

PUD Participating Installer Agreement Checklist

Please use the below checklist to ensure that your Participating Installer Application packet is complete and ready for submission. *Incomplete applications will be denied.*

Contract

- Two PUD Installer Agreements with original signatures [in blue ink](#). Note: upon approval of your application, you will receive a fully-executed original agreement.

Insurance Documentation

- Commercial General Liability and Copy of endorsement naming Clallam County PUD as an additional insured attached to the Certificate of Insurance.
- Policy includes: “Ten-day notice before cancellation” language.

Insurance Amounts

- Automobile insurance with limits of no less than \$1,000,000 combined single limit per accident for bodily injury and property damage.
- Commercial General Liability Insurance of \$1,000,000 combined single limit per occurrence and \$2,000,000 per aggregate.

Bonding

- Evidence of \$6,000 assurance bonding or other performance security for work performed under this agreement. ***The bond should name only the PUD and is for PUD programs only.***
- Bonding company must have A or better rating.

Miscellaneous

- Litigation and Liens form
- List of references
- List of all products, material, components, their manufacturer, and methods of application.
 - Heat Pump Installers - ACCA certification or NWPPA/NEEI

Primary Contact Person:

I certify that I have attached all of the above documents and that they are accurate and complete.

(Signature in blue ink) Title: _____

(Print Name) Date: _____ Phone: _____

Company: _____

LITIGATION AND LIENS

The undersigned hereby certify that the following is a complete list of all litigation involving work performed under the undersigned's Contractor's License to which the undersigned was a party during the preceding three (3) years:

CAPTION OF CASE **COUNTY OF LITIGATION** **FILING DATE OF CASE**

The undersigned further certifies that the following is a complete list of all liens, currently outstanding involving work performed by the undersigned under the undersigned's Contractor's License:

DATE OF LIEN FILING **AMOUNT OF LIEN** **COUNTY WHICH FILED**

Dated this _____ day of _____, 20_____

Owner

Name of Company

INSTALLER AGREEMENT

PARTIES:

This Agreement is executed on _____, 20____ by Public Utility District No. 1 of Clallam County (the District) and _____ (Installer), License No. _____. The parties agree as follows:

1. Term of Agreement

This Agreement shall be effective upon the date of execution and continue in effect until terminated pursuant to Section 14.

2. Purpose of Agreement

The Installer acknowledges that this Agreement is executed for the benefit of the Owner/ Authorized Agent who participates in the Public Utility District No. 1 of Clallam County (District) conservation programs. Copies of the Bid Sheet/Notice to Proceed, when signed by the Owner/ Authorized Agent, shall expressly incorporate the terms of the Agreement.

3. Exhibits and Attachments

Exhibit A (General Program and Material Specifications), Exhibit B (Bidding Standards and Invoice Procedures), Exhibit C (Site Built Home Weatherization Specifications), Exhibit D (Manufactured Home Weatherization Specifications), Exhibit E (Performance Tested Comfort Systems[®] Air Source Heat Pump System Installation Specifications), Exhibit F (Performance Tested Comfort Systems[®] Duct Program Standards and Testing Procedures), Exhibit G (Performance Tested Comfort Systems[®] - Geothermal Heat Pump Design and Installation Standards), Attachment 1 to Exhibits C, D and E, and Attachment 2 to Exhibit E are hereby made a part of the Agreement.

4. Participating Installer List

Subject to conditions of Sections 5, 9c, 12 and 13, the above-named Installer shall be listed by the District as one of a number of Installers willing to supply and install appropriate insulation and/or other conservation measures in the homes/facilities of certain Owners/Authorized Agents in the District "service territory", using materials/methods set forth in applicable exhibits and standards and codes.

The Installer understands and agrees that this is not an exclusive commitment to the Installer by the District. It is further understood and agreed that, as part of the Program, the District intends to sign Agreements similar to this one with a number of Installers. Nothing in this Agreement shall constitute a commitment by the District that any Owner/Authorized Agent will select the Installer for any work.

The District reserves the right in its sole discretion to remove an Installer's name from the Participating Installer list whenever the District deems such action to be in the best interests of its customers and/or the maintenance and integrity of its Conservation Program.

5. Installer Qualifications

To be included in the "Participating Installer List", an installer must meet the following criteria:

- (a) The Installer shall be an independent contractor in all work performed under this Agreement.

- (b) The Installer has not previously been disqualified from participating in Bonneville Power Administration or District conservation programs.
- (c) The Installer is a duly licensed contractor licensed to perform a specific type of work that is the subject of this Agreement in the State of Washington.
- (d) The Installer possesses such additional licenses or certifications to install conservation measures as may be required by local, state or Federal law.
- (e) The Installer shall supply the District with a written and signed statement, on the attached Litigation and Liens form, listing all litigation involving work performed under its contractor's license to which the Installer has been a party during the preceding three years and all liens currently outstanding involving work performed by the Installer under its contractor's license. The information shall be used by the District's Board of Commissioners to determine contracting risk for the protection of the owner/authorized agent, the District and the Program. Upon review of this information, the District's Board of Commissioners may refuse to qualify the Installer and refuse to allow the Installer to be included in the District's "Participating Installer List."
- (f) The Installer declares that the following insurance and bonding requirements have been met and/or exceeded and will be maintained for the duration of Program participation:
 - (1) A Certificate of Insurance evidencing:
 - a. Automobile Liability insurance with limits no less than \$1,000,000 combined single limit per accident for bodily injury and property damage.
 - b. Commercial General Liability insurance written on an occurrence basis with limits no less than \$1,000,000 combined single limit per occurrence and \$2,000,000 aggregate for personal injury, bodily injury and property damage.
 - c. Worker's compensation insurance, as required by law, covering all Installer employees who perform any of the obligations of the Installer under this Agreement.
 - (2) Deductible or self-insured retention payments shall be the sole responsibility of the Installer.
 - (3) The District shall be named as an additional insured on the Commercial General Liability Insurance policy, with respect to work performed by or on behalf of the Installer, and a copy of the endorsement naming the District as additional insured shall be attached to the Certificate of Insurance. The District reserves the right to review a certified copy of all required insurance policies in the Installer's office.
 - (4) The Installer's insurance shall contain a clause stating that coverage shall apply separately to each insured against whom claim is made or suit is brought, except with respects to the limits of the insurer's liability.
 - (5) All policies of insurance carried by the Installer will provide that notice will be given to the District 10 days before cancellation.
 - (6) If any employer/employee is not subject to the worker's compensation laws of Washington, then the Installer shall voluntarily obtain insurance to the same extent as would be required if the employer or employee were subject to worker's compensation laws.
 - a. The Installer promises to make available upon the District's or Owner/Authorized Agent's request, verifiable evidence of the insurance coverage, license, and certifications set out above for whom work is performed upon request.

- b. The Installer will provide that the insurer will notify the District, in writing, prior to any cancellation of policy or change in insurance coverage.
- (7) The Installer will not be eligible to submit bids or to receive awards for work under this Agreement, until such time as the bonding requirements of this Section are satisfied. The Installer shall provide to the District verifiable evidence that:
 - a. the Installer possesses assurance bonding or other performance security as may be authorized by the District of not less than the minimum amount of \$6,000.00 for work performed under this Agreement.
 - b. The surety company providing the installer's bond must have an A or better Best rating.
- (8) The Installer shall submit to the District a list of all products, material, components, and methods of application intended for use under this Agreement. Where required by the District, the Installer shall provide documentation of independent laboratory tests verifying that a product meets Program Specifications. Written acceptance by the District shall be required of all products and methods of applications prior to their use. Written acceptance shall be conditional upon the terms outlined in the specific conservation Program Specifications and applicable exhibits as now or hereafter amended.
 - a. The Installer shall warrant materials and labor as provided in the Conservation Program Specifications and Exhibits A, B, C, D, E, F, G and Attachment No. 1 and No. 2, as now or hereafter amended.
- (9) The Installer shall provide the District with references to be used in determining the Installer's ability to perform work under this Agreement. The reference may include, but is not limited to, credit agencies, banks, former or current customers, former or current weatherization programs, and other contracting or subcontracting parties or firms.

