes are located in the crawlspace, water pipe insulation shall be included with underfloor insulation, for freeze protection, installed in accordance with Section J "ALL HOMES - HYDRONIC AND WATER PIPE INSULATION".
7. Underfloor insulation support systems shall be installed so that the insulation remains in contact with the sub-floor, flat and in place for the life of the Residence. Support of the insulation may be provided by wood lath, twine, wire, or other material as approved by the Utility. If fiberboard sheathing is used to support insulation, then the sheathing shall have a water vapor permeability of 10 perms or more.
8. Vapor barriers installed as a part of floor insulation shall have a perm rating of 1.0 or less and shall be located between the insulation material and the Conditioned Space.
9. Upon completion of the installation of underfloor insulation, an acceptable ground-cover moisture barrier shall be present (new 6 mil black polyethylene or existing 4 mil polyethylene). All joints shall be overlapped with sufficient material so that all ground surface area is covered.
10. If underfloor insulation is installed over an unheated basement and the basement has no exposed soil, then the provisions for a ground cover and ventilation are not required. Any basement with exposed soil shall be treated as a crawl space and the provisions for ventilation shall be required. In addition, a ground cover shall be present which covers the entire area of exposed soil.
11. Underfloor insulation in areas which are exposed to environmental elements (wind, etc.) shall be protected after installation with a breathable cover or some type of perimeter system (e.g., skirts).
12. Ground covers are not required for Residences which are built on stilts and have no perimeter system which creates a crawl space.
13. Underfloor crawlspace areas shall be ventilated by openings in exterior foundation walls. Such openings shall have a net area of not less than 1 square foot for each 150 square feet of underfloor area. Openings shall be located as close to corners as practical and shall provide cross ventilation. The required area of such openings shall be approximately equally distributed along the length of at least two opposite sides. They shall be covered with corrosion-resistant wire mesh with mesh openings of 1/4-inch in dimension. Existing vent openings which are covered with wire mesh need not be modified.

Exception: Where moisture due to climate and ground water conditions is not considered excessive and where the building code official approves, operable louvers may be allowed and the required net area of vent opening may be reduced to 1/1500.

Exception: If continuously operated mechanical exhaust ventilation is provided at a rate of 1.0 CFM per 50 sq.ft. of floor area, ventilation openings may be omitted. (IBC 1203.3)

G. SITE BUILT - EXTERIOR PERIMETER INSULATION

1. General Program and General Material Specifications (sections A and B) shall be followed, in addition to the following Section G.
2. Exterior perimeter insulation may be installed on Residences with basements, slab on grade floors or an existing whole-house plenum system.
3. Insulation installed shall have a minimum thermal resistance of R-10 in exterior applications.
4. Slab, Crawlspace Plenum, or Basement Exterior Perimeter Insulation Installation Provisions:
 - a. Insulation shall be installed from the bottom edge of the siding to a depth equal to the local "frost line" or 2 feet below grade, whichever is greater. In those areas that do not have freezing conditions or where the "frost line" is higher than 12 inches, the insulation shall extend a minimum of 12 inches below grade. Insulation shall not be installed below the level of the footing, but shall extend horizontally away from the footing for the remaining required distance. Under no circumstances shall excavation take place below the level of any foundation footing.
 - b. Insulation shall be adhered to the foundation with an adhesive suitable for the purpose installed in continuous horizontal beads to block insect infestation.
 - c. The exterior surfaces of the insulation material shall be water proofed with a suitable barrier and shall be protected from mechanical damage, solvents, mastics, moisture, and ultraviolet light degradation. Above grade, the insulation shall be covered with a suitable coating compatible with either adjacent walls or the previously exposed foundation surface in color and general surface appearance.
 - d. Metal "Z" flashing shall be installed at the top edge of the insulation with the vertical flange extending up behind the siding to prevent water from getting behind the perimeter insulation.
5. Insulation board which is used for perimeter insulation shall have a moisture absorption rate no greater than 0.3 percent when tested in accordance with ASTM C-272 and a water vapor transmission rate no greater than 2.0 Perm/inch of thickness when tested in accordance with ASTM E-96. Expanded polystyrene (bead board) is not acceptable.

