




BENTON RURAL ELECTRIC ASSOCIATION

402 7TH Street • P.O. BOX 1150 • PROSSER, WASHINGTON 99350 • 509/786-2913 • Fax: 509/786-0291

A Touchstone Energy® Cooperative 

Dear Contractor,

I am glad that you are interested in our heat pump rebate program.

In order for your customers to qualify for Benton REA's rebates they must be members of Benton REA and you must be an approved contractor in Benton REA's program. To be approved, complete and return to me the contractor agreement form included in this document.

Benton REA requires contractors to have Performance Tested Comfort Systems (PTCS) training as efficiency standards improve over time. If you need PTCS training, I can help you find it.

Included with this letter are the following documents:

- Contractor Agreement
- PTCS Air Source Heat Pump Installation Specifications
- PTCS Air Source Heat Pump Form
- PTCS Duct Sealing Specifications
- Benefits of Duct Sealing Brochure
- PTCS Duct Sealing Form
- PTCS Program Information Sheet
- Confirmation of Completion Form

Benton REA Member Rebates

| Current Heat Source | New Heat Source | Member Rebate |
|---------------------|---------------------------|---------------|
| Older Heat Pump | High-Efficiency Heat Pump | \$200 |
| Older Heat Pump | Variable Speed Heat Pump | \$400 |
| Electric Furnace | High-Efficiency Heat Pump | \$1,100 |
| Electric Furnace | Variable Speed Heat Pump | \$1,300 |

In order for the Benton REA member or the contractor to receive a rebate, I must first receive the completed corresponding forms (included in this packet of information) and a copy of your invoice to the customer.

Contractor Incentives

The Bonneville Power Administration has concluded that much of the potential energy savings expected by heat pump owners can be lost because the equipment installation isn't fully optimize. There are two basic reasons: (1) Controls and Commissioning-programmable thermostats are not set up to prevent inadvertent activation of backup (resistance) heat and equipment testing during installation could be more thorough, and (2) Ductwork in the crawl space and attic often leaks precious conditioned air to

areas outside the structure of the home which can dramatically increase the cost of heating and cooling the home.

Commissioning is required and duct sealing is strongly encouraged, therefore Benton REA will pay the following incentives to the contractor for these measures.

| Measure | Contractor Incentive |
|--------------------------|---|
| Commissioning & Controls | \$300 |
| Duct Testing/Sealing | \$250 – Stick Built Home \$200 – Manufactured Home |

These services require specific equipment. For commissioning, you'll need a TrueFlow grid to measure air flow through the equipment. Duct sealing requires a blower door and duct blaster. Contact me if you have questions about this equipment.

If your customers have questions, I am happy to explain how they improve the HVAC system. I can also help explain that the cost of sealing ducts can exceed the amount incentivized and that, in those cases, they should expect to be billed for the additional cost.

Heat Pump Loans

Benton REA offers loans to members who wish to install a new heat pump (among other efficiency upgrades). If your customers have questions, please have them visit www.bentonrea.org or talk to me.

Our heat pump rebate program is somewhat complicated, but we want to make it as smooth and hassle-free as possible. We look forward to working with you.

Sincerely,

Eric Miller
Energy Services - Benton REA
402 Seventh Street, Prosser WA, 99350
509-781-6751
emiller@bentonrea.org

Benton Rural Electric Association

BPA Heat Pump Program

Contractor Agreement

This simply indicates that the undersigned wishes to be listed as a Participating Partner in Benton REA's Heat Pump Program. It also indicates that, in order to continue to be listed as a Participating Partner, the Contractor will continue to perform work that demonstrates a "good faith effort" to adhere to the various provisions of the Heat Pump Program.

Company Name: _____

Contact Person: _____

Address: _____

E-Mail Address: _____

Phone: _____ Fax: _____

Contractor License Number: _____

Signature: _____
Authorized Company Representative

Date: _____

In order to participate in this program, PTCS certification is required. Please indicate below your means of achieving this requirement.

| | PTCS | |
|---|--------------------------|--------------------------|
| | Ducts | C&C |
| Currently have trained personnel: | <input type="checkbox"/> | <input type="checkbox"/> |
| Plan to have personnel trained immediately: | <input type="checkbox"/> | <input type="checkbox"/> |
| Will use a third party provider to do work: | <input type="checkbox"/> | <input type="checkbox"/> |

Name of Subcontractor: _____

PTCS Program Info Sheet

A Procedure Path

FILL IN ENTIRE GREEN & ORANGE SECTIONS

Job Summary

Date: _____

Home Owner: _____ Best Phone #: _____

Address: _____

Home Type: ☐ Site-built Home ☐ Manufactured Home

HVAC Company: _____

Contact: _____ Phone #: _____

HVAC Signature: _____

Duct sealing is no longer required but is definitely encouraged and rebates are available

☐ PTCS Path: ductwork is primarily ($\geq 30\%$) outside the conditioned space and, when tested, the ducts are leaky (more than 250 cfm50 or 15% of floor area*).

☐ Prescriptive: measure only available if $\geq 30\%$ of ducts are outside conditioned space.