6. Bidding Procedures and Obligations

(a) Installer Bidding

The Installer agrees that as part of the bidding process, an on-site appraisal of the home/facility will be completed. The bid submitted will be for work that complies with the Program Specifications and Exhibits A, B, C, D, E, and Attachment No. 1, if applicable. The type of heating system installed in the home/facility, the existing type of heat and the approximate year the home/facility was constructed will be noted on the bid form. For the Residential Weatherization Program the Installer shall complete the District Bid Form and submit it to the Owner/Authorized Agent.

(b) Installer Obligations

- (1) It is the Installer's responsibility to check the building/facility for structural damage, clearances, access, and to verify content of the bid (i.e. square footage/dimensions, ventilation, existing conditions, and number of fixtures/equipment to be retrofitted).
- (2) The Installer shall incur all liability of financial loss where:
 - a. Installation is stopped or postponed due to structural damage or deterioration.
 - b. Ineligible measures are installed or measures do not comply with District/BPA specifications.
 - c. The home/facility is ineligible for the program (i.e. the home/building must be electrically heated and served by the PUD with electricity to be eligible for the weatherization programs).

7. Performance

(a) Licenses and Permits:

The Installer shall, without additional expense to the District or the Owner/Authorized Agent, obtain all licenses and permits required for the performance of the work. The Installer shall complete all work as specified on the Bid Sheet or Notice to Proceed.

(b) Homeowner/Installer Additional Agreements:

The Installer acknowledges that any work performed in addition to or at greater cost than that specified on the Bid or in the Program specifications is not covered by the Agreement. Such work shall be performed only pursuant to a separate agreement between the Owner/Authorized Agent and Installer. The Installer acknowledges that such separate agreement does not give rise to any obligations on the part of the Conservation Program or the District to provide the Owner/Authorized Agent with funds in addition to the amount agreed on previously.

(c) Subcontractors:

The Installer shall be fully responsible to the District and the Homeowner for acts and omissions of subcontractors or their agents and employees. Nothing contained herein shall create any contract between the subcontractor and the District or the Owner/Authorized Agent.

(d) Payment of Subcontractors:

The Installer shall promptly pay all subcontractors employed by the Installer to perform work under this Agreement.

(e) Liens on Property:

The Installer agrees that no lien will be placed upon the property of the Owner/Authorized Agents prior to the District's determination that work performed meets Program Specifications and applicable Exhibits and Attachments.

8. Indemnification

The Installer shall save harmless and indemnify the United States, the Department of Energy, BPA, All Conservation and Heat Pump Programs, the District and the Owner/Authorized Agent and their officers, agents, representatives, and employees from all claims, loss, damage, actions, causes of action, expense and/or liability, including court costs and reasonable attorneys fees, resulting from, brought for, or on account of any personal injury, property damage, or breach of contract received or sustained by any person, persons, or property growing out of, occurring, or attributable to any work performed under or related to this Agreement, arising out of or in any way connected with the Installer's failure to perform any of its obligations under this Agreement or from the negligence or other wrongful acts of the Installer or its employees or agents.

9. Payment for Work

(a) Inspection:

The District shall inspect work performed under the Agreement within fifteen working days of receiving the Installer's invoice and all required paperwork for completed measures unless the

District is unable to obtain access within this time. Conditional payment will be considered if the District is unable to gain access for the inspection within the fifteen working day period.

(b) Work Completed Satisfactorily:

The District shall pay the Installer from available Program funds within 60 days of the receipt of the Installer's invoice for any satisfactorily completed measures. The District shall find work to be satisfactorily completed if it conforms to Program specifications, generally accepted commercial practices and the conditions and terms of this Agreement and any applicable Bid Sheet or Notice to Proceed. It is agreed that the District's inspection of the work performed, approval of the work performed, and any payment made shall not bar the Owner/Authorized Agent, the District, BPA or Conservation Program from utilizing their rights to demand completion of work if it is subsequently discovered that the work has not been performed satisfactorily. It is further agreed that such inspections, approval, or payment shall not release the Installer from its indemnification or warrant responsibilities under this Agreement.

(c) Work Completed Unsatisfactorily:

- (1) If the work is completed unsatisfactorily, the District or its representative shall initiate the completion procedure by forwarding a written report indicating the measures not conforming to installation specifications, notifying the Installer to correct the deficiencies. Reinspection, to determine whether the correction has occurred, shall be performed on the basis of, but shall not be limited to, the original inspection of work completed.
- (2) The District shall withhold payment to the Installer until material or work deficiencies are corrected and all measures installed in conjunction with the *Bid or Notice to Proceed* conform to Program Specifications.
- (3) Furthermore, at the end of every month, the District will evaluate the Installer's completed jobs, noting the number of jobs requiring callbacks. If the District determines that the Installer is unable or unwilling to complete the awarded work, the District will remove the Installer from the "Participating Installer List" and may:
 - a. contact the installer's bonding company or other listed performance security company to make claim on that portion of the Installer's performance bond needed to complete the work; or
 - b. contract with a third party to complete the work and deduct the cost of completing the work from the amount owed the Installer and/or from the Installer's performance security bond, and/or from any other amounts due the Installer in conjunction with other work performed under the terms of this Agreement.
- (4) If the work has been completed and the Installer has been paid, following the notification procedures listed above, the District may seek corrective action in conjunction with the Installer Warranties provided under the terms of this Agreement, and make a claim on the Installer's performance security bond, or other amounts due the Installer to satisfactorily complete or correct the work if the Installer does not satisfactorily repair the deficiencies.

10. Contract Work Hours and Safety Standards

In the event that this Agreement is subject to the Contract Work Hours and Safety Standards Act, 40 USC §§3701-3708 (hereafter, the "CWHSSA"), then

- (a) the Installer or any subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall not require or permit any laborer or mechanic,

in any work week in which the laborer or mechanic is employed on that work, to work more than 40 hours in that work week, except as provided in the CWHSSA; and

(b) when a violation of clause (a) occurs, the Installer and any subcontractor responsible for the violation are liable

(1) to the affected employee(s) for the employee's/employees' unpaid wages; and

(2) to the United States Government or to the appropriate agency or instrumentality of the United States Government to the extent that any of the aforementioned is a party to this Agreement for liquidated damages to be computed for each individual employed as a laborer or mechanic in violation of this chapter and equal to \$10 for each calendar day on which the individual was required or permitted to work in excess of the standard work week without payment of the overtime wages required by the CWHSSA.

(c) In any event, the Installer and any subcontractors must comply with all Federal and State laws and regulations relating to employment.

11. Amendment

This Agreement may be amended in either of the following ways:

(a) by mutual written agreement of the parties; or

(b) the District may propose an amendment by giving 30 days written notice to the Installer of its intention to do so. If the District does not receive a written objection to the amendment from the Installer within that 30-day period, this Agreement shall be considered amended at the end of the 30-day period in accordance with the terms of the notice given. If the District receives a timely written notice of objection, the District, may, at its option, either (1) withdraw the proposed amendment by written notice; or (2) give the Installer 30 day's written notice of termination of this Agreement as provided in paragraph 14(a).

12. Probation

The District shall have the option of limiting an Installer to five projects at \$15,000.00 in total bid price (whichever is less) during the Installer's first six months of participation in the Program.

13. Suspension for Overdue Work

The District shall have the option of suspending an Installer from the "Participating Installer List" when work is not consistently completed within 60 days after receiving the Bid Sheet or Notice to Proceed.

14. Termination of Agreement

The District may terminate this Agreement:

(a) by giving the Installer 30 days written notice of termination,

(1) immediately upon Installer's loss of assurance bonding, liability insurance, or required state license,

(2) immediately upon notice to the Installer if the District determines that:

a. pursuant to Section 9, the Installer is performing work unsatisfactorily; or

- b. the Installer has received rebates, kickbacks, or provided any Homeowner with free services in exchange for the right to perform work specified on the Bid Sheet/Notice to Proceed.

