

DISPLAY THIS CARD ON PRINCIPAL FRONTAGE OF WORK



CITY OF PORTLAND BUILDING PERMIT



This is to certify that

EARL APARTMENTS LLC /Patriot Mechanical LLC

Located at

28 PREBLE ST

PERMIT ID: 2013-00249

CBL: 037 F005001

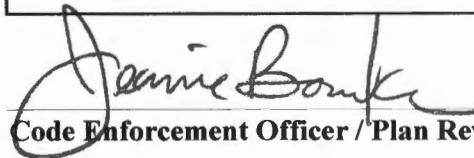
has permission to **install a Air Handler / Condensing Unit in basement**

provided that the person or persons, firm or corporation accepting this permit shall comply with all of the provisions of the Statues of Maine and of the Ordinances of the City of Portland regulating the construction, maintenance and use of the buildings and structures, and of the application on file in the department.

Notification of inspection and written permission procured before this building or part thereof is lathed or otherwise clsoed-in. 48 HOUR NOTICE IS REQUIRED.

A final inspection must be completed by owner before this building or part thereof is occupied. If a certificate of occupancy is required, it must be procured prior to occupancy.

Fire Prevention Officer



Code Enforcement Officer / Plan Reviewer

**THIS CARD MUST BE POSTED ON THE STREET SIDE OF THE PROPERTY
THERE IS A PENALTY FOR REMOVING THIS CARD**

PERMIT ID: 2013-00249

Located at: 28 PREBLE ST

CBL: 037 F005001

BUILDING PERMIT INSPECTION PROCEDURES
Please call 874-8703 (ONLY)
or email: buildinginspections@portlandmaine.gov

With the issuance of this permit, the owner, builder or their designee is required to provide adequate notice to the city of Portland Inspections Services for the following inspections. Appointments must be requested 48 to 72 hours in advance of the required inspection. The inspection date will need to be confirmed by this office.

- **Please read the conditions of approval that is attached to this permit!! Contact this office if you have any questions.**
- **Permits expire in 6 months. If the project is not started or ceases for 6 months.**
- **If the inspection requirements are not followed as stated below additional fees may be incurred due to the issuance of a "Stop Work Order" and subsequent release to continue.**

REQUIRED INSPECTIONS:

Final - Electric

Final - Commercial

The project cannot move to the next phase prior to the required inspection and approval to continue, REGARDLESS OF THE NOTICE OF CIRCUMSTANCES.

IF THE PERMIT REQUIRES A CERTIFICATE OF OCCUPANCY, IT MUST BE PAID FOR AND ISSUED TO THE OWNER OR DESIGNEE BEFORE THE SPACE MAY BE OCCUPIED.

City of Portland, Maine - Building or Use Permit

389 Congress Street, 04101 Tel: (207) 874-8703, Fax: (207) 874-8716

Permit No: 2013-00249	Date Applied For: 02/06/2013	CBL: 037 F005001
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Location of Construction: 28 PREBLE ST	Owner Name: EARL APARTMENTS LLC	Owner Address: 104 GRANT ST	Phone:
Business Name: REF 059700346	Contractor Name: Patriot Mechanical LLC	Contractor Address: Po Box 747 Gorham	Phone (208) 839-9500
Lessee/Buyer's Name	Phone:	Permit Type: HVAC	

Proposed Use: 64 Residential Units w/ Commercial on the first floor	Proposed Project Description: install a Air Handler / Condensing Unit in basement
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Dept: Zoning	Status: Approved	Reviewer: Marge Schmuckal	Approval Date: 02/11/2013
Note:	Ok to Issue: <input checked="" type="checkbox"/>		

Dept: Building	Status: Approved w/Conditions	Reviewer: Jeanie Bourke	Approval Date: 03/12/2013
Note:	Ok to Issue: <input checked="" type="checkbox"/>		

- 1) Separate permits are required for any electrical, plumbing, sprinkler, fire alarm, HVAC systems, heating appliances, including pellet/wood stoves, commercial hood exhaust systems and fuel tanks. Separate plans may need to be submitted for approval as a part of this process.
- 2) Permit approved based upon information provided by the applicant or design professional. Any deviation from approved plans requires separate review and approval prior to work.
- 3) Equipment shall be installed in compliance with the manufacturer's specifications and the UL listing.
- 4) Any modifications to existing building systems and all new systems (HVAC, electrical, plumbing) shall meet IECC 2009 or ASHRAE 90.1-2007 requirements for energy code compliance.
- 5) Duct penetrations shall be protected per IBC Sec. 713.1.1 & 716 and when through fire barriers, approved fire or smoke dampers or combination of, shall be installed in accordance with their listing.

Dept: Fire	Status: Approved w/Conditions	Reviewer: Ben Wallace Jr	Approval Date: 03/13/2013
Note:	Ok to Issue: <input checked="" type="checkbox"/>		

- 1) Installation shall comply with City Code Chapter 10.
- 2) Installation shall comply with NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems; NFPA 70, National Electrical Code; and the manufacturer's published instructions.

5

City of Portland, Maine - Building or Use Permit Application

389 Congress Street, 04101 Tel: (207) 874-8703, Fax: (207) 874-8716

Permit No: 2013-00249	Issue Date:	CBL: 037 F005001
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Location of Construction: 28 PREBLE ST	Owner Name: EARL APARTMENTS LLC	Owner Address: 104 GRANT ST PORTLAND , ME 04104	Phone:
Business Name: REF 059700346	Contractor Name: Patriot Mechanical LLC	Contractor Address: Po Box 747 Gorham ME 04038	Phone (208) 839-9500
Lessee/Buyer's Name	Phone:	Permit Type: HVAC	Zone: B3
Past Use: 64 Residential Units w/ Commercial <i>on 1st floor</i>	Proposed Use: 64 Residential Units w/ Commercial <i>on 1st floor</i>	Permit Fee: \$140.00	Cost of Work: \$12,000.00
Proposed Project Description: install a Air Handler / Condensing Unit in basement		FIRE DEPT: 3/13/13 <input checked="" type="checkbox"/> Approved <input type="checkbox"/> Denied <input type="checkbox"/> N/A	INSPECTION: Use Group: R-2 Type: HVAC MUBEC 2009
		Signature: <i>[Signature]</i> (58)	Signature: <i>JMB</i> 3/12/13
PEDESTRIAN ACTIVITIES DISTRICT (P.A.D.)			
Action: <input type="checkbox"/> Approved <input type="checkbox"/> Approved w/Conditions <input type="checkbox"/> Denied			
		Signature:	Date:

Permit Taken By: LDOBSON	Date Applied For: 02/06/2013	Zoning Approval
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<p>1. This permit application does not preclude the Applicant(s) from meeting applicable State and Federal Rules.</p> <p>2. Building permits do not include plumbing, septic or electrical work.</p> <p>3. Building permits are void if work is not started within six (6) months of the date of issuance. False information may invalidate a building permit and stop all work..</p>	<p>Special Zone or Reviews</p> <p><input type="checkbox"/> Shoreland</p> <p><input type="checkbox"/> Wetland</p> <p><input type="checkbox"/> Flood Zone</p> <p><input type="checkbox"/> Subdivision</p> <p><input type="checkbox"/> Site Plan</p> <p>Maj <input type="checkbox"/> Minor <input type="checkbox"/> MM <input type="checkbox"/></p> <p>Date: <i>2/11/13</i></p>	<p>Zoning Appeal</p> <p><input type="checkbox"/> Variance</p> <p><input type="checkbox"/> Miscellaneous</p> <p><input type="checkbox"/> Conditional Use</p> <p><input type="checkbox"/> Interpretation</p> <p><input type="checkbox"/> Approved</p> <p><input type="checkbox"/> Denied</p> <p>Date:</p>	<p>Historic Preservation</p> <p><i>with</i></p> <p><input type="checkbox"/> Not in District or Landmark</p> <p><input type="checkbox"/> Does Not Require Review</p> <p><input type="checkbox"/> Requires Review</p> <p><input type="checkbox"/> Approved</p> <p><input type="checkbox"/> Approved w/Conditions</p> <p><input type="checkbox"/> Denied</p> <p><i>Any extension work requires a separate review and approval</i></p> <p>Date:</p>
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CERTIFICATION

I hereby certify that I am the owner of record of the named property, or that the proposed work is authorized by the owner of record and that I have been authorized by the owner to make this application as his authorized agent and I agree to conform to all applicable laws of this jurisdiction. In addition, if a permit for work described in the application is issued, I certify that the code official's authorized representative shall have the authority to enter all areas covered by such permit at any reasonable hour to enforce the provision of the code(s) applicable to such permit.