*Manufactured homes, pre-leakage: ≥ 100 cfm50 for single wide plus 75 cfm per additional section

☐ Ducts Sealing:

Fix ductwork

File with PTCS Registry

Paperwork: This form, Invoice, PTCS Report

☐ Commissioning and Controls:

Install HP to PTCS requirements

File with PTCS registry

Provide all required paperwork

Summary of Options

| Paths | Eligibility Requirement | Single Family, New Const | Single Family, Existing | Manufactured Homes |
|---------------------------------------|----------------------------|--------------------------|-------------------------|--------------------|
| Duct Sealing (PTCS & Prescriptive) | Any ducted electric system | | \$250 | \$200 |
| Commissioning & Controls | Any new heat pump | \$300 | \$300 | \$300 |
| Both Ducts, C&C (Ducts Outside) | Any new heat pump | | \$550 | \$500 |

Old equipment: ☐ Elec. Wall Heaters ☐ Elec. Furnace ☐ Older Air Source HP ☐ Zonal or other

New equipment: ☐ Furnace ☐ <9 HSPF HP ☐ ≥ 9 HSPF HP ☐ VarSpeed HP

Tons: _____ CFM/Ton: _____ Sizing, Balance Point: _____ % of Ducts Outside: _____

Duct Sealing - Target Path: ☐ NA ☐ 10% of SqFt ☐ 50% cfm reduction ☐ New Ducts ☐ Prescriptive

Initial Leakage (cfm50): _____ Final Leakage (cfm50): _____

Registry #, Ducts: _____

Manual J Tech Name: _____ Registry #, C&C: _____

Duct Tech Name: _____ Tech ID#: _____

C&C Tech Name: _____ Tech ID#: _____

Requested amount and explanation: \$ _____

Forms Filed: ☐ PTCS Field Report(s) ☐ Loads ☐ Sizing ☐ AHRI ☐ Invoice ☐ This Form

Member Incentive: HP Upgrade is \$200 for ≥ 9.0 HSPF HP upgrade (\$400 for VS)

Conversion - Electric furnace to ≥ 9.0 HSPF HP is \$1100 (\$1300 for VS)

PTCS® Air Source Heat Pump Form (optional)

1) Enter all data on a mobile device or computer at ptcs.bpa.gov using the certified technician's account. This optional form can be filled out for later entry online. Issues entering data? Submit this form for entry:

- Customers of Bonneville Power Administration (BPA) utilities: email ResHVAC@bpa.gov, fax to 1.877.848.4074, or call 1.800.941.3867
- Customers of PGE or Pacific Power: email Residentialforms@energytrust.org or call 1.866.365.3526

2) Submit the Registry Installation Report (found online) and additional required documents to the customer utility. Unless requested by the utility, submission of this form is not required.

Site Information

| | | | | |
|---|----------------|---|------------------|----------|
| PTCS Tech # | PTCS Tech Name | Install Date | Electric Utility | |
| Installation Site Address | | Site City | Site State | Site Zip |
| Home Type: <input type="checkbox"/> Existing Site Built <input type="checkbox"/> New Construction Site Built <input type="checkbox"/> Manufactured: # of Sections <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 | | | | |
| Heated Area: Sq Ft | | Foundation Type (Site Built): <input type="checkbox"/> Crawlspace <input type="checkbox"/> Full Basement <input type="checkbox"/> Half Basement <input type="checkbox"/> Slab | | |
| Existing Heating System Being Replaced (If new home, indicate heating system installed): | | | | |
| <input type="checkbox"/> Electric Forced Air w/out AC <input type="checkbox"/> Electric Forced Air w/ AC <input type="checkbox"/> Electric Zonal <input type="checkbox"/> Air Source Heat Pump <input type="checkbox"/> Ground Source Heat Pump <input type="checkbox"/> Natural Gas Furnace (Gas Company: _____) <input type="checkbox"/> Other Non-Electric Space Heating: _____ | | | | |
| Back up Heat: <input type="checkbox"/> None <input type="checkbox"/> Electric Forced Air <input type="checkbox"/> Electric Zonal <input type="checkbox"/> Natural Gas Furnace <input type="checkbox"/> Non-Electric Space Heating | | | | |

New Heat Pump Equipment Data

*If less than 9.0 HSPF or 14 SEER, check with utility for requirements.

| | | | |
|----------------|--------------------|--|----------------------------|
| AHRI # | SEER* | HSPF* | Outdoor HP Capacity (tons) |
| Heat Pump Make | Outdoor HP Model # | <input type="checkbox"/> Non Variable Speed HP Compressor <input type="checkbox"/> Variable Speed HP Compressor | |
| | Indoor HP Model # | Balance Point? _____ Provide BP documentation to utility. | |

Did you perform all of your tests in Test Only/Check Charge mode? ☐ Yes ☐ No ☐ N/A

External Static Pressure Test

Check unit operating at full capacity unless conditions do not permit.

| | | |
|---|---------------------------|---|
| 1. Measure return static pressure 2. Measure supply plenum static pressure 3. Calculate external static pressure: add values in #1 and #2 values; ignore the minus sign | 1. Return Static Pressure | Units: <u>Use same units for TrueFlow test</u> <input type="checkbox"/> Pa <input type="checkbox"/> Inches H2O |
| | 2. Supply Static Pressure | 3. External Static Pressure |

TrueFlow Test

| | | | |
|--|-----------------------------------|--|--|
| 1. Measure NSOP (Normal System Operating Pressure) [A] 2. Check TrueFlow plate size and location 3. Measure TFSOP (Supply Pressure with TrueFlow Plate) [B] 4. Calculate Correction Factor [C] 5. Measure plate pressure 6. Enter Raw Flow CFM from tables [D] 7. Calculate Corrected Flow 8. Calculate CFM/ton | 1. NSOP [A] | 2a. Plate Size: <input type="checkbox"/> 14 <input type="checkbox"/> 20 | 2b. Plate location: <input type="checkbox"/> Air Handler <input type="checkbox"/> Return Grille |
| | 3. TFSOP [B] | 4. Correction Factor [C] from table or calculate $\sqrt{[A]/[B]}$ | |
| | 5. Plate Pressure | 6. Raw Flow CFM from tables [D] | |
| | 7. Corrected Flow CFM = [C] x [D] | 8. CFM/ton | |