INSTALLER

UTILITY

**PUBLIC UTILITY DISTRICT #1
OF CLALLAM COUNTY**

BY: _____

BY: _____

TITLE: _____

TITLE: _____

DATE: _____

DATE: _____

Contractor Agreement

Legend of Attachments

Exhibit A - General Program and Material Specifications

Exhibit B - Bidding Standards and Invoice Procedures

Exhibit C - Site Built Home Weatherization Specifications

Exhibit D - Mobile Home Weatherization Specifications

Exhibit E - Performance Tested Comfort Systems[®] Air Source Heat
Pump System Installation Specifications

Exhibit F - Performance Tested Comfort Systems[®] Duct Program
Standards and Testing Procedures

Exhibit G - Performance Tested Comfort Systems[®] Geothermal Heat
Pump Design and Installation Standards

Attachment 1 to Exhibits C, D and E

Attachment 2 to Exhibit E

Exhibit A
GENERAL PROGRAM AND MATERIALS SPECIFICATIONS

1. General Program Specifications

- (a) 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:
- (1) 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;
 - (2) 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
 - (3) 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.
- (b) Definitions – For purposes of this specification, the following definitions apply. All other applicable definitions can be found in the main body of this Agreement.
- (1) 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 Manufactured Home.
 - (2) 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.
- (c) The Utility shall be responsible for determining weatherization Measures eligible to be installed in each Residence per this specification.
- (d) All weatherization shall be completed in a manner that will provide a safe, permanent, effective, and Workmanlike installation.
- (e) 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:
- (1) address of the Residence;
 - (2) date of Installation;
 - (3) name and Address of Installer;
 - (4) the estimated R-value of any existing insulation;

- (5) the amount, R-value, depth and type (including product name) of insulation installed by the Installer;
 - (6) final R-value of insulation; and
 - (7) area of the space (in square feet) insulated.
- (f) 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.
 - (g) 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.
 - (h) 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.
 - (i) 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.
 - (j) Site-built additions shall be weatherized at the same time as the Manufactured Home, using the Site Built specifications for the component.
 - (k) 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 firebox opening.

2. General Material Specifications

- (a) 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.
- (b) Where written acceptance of materials, components, or products is required, the intent, unless otherwise stated in the specification or the acceptance, is that once accepted by the Utility or Bonneville for one installation, the material, component or product shall be acceptable for all similar installations without resubmittal to the Utility or Bonneville except as noted above in Specification 1(a) above.
- (c) 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.
- (d) Materials damaged in shipment or in assembly shall not be used.
- (e) 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.
- (f) 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

EXHIBIT B
BIDDING STANDARDS AND INVOICE PROCEDURES
CONSERVATION PROGRAM

1. Bidding Standards

- (a) The District shall not be obligated to accept any bid, or any part thereof, that is considered excessive in terms of average Program costs, nor to accept a bid from the Installer if the Installer is not in compliance with the Environmental Protection Agency's "Lead-Based Paint Renovation, Repair, and Painting Program," when the rules of that program are applicable to the installation.
- (b) The Installer shall separately identify, on the Bid Sheet/Notice to Proceed, any unusual (but necessary) costs that affect the price in providing a safe, permanent, effective and workmanlike weatherization installation.
- (c) The Installer should note on the Bid Sheet/Notice to Proceed the items that are not included in the bid. An example would be if interior trim were not included. If necessary, these items can be noted on a separate sheet and attached to the bid.
- (d) The Installer shall indicate in writing on the Bid Sheet/Notice to Proceed the types of materials to be used, brand names, methods of installation, identification of special problems and anything else which would minimize misunderstandings.

Note: To maintain the District's accounting standards, bids will be reviewed for computation errors before any Agreement is made. Unless an Installer has submitted to the District a "Bid Correction Authorization," the bid will be considered unacceptable if in error.

2. Invoicing Procedures

- (a) All invoices shall include the bid/file number (when applicable), Owner/Authorized Agent name and address, invoice amount and type of conservation measure installed.
- (b) Invoices shall also include any installer warranty, insulation certificate or manufacturers warranty.
- (c) Heat Pump invoices shall show a bid total to include the tax, less the rebate amount.

Exhibit C
SITE BUILT WEATHERIZATION SPECIFICATIONS

1. SITE BUILT - ATTIC INSULATION

1. General Material Specifications (Exhibit A) shall be followed, in addition to this Section A.
2. Ceilings shall be insulated to a minimum of R-49 or the highest R-value approaching R-49 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 Section F – Unfinished Wall Insulation, 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 C – 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 weather-stripped.
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 D – 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 District 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, non-rotating 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 A.11 through A.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.

B. SITE BUILT - UNDERFLOOR INSULATION

- 1. General Material Specifications (Exhibit A) shall be followed, in addition to this Section B.
- 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 weather-stripped with appropriate materials.

4. All exposed uninsulated ducts located in the crawlspace shall be insulated as specified in Section C “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 D “Site Built 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)

C. SITE BUILT - HVAC DUCT INSULATION

1. General Material Specifications (Exhibit A) shall be followed, in addition to this Section C.
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 C.7. below.
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.

D. SITE BUILT - HYDRONIC AND WATER PIPE INSULATION

1. General Material Specifications (Exhibit A) shall be followed, in addition to this Section D.
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 District 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.

E. SITE BUILT - PRIME WINDOW, SLIDING GLASS DOOR, AND FRENCH DOOR REPLACEMENTS

1. General Material Specifications (Exhibit A) shall be followed, in addition to this Section E.
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.
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. has 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 Exhibit D, Section D. “Manufactured Home – Mechanical Ventilation” shall be installed in all manufactured homes.

F. SITE BUILT WALL INSULATION

1. General Material Specifications (Exhibit A) shall be followed, in addition to this Section F.
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 ½” deep or greater with 1” or less of existing insulation; or
 2. less than 3 ½” 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 the 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 non-combustible insulation (per ASTM E-136) shall be installed in wall cavities adjoining fireplace 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.

Exhibit D
MANUFACTURED HOME WEATHERIZATION SPECIFICATIONS

1. Manufactured Home – Ceiling and Roof Insulation

- (a) General Material Specifications (Exhibit A) shall be followed, in addition to the following Section 1 of Exhibit D.
- (b) Ceiling Cavities
 - (1) 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.
 - (2) 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.
 - (3) All penetrations through the ceiling shall be sealed before ceiling cavities are insulated.
 - (4) If the ceiling cavity contains a non-ducted return-air system, the return-air system shall be eliminated as described in paragraph 3(h) below.
- (c) Exterior Roof Surfaces
 - (1) 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.
 - (2) Roof drainage systems shall function properly after weatherization has been installed.
 - (3) Weatherproof roof coverings shall be applied directly over the insulation.
 - (4) All penetrations through the roof covering and all joints between the roof covering and vertical surfaces (e.g. walls, chimneys, etc.) shall be flashed.
 - (5) Other methods of installing exterior roof insulation shall be approved by the Contractor in writing prior to beginning the work.
- (d) Ramada Roofs
 - (1) A ramada roof is a free standing (self supporting) covering over a Manufactured Home.
 - (2) The ramada roof shall be joined to the Manufactured Home to create an enclosed attic cavity. The ramada roof shall be weatherproof and be joined to prevent the entry of birds, animals, etc.
 - (3) The attic cavity shall meet the ventilation requirements of the site-built specifications.
 - (4) All exhaust-fan ducts, plumbing vent stacks, etc. shall extend outside & have proper termination.
 - (5) All heat producing fixtures shall be protected according to site-built weatherization specifications.
 - (6) The original roof cap of the Manufactured 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.
 - (7) All penetrations through the ceiling shall be sealed before the insulation is installed.

- (e) A mechanical ventilation system meeting the requirements of Section 4 “Manufactured Home – Mechanical Ventilation” shall be installed in all homes.
- (f) The District 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 District shall document the type of verification in the Consumer's permanent file.
- (g) 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.

2. Manufactured Home - Underfloors

- (a) General Material Specifications (Exhibit A) shall be followed, in addition to the following Section 2 of Exhibit D.
- (b) 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 paragraph 3(h) below.
- (c) All plumbing penetrations through the floor (e.g., bathtubs, clothes washers, sinks, etc.) shall be sealed before underfloor insulation is installed.
- (d) 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.
- (e) 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.
- (f) 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.
- (g) 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.
- (h) 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 Manufactured Home when skirting exists.
- (i) All water drains, including condensate drains from air conditioning equipment, shall be extended outside the crawl space.
- (j) All water pipes that have not been insulated by the floor insulation shall be insulated to at least R-3 for freeze protection. Water-pipe insulation shall be installed according to Section 7.
- (k) 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.