H. SITE BUILT - WALL INSULATION

1. General Program and General Material Specifications (sections A and B) shall be followed, in addition to the following Section H
2. Unfinished Walls
Applies to Exposed Frame Wall, Concrete, or Masonry Walls
 - a. Walls shall be insulated to a minimum of R-15 for nominal 4 inch walls and to a minimum of R-21 for nominal 6 inch walls.
 - b. Vapor barriers shall be installed when practical. Vapor barriers installed as part of wall insulation shall have a perm rating of 1.0 or less and shall be located between the insulation material and the Conditioned Space.
 - c. When rigid insulation is applied to the exterior stud surfaces of an open cavity frame wall, the insulation shall be installed tightly to minimize air leakage and an adequate air/vapor barrier shall be installed at the warm side of the insulation.
 - d. Upon completion of exterior surface retrofits, the exterior wall shall be weathertight with window and door jambs extended or modified to provide adequate drainage. Siding shall be installed per insulation or siding manufacturer instructions or as approved by the Utility.
3. Exterior Wall Cavities
 - a. Walls shall be insulated to minimum R-11 or the highest R-value that is practical.
 - b. Insulation may be installed in wall cavities that are:
 1. 3-1/2 inch deep or greater with 1 inch or less of existing insulation; or
 2. less than 3-1/2 inch deep with no existing insulation.
 - c. Walls shall be insulated with loose-fill insulation (fiberglass, rockwool, and cellulose) using the insert tube method. Any other method of installation must be approved in writing by Utility.
 - d. The entire stud bay shall be filled, including cavities requiring more than one hole because of blocking in the cavity.
 - e. Stud bays containing supply plumbing may be left uninsulated to prevent freezing.
 - f. The manufacturer's instructions shall be followed when blowing wall cavities.
 - g. The Utility shall verify the installation of insulation by inspection at electrical outlet or switch boxes by in-progress inspection or other method as determined by the Utility. The Utility shall document to the Residence file the type of verification used.
 - h. The Utility shall check a minimum of three electrical wall outlets or switch boxes to ensure that any insulation material which may have entered the boxes during blow-in wall insulation application was removed by the Installer.
 - i. Access to the wall cavities may be accomplished by either removing pieces of the siding prior to drilling through the sheathing, or by drilling directly through the siding and the sheathing.

- j. When access holes for installing the insulation are drilled through the finish siding and sheathing, the Utility shall verify that all holes were adequately plugged and provide a tight weatherproof seal.
- k. The UL label or equivalent label shall appear on every bag of loose fill cellulose material. It shall include the file number (R-number) of the manufacturer and the issue number for labels purchased. This ensures adherence to the requirements of CPSC cellulose regulation 16 CFR 1209 (i.e., critical radiant flux, smoldering combustion, settled density, and corrosiveness).
- l. Only noncombustible insulation (per ASTM E-136) shall be installed in wall cavities adjoining fireplaces and/or chimneys.
- m. Insulation shall not be installed in wall cavities which contain electric space heaters unless fire stops are present which isolate the heater from all contact by the insulation material. Verification shall be accomplished by removal of the heater after the insulation is installed.