Refrigerant Charge Check

Run unit for at least 15 minutes in compressor-only mode before taking readings.

| | |
|--|--|
| Outside Air Temp °F | Mode unit tested in: <input type="checkbox"/> Heating (if ≤ 65°F) <input type="checkbox"/> Cooling (if > 65°F) |
|--|--|

| Heating Mode (65°F or lower) | Cooling Mode (higher than 65°F) | Alternative Test Method |
|---------------------------------|---------------------------------|--|
| Supply Air (SA) Temp | Discharge Pressure | Specify method used |
| Return Air (RA) Temp | Discharge Temp [A] | Target |
| Temp Split (SA – RA) | Liquid Line Temp [B] | Test result |
| Expected Temp Split from table: | Sub cooling [A] – [B] | Meets specification? <input type="checkbox"/> Y <input type="checkbox"/> N |

Controls

| | | |
|---|-------------------------------|---|
| Compressor Low Ambient Lockout control (LAL) setting at 5° or less? <input type="checkbox"/> Yes <input type="checkbox"/> Not Installed/Disabled <input type="checkbox"/> Non-Electric Backup <input type="checkbox"/> No | | Auxiliary (strip) heat lockout has been set to: <input type="checkbox"/> 35°F <input type="checkbox"/> Below 35°F |
| HP Thermostat Make | HP Thermostat Model | |
| Is this a Multiple Capacity Compressor system? <input type="checkbox"/> Yes; The discharge air sensor control is used to control auxiliary heat and is set no higher than 85°F or, <input type="checkbox"/> Yes; The staging thermostat is set warmer than 85°F and the resistance heat cannot operate at temperatures above 35°F, or <input type="checkbox"/> No, this does not apply. | | |

Notes



Benton Rural Electric Association

Your Touchstone Energy® Cooperative



Heat Pump Confirmation of Completion

As a Benton REA member, I verify that this project has been completed satisfactorily at my residence by the following contractor:

(Name of Contractor)

(Main Contact)

Year my house was built: _____ Primary heating equipment is: ☐ Electric ☐ Other

Member Name (print): _____

Member Address: _____

E-Mail Address: _____

Daytime Phone: _____ Account #: _____

(Member Signature)

(Date)

My house is a:

- ☐ Conventional stick-frame house
- ☐ Manufactured home

I am installing a new HVAC system: ☐ Yes ☐ No

If so, the system I am replacing is an:

- ☐ Older Air-Source Heat Pump
- ☐ Electric Furnace
 - ☐ With central air conditioning
 - ☐ Without central air conditioning
- ☐ Zonal Heating (baseboard, wall heaters)
 - ☐ With central air conditioning
 - ☐ Without central air conditioning

My new system (if one is being installed) is a:

- ☐ Normal Efficiency Air-Source Heat Pump
- ☐ High Efficiency Air-Source Heat Pump
- ☐ Variable Speed Heat Pump
- ☐ Ductless Heat Pump
- ☐ Geothermal Heat Pump

The Contractor also performed:

- ☐ PTCS Duct Sealing
- ☐ PTCS Commissioning & Controls

My house has its ductwork (if any) primarily:

- ☐ In the crawlspace and/or attic
- ☐ Within the envelope of the home

Note: Programs change at the end of March and September – Rebates may change or discontinue at any time – please call Member Services (786-8265) to confirm.

PTCS® Duct Sealing Form (optional)

1) Enter all data on a mobile device or computer at ptcs.bpa.gov using the certified technician's account. This optional form can be filled out for later entry online. Issues entering data? Submit this form for entry:

- Customers of Bonneville Power Administration (BPA) utilities: email ResHVAC@bpa.gov, fax to 1.877.848.4074, or call 1.800.941.3867
- Customers of PGE or Pacific Power: email Residentialforms@energytrust.org or call 1.866.365.3526

2) Submit the Registry Installation Report (found online) and additional required documents to the customer utility.

Unless requested by the utility, submission of this form is not required.

Site Information

| | | | | |
|--|-----------------------|---|---------------------------------|------------------|
| PTCS Tech # | PTCS Tech Name | Install Date | Electric Utility | |
| Installation Site Address | | Site City | Site State | Site Zip |
| Home Type: <input type="checkbox"/> Existing Site Built <input type="checkbox"/> Manufactured: # of Sections <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 | | | Heated Area: _____ Sq Ft | |
| Foundation Type (Site Built): <input type="checkbox"/> Crawlspace <input type="checkbox"/> Full Basement <input type="checkbox"/> Half Basement <input type="checkbox"/> Slab | | | | |
| Existing Heating System: <input type="checkbox"/> Electric Forced Air w/out AC <input type="checkbox"/> Electric Forced Air w/ AC <input type="checkbox"/> Electric Zonal <input type="checkbox"/> Air Source Heat Pump <input type="checkbox"/> Ground Source Heat Pump <input type="checkbox"/> Natural Gas Furnace (Gas Company: _____) <input type="checkbox"/> Other Non-Electric Space Heating: _____ | | | | |
| Back up Heat: <input type="checkbox"/> None <input type="checkbox"/> Electric Forced Air <input type="checkbox"/> Electric Zonal <input type="checkbox"/> Natural Gas Furnace <input type="checkbox"/> Non-Electric Space Heating | | | | |
| Location of Duct Work. Ducts are considered to be in unconditioned space when they are in vented crawlspaces, attics, and unheated garages. Basements are considered conditioned space. The bellies of manufactured homes are considered accessible. | | | | |
| Are at least 30% of supply ducts in unconditioned space and accessible? <input type="checkbox"/> Y <input type="checkbox"/> N <i>If no, home does not qualify for duct sealing.</i> | | | | |
| Type of Ducts Sealed <i>Select one</i> | | <input type="checkbox"/> Seal Existing Ducts <input type="checkbox"/> New Ducts | # Supply | # Returns |