- (l) 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.
- (m) 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.
- (n) 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.
- (o) 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 Manufactured 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.
 - (1) 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.
 - (2) 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)
- (p) All HVAC ductwork, including plenums, shall be repaired, sealed and properly supported, according to Section 3 “Manufactured Home – HVAC Ducts”, before underfloor insulation is installed.
- (q) A mechanical ventilation system meeting the requirements of Section 4 “Manufactured Home – Mechanical Ventilation” shall be installed in all homes.
- (r). Water pipes that have not been covered by underfloor insulation shall be insulated according to Section 7 “Manufactured Home - Hydronic and Water Pipe Insulation”.
- (s) The District 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 District shall document the type of verification in the Consumer's permanent file.

3. Manufactured Home – HVAC Ducts

- (a) General Material Specifications (Exhibit A) shall be followed, in addition to the following Section 3 of Exhibit D.
- (b) 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.

- (c) Any portion of an HVAC duct that extends beyond the last register shall be sealed.
- (d) 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.
- (e) 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.
- (f) 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
- (g) Where clearances permit, crossover ducts shall be supported above ground by strapping or blocking.
- (h) If a non-ducted 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.
- (i) If bellyboard/rodent barrier has been removed and batt insulation is installed in the floor, all HVAC ducts, boots and plenums (except flexible crossover ducts) shall be wrapped with R-11 insulation.

4. Manufactured Home – Mechanical Ventilation

- (a) Non-Heat-Recovery Ventilation - Intermittent Operation Option
 - (1) 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.
 - (2) 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.
 - (3) 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.
 - a. **Performance Path:** The minimum measured airflow capacity shall be either 0.35 air-changes per hour (ACH) or those listed below:

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.

- b. **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.

- (4) 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 which allows occupants to turn the fan on or off, and to set the fan to operate a minimum of 8 hours per day.
- (5) The ventilation fan shall be wired to both the manual spot-ventilation switch in the bathroom and to a time clock.
- (6) 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.

- (7) 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 use.
- (8) 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.

(b) Unbalanced Non-Heat-Recovery Ventilation-Continuous Operation Option

- (1) 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.
- (2) The exhaust-air pickup in the kitchen shall not be over the kitchen range.
- (3) 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.
- (4) The continuous ventilation fan(s) shall be wired to an existing circuit or to the electrical service panel.
- (5) The outside-air inlet and source requirements shall be the same as paragraphs 4(a)(6), 4(a)(7) and 4(a)(8) above.

- (c) **Balanced Flow Non-Heat Recovery Ventilation-Continuous Operation Option.** Balanced flow non-heat-recovery air exchange units shall:
 - (1) have fans capable of providing the intake and exhaust airflow rates in paragraph 4(a)(3) above at 0-25 inches of water gauge as determined by HVI 916;
 - (2) provide complete isolation of the intake and exhaust air;
 - (3) have UL approval of all electrical components;
 - (4) have outside-air inlets in all living areas and bedrooms, positioned to avoid drafts; and
 - (5) be installed according to the manufacturers' instructions.
- (d) **Air-to-Air Heat Exchanger Option.** Air-to-air heat exchangers shall:
 - (1) Provide the ventilation rates per paragraph 4(a)(3);
 - (2) 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);
 - (3) have a filter on the upstream side in both the intake and exhaust airstreams;
 - (4) provide protection against ice buildup; prevent malfunctions during freezing weather; and
 - (5) be installed according to manufacturer's instructions.
- (e) Other mechanical ventilation systems meeting the Northwest Energy Efficient Manufactured Housing (NEEM) specifications may be used if approved by Bonneville.

5. Manufactured Home - Prime Window, Sliding Glass Door, And French Door Replacements

- (a) General Material Specifications (Exhibit A) shall be followed, in addition to the following Section 5 of Exhibit D.
- (b) Eligible measures include:
 - (1) replacement of prime windows with NFRC certified products;
 - (2) replacement of patio doors (French or Sliding) with NFRC certified products.
- (c) 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.
- (d) 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.

- (e) Any installation that results in increased window area, including garden windows, shall not be allowed under this Program.
- (f) No windows shall have exposed burrs, sharp corners or other potential hazardous condition that could be encountered by occupants during normal use.
- (g) 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.
- (h) Safety glass shall be used under the following conditions:
 - (1) Glazing in entrance doors;
 - (2) Glazing in fixed and sliding panels of sliding doors and panels in swinging doors other than wardrobe doors;
 - (3) 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;
 - (5) Glazing in an individual fixed or operable panel other than those covered by paragraph 5(h)(3) above that meet ALL of the following conditions:
 - a. has an exposed area of an individual pane greater than 9 square feet;
 - b. has an exposed bottom edge less than 18 inches above the floor;
 - c. has an exposed top edge greater than 36 inches above the floor; and,
 - d. has one or more walking surfaces within 36 inches horizontally of the plane of the glazing.
 - (7) 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.
 - (6) 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.
- (i) 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).
- (j) Retrofitted vertically-opening prime windows shall not free fall. They shall be designed to hold the sash secure and level in ventilating positions
- (k) Security latches are required on all prime window replacements.
- (l) 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.

- (m) A mechanical ventilation system meeting the requirements of Section 4. “Manufactured Home – Mechanical Ventilation” shall be installed in all manufactured homes.

7. Manufactured Home - Hydronic And Water Pipe Insulation

- (a) General Material Specifications (Exhibit A) shall be followed, in addition to the following Section 7 of Exhibit D.
- (b) Pipe insulation shall be installed to minimum R-values determined according to the following:
 - (1) 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.
 - (2) 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.
 - (3) 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.
- (c) The piping shall be free from water leaks and properly secured to support the weight of the piping and insulation.
- (d) 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 District and be appropriate for the pipe size intended to be insulated.
- (e) 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.
- (f) Insulation shall be firmly secured to the piping system using adhesive, tape, or plastic or galvanized wire ties.
- (g) All slits and joints in the material shall be sealed on hydronic heating system pipes.
- (h) 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.
- (i) Pipe insulation shall meet the following provisions:
 - (1) Pipe insulation materials shall be comprised of mineral fiber, elastomers, urethanes, isocyanurates, or other suitable materials;

- (2) 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;
- (3) 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
- (4) 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.
- (j) 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.
- (k) 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.

Exhibit E
Performance Tested Comfort Systems® Air Source Heat Pump System Installation
Specifications

1. Introduction

(a) “Should and Shall” will be interpreted as follows:

- (1) Where shall or shall not is used for a provision, that provision is mandatory if compliance with the standard is claimed.
- (2) Where should is used it will indicate provisions which are not mandatory but which are desirable as good practice.

2 New Equipment Requirements

(a) Approved Manufacturer

Equipment shall be manufactured by a company appearing in the ARI Unitary Directory.

(b) Ratings

Heat pump equipment shall meet the performance, safety, and rating requirements as given in the latest revision of Air Conditioning and Refrigeration Institute (ARI) Standard 240. Units shall be listed by Underwriters’ Laboratories, or equal, and shall display the ARI symbol of certification.

(c) Performance

Air Source Heat Pumps shall have an HSPF rating of not less than 8.5 and SEER ratings of not less than 14.0, as certified by ARI.

(d) Protective Devices

Equipment should be provided with a crankcase heater and a liquid-line filter drier. Delay timers to protect against damage from short cycling of the compressor and compressor motor start-assist kits shall be installed when recommended by the manufacturer. The compressor shall be protected from abnormal operating pressures, temperatures, and loss of refrigerant by suitable pressure or temperature overload devices.

If a low ambient temperature compressor cutout option is installed, it shall not cutout the compressor at temperatures above 0°F.

To prevent floodback of liquid refrigerant to the compressor, a suction line accumulator shall be installed, unless not recommended by the manufacturer.

3. Participating Installer Requirements

(a) Training

Participating Installer shall be responsible for the technical competence and qualifications of all salespeople, installers, and service mechanics. These personnel should participate annually in at least one manufacturer's training session on heat pump application, installation, or service or receive equivalent training. At least one fourth of all the Participating Installer's installers should be Refrigeration Service Engineers Society (RSES) or North American Technical Excellence (NATE) heat pump certified or have equivalent certification. At least one System Installer or Technician on each HVAC Contractor job shall be certified in Air Conditioning Contractors of America (ACCA) Manual D. System Designers shall be certified in ACCA Manual D and Manual J.