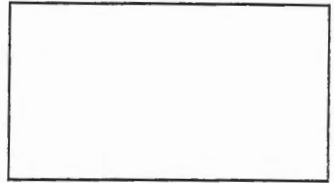
SIGNATURE OF APPLICANT	ADDRESS	DATE	PHONE
RESPONSIBLE PERSON IN CHARGE OF WORK, TITLE		DATE	PHONE



FILL IN AND SIGN WITH INK

APPLICATION FOR PERMIT HEATING OR POWER EQUIPMENT

201300249



To the INSPECTOR OF BUILDINGS, PORTLAND, ME.

The undersigned hereby applies for a permit to install the following heating, cooking or power equipment in accordance with the Laws of Maine, the Building Code of the City of Portland, and the following specifications:

37 FS

Location / CBL 34 PREBLE STREET Use of Building BUSINESS Date 2/5/13

Name and address of owner of appliance PORT PROPERTY MANAGEMENT 104 GRANT STREET PORTLAND, ME. 04101

Installer's name and address PATRIOT MECHANICAL, LLC - P.O. Box 747, GORHAM, ME. 04038 Telephone 207-839-9500

Location of appliance:
 Basement Floor
 Attic Roof

Type of Fuel:
 Gas Oil Solid

Appliance Name: GOODMAN / HEAT PUMP / AIR / AIR
U.L. Approved Yes No

Will appliance be installed in accordance with the manufacture's installation instructions? Yes No

IF NO Explain: _____
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Dept. of Building Inspections
City of Portland Maine

The Type of License of Installer:
 Master Plumber # _____
 Solid Fuel # _____
 Oil # _____
 Gas # _____
 Other REF # 059700346

Type of Chimney:
 Masonry Lined
Factory built _____

Metal
Factory Built U.L. Listing # _____

Direct Vent
Type _____ UL# _____

Type of Fuel Tank
 Oil
 Gas

Size of Tank _____

Number of Tanks _____

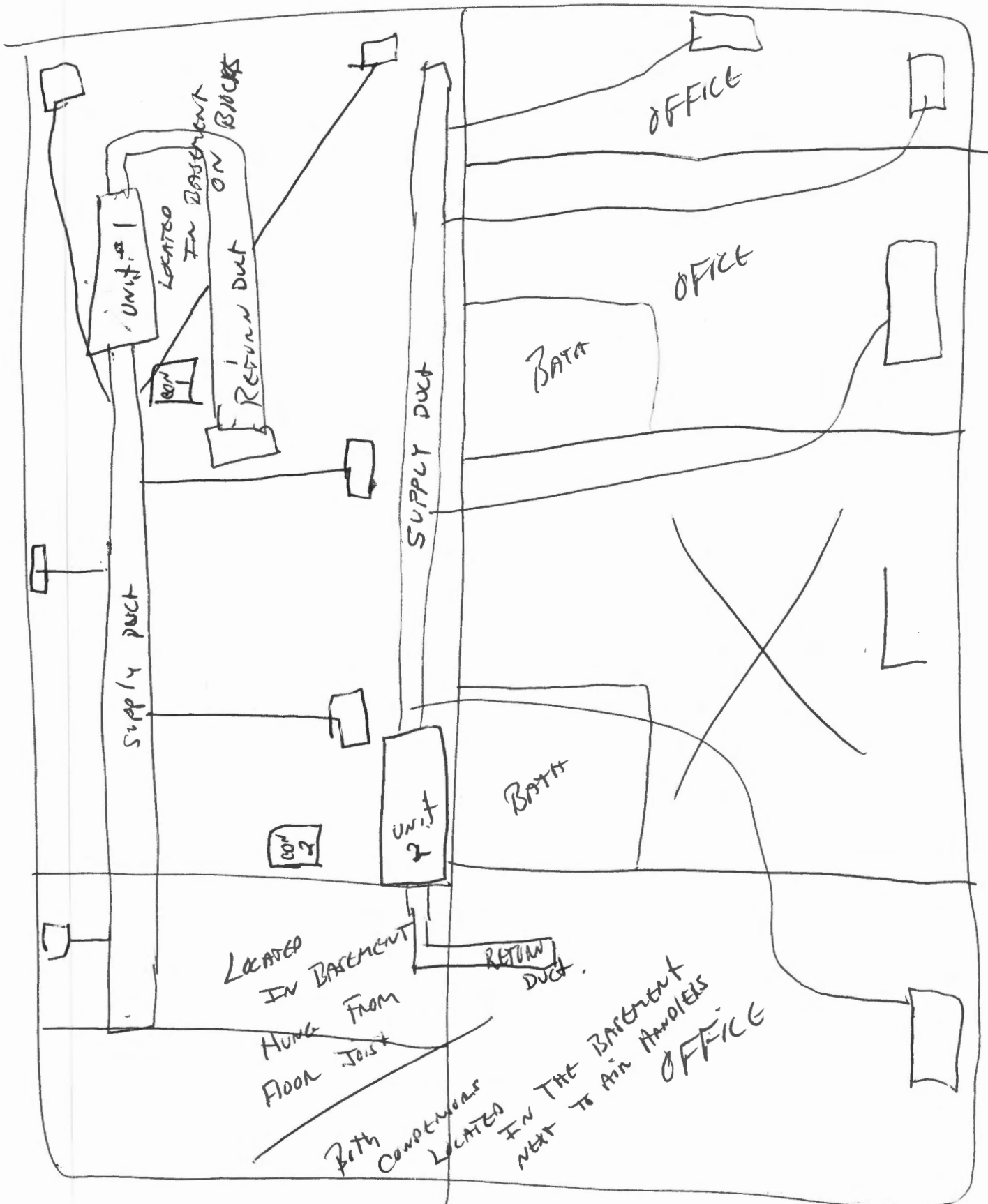
Distance from Tank to Center of Flame _____ feet.

Cost of Work: \$11,250.00

Permit Fee: \$ _____

Approved
Fire: _____
Ele.: _____
Bldg.: _____
Signature of Installer [Signature]

Approved with Conditions
 See attached letter or requirement
Inspector's Signature _____ Date Approved _____



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Dept. of Building Inspections
 City of Portland Maine

CONDENSING UNIT


HEAT PUMP

INSTALLATION & SERVICE REFERENCE

© 2005-2012 Goodman Manufacturing Company, L.P.
5151 San Felipe, Suite 500, Houston, TX 77056
www.goodmanmfg.com -or- www.amana-hac.com
P/N: IO-259R Date: July 2012


Important Safety Instructions


The following symbols and labels are used throughout this manual to indicate immediate or potential safety hazards. It is the owner's and installer's responsibility to read and comply with all safety information and instructions accompanying these symbols. Failure to heed safety information increases the risk of personal injury, property damage, and/or product damage.