House Pressurization and Duct Blaster Tests

Work must be done to PTCS Duct Sealing Specification found at bpa.gov/goto/reshvac.

| | | | | | |
|--|---|---|---|--|--|
| Do either of these conditions apply? <input type="checkbox"/> Record Only (No duct sealing done) <input type="checkbox"/> PTCS Certification ONLY (Pre-test leakage below requirement) | | Testing Equipment Used: <input type="checkbox"/> Energy Conservatory <input type="checkbox"/> RetroTec <input type="checkbox"/> Other: _____ | | | |
| Duct Insulation (select one): <input type="checkbox"/> Ducts were not insulated OR <input type="checkbox"/> Existing duct insulation was re-installed OR <input type="checkbox"/> New insulation was installed | | | | | |
| House Pressurized (Blower Door) to: <input type="checkbox"/> +50Pa <input type="checkbox"/> Other _____ Pa | | Duct Blaster Location: <input type="checkbox"/> Return Grille <input type="checkbox"/> Other: _____ | | | |
| | | Pressure Tap Supply Register Location: | | | |
| <p><u>Duct Leakage Test:</u> DUCT BLASTER CFM READING with Duct Pressure at 0Pa with respect to house and Blower Door @ +50Pa.</p> <p><u>Duct Blaster Fan Pressure:</u> It is the fan pressure, NOT the house pressure. (Ex. Ring 1, 78 Pa Fan Pressure, 364 CFM)</p> <p>Note: CFM leakage is calculated in the online registry using the ring size and fan pressure.</p> | Pre-Test | Existing Home, Site Built | | Manufactured Home | |
| | | Pre-test Ring <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> Open <input type="checkbox"/> H <input type="checkbox"/> M <input type="checkbox"/> L | | <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> Open <input type="checkbox"/> H <input type="checkbox"/> M <input type="checkbox"/> L | |
| | | Duct Blaster Fan Pressure _____ Pa | | _____ Pa | |
| | | Duct Blaster CFM _____ CFM | | _____ CFM | |
| | | Pre-leakage Requirements <input type="checkbox"/> ≥ 250 CFM (>1667 sq ft) <input type="checkbox"/> ≥ 15% of home's sq ft | | <input type="checkbox"/> ≥ 100 CFM, Single Wide <input type="checkbox"/> ≥ 150 CFM, Double Wide <input type="checkbox"/> ≥ 225 CFM, Triple Wide | |
| | | Post-test Ring <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> Open <input type="checkbox"/> H <input type="checkbox"/> M <input type="checkbox"/> L | | <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> Open <input type="checkbox"/> H <input type="checkbox"/> M <input type="checkbox"/> L | |
| | | Duct Blaster Fan Pressure _____ Pa | | _____ Pa | |
| | | Duct Blaster CFM _____ CFM | | _____ CFM | |
| Post-Test | Leakage Reduction Requirements <input type="checkbox"/> ≤ 10% of home's sq ft <input type="checkbox"/> ≥ 50% Reduction | | <input type="checkbox"/> ≤ 50 CFM, Single Wide <input type="checkbox"/> ≤ 80 CFM, Double Wide <input type="checkbox"/> ≤ 110 CFM, Triple Wide <input type="checkbox"/> ≥ 50% Reduction | | |

Specification Requirements The duct sealing at this site meets program requirements including: repairs, metal ducts secured with screws, flex duct interior and exterior liners secured with nylon straps or steel band clamps, ducts are supported and off the ground, boots are mechanically fastened to floor/ceiling, plenum, main ducts, takeoffs and boots sealed, and a good faith effort was made to remove existing duct tape and cover with mastic. ☐ Y ☐ N

Combustion Appliance Zone (CAZ)

Check for common CAZ devices, such as fireplaces, wood stoves, gas furnaces, and gas water heaters.

Are there any combustion appliances in the home?

☐ Y ☐ N

Is there a UL-approved and functioning CO detector installed in the home? ☐ Y ☐ N

A carbon monoxide (CO) detector installed in the home is **required** in all cases where a sealed or non-sealed combustion appliance is located in a conditioned space or attached structure i.e. garage. RECOMMENDED CO detector specifications: UL 2034/CSA 6.19-01, digital display, peak CO memory and recall.