Alternately, duct design, heat pump sizing, and installations may be certified by the utility if the utility has staff that is certified in ACCA's Manual D and Manual J.

(b) Certification

Each heat pump system installed shall be certified as a "PTCS Commissioned Heat Pump." This requires testing and documentation of auxiliary heat controls (Section 4.4), airflow across indoor coil (Section 6.3), and refrigerant charge (Section 5.4) by an RTF approved PTCS Service Provider certified "Heat Pump Technician."

Where heat pump systems are installed in houses with a substantial amount of ductwork in unconditioned space, the duct system shall be certified as a "PTCS Duct System." This requires duct testing and documentation (Section 6.2.2) by an RTF approved PTCS Service Provider certified "Duct Technician" and may require sealing.

Applicable heat pump commissioning and duct system PTCS certifications shall be submitted to the utility. The utility shall maintain record of certifications and make the records available to BPA, the RTF, or the RTF approved PTCS Service Provider upon request.

(c) New System Warranty

The participating Installer shall provide to the consumer in writing the manufacturer's warranty. Heat pump equipment shall be warranted by the manufacturer against defects in material and workmanship for a minimum of 5 years from the date of start-up of the equipment. In addition, the compressor shall be warranted by the manufacturer against defects in material and workmanship for a minimum of five years from the date of start-up. Warranties shall cover parts and labor. Participating Installers may offer to consumers the manufacturer's extended warranty or service agreement to comply with the warranty requirements. This warranty should not be considered to cover equipment failure caused by failure to perform normal maintenance, abuse, or external causes beyond the control of the installing Participating Installer.

(d) Consumer Instruction

Participating Installer shall instruct the consumer in proper operation and maintenance of the heat pump system. Participating Installer shall provide the consumer with the manufacturer's owner's manual, demonstrate filter replacement (or cleaning), and demonstrate the operation of all indoor thermostat controls and indicator lights to the consumer. Participating Installer shall explain to the consumer the different operating modes of the heat pump system (e.g., heating, emergency heat,

defrost, and the effects of obstructing registers). All this information shall be provided in an operation manual given to the owner.

4. New Equipment Selection

(a) Heating and Cooling Calculations

- (1) Heating loss and cooling gain calculations shall be made using 70°F indoor design temperature for heating and 75°F for cooling.
- (2) The recommended ASHRAE winter design temperature and cooling design temperature for the nearest weather station representative of the installation shall be used.
- (3) The recommended method and form for calculations is available in the Air Conditioning Contractors of America (ACCA) Manual J. Alternate computer or manual methods of calculating heating and cooling loads may be used if approved in advance by the utility.
- (4) Component U-values and F-values used in the heat loss and heat gain coefficients shall reflect the actual construction of the building and be generally consistent with those found in ACCA Manual J 7th Edition, or later.
- (5) A copy of the whole house heating and cooling load calculations shall be submitted to the utility. The utility shall hold the calculations on file and make them available to BPA, the RTF, or the RTF approved PTCS Service Provider upon request.
- (6) An infiltration rate of 0.5 or 0.8 air changes per hour shall be used for houses built in or after 1980 or before 1980, respectively, in sizing calculations unless a house (de)pressurization test has been performed and an estimate is made using the result.
- (7) Where available, the results of duct pressurization testing shall be used to estimate the duct system efficiency used in sizing calculations. If a duct pressurization test has not been performed on the house, a default duct system loss of 25 percent shall be used. Exception: If the air handler and all ductwork are within the thermal envelope of the house, 0 percent shall be used as the duct system loss in sizing calculations.

(b) Heat Pump System Sizing

The heat pump system shall be sized using either of the following methods, rounding up or down to the nearest 6,000 Btu/hr capacity at ARI rating conditions:

1. Heat pumps shall be sized using a 30°F Balance Point.
2. Heat pumps shall be sized in accordance with the sizing method specified by the utility.

However, in no case shall the Balance Point used for sizing be higher than 35°F. A Balance Point Worksheet shall be submitted to the utility. The utility shall hold the Balance Point Worksheet on file and make it available to BPA, the RTF, or the RTF approved PTCS Service Provider upon request.

(c) Auxiliary Heat Sizing

Installed auxiliary heat capacity shall not exceed 125 percent of the heating design load.

(d) Control of Auxiliary Heat

New system installations and systems serviced in accordance with PTCS specifications shall employ control strategies that minimize the unnecessary use of auxiliary heat. In all systems, auxiliary heat shall not operate during a first stage heating call (unless system is switched to emergency heat). Auxiliary heat shall be controlled in the following manner depending on system type:

- (1) For systems with a single stage of compression and for systems with multiple stages of compression but without supply air temperature sensor control: Auxiliary heat shall be controlled in such a manner that it does not engage when the outdoor air temperature is above 35°F, except when supplemental heating is required during a defrost cycle or when emergency heating is required during a refrigeration cycle failure. Exception: If the minimum setting available for auxiliary cutout on the indoor thermostat is 40°F, 40°F may be used.
- (2) For systems with a single stage of compression and the option of supply air temperature sensor control, supply air temperature sensor shall not be allowed to bring on auxiliary heat when the outdoor air temperature is above 35°F, except when supplemental heating is required during a defrost cycle or when emergency heating is required during a refrigeration cycle failure.
- (3) For systems with multiple stages of compression and supply air temperature sensor control:
 - a. Auxiliary heat shall be controlled in such a manner that it engages only after all stages of compression have been engaged and the supply air temperature falls below 85° F, OR
 - b. If the staging temperature is set higher than 85°F, the system shall be equipped with an outdoor thermostat or equivalent control that prevents auxiliary heat from operating when outdoor temperatures are above 35°F, except when supplemental heating is required during a defrost cycle or when emergency heating is required during a refrigeration cycle failure.
- (4) Method of controlling auxiliary heat shall be documented by the certified heat pump Technician and submitted to the RTF-approved PTCS Service Provider.

5. **New Equipment Installation**

(a) Access

Equipment shall be located to allow easy service access and adequate working space for servicing any component without removal of piping, duct work, or other permanently installed fixtures. Special care shall be taken in locating components which require frequent attention, such as filters.

(b) Location and Support of Indoor Units

Indoor units shall be located to permit smooth duct transitions and shall be adequately supported or placed in a suitable platform in accordance with manufacturer's instructions and recommendations.

(c) Location and Support of Outdoor Units

Outdoor units shall be located to avoid restrictions in the outdoor airstream. Units shall be mounted on an adequate, solid, secure pad which provides proper drainage and prevents a buildup of water, snow, or ice. A minimum clearance shall be provided as per manufacturer's instructions and recommendations. In any installation there shall be a minimum of 3 inches of free and clear area under the outdoor coil drainage area. Condensate shall not drain onto areas where ice formation may create a hazard (e.g., walkways).

(d) Refrigerant Charge

- (1) Technician shall follow manufacturer's guidelines when charging a new system and make any needed adjustments for non-standard line set lengths or mismatched coils.
- (2) Technician shall perform a refrigerant charge verification test on all systems installed or serviced in accordance with PTCS specifications. Refrigerant charge testing shall include at least one of the following:
 - a. discharge and (if needed) suction pressure(s) compared to manufacturer's table of expected pressures at various outdoor and indoor temperatures
 - b. heat pump system capacity in heating mode compared to expected capacity at outdoor conditions
 - c. superheat, subcooling, or (Lennox) Approach temperature compared to manufacturer's targets

Refrigerant charge test shall be performed and documented using one of the following:

- a. Proctor Engineering's CheckMe® program
 - b. Honeywell's ACRx hand tool
 - c. "PTCS Heat Pump Startup Form".
 - d. other approved Performance Tested Comfort Systems methods
- (3) Results from refrigerant charge test or documentation of refrigerant charge shall be submitted to the RTF-approved PTCS Service Provider.

