Ground Source Heat Pump System Installation Standards[1]

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[1] These standards have been revised from those orginally developed by the Umatilla Electric Cooperative.

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1.0 INTRODUCTION

1.1 "Should and Shall" will be interpreted as follows:

A Where shall or shall not is used for a provision, that provision is mandatory if compliance with the standard is claimed.

B Where should is used it will indicate provisions which are not mandatory but which are desirable as good practice.

2.0 NEW EQUIPMENT REQUIREMENTS

2.1 Systems shall use a closed-loop ground heat exchanger. Open loop systems and direct exchange systems are not allowed.

2.2 Ground Source Heat Pumps: Water to Air Ducted Distribution

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

B Ratings: Systems shall have the following:
- i AHRI/ISO label;
- ii U.L or ETL-US label; and
- iii Energy Star label.

C Performance
- i AHRI rated heating COP shall be at least 3.5 (@32°F. Entering Water Temperature (EWT) per ISO 13256-1).
- ii AHRI rated cooling EER shall be at least 16.1 (@77°F. EWT per ISO 13256-1).
- iii The primary air-handler fan for water-to-air systems shall use an electrically commutated permanent magnet motor.

D All ground source heat pumps shall be shipped factory pre-charged with refrigerant.

2.3 Loop Circulation Pump

A Pumps shall be rated by UL or ETL-US.

B Performance
- i Total installed pump power shall be no greater than 150 Watts per nominal ton of installed heat pump capacity.
- ii Pumps shall be sized to provide 3 gallons per minute per nominal ton of installed heat pump capacity.
- iii Pumps shall be cast iron or bronze in construction.
- iv Pumps shall be approved for use with methanol, ethylene glycol or propylene glycol.
- v Flow centers shall have filling and air purge ports.

2.4 Ground Loop Heat Exchanger Piping

A Piping manufacturer shall be listed as an IGSHPA-approved manufacturer of HDPE and PEX piping.

B Ratings
  i HDPE: SDR 11 Min Pressure Class,
  ii HDPE shall use PE 3408 virgin resins with 2% carbon black UV inhibitors
  iii PEX-A Engle Method

C Materials and Application
  i HDPE shall be heat fused, either socket weld or butt welded
  ii PEX shall use non-metallic connection methods.

2.5 Desuperheater Coil shall:
- A be approved for use with the GSHP unit by the manufacturer of the GSHP unit;
- B have a vented double wall heat exchanger; and
- C be constructed of copper or stainless steel.

2.6 Desuperheater Circulation Pump shall:
- A be rated by UL or ETL-US;
- B be bronze in construction; and
- C be rated for potable water.

2.7 Desuperheat Preheat Buffer Tank (no elements connected)
- A Approved Manufacturer
  - i IAPMO/NSF/GAMA rated electric tank manufacturer
- B Minimum Efficiency Rating
  - i GAMA EF rating 0.93
- C Materials and Application
  - i Glass Lined Steel tank, 50 gal min size

3.0 PARTICIPATING INSTALLER REQUIREMENTS

3.1 Training

Participating Installer shall be responsible for the technical competence and qualifications of all salespeople, installers, and service mechanics. These personnel should participate in at least one manufacturer's training session on ground source heat pump application, installation, or service or receive equivalent training. All the Participating Installer's installers shall be IGSHPA certified and Factory Certified Fusion Technician.

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.

3.2 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), loop sizing (section 4.2) and Horizontal Loop Installation (Section 5.4).

Heat pump commissioning PTCS certification 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.

3.3 New System Warranty

All system components, including the ground loop, shall be warranted for a period of no less than 5 years.

3.4 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

4.0 NEW EQUIPMENT SELECTION

4.1 Heating and Cooling Calculations

A Heating loss and cooling gain calculations shall be made using 70°F indoor design temperature for heating and 75°F for cooling.

B The recommended ASHRAE winter design temperature and cooling design temperature for the nearest weather station representative of the installation shall be used.

C 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.

D 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.

E 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**.**

F 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.

G 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.