Notes

PTCS Air Source Heat Pump Installation Specification

1. Equipment Selection and Sizing

The new Air-Conditioning, Heating, and Refrigeration Institute (AHRI) rated air source heat pump system must be sized using a balance point of 30°F or less. To determine the balance point, the following specification must be used:

- A 70°F indoor design temperature for heating and 75°F for cooling load calculations using ASHRAE winter design temperature and cooling design temperature for the nearest weather station representative of the installation.
- U-values and F-values consistent with those found in Air Conditioning Contractors of America (ACCA) Manual J 8th Edition, or later.
- An infiltration rate of 0.8 air changes per hour for homes built before 1980 and 0.5 for homes built 1980 or later, unless a house (de)pressurization test has been performed and an estimate is made using the result. If a duct pressurization test has not been performed on the house, a default duct system loss of 25% shall be used.
Exception: If the air handler and all ductwork are within the thermal envelope of the house, 0% shall be used as the duct system loss in sizing calculations.

The recommended method and form for calculations is available in the ACCA Manual J. Alternate computer or manual methods of calculating heating and cooling loads may be used if approved in advance by the utility.

2. External Static Pressure

The total external static pressure acting on the system air handler must not exceed 0.8 inches of water (200 Pa).

3. Air Flow

Air flow across the indoor coil must be as specified in the heat pump manufacturer's documentation, or at least 325 to no more than 500 cubic feet per minute (CFM) per 12,000 Btu/hr output at AHRI rating conditions if the manufacturer's documentation is not specific. Approved measurement methods are using a TrueFlow plate or using the duct pressurization fan matching method per plate.

4. Refrigerant Charge

- Heating.** If the outdoor temperature is 65°F or less, test in heating mode after operating the heat pump for a recommended 15 minutes, if not specified by manufacturer, with auxiliary back-up heat off. Temperature change across the air handler indoor coil must be at or above the minimum temperature split shown in the R-410A Temperature Split Table (https://www.bpa.gov/EE/Sectors/Residential/Documents/HP_Temp_Split_Table.pdf).
- Cooling.** If the outdoor temperature is greater than 65°F, test in cooling mode after operating the heat pump for a recommended 15 minutes if not specified by manufacturer. The subcooling (discharge temp. – liquid line temp.) must meet manufacturer's documented requirements. See R-410A Pressure-temperature chart (https://www.bpa.gov/EE/Sectors/Residential/Documents/R-410A_Pressure_Temperature_Chart.pdf) for discharge pressures and corresponding temperatures.

Other alternative refrigerant measuring methods approved and documented by the manufacturer are also acceptable.

5. Controls

- Compressor Control.** If a low ambient temperature compressor cutout option is installed, it must not cut out the compressor at temperatures above 5°F.
- Auxiliary Heat Control.** Auxiliary heat must 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.

For constant speed systems with multiple stages of compression and supply air temperature sensor control, auxiliary heat shall be controlled in such a manner that it does not engage when the supply air temperature is above 85°F.



PTCS ASHP Installation Best Practices

The program recommends but does not require the following as Air Source Heat Pump installation best practices:

- Check with the local utility about any requirements they may have about sizing auxiliary heat.
- Make sure openings in the unit cabinet or building structure are properly sealed.



PTCS Duct Sealing Specification

Updated: April 1, 2015

Applicability: This specification outlines the requirements for repairing and sealing new or existing ductwork in existing single family homes and existing manufactured homes, heated with an electric forced air furnace or a heat pump.

Technician qualification: Performance Tested Comfort Systems (PTCS) Duct Sealing shall be performed by a technician certified in PTCS Duct Sealing, or an approved alternative (as listed in the [PTCS Program Requirements](#)), and technicians shall be listed as active in the [online registry](#).

Note: Sections A, B, and C reference the pre and post-test specification. Sections 1 – 9 are in alignment with the Prescriptive Duct Sealing Specification.

PTCS Duct Leakage Pre-Test Specifications

- A. Duct System Diagnostic Procedures:** One of the following tests shall be used to measure the duct leakage in a system, unless otherwise specified in this document.
 - A.1. **Duct Leakage to Exterior Test** (Appendix A)
 - A.2. **Duct Leakage to Exterior Supply Side Only Test** (Appendix B)
 - A.3. **Total Duct Leakage Test** (Appendix C)
- B. Home and Duct System Types**
 - B.1. Existing Home / New Ducts**
 - B.1.1. To be certified as PTCS, new ducts shall be sealed as they are installed and meet the post-test requirements as listed in C.1.
 - B.2. Existing Home / Existing Ducts**
 - B.2.1. The air leakage of the duct system shall be measured before sealing the system using the **Duct Leakage to Exterior Test** (Appendix A).
 - B.2.2. In order to certify the ducts as PTCS, the CFM leakage in the duct system before sealing shall be greater than or equal to 15% of the floor area if the home is less than 1667 square feet. If the home is greater than or equal to 1667 square feet, the duct leakage shall be greater than or equal to 250 CFM50.
 - B.2.3. In cases where return ducts are non-existent (building cavity return), panned joist, or inaccessible, the **Duct Leakage to Exterior Supply Side Only Test** (Appendix B) may be used to determine the duct leakage.
 - B.3. Existing Manufactured Homes**
 - B.3.1. The air leakage of the duct system shall be measured before sealing the system using the **Duct Leakage to Exterior Test** (Appendix A).
 - B.3.2. In order to certify the ducts as PTCS, the CFM leakage in the duct system before sealing shall be greater than or equal to 100 CFM50 for a single wide home, 150 CFM50 for a double wide home, or 225 CFM50 for a triple wide home.