6. Duct Work

(a) Design Requirements

This section applies to all new duct work, including the addition of duct systems to existing housing or significant alterations to existing duct systems. All new duct work (including the addition of duct systems to existing housing) should be designed and installed in accordance with recommended practice as outlined in Air Conditioning Contractors of America (ACCA) Manual G, "Selection of Distribution Systems"; Manual E, "Room Air Distribution Consideration" and Manual D, "Residential Duct Design and Equipment Selection" or Sheet Metal and Air Conditioning Contractors National Association (SMACNA) "HVAC Duct System Design" or American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) handbooks. Installation of balancing dampers is recommended in order to easily adjust distribution of air to rooms.

(1) Flex Duct

Flex duct shall not be used for main supply trunks in crawl spaces or areas that could be subject to physical damage from normal occupant activities, weather or animals. When flex duct is used for main trunks or run outs the size shall be determined by using the “Wire Helix Flexible Duct” scale on an ACCA Duct Sizing Slide Rule, or equivalent and all other requirements in Section 6.0 of these specifications shall be met.

(2) Building Cavities and Ducts

In newly installed ductwork, building cavities shall not be used as ducts to convey return or supply air.

(3) Static Losses

Supply and return ducts shall be designed on the basis of not more than 0.10 and 0.08 inches loss per 100 feet, respectively. Supply and Return Ducts shall be designed so that the total system static pressure does not exceed the available static pressure provided by the air handler at design CFM. Flex duct shall be supported in a manner that does not create restrictions in air flow and located to minimize bending.

(4) Maximum Velocities

Velocity shall not create unacceptable noise levels and return air shall be sufficient size to meet requirements of installed systems. New duct work shall be designed so air velocities do not exceed the following:

Supply Ducts

Main Ducts	900 FPM
Branch Ducts	600 FPM
Supply Outlet Face Velocity	700 FPM
Return Grills Face Velocity	500 FPM
Filter Grille Face Velocity	300 FPM

(5) Duct Connections

All new and all readily 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.

(6) Zonal Pressure Relief

In new system construction, sufficient return pathways shall be provided between axial zones (e.g. bedrooms) and the main body of the dwelling. Return pathways include return ducts, pass-through grilles, pressure-relief ducts, or similar devices. Return pathways should limit absolute pressurization of axial zones to 3 Pa or less with reference to the main body of the house when the system is operating at maximum system airflow, tested with all doors closed. (That is, axial zone

must be within ± 3 Pa of main body of house with air handler operating at maximum system airflow.)

(b) Duct Installation

(1) Insulation

- a. All newly installed rigid ducts and plenums and accessible uninsulated existing rigid ductwork outside the heated space shall be insulated to an installed value of at least R-8. A vapor barrier meeting a flame spread rating of 25 or less and smoke developed rating of 50 or less (in accordance with ASTM E-84) shall be installed on the outside surface of the insulation.
- b. All newly installed flexible HVAC ducts outside the heated space shall have an Air Diffusion Council (ADC) certified minimum R-value of R-8.
- c. All newly installed HVAC ducts routed within exterior wall cavities shall be insulated to a minimum installed value of R-8 between the duct and the exterior wall sheathing.
- d. All duct insulation shall be installed and supported using mechanical fasteners such as permanent plastic straps or nylon twine. Tape is not a mechanical fastener. Approved tape may be used at insulation seams to provide a continuous barrier.

(1) Air Tightness – Where a substantial amount of ductwork is in unconditioned space, duct air tightness shall be certified by a PTCS Certified Duct Technician to meet PTCS standards and duct test results recorded and submitted to an RTF approved PTCS Service Provider.

- a. Duct leakage in new construction shall not exceed 0.06 CFM50 x floor area served by the system (in square feet), or 75 CFM50, whichever is greater when tested in accordance with the PTCS duct leakage measurement protocol for “Total Leakage Testing” or “Leakage Testing to Exterior.” If the air handler is located completely within conditioned space, it is not required to be in place during the test. If the air handler is located in unconditioned space, and it is not in place during the test, the leakage limit shall be decreased to 0.04 x floor area served by the system (in square feet) or 50 CFM50, whichever is greater.
- b. Duct leakage in existing homes with new ducts shall not exceed 0.10 CFM50 x floor area served by the system (in square feet), or 75 CFM50, whichever is greater.
- c. Duct leakage in existing homes with existing ducts shall not exceed 0.10 CFM50 x floor area (in square feet) served by the system; or it shall be documented that a 50 percent reduction* in leakage to the exterior has been achieved by comparing duct leakage to the outside before and after sealing when tested in accordance with the PTCS duct leakage measurement protocol for “Leakage Testing to Exterior.”

Exception: Where return ducts are inaccessible, compliance with either 0.10 CFM50 x floor area or a 50 percent reduction in leakage to the exterior (whichever is less) may be accomplished by testing the supply side only.

- d. Duct leakage in manufactured homes shall either:

- i. not exceed 100 CFM50 for single wide homes or 150 CFM50 for double wide or larger homes; or
- ii. be documented to have experienced a 50 percent reduction in leakage to the outside by comparing duct leakage to the outside before and after sealing.

(c) System Air Flow

- (1) All existing ductwork shall be inspected by the HVAC Contractor for conditions which will affect the efficiency or proper operation of the new heat pump system. It is the Participating Installer's responsibility to ensure existing ductwork is compatible with the equipment that is installed.
- (2) The air distribution system design and installation shall be such that air flow across the indoor coil is as specified in the heat pump manufacturer's literature, or is between 350 and 425 cubic feet per minute (CFM) per 12,000 BTU/hr output at ARI rating conditions if the manufacturer's literature is not specific.
- (3) After installation and start-up, total airflow in the heat pump mode (in cubic feet per minute, or CFM) across the heat pump coil shall be measured using a TrueFlow plate or using duct pressurization fan matching method per plate or fan manufacturer's instructions. This shall be reported to the RTF approved PTCS Service Provider using the "PTCS Heat Pump Startup Form".
- (4) The total external static pressure acting on the system air handler shall be tested with approved instruments and recorded at time of startup and submitted to the RTF approved PTCS Service Provider using the "PTCS Heat Pump Startup Form" or RTF approved equivalent form. A measured external static pressure of more than 0.8" (200 Pa) should cause installer to consider taking corrective measures with system ductwork.

7. Filters

(a) Location

Air filters shall be installed in the return air system in a location that will be easily accessible to the user for filter servicing and in a position where all return air and outside air will pass through the filters before crossing the indoor coil. Filters should not be installed in crawl spaces or attics.

(b) Type and Size

Filter types and sizes shall meet the standard manufacturer's instructions and recommendations. Filters and/or air cleaners that are not an integral part of the equipment and selected by the manufacturer shall be accepted if the total CFM is within the range as specified by the manufacturer. Any filter that exceeds 0.22 inches pressure drop as installed shall not be allowed.

8. Refrigerant Piping

This section applies to new piping and repairs made to existing piping.

(a) Materials

Field-supplied refrigerant piping shall be clean, dehydrated, and sealed Types K and L seamless copper tubing or the manufacturer's pre-charged tubing. Fittings shall be wrought copper. Field supplied tubing shall be evacuated to 500 microns and purged and pressure tested as per manufacturer's recommendation; soft solders shall not be permitted.

(a) Sizing

To maintain oil return to the compressor and avoid inefficiency and capacity loss, refrigeration piping or refrigeration line set shall be sized and installed in accordance with the manufacturer's instructions and recommendations. Piping between the two sections of split units shall not exceed the manufacturer's maximum recommended length, horizontally or vertically, and shall be run parallel to building lines and in a straight and workmanlike manner to prevent oil traps.

(b) Support

Refrigerant piping shall be properly supported in accordance with manufacturer's specifications, ARI, and IMC (International Mechanical Code).

(c) Penetrations

Refrigerant piping passing through openings in the unit cabinet or the building structure shall be installed to prevent wear or sound generation due to contact with the cabinet or building structure. All penetrations shall be properly sealed.

(d) Insulation

Suction lines shall be insulated with a minimum of 1/2-inch-thick continuous closed-cell foam rubber. Where insulation is exposed to the elements, it should have a weatherproof covering. Vapor and liquid lines shall be separated so that heat exchange does not take place. Factory insulated pre-charged lines will be accepted.

(e) Exposed Piping

All refrigerant piping exposed to possible damage from foot traffic around or near an outdoor unit shall be protected or buried in PVC or other corrosion-resistant pipe, in accordance with the manufacturer's instructions, to prevent damage to piping or pipe insulation or injury to people, and to permit replacement if necessary.