I. SITE BUILT - HVAC DUCT INSULATION

1. General Program and General Material Specifications (sections A and B) shall be followed, in addition to the following Section I.
2. HVAC ducts shall be insulated to a minimum R-11.
3. Ducts shall be properly supported before insulation is installed. All new and all accessible existing duct joints, plenum drives, metal joints to include all slips and drives shall be mechanically fastened with screws. Flexible ducts shall be attached using nylon/plastic straps tightened with a manufacturer approved tool (hand tightening is not acceptable) or stainless steel worm drive clamps. Mastic and/or tape shall not be used as mechanical fasteners.
4. All new and all accessible existing HVAC supply and return ducts, air handlers, and plenums outside the heated space shall be sealed at all joints and corners, including prefabricated joints, with duct mastic. It is unnecessary to seal longitudinal seams unless they are damaged. Tape is not allowed except for use on operable doors in the system such as on the air handler. In this case, foil tape with a 15-mil butyl sealant, or cleaning the joint with a suitable solvent and sealing with a UL-181 listed tape may be used.
5. Except for ducts entirely within the conditioned space, the entire system including plenums and boots shall be insulated. All duct insulation should be installed and supported using mechanical fasteners such as permanent plastic straps or nylon twine. Tape is not a mechanical fastener. Tape may be used on insulation seams to provide a continuous barrier. Special care shall be taken when insulating flex duct so that the duct wall does not collapse.
6. Ducts which carry chilled air (any type of heating and air conditioning system) shall be completely insulated with a material that has a facing with the proper flame spread rating as defined in I.7.
7. Duct insulation for use in unconditioned areas on ducts not subject to routine human contact shall meet the requirements of ASTM C 665, any type. For ducts subject to routine human contact during servicing or storage activities, (e.g., in garages, basements, attics used for storage) the insulation shall meet ASTM C 665 and either be classified as Type 2 or 3, Class A (reflective or non-reflective, flame rated, faced batts) material. Faced material shall have a covering which provides physical protection to the insulation and has a flame spread of 50 or less when tested in accordance with ASTM E-84-05 when used on duct systems which serve single Residences only. In Buildings having a duct system which serves more than one Residence, the covering shall have a flame spread of 25 or less when tested in accordance with ASTM E-84-05.

J. ALL HOMES - HYDRONIC AND WATER PIPE INSULATION

1. General Program and General Material Specifications (sections A and B) shall be followed, in addition to the following Section J.
2. Pipe insulation shall be installed to minimum R-values determined according to the following:
 - a. Hydronic heating system pipes having a nominal diameter of 1-inch or less shall be insulated with material having a minimum R-value of 3.6 tested in accordance with ASTM C-177 at a mean temperature of 75 degrees Fahrenheit.
 - b. Hydronic heating system pipes with a nominal diameter greater than 1 inch shall be insulated with material having a minimum R-value of 5.4 tested in accordance to ASTM C-177 at a mean temperature of 75 degrees Fahrenheit.
 - c. Water pipes shall be insulated with material having a minimum R-value of 3.0 tested in accordance with ASTM C-1775 at a mean temperature of 75 degrees Fahrenheit.
3. The piping shall be free from water leaks and properly secured to support the weight of the piping and insulation.
4. The product may be either flat and capable of being molded to the outside surface of common pipe sizes, or preformed to fit standard pipe diameters. If the product is preformed, dimensions shall be specified by the Utility and be appropriate for the pipe size intended to be insulated.
5. Pipe insulation shall be installed on piping, joints, elbows, valve bodies, etc. except those sections of the system which are obstructed by existing wood framing members or other Residence components. Insulation material shall be cut and folded or otherwise molded to completely cover all sections of the system without compressing the insulation or allowing gaps to occur in the insulation.
6. Insulation shall be firmly secured to the piping system using adhesive, tape, or plastic or galvanized wire ties.
7. All slits and joints in the material shall be sealed on hydronic heating system pipes.
8. If insulation is installed on piping exposed to the weather, then such insulation 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. Manufacturer's recommendation for outdoor installations shall be followed in all cases.
9. Pipe insulation shall meet the following provisions:
 - a. Pipe insulation materials shall be comprised of mineral fiber, elastomers, urethanes, isocyanurates, or other suitable materials;
 - b. the material shall be capable of withstanding continuous operating temperatures of not less than 180 degrees Fahrenheit. Hydronic pipe insulation shall be capable of continuous operation at 250 degrees Fahrenheit;
 - c. The product shall be finished with a jacket or facing, suitable to resist damage and degradation. However, if the product is made of closed cell foam and is installed in a location protected from moisture, ultraviolet light and extremes in temperature, then a protective jacket or facing is not required; and