Duct Sealing (Sections 1 - 9 align with the Prescriptive Duct Sealing Specification dated April 1, 2015)

- 1. Ducts in Unconditioned Space:** At least 30% of the supply ducts must be located in unconditioned space and are accessible. [*Exception: Where high operating pressure leaks are located in an unconditioned space, the system shall be eligible for duct sealing, even if less than 30% of the supply ducts are in unconditioned space. A high operating pressure leak is defined as any leak occurring on the main trunk line within 15 feet of the furnace, especially those at the furnace or plenum connection.*]
 - 1.1. For new duct systems, the entire duct system is considered to be accessible.
 - 1.2. Ducts in basements are considered to be in conditioned space; while vented crawlspaces, attics with floor insulation, and unheated garages are considered unconditioned.

- 1.3. The inner liner on manufactured home crossover ducts is considered accessible; while all other flexible duct connections, including those on single family homes, which have properly secured exterior liners, may be considered to have interior liners that are not accessible.
- 1.4. The belly of manufactured homes is considered accessible if a visual inspection via non-intrusive methods (mirrors, digital cameras etc.) identifies large holes/leaks.
- 1.5. The furnace to plenum connection is considered accessible.
- 2. Duct Insulation/Asbestos:** The presence of insulation alone shall not be considered a barrier to accessibility, unless the contractor suspects asbestos may be present. If at any time asbestos is suspected to be present, the contractor shall stop work immediately and notify the homeowner that the site requires professional assessment, and possibly remediation, before duct sealing work can be done.
- 3. Previously Sealed Ducts:** Ducts must not have been previously sealed through the Performance Tested Comfort Systems or BPA's Prescriptive Duct Sealing program unless a utility pre-inspection confirms that additional duct sealing is required.
- 4. Implementation Standards:** Installation must comply with all applicable codes.
- 5. Duct Repair**
 - 5.1. All accessible portions of the duct system shall be repaired and mechanically fastened, where needed.
 - 5.2. Inferior sections of duct—such as rusted, crushed, disconnected or sections otherwise ineffective—shall be repaired or replaced before duct sealing is performed.
 - 5.3. When there are large gaps in sheet metal or duct connections, repairs shall be made using sheet metal, sheet metal screws, and/or mastic with mesh-reinforcing tape. Gaps greater than 1/4 inch shall be reinforced using mesh-reinforcing tape before applying mastic.
 - 5.4. All metal ducts shall be secured using at least three sheet metal screws at each connection and an attempt be made to have them be equally distributed around the ducts.
 - 5.5. All flexible ducts shall be joined to a section of rigid duct of matching diameter, including locations where two separate sections of flex duct meet. Both the inner and outer lining shall be tightly fastened using a compression strap tightened with a tool designed for that purpose. Tape may remain as long as a compression strap is installed to maintain a permanent connection.
 - 5.6. In manufactured homes with two or more sections, defective or missing cross-over ducts shall be repaired or replaced.
- 6. Duct Support**
 - 6.1. All accessible portions of the duct system which require support shall be supported.
 - 6.2. To minimize the possibility of disconnection, flexible ducts shall be supported every 4 feet and within 3 feet of each connection to a rigid duct with straps that are not less than 1 1/2 inches wide each and that do not restrict airflow.
 - 6.3. Ducts shall be supported above the ground. When contact with the ground is unavoidable, a minimum of R-4 closed-cell rigid insulation shall be placed between the duct and the ground. This duct shall not come in contact with standing water.
- 7. Duct Sealing and Acceptable Materials**
 - 7.1. All accessible portions of the duct which require sealing shall be exposed and sealed with approved materials. The following are examples of sealing opportunities: Plenum; Air-handler cabinet to plenum; Plenum-to-take-off connections; Finger/dovetail joints; Branch T's, Y's and L's; Supply and Return Boots; Duct-to-duct connections; Gores on Adjustable Elbows; and End Caps.
 - 7.2. Loose tape shall be removed from rigid metal ducts prior to sealing. Secured tape that remains must be completely covered with mastic which shall extend at least 1/2 inch beyond the tape edge on either side and be at least 1/8 inch thick.

- 7.3. Non-flex duct joints, connections and seams shall be sealed with UL-181 listed mastic.
 - 7.3.1. The application of mastic shall be done according to manufacturer specifications.
 - 7.3.2. Take offs and crimped fitted joints shall be mechanically secured with screws and sealed with mastic. Non-leaking seams such as S-drives or snappies are exempt from being sealed with mastic.
 - 7.3.3. On the air handler, only foil or mastic HVAC tape labeled as meeting UL-181 standards may be used.
 - 7.3.4. Cloth-backed duct tape shall not be used to seal, secure, or fasten ducts.
 - 7.3.5. Boots shall be mechanically fastened to the subfloor and sealed with UL-181 mastic or UL-181 sealant.
- 7.4. 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 are also acceptable.
- 7.5. The return should be sealed if it is easily accessible and in unconditioned space.
- 7.6. End caps must be made of either sheet metal or a UL-181 approved rigid product.

8. Insulation

- 8.1. When duct insulation is removed, the insulation shall be re-installed and securely attached to the duct system using mechanical fasteners such as, permanent plastic straps, nylon twine or fastening material specified by the insulation manufacturer. Mastic will not effectively hold insulation in place.

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

- 9.1. 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 detector shall be installed.

PTCS Duct Leakage Post-Test Specifications

C. Home and Duct System Types

C.1. Existing Home / New Ducts

- C.1.1. The air leakage of the duct system shall be measured using either the **Duct Leakage to Exterior Test** (Appendix A) or the **Total Duct Leakage Test** (Appendix C).
- C.1.2. In order to certify the ducts as PTCS, the CFM 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.