 **WARNING**


HIGH VOLTAGE!

Disconnect ALL power before servicing. Multiple power sources may be present. Failure to do so may cause property damage, personal injury or death.



 **WARNING**

Installation and repair of this unit should be performed **ONLY** by individuals meeting the requirements of an "entry level technician" as specified by the Air Conditioning, Heating and Refrigeration Institute (AHRI). Attempting to install or repair this unit without such background may result in product damage, personal injury or death.

 **CAUTION**

Scroll equipped units should never be used to evacuate the air conditioning system. Vacuums this low can cause internal electrical arcing resulting in a damaged or failed compressor.

Important Note to the Owner regarding Product Warranty

Your warranty certificate is supplied as a separate document with the unit installed by your contractor. Read the limited warranty certificate carefully to determine what is and is not covered and keep the warranty certificate in a safe place. If you are unable to locate the warranty certificate please contact your installing contractor or contact customer service (877-254-4729) to obtain a copy.

IMPORTANT: To receive the 10-Year Parts Limited Warranty, online registration must be completed within 60 days of installation. Online registration is not required in California or Quebec. Complete warranty details available from your local dealer or, for Goodman® brand products, visit www.goodmanmfg.com, and for Amana® brand products, visit www.amana-hac.com.

IMPORTANT: To register your Goodman® brand unit, go to www.goodmanmfg.com and click "Warranty Registration". Complete registration as prompted.

To register your Amana® brand unit, go to www.amana-hac.com and click "Warranty Registration". Complete registration as prompted.

Product limited warranty certificates for models currently in production can be viewed at www.goodmanmfg.com or www.amana-hac.com. If your model is not currently in production or does not appear on the website, please contact your installing contractor or contact customer service (877-254-4729) to obtain a copy of your warranty certificate.

Each product overview page contains a Product Warranty link; by clicking on it you will be able to view the limited warranty coverage for that specific product. To view warranty registration information, click on the Product Warranty text on the left navigation panel on the home page of each website. The Online Product Registration pages are located in this same section.

Shipping Inspection

Always keep the unit upright; laying the unit on its side or top may cause equipment damage. Shipping damage, and subsequent investigation is the responsibility of the carrier. Verify the model number, specifications, electrical characteristics, and accessories are correct prior to installation. The distributor or manufacturer will not accept claims from dealers for transportation damage or installation of incorrectly shipped units.

Codes & Regulations

This product is designed and manufactured to comply with national codes. Installation in accordance with such codes and/or prevailing local codes/regulations is the responsibility of the installer. The manufacturer assumes no responsibility for equipment installed in violation of any codes or regulations. Rated performance is achieved after 72 hours of operation. Rated performance is delivered at the specified airflow. See outdoor unit specification sheet for split system models or product specification sheet for packaged and light commercial models. Specification sheets can be found at www.goodmanmfg.com for Goodman® brand products or www.amana-hac.com for Amana® brand products. Within either website, please select the residential or commercial products menu and then select the submenu for the type of product to be installed, such as air conditioning or heat pumps, to access a list of product pages that each contain links to that model's specification sheet.

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City of Portland Maine



The United States Environmental Protection Agency (EPA) has issued various regulations regarding the introduction and disposal of refrigerants. Failure to follow these regulations may harm the environment and can lead to the imposition of substantial fines. Should you have any questions please contact the local office of the EPA.

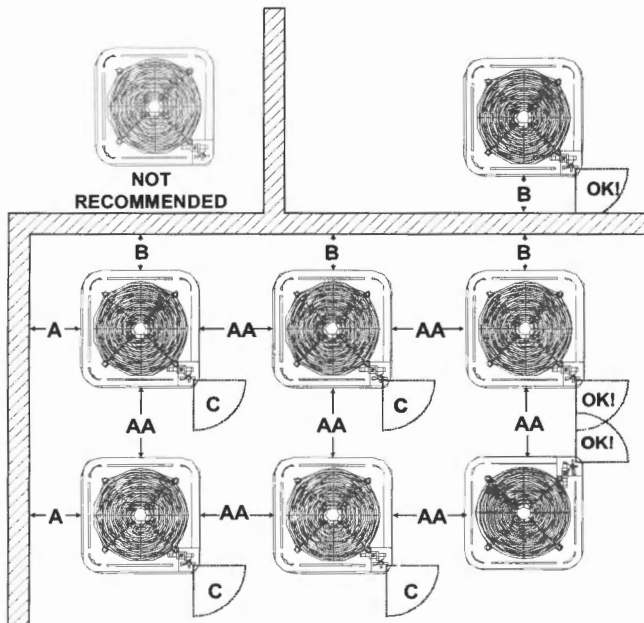
If replacing a condensing unit or air handler, the system must be manufacturer approved and Air Conditioning, Heating and Refrigeration Institute (AHRI) matched. **NOTE:** Installation of unmatched systems is not allowed.

Operating the unit in a structure that is not complete (either as part of new construction or renovation) will void the warranty.

Installation Clearances

Special consideration must be given to location of the condensing unit(s) in regard to structures, obstructions, other units, and any/all other factors that may interfere with air circulation. Where possible, the top of the unit should be completely unobstructed; however, if vertical conditions require placement beneath an obstruction **there should be a minimum of 60 inches between the top of the unit and the obstruction(s).** The specified dimensions meet requirements for air circulation only. Consult all appropriate regulatory codes prior to determining final clearances.

Another important consideration in selecting a location for the unit(s) is the angle to obstructions. Either side adjacent the valves can be placed toward the structure provided the side away from the structure maintains minimum service clearance. Corner installations are strongly discouraged.



Minimum Airflow Clearance				
Model Type	A	B	C	AA
Residential	10"	10"	18"	20"
Light Commercial	12"	12"	18"	24"

This unit can be located at ground floor level or on flat roofs. At ground floor level, the unit must be on a solid, level foundation that will not shift or settle. To reduce the possibility of sound transmission, the foundation slab should not be in contact with or be an integral part of the building foundation. Ensure the foundation is sufficient to support the unit. A concrete slab raised above ground level provides a suitable base.

Rooftop Installations

If it is necessary to install this unit on a roof structure, ensure the roof structure can support the weight and that proper consideration is given to the weather-tight integrity of the roof. Since the unit can vibrate during operation, sound vibration transmission should be considered when installing the unit. Vibration absorbing pads or springs can be installed between the condensing unit legs or frame and the roof mounting assembly to reduce noise vibration.

NOTE: These units require special location consideration in areas of heavy snow accumulation and/or areas with prolonged continuous subfreezing temperatures. Heat pump unit bases have cutouts under the outdoor coil that permit drainage of frost accumulation. Situate the unit to permit free unobstructed drainage of the defrost water and ice.

In more severe weather locations, it is recommended that the unit be elevated to allow unobstructed drainage and air flow. The following elevation minimums are recommended:

Design Temperature	Suggested Minimum Elevation
+15° and above	2 1/2"
-5° to +14°	8"
below -5°	12"

Safe Refrigerant Handling

While these items will not cover every conceivable situation, they should serve as a useful guide.

WARNING

To avoid possible injury, explosion or death, practice safe handling of refrigerants.

WARNING

Refrigerants are heavier than air. They can "push out" the oxygen in your lungs or in any enclosed space. To avoid possible difficulty in breathing or death:

- Never purge refrigerant into an enclosed room or space. By law, all refrigerants must be reclaimed.
- If an indoor leak is suspected, thoroughly ventilate the area before beginning work.
- Liquid refrigerant can be very cold. To avoid possible frostbite or blindness, avoid contact and wear gloves and goggles. If liquid refrigerant does contact your skin or eyes, seek medical help immediately.
- Always follow EPA regulations. Never burn refrigerant, as poisonous gas will be produced.