- d. the insulation material, any jackets or facings, and adhesive, if used, shall be tested as a composite product and shall have a flame spread rating of 25 or less, and a smoke density of 50 or less when tested in accordance with ASTM E-84.
10. Pipe insulation shall not be installed on pressure temperature relief valves, on the operating portion of any valves, or on any other control and safety devices.
 11. Where water pipe heaters are present for freeze protection, such heaters shall include a thermostat set at approximately 35 degrees Fahrenheit and they shall be placed around all water pipes (both hot and cold water) in the crawl space inside the pipe insulation in contact with pipe surface. Such installation shall conform to provisions of the National Electric Code and any applicable State or local code.

K. ALL HOMES - PRIME WINDOW, SLIDING GLASS DOOR, AND FRENCH DOOR REPLACEMENTS

1. General Program and General Material Specifications (sections A and B) shall be followed, in addition to the following Section K.
2. Eligible measures include:
 - a. replacement of prime windows with NFRC certified products;
 - b. replacement of patio doors (French or Sliding) with NFRC certified products.
3. The weighted average of all windows installed shall have a National Fenestration Rating Council (NFRC) rated u-value of 0.30 or lower. All patio doors shall have a NFRC rated u-value of 0.35 or lower.
4. Window and door frames shall be permanently affixed to the Residence. After installation, access to latches shall not be impaired. Upon installation completion, units shall operate smoothly and properly. Hardware shall be durable, function properly, and not create interference. When closed, the entire assembly shall provide a complete weather-barrier to the entire opening. All materials shall have sufficient strength and durability to resist damage or distortion from wind loads, thermal stress (including that due to solar gain), or induced installation stresses. All operable windows shall be of sufficient combinations of glass/slider- frame rigidity to prevent bowing after installation.
5. Any installation that results in increased window area, including garden windows, shall not be allowed under this Program.

_____ ~~E~~Exception: window area increases shall be permitted to meet minimum code egress requirements.
6. No windows shall have exposed burrs, sharp corners or other potential hazardous condition that could be encountered by occupants during normal use.
7. Sources of evident water penetration through prime openings shall be located and corrected. Necessary repairs shall be accomplished by the Homeowner or Homeowner Designee prior to installation of storm windows.
8. Safety glass shall be used under the following conditions:
 - a. Glazing in entrance doors;
 - b. glazing in fixed and sliding panels of sliding doors and panels in swinging doors other than wardrobe doors;
 - c. glazing in fixed or operable panels adjacent to a door where the nearest exposed edge of the glazing is within a 24-inch arc of the vertical edge of the door in a closed position and where the bottom edge of the glazing is less than 60-inches above the floor or walking surface unless there is an intervening wall or permanent barrier between the door and the glazing;
 - d. glazing in an individual fixed or operable panel other than those covered by L.8.c. above that meet ALL of the following conditions:
 1. have an exposed area of an individual pane greater than 9 square feet;
 2. has an exposed bottom edge less than 18 inches above the floor;

3. has an exposed top edge greater than 36 inches above the floor; and,
4. has one or more walking surfaces within 36 inches horizontally of the plane of the glazing.

In lieu of safety glazing, such glazed panels may have a protective bar installed on the accessible sides of the glazing 34 to 38 inches above the floor. The bar shall be capable of withstanding a horizontal load of 50 pounds per linear foot without contacting the glass and be a minimum of 1 1/2 inches in height.