(f) Leak Testing, Evacuation, and Charging

Factory, as well as field joints, shall be checked and any leaks found shall be repaired. Evacuation and charging shall be done in accordance with the manufacturer's instructions and recommendations.

9. Condensate Piping

(a) Manufacturer's Recommendations

Condensate drain piping shall meet IMC and should be copper, plastic, or other corrosion-resistant material.

(b) Drains

Condensate drain lines shall be trapped and run to an open drain or outside of the building foundation. Under no circumstances may condensate be drained into a crawl space or direct connected into a sewer line. When indoor units are located in attics, the installation should include a secondary drain pan to collect condensate when a problem exists in the primary drain line. The secondary drain pan should be connected to a drain line that will drip at a location that will draw attention to the problem in the primary drain line.

(c) Condensate Pump

Condensate drain lines shall be pitched in the direction of flow to prevent backup of overflow of water in the drain pan. If the indoor unit is lower than the floor drain or dry well, a condensate pump shall be installed to pump condensate to the level of the drain or dry well. An automatic control to shut down system in case of pump failure should be installed. A check valve shall be installed if pump is not equipped with one.

10. Electrical

(a) Field Wiring

All field wiring, line and low-voltage, shall comply with the manufacturer's recommendations, the National Electrical Code, and all local codes and ordinances.

11. Indoor Thermostats

(a) Installation

Indoor thermostats shall be located and installed according to the manufacturer's instructions and recommendations. Thermostats generally are installed 5 feet off the floor on an inside wall in the return airflow pattern, and where they are not in the sun or any other heat source at any time.

(b) Auxiliary Heat Indicator

Thermostat shall provide a visible indication when the auxiliary stage or emergency heat are operating.

(c) Heating and Cooling

Thermostats used for both heating and cooling shall have a manual changeover feature or heating/cooling lockout to prevent cross-cycling between heating and cooling.

(d) Emergency Heat Relay

All indoor thermostats shall include a manual selector switch to permit all supplemental heaters or the furnace to be energized under control of the indoor thermostat (with the compressor and outdoor thermostats bypassed).

12. Add-On Heat Pump To Gas, Propane Or Oil Furnace

(a) Indoor Coil

For an add-on heat pump, the indoor coil shall be installed in the downstream air from the heat exchanger according to the International Mechanical Code.

(b) Furnace Operation

The furnace shall lock out the heat pump when it operates on second-stage heat, unless heat pump manufacturer's special add-on heat pump control permits operation of both.

(c) Emergency Heat Operation

Emergency heat switch shall activate the furnace and bypass the heat pump.

Exhibit F
Performance Tested Comfort Systems[®] Duct Technical Specifications

1. Introduction and Scope

1.1. This document sets forth the specifications for duct sealing in according to the Performance Tested Comfort Systems (PTCS) Program.

2. **All Testing** shall be done by a PTCS Certified Technician or Inspector.

3. **Duct System Diagnostic Procedures:** One or both of the following tests shall be used to measure the duct leakage in a system, unless otherwise specified in this document.

3.1. **Total Duct Leakage Test** – According to the protocol set forth in the **PTCS Duct Testing Procedures**

3.2. **Duct Leakage to Exterior Test**– According to the protocol set forth in the **PTCS Duct Testing Procedures**

4. Sealing Materials and Duct Connections Definitions

4.1. Non-flex duct joints and connections shall be sealed with UL-181 listed mastic.

4.1.1. The application of mastic shall be done properly, according to manufacturer specifications.

4.1.2. Take offs and slip joints shall be mechanically secured with screws and sealed with mastic.

4.1.3. Where service access is necessary, only UL-181 listed foil tape shall be used. The furnace to plenum connection is also allowed to be sealed with UL-181 listed foil tape.

4.1.4. Cloth-backed duct tape shall not be used to seal, secure, or fasten ducts.

4.2. Flexible duct connections shall have the interior and exterior liners secured and air-sealed with nylon straps (Panduit or equivalent) and tightened with a manufacturer-approved tensioning tool. Steel band clamps with worm drive tension adjusters also are acceptable.

5. Duct Connecting and Sealing Applicability

5.1. All accessible portions of the duct system shall be inspected for signs of leakage and soundness of materials. For new duct systems, the entire duct system is considered to be accessible.

5.1.1. Accessible plenum connections and take-offs shall be exposed, properly connected and sealed.

5.1.2. Accessible wyes, elbows and other duct connections shall be exposed, properly connected and sealed when they are found to show signs of leakage or poor fit.

5.1.2.1.Exception: new duct systems shall have all connections between duct components properly connected and sealed.

5.1.3. Flexible duct connections that have properly secured exterior liners may be considered to have interior liners that are not accessible.

5.1.3.1.Exception: The inner liner on manufactured home crossover ducts shall be considered accessible.

5.2. Where a large section of duct insulation is removed, the insulation shall be re-installed and securely attached to the duct system. Recommended methods include the use of twine. Mastic will not effectively hold insulation in place.

6. Home and Duct System Types

6.1. **New Construction / New Ducts; Site or Manufactured Homes** – The home must be new construction and not have been occupied for more than 1 year.

6.1.1. The duct leakage in a new home shall not exceed 6% of the floor area served by the system (0.06 x SF CFM50) or 75 CFM50, whichever is greater, as measured according to the testing protocols identified in 3.1 and/or 3.2.

6.1.1.1. Exception 1- If the air handler is located completely within the conditioned space, it is not required to be in place during the test.

6.1.1.2. Exception 2- If the air handler is located in unconditioned space, it is not required to be in place during the test, the leakage limit shall be decreased to 4% of the floor area served by the system (0.04 x SF CFM50) or 50 CFM50, whichever is greater.

6.1.2. If a new airhandler is being installed, the total external static pressure acting on the system air handler should be tested with approved instruments and recorded at time of startup. A measured external static pressure of more than 0.8" (200 Pa) should cause installer to consider taking corrective measures with system ductwork.

6.2. Existing Home / New Ducts

6.2.1. In order to qualify as an existing home, it must be occupied for at least one year.

6.2.2. The air leakage of the duct system shall be measured before sealing the system, using either protocol identified in 3.1 and 3.2; and the **same** test shall be used to measure the leakage in the system after it is sealed.

- 6.2.2.1. If a new section is being added to an existing duct system, no pre-test is necessary; and the final test for the entire system shall not exceed 10% of the floor area served by the system (0.10 x SF CFM50) or 75 CFM50, whichever is greater.
- 6.2.3. In order to certify the home under PTCS, the leakage in the duct system after sealing shall not exceed 10% of the floor area served by the system (0.10 x SF CFM50) or 75 CFM50, whichever is greater.
- 6.2.4. A home which meets these standards without additional sealing may be certified.
- 6.2.5. If a new air handler is being installed, the total external static pressure acting on the system air handler should be tested with approved instruments and recorded at time of startup. A measured external static pressure of more than 0.8" (200 Pa) should cause installer to consider taking corrective measures with system ductwork.

6.3. Existing Home / Existing Ducts

- 6.3.1. In order to qualify as an existing home, it must be occupied for at least one year.
- 6.3.2. The air leakage of the duct system shall be measured before sealing the system, using the protocol identified in 3.2: **Duct Leakage to the Exterior**.
- 6.3.3. In order to qualify, the measured leakage of the system after sealing, using the same test method as above, shall meet either of the following criteria:
 - 6.3.3.1. It shall not exceed 10% of the floor area served by the system (0.10 x SF CFM50) **OR**
 - 6.3.3.2. The measured leakage in the system after sealing measures have been done shall show a reduction of at least 50%.
- 6.3.4. In cases where return ducts are inaccessible, compliance with 6.3.3.1 or 6.3.3.2 may be accomplished by performing the Duct Leakage to the Exterior test on the supply side only (using the more stringent of the two – whichever is less).

6.4. Existing Manufactured Homes

- 6.4.1. The air leakage of the duct system shall be measured before sealing the system using the protocol identified in 3.2: **Duct Leakage to the Exterior**.
- 6.4.2. In order to be eligible for certification, the duct system must have a measured leakage of 50 CFM50 or less for single section homes, plus an additional 30 CFM50 allowed for each additional section.
- 6.4.3. If compliance with 6.4.2 is not possible, then the duct system leakage, after the sealing measures have been performed, shall document a 50% reduction using the same test as in 6.4.1.