C.2. Existing Home / Existing Ducts

- C.2.1. The air leakage of the duct system shall be measured after sealing using the same test method as the pre-test, the **Duct Leakage to Exterior Test** (Appendix A) or **Duct Leakage to Exterior Supply Side Only Test** (Appendix B).
- C.2.2. In order to certify the ducts as PTCS, the CFM 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** shall document a reduction of at least 50%.

C.3. Existing Manufactured Homes

- C.3.1. The air leakage of the duct system shall be measured after sealing using the same test method as the pre-test, the **Duct Leakage to Exterior Test** (Appendix A).
- C.3.2. In order to certify the ducts as PTCS, the CFM leakage in the duct system after sealing shall not exceed 50 CFM50 for a single wide home, 80 CFM50 for a double wide home, or 110 CFM50 for a triple wide home **OR** shall document a reduction of at least 50%.
- C.3.3. If the final tested leakage rate is greater than that specified in C.3.2., the air-handler transition-to-trunk duct connection shall be sealed.

Appendix A: Duct Leakage to Exterior Test

1. Install blower door with fan bringing air into house.
2. Turn OFF air handler, dryer, all fans and combustion equipment.
3. Tape off grilles/registers. Connect duct blaster hose to return grill.
4. Open all interior doors. Close all exterior doors and windows.
5. Connect hose as shown (house wrt outside on side A).
6. Manometer **MODE** should read PR/PR.

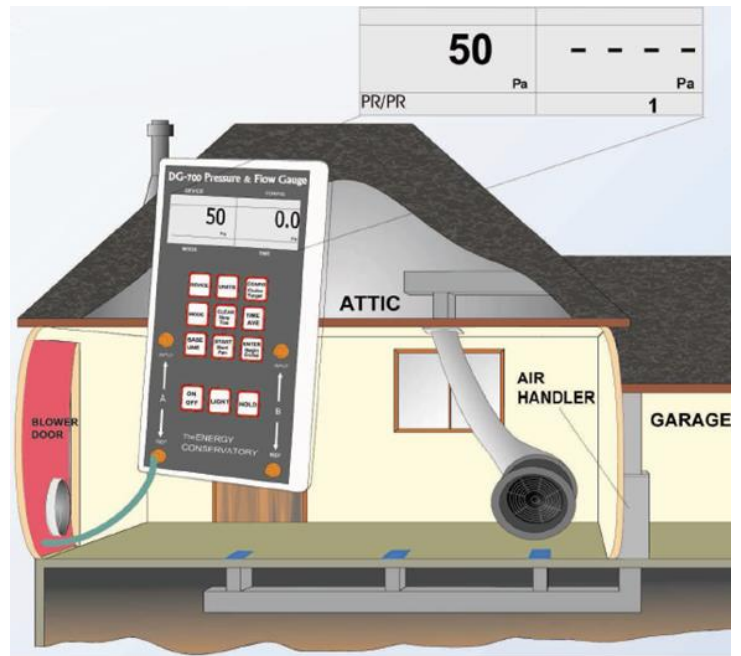


Figure 1: Duct Leakage to Exterior Test 1

7. Connect the manometer to Duct Blaster; side A to ducts (usually supply side) and side B to fan.
8. Configure manometer; **MODE:** PR/FL; **DEVICE:** DBA (if white) or DBB (if black); **TIME AVERAGE:** 1; **CONFIG:** ring you are using.
9. Turn on blower door, pressurize house to 50 Pascals (side A reading). Use cruise control if possible.
10. Pressurize the ducts (blowing air into the duct) until the pressure in the ducts side A reads 0 (with respect to the house – which means the ducts and house are both at 50 Pa with respect to outside).
11. Use the smallest ring possible to get 0 Pa. If you have to change the ring, be sure to reflect that in the manometer **CONFIG** setting.
12. Check blower door reading (house pressure wrt outside). Readjust to 50 Pa if necessary.
13. The CFM reading of the duct blaster is the leakage to outside at 50 Pa.

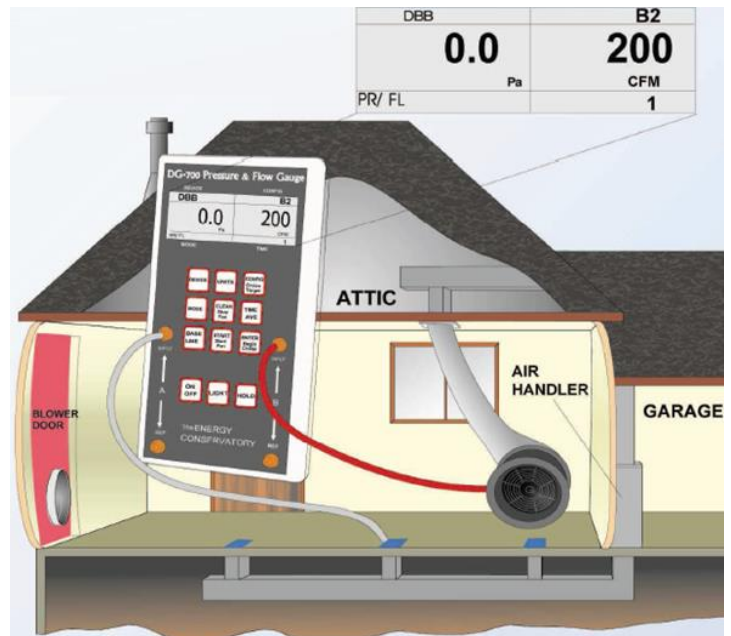


Figure 2: Duct Leakage to Exterior Test 2

Appendix B: Duct Leakage to Exterior Supply Side Only Test

1. Isolate the supply duct from the return duct using a cardboard block or other method, typically at the furnace, and only pressurize the supply ducts with the duct blaster.