WARNING

To avoid possible explosion:

- Never apply flame or steam to a refrigerant cylinder. If you must heat a cylinder for faster charging, partially immerse it in warm water.
- Never fill a cylinder more than 80% full of liquid refrigerant.
- Never add anything other than R-22 to an R-22 cylinder or R-410A to an R-410A cylinder. The service equipment used must be listed or certified for the type of refrigerant used.
- Store cylinders in a cool, dry place. Never use a cylinder as a platform or a roller.

WARNING

To avoid possible explosion, use only returnable (not disposable) service cylinders when removing refrigerant from a system.

- Ensure the cylinder is free of damage which could lead to a leak or explosion.
- Ensure the hydrostatic test date does not exceed 5 years.
- Ensure the pressure rating meets or exceeds 400 lbs.

When in doubt, do not use cylinder.

Refrigerant Lines

CAUTION

The compressor POE oil for R-410A units is extremely susceptible to moisture absorption and could cause compressor failure. Do not leave system open to atmosphere any longer than necessary for installation.

Use only refrigerant grade (dehydrated and sealed) copper tubing to connect the condensing unit with the indoor evaporator. After cutting the tubing, install plugs to keep refrigerant tubing clean and dry prior to and during installation. Tubing should always be cut square keeping ends round and free from burrs. Clean the tubing to prevent contamination.

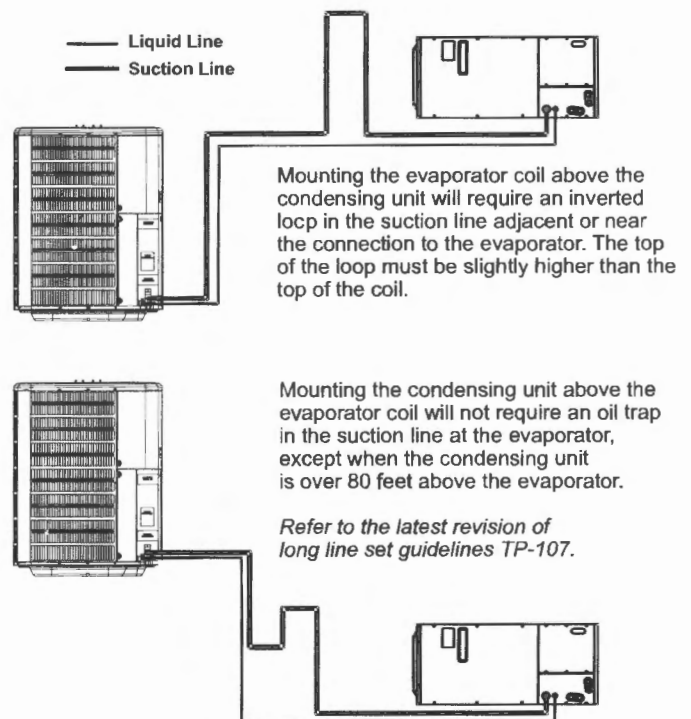
Do NOT let refrigerant lines come in direct contact with plumbing, ductwork, floor joists, wall studs, floors, and walls. When running refrigerant lines through a foundation or wall, openings should allow for sound and vibration absorbing material to be placed or installed between tubing and foundation. Any gap between foundation or wall and refrigerant lines should be filled with a pliable silicon-based caulk, RTV or a vibration damping material. Avoid suspending refrigerant tubing from joists and studs with rigid wire or straps that would come in contact with the tubing. Use an insulated or suspension type hanger. Keep both lines separate and always insulate the suction line.

These sizes are recommended for line lengths of 79 feet or less to obtain optimum performance. For alternate line sizing options or runs of more than 79 feet, refer to Remote Cooling Service Manual, or TP-107 Long Line Set Application R-410A, or contact your distributor for assistance.

RECOMMENDED INTERCONNECTING TUBING (Ft)

Cond Unit Tons	0-24		25-49		50-79*	
	Line Diameter (In. OD)					
	Suct	Liq	Suct	Liq	Suct	Liq
1 1/2	5/8	1/4	3/4	3/8	3/4	3/8
2	5/8	1/4	3/4	3/8	3/4	3/8
2 1/2	5/8	1/4	3/4	3/8	7/8	3/8
3	3/4	3/8	7/8	3/8	1 1/8	3/8
3 1/2	7/8	3/8	1 1/8	3/8	1 1/8	3/8
4	7/8	3/8	1 1/8	3/8	1 1/8	3/8
5	7/8	3/8	1 1/8	3/8	1 1/8	3/8

* Lines greater than 79 feet in length or vertical elevation changes more than 50 feet refer to the Remote Cooling Service Manual or contact your distributor for assistance.



Insulation is necessary to prevent condensation from forming and dropping from the suction line. Armflex (or satisfactory equivalent) with 3/8" min. wall thickness is recommended. In severe conditions (hot, high humidity areas) 1/2" insulation may be required. Insulation must be installed in a manner which protects tubing from damage and contamination.

Where possible, drain as much residual compressor oil from existing systems, lines, and traps; pay close attention to low areas where oil may collect. **NOTE:** If changing refrigerant types, ensure the indoor coil and metering device is compatible with the type of refrigerant being used; otherwise, the indoor coil must be replaced.

Burying Refrigerant Lines

If burying refrigerant lines can not be avoided, use the following checklist.

1. Insulate liquid and suction lines separately.
2. Enclose all underground portions of the refrigerant lines in waterproof material (conduit or pipe) sealing the ends where tubing enters/exits the enclosure.
3. If the lines must pass under or through a concrete slab, ensure lines are adequately protected and sealed.

Refrigerant Line Connections

IMPORTANT

To avoid overheating the service valve, TXV valve, or filter drier while brazing, wrap the component with a wet rag, or use a thermal heat trap compound. Be sure to follow the manufacturer's instruction when using the heat trap compound. Note: Remove Schrader valves from service valves before brazing tubes to the valves. Use a brazing alloy of 2% minimum silver content. Do not use flux.

Torch heat required to braze tubes of various sizes is proportional to the size of the tube. Tubes of smaller size require less heat to bring the tube to brazing temperature before adding brazing alloy. Applying too much heat to any tube can melt the tube. Service personnel must use the appropriate heat level for the size of the tube being brazed. Note: The use of a heat shield when brazing is recommended to avoid burning the serial plate or the finish on the unit.

1. The ends of the refrigerant lines must be cut square, deburred, cleaned, and be round and free from nicks or dents. Any other condition increases the chance of a refrigerant leak.
2. "Sweep" the refrigerant line with nitrogen or inert gas during brazing to prevent the formation of copper-oxide inside the refrigerant lines. The POE oils used in R-410A applications will clean any copper-oxide present from the inside of the refrigerant lines and spread it throughout the system. This may cause a blockage or failure of the metering device.
3. After brazing, quench the joints with water or a wet cloth to prevent overheating of the service valve.
4. Ensure the filter drier paint finish is intact after brazing. If the paint of the steel filter drier has been burned or chipped, repaint or treat with a rust preventative. This is especially important on suction line filter driers which are continually wet when the unit is operating.

NOTE: Be careful not to kink or dent refrigerant lines. Kinked or dented lines will cause poor performance or compressor damage.

Do NOT make final refrigerant line connection until plugs are removed from refrigerant tubing.

NOTE: Before brazing, verify indoor piston size by checking the piston kit chart packaged with indoor unit.