4.2 Horizontal Ground Loop Sizing:

Horizontal Ground loops shall be designed and sized for 30 degree Entering Water Temp (EWT) using an IGSHPA approved software design package. All horizontal closed loops shall be no shorter than and no shallower than shown in the table below which lists total loop length as a function of design heat load of the house using ASHRAE design temperatures as discussed above. Heating zones shall be as defined by the RTF.

Heating Zone	Loop Depth	Loop Length/Ton of design heating load
1	5'	690
2	5'	1270
3	5'	1960
3 (optional)	8'	1260

i Example: 2200 sf house in heating zone 3 has a design heat load at an ASHRAE design temperature of -15°F of 37,000 btu/hr. Divide this peak load by 12,000 btu/hr to get Tons ~ 3.1 Tons. (3.1 Tons * 1960') = 6055 total feet of pipe in the ground at a 5' depth. Alternatively, this same load would require 3893' total feet of pipe at an 8' depth.

4.3 Heat Pump Unit Sizing

The heat pump unit shall be sized using either of the following methods, rounding up or down to the nearest 6,000 Btu/hr (½ ton) capacity at ARI rating conditions:

A Heat pumps shall be sized using a 25°F Balance Point. Ducted Heat pumps shall be sized assuming they meet the house load at 25°F outside air temperature and at 30°F entering water temperature (EWT). OR

B Heat pumps shall be sized in accordance with the sizing method specified by the utility.

4.4 Auxiliary Heat Sizing

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

4.5 Control of Auxiliary Heat

Systems shall employ control strategies that minimize the unnecessary use of auxiliary heat. Auxiliary heat shall not operate during a first stage heating call (unless system is switched to emergency heat). Auxiliary heat shall have two stages. Auxiliary heat shall be controlled in such a manner that it does not engage when the outdoor air temperature is above 30°F, except when supplemental heating is required during a defrost cycle or when emergency heating is required during a refrigeration cycle failure. Method of controlling auxiliary heat shall be documented by the certified heat pump Technician and submitted to the RTF-approved PTCS Service Provider.

5.0 NEW EQUIPMENT INSTALLATION

5.1 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.

5.2 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.

5.3 Outdoor Horizontal Loop Installation

A Loops shall be installed at a minimum 5' depth Below Grade in accordance with Section 4.2 and be designed in an IGSHPA approved configuration.
B All header piping shall be configured in reverse return and stepped down in size to maintain 2 feet per second in all parts of the piping
C Loops shall be flushed using a properly sized flush cart per IGSHPA
D Backfill with sand if native soils have sharp rocks that could puncture or damage piping
E Any direct potable water connections shall be protected by approved backflow prevention devices.

6.0 DUCT WORK

6.1 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.

A 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.

B Building Cavities and Ducts

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

C 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.

D Maximum Velocities

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

Velocity shall not create unacceptable noise levels and return air shall be sufficient size to meet requirements of installed systems.

E 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.

F 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.

6.2 Duct Installation

A Insulation

i 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.

ii All newly installed flexible HVAC ducts outside the heated space shall have an Air Diffusion Council (ADC) certified minimum R-value of R-8.

iii 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.

iv 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.

6.3 System Air Flow

A 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.

B 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.

C 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".

D 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.

7.0 FILTERS

7.1 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.

7.2 Type and Size

Filter types and sizes shall meet the manufacturer's instructions and recommendations. Filters and/or air cleaners that are not an integral part of the equipment and not selected by the manufacturer shall be accepted if the total CFM is within the range as specified by 6.3.B. Any filter that exceeds 0.22 inches pressure drop as installed shall not be allowed.

8.0 CONDENSATE PIPING

8.1 Piping Material

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

8.2 Drains

Condensate drain lines shall be trapped and run to an open drain or outside of the building foundation. Condensate shall not be drained into a crawl space or direct connected into a sewer line.

8.3 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. A check valve shall be installed if pump is not equipped with one.

9.0 ELECTRICAL

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

10.0 INDOOR THERMOSTATS

10.1 Installation

Indoor thermostats shall be located and installed according to the manufacturer's instructions and recommendations.

10.2 Auxiliary Heat Indicator

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