- e. Glazing in any portion of a building wall enclosing showers, hot tubs, whirlpools, saunas, steam rooms, and bathtubs where the bottom exposed edge is less than 5 feet above a standing surface or drain inlet.
9. Each pane of safety glass lite shall be marked with the name of the manufacturer and place of manufacture, and shall certify compliance with all applicable standards for the manufacture and testing of safety glass (e.g., CPSC Class 2).
10. Retrofitted vertically-opening prime windows shall not free fall. They shall be designed to hold the sash secure and level in ventilating positions
11. Security latches are required on all prime window replacements.
12. Sealed insulating glass panels within prime windows and doors shall incorporate sealed, insulating glass, certified as "Class A" under a SIGMA-approved Program, which requires compliance with ASTM E 774. Manufacturer identification of certified panels shall be stamped, engraved, or inked on the spacer which separates the panes of glass, etched on the glass itself, or printed on a label located between the panes of glass and affixed to the glass. Such identification indicates the certifying agency (e.g., ALI or IGCC) and the performance class or classes of the unit.
13. A mechanical ventilation system meeting the requirements of Section O "MANUFACTURED HOME – MECHANICAL VENTILATION" shall be installed in all manufactured homes.

L. MANUFACTURED HOME – CEILING AND ROOF INSULATION

1. General Program and General Material Specifications (sections A and B) shall be followed, in addition to the following Section L.
2. Ceiling Cavities
 - A. Ceiling cavities under flat or crowned metal roofs shall be insulated by completely filling them with blown-in insulation and sealing all existing attic ventilation except existing roof jacks. It is recommended that this application be done in conjunction with insulation on the exterior roof surface because of concerns about the potential for moisture condensation.
 - B. Ceiling cavities under pitched roofs shall be insulated to R-38 or to the maximum practical R-value, and ventilated to 1 ft² for each 300 ft² of ceiling area.
 - C. All penetrations through the ceiling shall be sealed before ceiling cavities are insulated.
 - D. If the ceiling cavity contains a non-ducted return-air system, the return-air system shall be eliminated as described in Specification N.8.
3. Exterior Roof Surfaces
 - A. If exterior roof insulation is installed, it shall be a minimum of R-7. Exterior roof insulation shall not be installed over ventilated ceiling cavities or over cavities containing air spaces.
 - B. Roof drainage systems shall function properly after weatherization has been installed.
 - C. Weatherproof roof coverings shall be applied directly over the insulation.
 - D. All penetrations through the roof covering and all joints between the roof covering and vertical surfaces (e.g. walls, chimneys, etc.) shall be flashed.
 - E. Other methods of installing exterior roof insulation shall be approved by the Contractor in writing prior to beginning the work.
4. Ramada Roofs
 - A. A ramada roof is a free standing (self supporting) covering over a Mobile Home.
 - B. The ramada roof shall be joined to the Mobile Home to create an enclosed attic cavity. The ramada roof shall be weatherproof and be joined to prevent the entry of birds, animals, etc.
 - C. The attic cavity shall meet the ventilation requirements of the site-built specifications.
 - D. All exhaust-fan ducts, plumbing vent stacks, etc. shall be extended outside and have a proper termination.
 - E. All heat producing fixtures shall be protected according to Specification C.14.
 - F. The original roof cap of the Mobile Home shall be opened to allow a full fill of insulation inside the cap. Insulation shall be installed above the original roof to provide an installed level of R-38. The openings in the original roof shall NOT be sealed.
 - G. All penetrations through the ceiling shall be sealed before the insulation is installed.

5. A mechanical ventilation system meeting the requirements of Section O “MANUFACTURED HOME – MECHANICAL VENTILATION” shall be installed in all homes.
6. The Utility shall verify the installation of insulation and air sealing by an in-progress inspection or other methods determined to be appropriate by the Utility. The Utility shall document the type of verification in the Consumer's permanent file.
7. All combustion appliances, except gas cooking appliances and gas clothes dryers, shall have outside combustion air ducted directly to the appliance. Fireplaces and wood-burning stoves shall have tight-fitting glass or metal doors that cover the entire opening of the firebox.