Leak Testing (Nitrogen or Nitrogen-Traced)



WARNING

To avoid the risk of fire or explosion, never use oxygen, high pressure air or flammable gases for leak testing of a refrigeration system.



WARNING

To avoid possible explosion, the line from the nitrogen cylinder must include a pressure regulator and a pressure relief valve. The pressure relief valve must be set to open at no more than 150 psig.

Pressure test the system using dry nitrogen and soapy water to locate leaks. If you wish to use a leak detector, charge the system to 10 psi using the appropriate refrigerant then use nitrogen to finish charging the system to working pressure then apply the detector to suspect areas. If leaks are found, repair them. After repair, repeat the pressure test. If no leaks exist, proceed to system evacuation.

System Evacuation

Condensing unit liquid and suction valves are closed to contain the charge within the unit. The unit is shipped with the valve stems closed and caps installed. **Do not open valves until the system is evacuated.**



WARNING

REFRIGERANT UNDER PRESSURE!
Failure to follow proper procedures may cause property damage, personal injury or death.

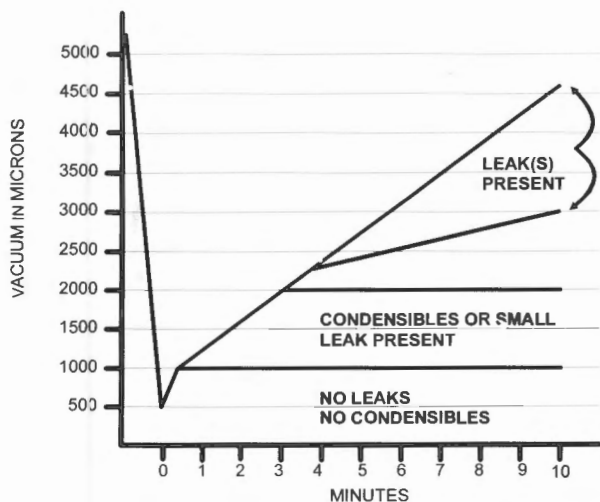
NOTE: Scroll compressors should never be used to evacuate or pump down a heat pump or air conditioning system.



CAUTION

Prolonged operation at suction pressures less than 20 psig for more than 5 seconds will result in overheating of the scrolls and permanent damage to the scroll tips, drive bearings and internal seal.

1. Connect the vacuum pump with 250 micron capability to the service valves.
2. Evacuate the system to 250 microns or less using suction and liquid service valves. Using both valves is necessary as some compressors create a mechanical seal separating the sides of the system.
3. Close pump valve and hold vacuum for 10 minutes. Typically pressure will rise during this period.



- If the pressure rises to 1000 microns or less and remains steady the system is considered leak-free; proceed to startup.
- If pressure rises above 1000 microns but holds steady below 2000 microns, moisture and/or noncondensibles may be present or the system may have a small leak. Return to step 2: If the same result is encountered check for leaks as previously indicated and repair as necessary then repeat evacuation.
- If pressure rises above 2000 microns, a leak is present. Check for leaks as previously indicated and repair as necessary then repeat evacuation.

Electrical Connections



WARNING

HIGH VOLTAGE!

Disconnect ALL power before servicing. Multiple power sources may be present. Failure to do so may cause property damage, personal injury or death due to electric shock. Wiring must conform with NEC or CEC and all local codes. Undersized wires could cause poor equipment performance, equipment damage or fire.



WARNING

To avoid the risk of fire or equipment damage, use copper conductors.

NOTICE

Units with reciprocating or rotary compressors and non-bleed TXV's require a Hard Start Kit.

The condensing unit rating plate lists pertinent electrical data necessary for proper electrical service and overcurrent protection. Wires should be sized to limit voltage drop to 2% (max.) from the main breaker or fuse panel to the condensing unit. Consult the NEC, CEC, and all local codes to determine the correct wire gauge and length.

Local codes often require a disconnect switch located near the unit; do not install the switch on the unit. Refer to the installation instructions supplied with the indoor furnace/air handler for specific wiring connections and indoor unit configuration. Likewise, consult the instructions packaged with the thermostat for mounting and location information.

Overcurrent Protection

The following overcurrent protection devices are approved for use.

- Time delay fuses
- HACR type circuit breakers

These devices have sufficient time delay to permit the motor-compressor to start and accelerate its load.

Three Phase Compressor Rotation



CAUTION

Use care when handling scroll compressors. Dome temperatures could be hot.

Three phase compressors are power phase dependent and can rotate in either direction.

Verify proper rotation for three phase compressors by ensuring the suction pressure drops and discharge pressure rises when the compressor is energized. **NOTE:** When operated in reverse, a three phase scroll compressors is noisier and its current draw substantially reduced compared to marked values.

To correct, disconnect power and switch any two leads at the unit contactor and re-observe.

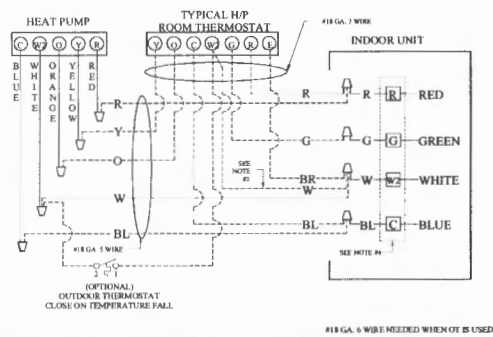
High Voltage Connections

Route power supply and ground wires through the high voltage port and terminate in accordance with the wiring diagram provided inside the control panel cover.

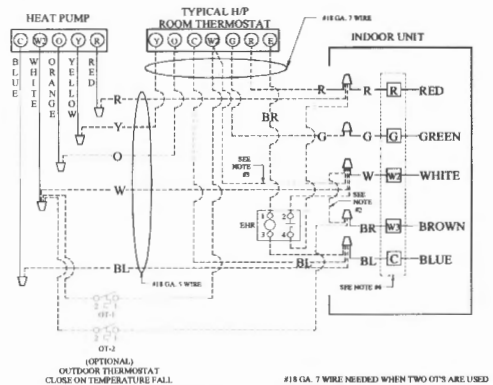
Low Voltage Connections

The indoor transformer must supply 24 volt AC low voltage power to the outdoor section for the control wiring. Cooling only units require 25VA minimum and heat pump units require 40VA minimum. Low voltage wiring for two-stage units depends on the thermostat used and the number of control wires between the indoor unit and the condensing unit. Route control wires through the low voltage port and terminate in accordance with the wiring diagram provided inside the control panel cover.

SYSTEM COMPOSITE DIAGRAM
HEAT PUMPS
10 KW & BELOW



SYSTEM COMPOSITE DIAGRAM
HEAT PUMPS
ABOVE 10 KW



- NOTES:
- 1) OUTDOOR THERMOSTAT (OT-1) SHOULD BE THE FIRST TO CLOSE AND THE LAST TO OPEN.
 - 2) CONNECT WHITE AND BROWN WIRES FROM AIR-HANDLER TOGETHER IF OT-2 IS NOT USED.
 - 3) REMOVE WIRE WHEN USING OUTDOOR THERMOSTAT
 - 4) TERMINAL BLOCK MARKINGS ARE FOR AMANA AIRHANDLERS.

- NOMENCLATURE
- OT—OUTDOOR THERMOSTAT (OPTIONAL)
 - EMR—EMERGENCY HEAT RELAY (OPTIONAL)

- COLOR CODES
- R—RED
 - Y—YELLOW
 - BR—BROWN
 - O—ORANGE
 - W—WHITE
 - G—GREEN

Thermostat with Low Voltage Wires to Heat Pump Unit System Start Up

NOTE: Units with crankcase heaters should have high voltage power energized for 24 hours prior to start up.