Appendix C: Total Duct Leakage Test

1. Connect manometer to Duct Blaster; side A to ducts (usually supply side) and side B to fan.
2. Configure manometer; **MODE**: PR/FL; **DEVICE**: DBA (if white) or DBB (if black); **TIME AVERAGE**: 1; **CONFIG**: ring you are using.
3. Turn air handler and all combustion equipment off, interior doors open, and at least one window to exterior must be open.
4. Pressurize the ducts (blowing air into the ducts) until the pressure in the ducts side A reads 50 (with respect to the house).
5. Use the smallest ring possible to get to 50 Pa. If you have to change the ring, be sure to reflect that in the manometer CONFIG setting.
6. The CFM reading is the total leakage (leakage to outside plus leakage to the house) at 50 Pa.

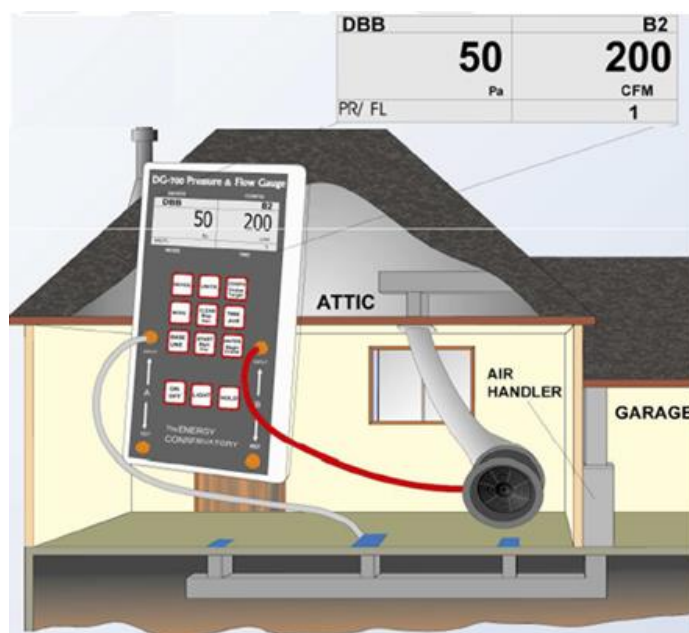


Figure 3: Total Duct Leakage Test

Washington State Energy Code Requirements



Did you know that testing ductwork in your house is now required by the Washington State Energy Code (WSEC) if you are repairing or replacing certain parts of your heating or cooling (HVAC) system?

Your HVAC contractor must test the ducts in your home and provide the results to you and the building official that issued your permit. Once you have the results, you can choose whether or not you want the contractor to seal your ducts.

Some houses are exempt from these requirements. If your house has any of the following, you do not have to test your ducts:

- All of the ductwork is contained inside your house or less than 40 linear feet is outside of the conditioned space.
- The ducts have been previously tested and sealed.
- The ducts contain asbestos.

More information

For more facts about duct sealing, you can watch the video " Duct Sealing for Comfort, Energy and Indoor Air Quality ."



This video can be found on our website:
www.energy.wsu.edu/code

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Why should you seal your ducts?

Sealing the ducts in your home is an easy decision that can help you reap several benefits.

Energy Savings

Duct sealing can help you save on your monthly heating and cooling bills, resulting in more money in your pocket. Leaky duct systems typically contribute to 20-40 percent of a home's heating and cooling costs. Duct sealing can increase a heating and/or cooling system's efficiency to a greater degree than upgrading to a high-efficiency furnace and with less of an investment.



Additionally, if you plan to install a new heating and cooling system, having efficient ducts may make it possible for you to downsize to a smaller, less costly system.



Improved Comfort

If you find that some rooms in your home get too warm while others stay too cool – or if you experience uncomfortable drafts – it might be due to leaks in your duct system. Sealing ducts can help keep the temperature even.

Cleaner Air

Sealing your ducts can also improve the air quality inside your home and safeguard the health of your family. Leaky ducts can cause the air in your home to carry pollutants like car exhaust, pesticides, insulation fibers, mold or mildew, and more. Duct leaks can also draw in combustion gases from fireplaces, wood stoves, gas and oil furnaces, and water heaters.

Help the Environment

When you seal the ducts in your home, it reduces the amount of energy your home uses. The less energy we use, the less pollution we create. If we all do our part to conserve energy, we will have a cleaner, healthier environment.

Cost vs. Savings

The cost of sealing your ducts will vary based on the market and the going rate of labor where you live. The type of existing ductwork system that you have in your house will also impact the cost of duct sealing.

Evaluating the payback is impacted by many variables such as: the climate where you live, where your ductwork is located, how frequently your heating and air conditioning equipment is running, and the cost of energy from your local utility.



In general, research proves that duct sealing has a quick payback and is one of the most effective energy saving measures you can perform on your home.

- National Renewable Energy Laboratory and U.S. Department of Energy (DOE) research concludes that the cost of sealing and/or insulating ductwork can often be paid for in three years from energy savings alone.
- According to a study by DOE's Energy Information Administration, duct sealing yields the greatest energy savings out of 12 measures studied – and it was the least expensive.
- Research by Lawrence Berkeley National Laboratory concludes that 25 percent of the energy typically used – and money spent – for heating and cooling is wasted through duct system energy losses in forced air distribution systems.