

## *1.0 Introduction*

- 1.1 “SHALL,” “SHOULD,” shall be interpreted as follows:
  - 1.1.1 Shall. “SHALL” or “SHALL NOT” is used for provisions that are mandatory if compliance with the standard is claimed.
  - 1.1.2 Should. “SHOULD,” is used to indicate provisions that are not mandatory but which are desirable as good practice.

## *2.0 Dealer Requirements*

- 2.1 Training: Contractor SHALL be responsible for the technical competence and qualifications of his installers and service mechanics. The contractor SHALL have at least one person on staff who has successfully completed the Service/Installation Technician training. At least 10 percent of the contractor’s technicians SHOULD attend this course. Additionally, the contractor SHALL have at least one employee (depending on numbers of employees — at least 10 percent is recommended) attend any additional WaterFurnace training program (field or factory site) annually.
- 2.2 Consumer Instruction: Contractor SHALL instruct the consumer in proper operation and maintenance of the heat pump system. Contractor SHALL provide the consumer with the manufacturer’s owner’s manual for the equipment installed, demonstrate filter replacement (or cleaning), and demonstrate the operation of all indoor thermostat controls and indicator lights to the consumer. Contractor SHALL explain to the consumer the different operating modes of the heat pump system (e.g. heating, emergency, cooling, continuous fan) and the effect of obstructing registers.

## *3.0 System Design*

- 3.1 The system SHALL be designed using the WaterFurnace Energy Analysis Software. WaterFurnace performance calculations SHOULD be made using the appropriate city location and system information for the installation.
- 3.2 Heat Loss/Gain Calculations: Heat loss/Gain calculations SHALL be made using the WaterFurnace Energy Analysis software Load Calculation program; or Air Conditioning Contractors of America (ACCA) Manual J, “Load Calculation for Winter and Summer Air Conditioning;” or American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE), “Fundamentals” handbook; or equivalent. Heat loss/gain calculations SHOULD be made using the appropriate indoor and outdoor design temperatures for the geographical areas where the installation occurs.

**4.0 Equipment Installation**

- 4.1 Access: Equipment SHALL be located to allow easy service access for filter replacement and adequate working space provided for filter replacement. Adequate working space SHOULD be provided for servicing components without removal of piping, duct work or other permanently installed fixtures. Special care SHOULD be taken in locating components that require frequent attention.
- 4.2 Location and Support of Units: Unit SHALL be located to permit smooth duct transitions and shall be adequately supported or placed on a suitable platform, capable of absorbing vibration and also preventing the unit base from contacting a moist surface. Units SHALL Not Be located in areas subject to ambient temperatures below 45°F without appropriate enclosure with provisions for freezing conditions. Horizontal units SHALL be set so that the condensate pan has a 1/4-inch per foot pitch for condensate drain.

**5.0 Duct Work**

- 5.1 Main supply and return duct work SHALL be metal or rigid fiberglass. Branch ducts SHOULD be metal. If flex duct is used for branch duct runs, it SHOULD be 1 inch larger in diameter than properly sized metal branch ducts. Support for this flex duct SHALL be at maximum spacing of every four feet. If sheet metal supply/return is used, supply/return plenum SHALL be isolated from the unit by a canvas connector or equivalent to prevent transfer of vibration noise to duct work. Turning vanes SHOULD be used on any supply turn of over 500 CFM. At least one 90° turn should be used on any supply or return ducting to attenuate blower/unit noise. Metal supply and return plenums and metal main supply trunk SHOULD be internally insulated at least 2 feet downstream each way of unit to prevent noise.

In installations where flex duct is used it SHALL be installed so that duct runs are not allowed to “sag” or “droop” between supports more than two (2) inches from the horizontal. Such supports shall consist of 2-inch-wide nylon, polyester or similar material. Extensive use of support material in a “spiral” fashion around ducts may be necessary in order to meet this requirement. Multiple supports SHALL be provided at intersections to ensure the long-term integrity of the duct system at these junctions. Flex duct turns with an angle larger than 30° SHOULD be accomplished with a metal 45° or 90° elbow. Supply air registers can be installed with insulated metal 90° elbow collars or short runs (2 to 4 ft.) of flex duct could be installed in the metal branch runs to suppress air noise at the register. The insulated flex duct can then be fastened to this elbow in the horizontal plane with no “crimping.”

Under no circumstances SHOULD any of the flex duct be allowed to be crimped, crushed, or in any other way constricted so as to limit the free-flow of air through the system. All flex duct in excess of minimum required between duct connections should be removed and discarded.

- 5.2 Design Requirements: All new duct work SHALL be designed in accordance with recommended practice as outlined in Sheet Metal and Air Conditioning Contractors National Association (SMACNA) “HVAC Duct System Design”; or Air Conditioning Contractors of America (ACCA) Manual G, “Selection of Distribution System,” Manual E, “Room Air Distribution Consideration” and Manual D, “Residential Duct Design and Equipment Selection”; or American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) handbooks.