M. MANUFACTURED HOME - UNDERFLOORS

1. General Program and General Material Specifications (sections A and B) shall be followed, in addition to the following Section M.
2. HVAC ducts and plenums shall be inspected for leaks or openings, and leaks or openings shall be repaired and sealed before underfloor insulation is installed. Non-ducted return-air systems in the floor cavity shall be eliminated per Specification N.8.
3. All plumbing penetrations through the floor (e.g., bathtubs, clothes washers, sinks, etc.) shall be sealed before underfloor insulation is installed.
4. Insulation shall be protected by a moisture permeable covering or skirting before underfloor insulation is installed. Skirting shall be as close to the ground as practical.
5. A minimum of R-19, or the maximum R-value achievable to fill the floor cavity, shall be installed. Special care shall be taken when insulating the floors of tip-outs or expandos.
6. Where required by State or local codes, a moisture permeable rodent barrier shall be in place and in good repair after the insulation is installed.
7. All combustion appliances, except gas cooking appliances and gas clothes dryers, shall have outside combustion air ducted directly to the appliance. Fireplaces and wood-burning stoves shall have tight-fitting glass or metal doors that cover the entire opening of the firebox.
8. All exhaust ducts, such as those for kitchen ranges and dryers, shall be extended to the outside of the crawl space and sealed to prevent exhausted air from returning to the crawl space and/or the Mobile Home when skirting exists.
9. All water drains, including condensate drains from air conditioning equipment, shall be extended outside the crawl space.
10. Water-pipe heaters may be installed in localities with sustained periods of subfreezing winter temperatures. Such heaters shall include a thermostat set at approximately 35 degrees Fahrenheit. They shall be placed around all water pipes (both hot and cold water) in the crawl space, inside the pipe insulation, and in contact with the pipe surface. Such installations shall conform to the National Electric Code and any applicable State or local code.
11. Underfloor insulation support systems shall be installed so that the insulation remains in contact with the sub-floor, flat and in place for the life of the Residence. Support of the insulation may be provided by wood lath, twine, wire, or other material as approved by the Utility.
12. Vapor retarders installed as a part of floor insulation shall have a perm rating of 1.0 or less and shall be located between the insulation material and the Conditioned Space.
13. After underfloor insulation has been installed, an acceptable ground-cover moisture barrier shall be present (new 6 mil black polyethylene or existing 4 mil polyethylene) where skirting exists. All joints shall be overlapped with sufficient material so that all ground surface area is covered.
14. When skirted, the entire enclosed underfloor crawl space area shall be ventilated by openings in the skirting. Such openings shall have a net area of not less than 1 square foot for each 150 square feet of underfloor area, including the crawl space area of all structures which open to that of the Mobile Home. Openings shall be located as close to corners as practical and shall provide cross ventilation. The required area of such openings shall be approximately equally distributed

along the length of at least two opposite sides. They shall be covered with corrosion-resistant wire mesh with maximum mesh openings of 1/4-inch. Existing vent openings which are covered with wire mesh need not be modified.

Exception: Where moisture due to climate and groundwater conditions are not considered excessive and where the building code official approves, operable louvers may be allowed and the required net area of vent opening may be reduced to 1/1500.

Exception: If continuously operated mechanical exhaust ventilation is provided at a rate of 1.0 CFM per 50 sq.ft. of floor area, ventilation openings may be omitted. (IBC 1203.3)

15. All HVAC ductwork, including plenums, shall be repaired, sealed and properly supported, according to Section N “MANUFACTURED HOME – HVAC DUCTS”, before underfloor insulation is installed.
16. Water pipes that have not been covered by underfloor insulation shall be insulated according to Section J “ALL HOMES - HYDRONIC AND WATER PIPE INSULATION”.
17. A mechanical ventilation system meeting the requirements of Section O “MANUFACTURED HOME – MECHANICAL VENTILATION” shall be installed in all homes.
18. The Utility shall verify the installation of insulation and air sealing by an in-progress inspection or other methods determined to be appropriate by the Utility. The Utility shall document the type of verification in the Consumer's permanent file.