Heat pumps are equipped with a time/temperature defrost control with field selectable defrost intervals of 30, 60, or 90 minutes. This setting should be adjusted at this time if needed. The defrost control also has SmartShift™ technology, which delays compressor operation at defrost initiation and termination. If disabling this function is desired, move the jumper from “DLY” to “NORM” on the defrost control

Adequate refrigerant charge for a matching evaporator and 15 feet lineset is supplied with the condensing unit. If line set exceeds 15 feet in length, refrigerant should be added at .6 ounces per foot of liquid line.

Open the suction service valve first! If the liquid service valve is opened first, oil from the compressor may be drawn into the indoor coil TXV, restricting refrigerant flow and affecting operation of the system.

CAUTION

POSSIBLE REFRIGERANT LEAK

To avoid a possible refrigerant leak, open the service valves until the top of the stem is 1/8” from the retainer.

When opening valves with retainers, open each valve only until the top of the stem is 1/8” from the retainer. To avoid loss of refrigerant, **DO NOT** apply pressure to the retainer. When opening valves without a retainer remove service valve cap and insert a hex wrench into the valve stem and back out the stem by turning the hex wrench counterclockwise. Open the valve until it contacts the rolled lip of the valve body.

NOTE: These are not back-seating valves. It is not necessary to force the stem tightly against the rolled lip.

After the refrigerant charge has bled into the system, open the liquid service valve. The service valve cap is the secondary seal for the valve and must be properly tightened to prevent leaks. Make sure cap is clean and apply refrigerant oil to threads and sealing surface on inside of cap. Tighten cap finger-tight and then tighten additional 1/6 of a turn (1 wrench flat), or to the following specification, to properly seat the sealing surfaces.

1. 3/8” valve to 5 - 10 in-lbs
2. 5/8” valve to 5 - 20 in-lbs
3. 3/4” valve to 5 - 20 in-lbs
4. 7/8” valve to 5 - 20 in-lbs

Do not introduce liquid refrigerant from the cylinder into the crankcase of the compressor as this may damage the compressor.

1. Break vacuum by fully opening liquid and suction base valves.
2. Set thermostat to call for cooling. Check indoor and outdoor fan operation and allow system to stabilize for 10 minutes for fixed orifices and 20 minutes for expansion valves.

Charge Verification



WARNING

REFRIGERANT UNDER PRESSURE!

- Do not overcharge system with refrigerant.
- Do not operate unit in a vacuum or at negative pressure.

Failure to follow proper procedures may cause property damage, personal injury or death.



CAUTION

Use refrigerant certified to AHRI standards. Used refrigerant may cause compressor damage. Most portable machines cannot clean used refrigerant to meet AHRI standards.

NOTICE

Violation of EPA regulations may result in fines or other penalties.



CAUTION

Operating the compressor with the suction valve closed will void the warranty and cause serious compressor damage.

Final Charge Adjustment

The outdoor temperature must be 60°F or higher. Set the room thermostat to COOL, fan switch to AUTO, and set the temperature control well below room temperature.

Purge gauge lines. Connect service gauge manifold to base-valve service ports. Run the system (on low stage for two-stage units) for 10 minutes to allow pressures to stabilize, then check subcooling and/or superheat as detailed in the following sections.

Superheat = Suct. Line Temp. - Sat. Suct. Temp.

Subcooling = Sat. Liquid Temp. - Liquid Line Temp.



CAUTION

To prevent personal injury, carefully connect and disconnect manifold gauge hoses. Escaping liquid refrigerant can cause burns. Do not vent refrigerant into the atmosphere. Recover all refrigerant during system repair and before final unit disposal.

SYSTEM SUPERHEAT									
Outdoor Dry Bulb Temperature, °F	Indoor Wet Bulb Temperature, °F								
	55	57	59	61	63	65	67	69	71
60	10	13	17	20	23	26	29	30	31
65	8	11	14	16	19	22	26	27	29
70	5	8	10	13	15	19	23	24	25
75	-----	-----	6	9	11	15	20	21	23
80	-----	-----	-----	-----	7	12	17	18	20
85	-----	-----	-----	-----	-----	8	13	15	16
90	-----	-----	-----	-----	-----	5	10	11	13
95	-----	-----	-----	-----	-----	-----	5	8	10
100	-----	-----	-----	-----	-----	-----	-----	5	8
105	-----	-----	-----	-----	-----	-----	-----	-----	5
110	-----	-----	-----	-----	-----	-----	-----	-----	-----
115	-----	-----	-----	-----	-----	-----	-----	-----	-----

SUPERHEAT FORMULA = SUCT. LINE TEMP. - SAT. SUCT. TEMP.

SATURATED SUCTION PRESSURE TEMPERATURE CHART		
SUCTION PRESSURE	SATURATED SUCTION TEMPERATURE °F	
	PSIG	R-22
50	26	1
52	28	3
54	29	4
56	31	6
58	32	7
60	34	8
62	35	10
64	37	11
66	38	13
68	40	14
70	41	15
72	42	16
74	44	17
76	45	19
78	46	20
80	48	21
85	50	24
90	53	26
95	56	29
100	59	31
110	64	36
120	69	41
130	73	45
140	78	49
150	83	53
160	86	56
170	90	60

SATURATED LIQUID PRESSURE TEMPERATURE CHART		
LIQUID PRESSURE	SATURATED LIQUID TEMPERATURE °F	
	PSIG	R-22
200	101	70
210	105	73
220	108	76
225	110	78
235	113	80
245	116	83
255	119	85
265	121	88
275	124	90
285	127	92
295	130	95
305	133	97
325	137	101
355	144	108
375	148	112
405	155	118
415	157	119
425	n/a	121
435	n/a	123
445	n/a	125
475	n/a	130
500	n/a	134
525	n/a	138
550	n/a	142
575	n/a	145
600	n/a	149
625	n/a	152

NOTE: SPECIFICATIONS AND PERFORMANCE DATA LISTED HEREIN ARE SUBJECT TO CHANGE WITHOUT NOTICE.

Fixed Orifice

1. Temporarily install a thermometer 4-6" from the compressor on the suction line. Ensure the thermometer makes adequate contact and is insulated for best possible readings. Use vapor temperature to determine superheat.
2. Refer to the superheat table provided for proper system superheat. Add charge to lower superheat or recover charge to raise superheat.

Expansion Valve System

NOTE: AVPTC air handlers have a non-adjustable TXV. Charge unit match with this air handler by subcooling only.

1. Temporarily install a thermometer on the liquid line at the liquid line service valve and 4-6" from the compressor on the suction line. Ensure the thermometer makes adequate contact and is insulated for best possible readings. Use liquid line temperature to determine sub-cooling and vapor temperature to determine superheat.
2. Check subcooling and superheat. Systems with TXV application should have a subcooling of 7 to 9 °F and superheat of 7 to 9 °F.
 - a. If subcooling and superheat are low, **adjust** TXV to 7 to 9 °F superheat, then check subcooling.

NOTE: To adjust superheat, turn the valve stem clockwise to increase and counter clockwise to decrease.

- b. If subcooling is low and superheat is high, **add** charge to raise subcooling to 7 to 9 °F then check superheat.
- c. If subcooling and superheat are high, **adjust** TXV valve to 7 to 9 °F superheat, then check subcooling.
- d. If subcooling is high and superheat is low, **adjust** TXV valve to 7 to 9 °F superheat and **remove** charge to lower the subcooling to 7 to 9 °F.

NOTE: Do **NOT** adjust the charge based on suction pressure unless there is a gross undercharge.