- 5.2.1 Maximum Velocities: Duct work SHALL be designed so air velocities do not exceed the following:

	<u>Supply</u>	<u>Return</u>
Main Ducts	700 - 900 FPM	less than 900 FPM
Branch Ducts	600 - 700 FPM	less than 600 FPM
Registers, Diffusers and Grills (face velocity)	500 - 600 FPM	less than 600 FPM

**RETURN AIR REGISTER LOCATION**

Return air inlets are normally placed so that air is not drawn over 30 feet from a supply. For air conditioning, it is recommended that 60 per cent of the return air should be taken from the second floor. In homes with vaulted ceiling or ceilings of 8 feet or more, at least 50 percent of return air SHALL be taken back to the indoor unit from a ceiling or high-side wall location, and not more than 50 percent from the floor or low-side wall location.

- 5.2.2 All duct joints, plenum drives, metal joints to include all slips and drives must be suitably sealed to prevent leakage.

**6.0 Duct Installation**

- 6.1 Thermal Insulation: All duct work in an unheated space that is not constructed of at least 1-inch of fibrous glass material or equivalent shall be internally lined with at least 1-inch fibrous glass duct liner or externally wrapped with 2-inch fibrous glass insulation. According to *ASHRAE Fundamentals Handbook*, adequate thermal insulation is determined by the following formula:

$$R = t + 15$$

where:

R = thermal resistance excluding film resistance ft<sup>2</sup>•°F•Btuh

t = design temperature differential between duct air and duct surface, °F

A vapor barrier SHOULD be installed on the outside of duct insulation. Where duct is internally lined, the liner liner SHALL be installed in accordance with SMACNA's Duct Liner Application Standard, second edition.

- 6.2 After installation and start-up, a total heat of rejection/extraction across the water coil SHOULD be made.

**7.0 Filters**

- 7.1 Air filter 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. Filter types and sizes SHALL be according to the manufacturer's instructions and recommendations.

**8.0 Desuperheater Installation**

- 8.1 Piping: Desuperheater piping SHALL be all copper and suitably supported and installed in a workmanlike manner. All piping shall be joined with lead-free solder. A vent SHALL be installed at the highest point of the piping system for air purging. All piping SHALL be insulated if minimum ambient temperature is less than 65°F. If minimum ambient temperature is less than 45°F, desuperheater installation is not recommended, even if insulation is used. Water heater SHOULD be a minimum of 52 gallons in single family residence.

**9.0 Premier (Split system) Refrigerant Piping**

- 9.1 Materials: Field-supplied refrigerant piping SHALL be cleaned, dehydrated, and sealed types K and L seamless copper tubing or the manufacturer's pre-charged tubing. Fittings SHALL be wrought copper. The system SHOULD be evacuated to 200 - 500 microns and purged.

- 9.2 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 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 SHOULD not be run parallel to building lines and in a straight and workmanlike manner to prevent oil pockets.
- 9.3 Support: Refrigerant piping SHALL be properly supported in accordance with manufacturer's specifications.
- 9.4 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.
- 9.5 Insulation: Suction line SHALL be insulated with a minimum of 1/2 inch thick stock supply continuous closed-cell foam rubber. Where insulation is exposed to the elements, it SHALL have a weatherproof covering such as paint or black plastic film. Vapor and liquid lines SHALL be separated so that heat exchange does not take place.
- 9.6 Leak Testing Evacuation and Charging: Factory and field joints SHALL be checked and any leaks found SHALL be repaired. Evacuation and charging SHALL be done in accordance with the installation instructions and ARI Standard 260-75, 3.5-3.7.

### 10.0 *Condensate Piping*

- 10.1 Condensate drain piping SHALL be installed in accordance with installation instructions. Piping SHOULD be the size of the equipment drain connection, but not less than 3/4 inch nominal pipe size and SHOULD be copper, plastic or other corrosion-resistant material.
- 10.2 Drains: Condensate drain lines SHALL be trapped (and vented if necessary), and run to a floor drain or outside of the building foundation. The outlet line (on the other side of the trap) SHALL be at least 1-1/2 inches below the inlet line. The depth of the trap SHALL be at least 1-1/2 inches from the bottom of the outlet line to the bottom of the trap (3 inches from the bottom of the inlet line to the bottom of the trap). All local codes supersede these requirements. Under no circumstances may condensate be drained into a crawl space. *Note that some WaterFurnace vertical units include an internal condensate line trap.*
- 10.3 Condensate Pump: Condensate drain lines SHALL be pitched in the direction of flow to prevent 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.

### 11.0 *Electrical*

- 11.1 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.

### 12.0 *Indoor Thermostats*

- 12.1 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 at anytime. If a zoning system is to be installed, thermostat and zoning equipment SHALL be installed according to manufacturer's recommendations.

*13.0 Add-on Heat Pump to a Gas Furnace*

- 13.1 Indoor Coil: For an add-on heat pump, the indoor coil SHALL be installed down stream of the furnace heat exchanger to prevent condensation and eventual corrosion of the furnace heat exchanger in the cooling mode.
- 13.2 Return Air Grilles: Return air grilles SHALL NOT be located in an area where a gas line is located or where a gas line is in the air stream. Local codes supersede these requirements.
- 13.3 Furnace Operation: The furnace SHALL lock out the heat pump when it operates on a second-stage heat.
- 13.3 Emergency Heat Operation: Emergency heat switch SHALL activate the furnace and bypass the heat pump.







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## Design & Installation Standards

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