N. MANUFACTURED HOME – HVAC DUCTS

1. General Program and General Material Specifications (sections A and B) shall be followed, in addition to the following Section N.
2. All new and all accessible existing HVAC supply and return ducts, air handlers, and plenums outside the heated space shall be sealed at all joints and corners, including prefabricated joints, with duct mastic. It is unnecessary to seal longitudinal seams unless they are damaged. Tape is not allowed except for use on operable doors in the system such as on the air handler. In this case, foil tape with a 15-mil butyl sealant shall be used; alternately, the joints can be cleaned with a suitable solvent and sealed with a UL-181 listed tape.
3. Any portion of an HVAC duct that extends beyond the last register shall be sealed.
4. The crossover ducts shall be installed to prevent compressions or sharp bends, minimize stress at the connections, avoid standing water, and avoid excessive duct lengths. When skirting is not present, the crossover duct shall be protected against rodents, pets, etc.
5. Crossover ducts shall be secured with mechanical fasteners (e.g., stainless steel worm drive clamps, plastic/nylon straps applied with tightening tool, etc.) and sealed with mastic or aluminum/foil backed butyl or equivalent sealant tape.
6. Existing flexible crossover duct with an insulation value of R-4 or less or which has been damaged shall be replaced with new flexible duct with an insulation value of R-8 and an exterior vapor retarder rated at 1.0 perms or less. New crossover ducts shall have an inner liner material which includes a spring-steel wire helix bonded within two layers of 57-gauge or thicker mylar film
7. Where clearances permit, the crossover duct shall be supported above the ground by strapping or blocking.
8. If a nonducted return-air system is in the floor or ceiling cavity, it shall be eliminated. Seal all return-air openings in the floor or ceiling and seal the main return-air opening in the floor or ceiling of the furnace closet. Return air shall be provided through grills in the furnace closet to the heated space. These grills shall be adequately sized for the installed heating system. All interior doors shall be undercut, or other means provided, to allow return air to flow back to the furnace closet.
9. If the belly board/rodent barrier has been removed and batt insulation has been installed in the floor, all HVAC ducts, boots and plenums, except flexible crossover ducts, shall be wrapped with R-11 insulation.

O. MANUFACTURED HOME – MECHANICAL VENTILATION

1. Non-Heat-Recovery Ventilation - Intermittent Operation Option

- A. This option shall include a bathroom exhaust fan controlled by both a manual switch, crank timer or dehumidistat in the bathroom to provide spot ventilation AND a time clock to provide whole-house ventilation when called for by the timer. Outside-air inlets shall be installed in all living areas and bedrooms, and undercut doors, grilles, transoms, or other approved means to provide fresh-air circulation through the house to the bath fan.
- B. Exhaust ducts shall be smooth metal and terminate outside the house at the closest possible location. All connections shall be tight fitting and taped or sealed, and backdraft dampers shall be provided.
- C. The minimum exhaust airflow rates shall comply with either the performance OR prescriptive paths listed below. Surface-mounted fans shall have a sone rating of 1.5 or less, or other rating as approved by the Contractor. Existing fans that meet the minimum airflow rates are exempt from the sone rating requirement.

1. **Performance Path:** The minimum measured airflow capacity shall

Number of Bedrooms	Measured Exhaust Flow
1	45 cfm
2	60 cfm
3	75 cfm
4	90 cfm

To calculate the ACH for a fan with a MEASURED airflow of 45cfm multiply by 60 to obtain the airflow per hour (45 X 60 = 2700 cfh) and divide by the volume of the heated space.