NOTE: Check the Schrader ports for leaks and tighten valve cores if necessary. Install caps finger-tight.

Heat Pump - Heating Cycle

The proper method of charging a heat pump in the heat mode is by weight with the additional charge adjustments for line size, line length, and other system components. For best results, on outdoor units with TXVs, superheat should be 2-5° at 4-6" from the compressor. Make final charge adjustments in the cooling cycle.

Troubleshooting Information

Complaint	No Cooling						Unsatisfactory Cooling/Heating						System Operating Pressures				Test Method Remedy			
	SYMPTOM	System will not start	Compressor will not start - fan runs	Comp. and Cond. Fan will not start	Evaporator fan will not start	Condenser fan will not start	Compressor runs - goes off on overload	Compressor cycles on overload	System runs continuously - little cooling/heating	Too cool and then too warm	Not cool enough on warm days	Certain areas too cool, others too warm	Compressor is noisy	System runs - blows cold air in heating	Unit will not terminate defrost	Unit will not defrost		Low suction pressure	Low head pressure	High suction pressure
Power Failure	•																			Test Voltage
Blown Fuse	•		•	•																Inspect Fuse Size & Type
Unbalanced Power, 3PH		•					•													Test Voltage
Loose Connection	•			•			•													Inspect Connection - Tighten
Shorted or Broken Wires	•	•	•	•	•	•														Test Circuits With Ohmmeter
Open Fan Overload				•	•															Test Continuity of Overload
Faulty Thermostat	•		•	•				•												Test Continuity of Thermostat & Wiring
Faulty Transformer	•		•																	Check Control Circuit with Voltmeter
Shorted or Open Capacitor		•		•	•	•	•													Test Capacitor
Internal Compressor Overload Open		•											♦							Test Continuity of Overload
Shorted or Grounded Compressor		•				•														Test Motor Windings
Compressor Stuck		•				•	•													Use Test Cord
Faulty Compressor Contactor			•		•	•														Test Continuity of Coil & Contacts
Faulty Fan Relay				•																Test Continuity of Coil And Contacts
Open Control Circuit				•																Test Control Circuit with Voltmeter
Low Voltage		•				•	•													Test Voltage
Faulty Evap. Fan Motor				•												•		♦		Repair or Replace
Shorted or Grounded Fan Motor				•															•	Test Motor Windings
Improper Cooling Anticipator							•	•												Check Resistance of Anticipator
Shortage of Refrigerant							•	•					♦							Test For Leaks, Add Refrigerant
Restricted Liquid Line							•	•								•	•	•		Remove Restriction, Replace Restricted Part
Open Element or Limit on Elec. Heater								♦						♦						Test Heater Element and Controls
Dirty Air Filter								•	•	•						•			♦	Inspect Filter-Clean or Replace
Dirty Indoor Coil								•	•	•						•			♦	Inspect Coil - Clean
Not enough air across Indoor Coil								•	•	•						•			♦	Check Blower Speed, Duct Static Press, Filter
Too much air across Indoor Coil																♦	•			Reduce Blower Speed
Overcharge of Refrigerant						•	•					•	♦				•	•		Recover Part of Charge
Dirty Outdoor Coil					•	•										♦				Inspect Coil - Clean
Noncondensibles							•						♦							Recover Charge, Evacuate, Recharge
Recirculation of Condensing Air							•												•	Remove Obstruction to Air Flow
Infiltration of Outdoor Air							•		•	•										Check Windows, Doors, Vent Fans, Etc.
Improperly Located Thermostat					•			•												Relocate Thermostat
Air Flow Unbalanced								•		•										Readjust Air Volume Dampers
System Undersized								•	•											Refigure Cooling Load
Broken Internal Parts												•	♦							Replace Compressor
Broken Valves								•								•	•			Test Compressor Efficiency
Inefficient Compressor								•								•	•			Test Compressor Efficiency
Wrong Type Expansion Valve						•	•	•	•							•	•		♦	Replace Valve
Expansion Device Restricted						•	•	•	•							•	•			Remove Restriction or Replace Expansion Device
Oversized Expansion Valve								•												Replace Valve
Undersized Expansion Valve						•	•	•	•							•				Replace Valve
Expansion Valve Bulb Loose													•							Tighten Bulb Bracket
Inoperative Expansion Valve						•										•				Check Valve Operation
Loose Hold-down Bolts													•							Tighten Bolts
Faulty Reversing Valve						•								♦	♦	♦		♦	♦	Replace Valve or Solenoid
Faulty Defrost Control						•								♦	♦	♦	♦	♦	♦	Test Control
Faulty Defrost Thermostat														♦	♦	♦	♦	♦	♦	Test Defrost Thermostat
Flowrator Not Seating Properly								•									•	•		Check Flowrator & Seat or Replace Flowrator

• Cooling or Heating Cycle (Heat Pump)

♦ Heating Cycle Only (Heat Pump)

For detailed service information refer to the Remote Condensing Unit Service manual.

NOTICE

Units with rotary or reciprocating compressors and non-bleed TXV's require a Hard Start Kit.

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SPLIT SYSTEMS

AIR CONDITIONING AND HEAT PUMP HOMEOWNER'S ROUTINE MAINTENANCE RECOMMENDATIONS

We strongly recommend a bi-annual maintenance checkup be performed before the heating and cooling seasons begin by a qualified servicer.

Replace or Clean Filter

IMPORTANT NOTE: Never operate unit without a filter installed as dust and lint will build up on internal parts resulting in loss of efficiency, equipment damage and possible fire.

An indoor air filter must be used with your comfort system. A properly maintained filter will keep the indoor coil of your comfort system clean. A dirty coil could cause poor operation and/or severe equipment damage.

Your air filter or filters could be located in your furnace, in a blower unit, or in "filter grilles" in your ceiling or walls. The installer of your air conditioner or heat pump can tell you where your filter(s) are, and how to clean or replace them.

Check your filter(s) at least once a month. When they are dirty, replace or clean as required. Disposable type filters should be replaced. Reusable type filters may be cleaned.

You may want to ask your dealer about high efficiency filters. High efficiency filters are available in both electronic and non-electronic types. These filters can do a better job of catching small airborne particles.

Compressor

The compressor motor is hermetically sealed and does not require additional oiling.

Motors

Indoor and outdoor fan motors are permanently lubricated and do not require additional oiling.

Clean Outside Coil (Qualified Servicer Only)



WARNING

HIGH VOLTAGE!

DISCONNECT ALL POWER BEFORE SERVICING.
MULTIPLE POWER SOURCES MAY BE PRESENT.
FAILURE TO DO SO MAY CAUSE PROPERTY DAMAGE,
PERSONAL INJURY OR DEATH.



Air must be able to flow through the outdoor unit of your comfort system. Do not construct a fence near the unit or build a deck or patio over the unit without first discussing your plans with your dealer or other qualified servicer. Restricted airflow could lead to poor operation and/or severe equipment damage.

Likewise, it is important to keep the outdoor coil clean. Dirt, leaves, or debris could also restrict the airflow. If cleaning of the outdoor coil becomes necessary, hire a qualified servicer. Inexperienced people could easily puncture the tubing in the coil. Even a small hole in the tubing could eventually cause a large loss of refrigerant. Loss of refrigerant can cause poor operation and/or severe equipment damage.

Do not use a condensing unit cover to "protect" the outdoor unit during the winter, unless you first discuss it with your dealer. Any cover used must include "breathable" fabric to avoid moisture buildup.