6.4.4. If the final tested leakage rate is greater than that specified in 6.4.2, the air-handler transition-to-trunk duct connection shall be sealed.

6.4.5. Regardless of qualifying path, all accessible components of the duct system shall be sealed, including the crossover takeoff-to-trunk duct connections and crossover-to-crossover takeoff connections.

7. Combustion Appliance Requirements (Does not apply if there is no combustion appliance)

7.1. Whenever there is a Combustion Appliance present in the house, garage, or other attached space, a UL listed, C-UL listed, or equivalent carbon monoxide alarm shall be installed in accordance with the carbon monoxide alarm manufacturer's instructions.

Exhibit G
Performance Tested Comfort Systems - Geothermal Heat Pump
Design and Installation Standards

1. Introduction

- (a) “Should and Shall” will be interpreted as follows:
 - (1) Where shall or shall not is used for a provision, that provision is mandatory if compliance with the standard is claimed.
 - (2) Where should is used it will indicate provisions which are not mandatory but which are desirable as good practice.

3. Participating Installer Requirements

- (a) System installer shall be an IGSHPA Accredited Installer. Exception: Proof of successful completion of an IGSHPA installer’s workshop and exam shall qualify in lieu of IGSHPA Accredited Installer certification.

4. New Equipment Selection

- (a) ARI-rated COP shall be no less than 3.3 for closed loop systems (GLHP) or no less than 3.6 for open loop systems (GWHP).
- (b) Systems should be designed and installed according to IGSHPA guidelines, manufacturer recommendations, and all local, state, and federal laws and ordinances.
- (c) Systems should be sized to meet no less than 100% of the design heating load.
- (b) All system components, including the ground loop, shall be warranted for a period of no less than 5 years.

5. New Equipment Installation

- (c) System shall be certified as a “PTCS Commissioned Heat Pump” by an RTF approved PTCS Service Provider certified “Heat Pump Technician”. For ground source heat pumps, this requires installations to meet section 4 (d) (Control of Auxiliary Heat) and section 6 (c) (System Air Flow) of *Exhibit E - Performance Tested Comfort Systems – Air-Source Heat Pump System Installation Specifications*. In addition, the technician shall test and document startup measurements using the “PTCS GSHP Startup Form”. (www.PTCSnw.com)
- (d) Duct systems shall meet the requirements of *Exhibit E - Performance Tested Comfort Systems – Air-Source Heat Pump System Installation Specifications*, section 6.

**PUBLIC UTILITY DISTRICT NO.1 OF CLALLAM COUNTY
WEATHERIZATION SPECIFICATIONS**

ATTACHMENT 1 TO EXHIBIT "C", "D" & "E"

This is an attachment to the Installer Agreement for clarifications or additions to the Residential Weatherization Program Specifications. They are as follows:

1. Site Built

- (a) The following are requirements for baffling of attic ventilation.
 - (1) Baffles shall be capable of permanently retaining and separating the insulation from the incoming air access. Baffles shall be stapled to the bottom of the joist/truss system and shall extend above the final insulation level.
 - (2) All soffit, eave or frieze openings shall be left free of any blockage by the insulation or other materials and such eave systems must remain effective following weatherization.
- (c) Attic venting: Replace the wording "or provided" with the following: Likewise, the net free ventilating area may be 1/300 provided a vapor barrier with a perm rating of 1.0 or less is present between the insulation and the upper surface of the ceiling throughout the attic space. Eave, soffit, or frieze vents, by themselves, shall not be considered as providing adequate "cross ventilation." Gable end vents shall not be used for lower ventilation. Any other methods other than stated above shall be put in writing and approved by the District/Residential Weatherization Program.
- (d) An Installer certificate shall be in place on all insulation jobs. The certificate shall be located at or very near the entrance to the attic or floor or attached to the door/cover. A list of information needed on the certificate can be found in the Exhibit A, Section 1, Paragraphs (e) (1) through (e)(7).
- (e) All new ducting material for bath/kitchen fans, dryer extensions, etc., shall be metal and meet the metal gage requirements.
- (f) An in-progress inspection shall be required in all attic spaces containing heat producing fixtures or chimney and wood stove flues referenced in Exhibit C, Section 1, paragraph (1)(n) and (1)(o). Failure to call for an in-progress inspection will cause the District to withdraw its share of the funding for the project.
- (g) Existing active whole house plenum heating systems shall not be converted into ventilated crawl spaces in this program to receive floor insulation.
- (h) Existing insulated rafter areas in attic spaces shall constitute an existing conditioned space and shall not be converted to a ventilated space receiving insulation.
- (i) If existing duct insulation is less than R-5, do one of the following options:
 - (1) Seal only exposed seams, connections and major air leaks and then insulate to R-11, or
 - (2) Remove existing insulation and perform a completed duct air seal. Then, insulate to R-11 with the homeowner paying the cost of insulating from R-0 to the existing R-value.

2. Manufactured Homes

- (a) Skirting shall be required on all manufactured homes receiving floor insulation or air sealing measures, at the homeowner's expense.
- (b) The following are the District's Prescriptive Method Specifications for Air Sealing:
- (1) All gaps, holes, joints and seams in HVAC ducts and plenums shall be sealed. This includes blocking off all ducts just beyond the last register, sealing all joints from the furnace to the plenum, the plenum to the main duct, the boots for each register to the main duct, the boots for each register to the floor. Seal all branch-duct to main-duct connections when necessary.
 - (2) All gaps and holes where HVAC ducts, plenums and registers penetrate the envelope shall be sealed.
 - (3) All plumbing penetrations, including those in water heater closets, shall be sealed. Place special emphasis on penetrations for bathtub, sink and clothes washer drains.
 - (4) All gaps between exhaust-fan ducts and the envelope, including those, for kitchen ranges, bathrooms and clothes dryers, shall be sealed. All exhaust ducts shall have functional, operable backdraft dampers.
 - (5) All gaps between the ceiling for swamp cooler ducts shall be sealed.
 - (6) The entire length of marriage lines and the joints for tip-outs, expandos and add-on rooms shall be sealed.
 - (7) All electrical penetrations, including the electrical service panel shall be sealed.
 - (8) All air bypasses in electrical/plumbing chases and around chimneys, flues, etc., except for single-wall metal flues, that penetrate floors and ceilings shall be sealed with 5/8-inch, Type-X sheet rock.
 - (9) Mastic for smaller holes and cracks, mastic with fiber reinforcing for larger holes and cracks shall be used to seal duct systems.
 - (10) Whenever an air seal is performed on the floor, whether or not the heating ducts are an eligible measure, the register boots shall be secured to the subfloor with screws and sealed. Also, all other exposed seams and major air leaks (sometimes indicated by discolored insulation) shall be sealed.
 - (11) Plumbing and electrical penetrations shall be sealed with a spray foam sealant or caulk.
 - (12) Sheet metal or aluminum and non-combustible sealant or 5/8" Type-X sheetrock and non-combustible sealant shall be used to seal next to masonry chimneys. All metal flues, single or double wall, shall not be sealed and sheet metal baffles shall be used to maintain a three inch air clearance to all insulating materials. Also, no baffles are required around masonry chimneys if non combustible insulation, tested to ASTM 136-82 is used.
 - (13) Ventilation fans may be covered with insulation if all holes and penetrations are sealed with a nonflammable sealant (Fans with heat producing heaters or lights are not included). This covering of fans was not previously permitted by the District.
- (c) For manufactured homes, attic ventilation baffles are not required. Lower vents can be blocked with insulation, if the attic has a vapor barrier and is vented at 1/300 not including the blocked venting.

**PUBLIC UTILITY DISTRICT NO.1 OF CLALLAM COUNTY
WEATHERIZATION SPECIFICATIONS**

**ATTACHMENT 2 TO EXHIBIT E - Performance Tested Comfort Systems® Air Source
Heat Pump System Installation Specifications**

The following is a clarification and/or addition to *Exhibit E* of the *Installer Agreement*:
Performance Tested Comfort Systems® Air Source Heat Pump System Installation
Specifications:

1. Duct Work: No new duct board shall be installed.