2. **Prescriptive Path:** Ventilation systems that do not meet the performance path shall provide 0.35 ACH based upon the rated fan flow minus 15 cfm or use the rated fan flows in the following table:

Number of Bedrooms	Rated Fan Flow
1	70 cfm
2	85 cfm
3	100 cfm
4	115 cfm

To calculate ACH based on the RATED airflow, subtract 15 cfm, multiply by 60, and divide by the volume of the heated space.

- D. The fan shall have both automatic and manual controls. Automatic controls shall include a time clock or cycle timers with a minimum of 2 on-periods per day, a manual control switch to let the occupant turn the fan on or off, and be set to operate a minimum of 8 hours per day.
- E. The ventilation fan shall be wired to both the manual spot-ventilation switch in the bathroom and to a time clock.
- F. Individual outside-air inlets, located to avoid drafts, shall provide a minimum of 4 sq. inches per bedroom and combined living area.

If a whole house blower door test, in accordance with Appendix T and conducted after air sealing measures are installed, results in an $ACH_{50} \div 20$ greater than 0.35 and the house has no combustion appliances capable of backdrafting (i.e. naturally vented or atmospheric chimneys) within the exterior shell of the house, outside-air inlets may be omitted.

- G. The outside-air source shall be located at least 3 feet from exhaust vents and to minimize drawing outdoor pollutants and excessive outdoor noise inside during operation.
 - H. The outside-air source shall limit excessive airflows during normal operation and have a weather protection hood and maximum 1/4" screen-mesh, or as approved.
2. Unbalanced Non-Heat-Recovery Ventilation-Continuous Operation Option
- A. This system shall consist of a continuously-operating fan to exhaust air at a minimum rate of 25 cfm for the kitchen, and 20 cfm for each bathroom, with a maximum rate of 0.5 ACH. One exhaust fan shall be installed in the kitchen and one in each bathroom to provide spot ventilation. An integrated spot and whole-house fan is acceptable if spot ventilation is also provided for the kitchen and for the bathrooms.
 - B. The exhaust-air pickup in the kitchen shall not be over the kitchen range.
 - C. If the exhaust flow from each kitchen and bathroom is not measured, the rated fan capacity shall exceed the required flow rate by a minimum of 15 cfm.
 - D. The continuous ventilation fan(s) shall be wired to an existing circuit or to the electrical service panel.
 - E. The outside-air inlet and source requirements shall be the same as Sections 114.105, 114.130, 114.135, and 114.140.
3. Balanced Flow Non-Heat Recovery Ventilation-Continuous Operation Option. Balanced flow non-heat-recovery air exchange units shall:
- A. have fans capable of providing the intake and exhaust airflow rates in Specification O.1.C at 0-25 inches of water gauge as determined by HVI 916;
 - B. provide complete isolation of the intake and exhaust air;
 - C. have UL approval of all electrical components;
 - D. have outside-air inlets in all living areas and bedrooms, positioned so-as-to avoid drafts; and
 - E. be installed according to the manufacturers instructions.
4. Air-to-Air Heat Exchanger Option. Air-to-air heat exchangers shall:
- A. Provide the ventilation rates in Specification O.1.C;
 - B. have a minimum sensible heat recovery efficiency of 65 percent at 117 cfm and 32°F for homes larger than 1300 ft.2 and 55 percent at 64 cfm and 32°F for houses of 1300 ft2 or less as certified by the Home Ventilation Institute (HVI);
 - C. have a filter on the upstream side of the heat exchanger in both the intake and exhaust airstreams;
 - D. provide protection against ice buildup that does not disable the unit during freezing weather; and
 - E. be installed according to manufacturer's instructions.
5. Other mechanical ventilation systems meeting the Northwest Energy Efficient Manufactured Housing (NEEM) specifications may be used if approved by Bonneville.

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