BEFORE CALLING YOUR SERVICER

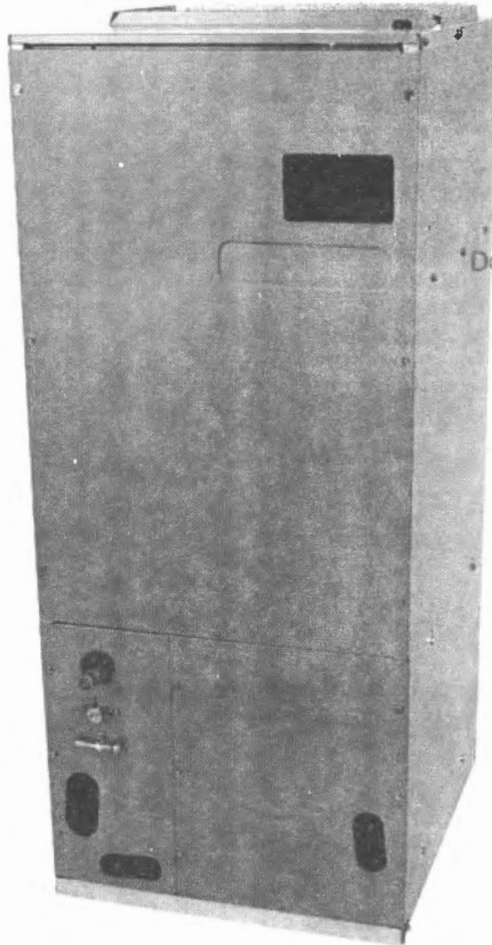
- Check the thermostat to confirm that it is properly set.
- Wait 15 minutes. Some devices in the outdoor unit or in programmable thermostats will prevent compressor operation for awhile, and then reset automatically. Also, some power companies will install devices which shut off air conditioners for several minutes on hot days. If you wait several minutes, the unit may begin operation on its own.
- Check the electrical panel for tripped circuit breakers or failed fuses. Reset the circuit breakers or replace fuses as necessary.
- Check the disconnect switch near the indoor furnace or blower to confirm that it is closed.
- Check for obstructions on the outdoor unit. Confirm that it has not been covered on the sides or the top. Remove any obstruction that can be safely removed. If the unit is covered with dirt or debris, call a qualified servicer to clean it.
- Check for blockage of the indoor air inlets and outlets. Confirm that they are open and have not been blocked by objects (rugs, curtains or furniture).
- Check the filter. If it is dirty, clean or replace it.
- Listen for any unusual noise(s), other than normal operating noise, that might be coming from the outdoor unit. If you hear unusual noise(s) coming from the unit, call a qualified servicer.



CAUTION

TO AVOID THE RISK OF EQUIPMENT DAMAGE OR FIRE, INSTALL THE SAME AMPERAGE BREAKER OR FUSE AS YOU ARE REPLACING. IF THE CIRCUIT BREAKER OR FUSE SHOULD OPEN AGAIN WITHIN THIRTY DAYS, CONTACT A QUALIFIED SERVICER TO CORRECT THE PROBLEM.
IF YOU REPEATEDLY RESET THE BREAKER OR REPLACE THE FUSE WITHOUT HAVING THE PROBLEM CORRECTED, YOU RUN THE RISK OF SEVERE EQUIPMENT DAMAGE.

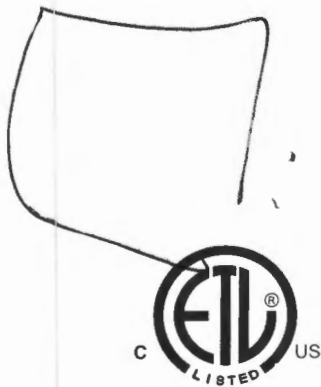
ATUF/ARUF/ARPF/ADPF/ASPF AIR HANDLERS INSTALLATION & OPERATING INSTRUCTIONS



RECEIVED

FEB 06 2013

Dept. of Building Inspections
City of Portland Maine



**NOTE: ATUF models are suitable for Upflow and Horizontal Installations only.
Do not use for Downflow Installations**



RECOGNIZE THIS SYMBOL AS A SAFETY PRECAUTION.

ATTENTION INSTALLING PERSONNEL

Prior to installation, thoroughly familiarize yourself with this Installation Manual. Observe all safety warnings.
During installation or repair, caution is to be observed.

It is your responsibility to install the product safely and to educate the customer on its safe use.



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Important Safety Instructions

The following symbols and labels are used throughout this manual to indicate immediate or potential safety hazards. It is the owner's and installer's responsibility to read and comply with all safety information and instructions accompanying these symbols. Failure to heed safety information increases the risk of personal injury, property damage, and/or product damage.

WARNING

HIGH VOLTAGE!
Disconnect ALL power before servicing.
Multiple power sources may be present.
Failure to do so may cause property damage,
personal injury or death.



WARNING

Installation and repair of this unit should be performed **ONLY** by individuals meeting the requirements of an "entry level technician", at a minimum, as specified by the Air-Conditioning, Heating and Refrigeration Institute (AHRI). Attempting to install or repair this unit without such background may result in product damage, personal injury or death.

WARNING

This product is factory-shipped for use with 208/240/1/60 electrical power supply. **DO NOT** reconfigure this air handler to operate with any other power supply.

WARNING

To avoid property damage, personal injury or death due to electrical shock, this unit **MUST** have an **uninterrupted, unbroken** electrical ground. The electrical ground circuit may consist of an appropriately sized electrical wire connecting the ground lug in the unit control box to the building electrical service panel.

Other methods of grounding are permitted if performed in accordance with the National Electric Code (NEC)/American National Standards Institute (ANSI)/National Fire Protection Association (NFPA) 70 and local/state codes. In Canada, electrical grounding is to be in accordance with the Canadian Electric Code (CSA) C22.1.

CAUTION

When installing or servicing this equipment, safety clothing, including hand and eye protection, is strongly recommended. If installing in an area that has special safety requirements (hard hats, etc.), Observe these requirements.

WARNING

Do not connect to or use any device that is not design-certified by Goodman for use with this unit. Serious property damage, personal injury, reduced unit performance and/or hazardous conditions may result from the use of such non-approved devices.

WARNING

To prevent the risk of property damage, personal injury, or death, do not store combustible materials or use gasoline or other flammable liquids or vapors in the vicinity of this unit.

**DANGER**
PELIGRO



CARBON MONOXIDE POISONING HAZARD

Special Warning for Installation of Furnace or Air Handling Units in Enclosed Areas such as Garages, Utility Rooms or Parking Areas

Carbon monoxide producing devices (such as an automobile, space heater, gas water heater, etc.) should not be operated in enclosed areas such as unventilated garages, utility rooms or parking areas because of the danger of carbon monoxide (CO) poisoning resulting from the exhaust emissions. If a furnace or air handler is installed in an enclosed area such as a garage, utility room or parking area and a carbon monoxide producing device is operated therein, there must be adequate, direct outside ventilation.

This ventilation is necessary to avoid the danger of CO poisoning which can occur if a carbon monoxide producing device continues to operate in the enclosed area. Carbon monoxide emissions can be (re)circulated throughout the structure if the furnace or air handler is operating in any mode.

CO can cause serious illness including permanent brain damage or death.

B10259-216

Important Note to the Owner regarding Product Warranty

Your warranty certificate is supplied as a separate document with the unit installed by your contractor. Read the limited warranty certificate carefully to determine what is and is not covered and keep the warranty certificate in a safe place. If you are unable to locate the warranty certificate please contact your installing contractor or contact customer service (877-254-4729) to obtain a copy.

To receive the 10 Year Parts Limited Warranty, online registration must be completed within 60 days of installation. Online registration is not required in California or Quebec.

To register your Goodman® brand unit, go to www.goodmanmfg.com. Click on the word "Warranty" located on the left side of the home page. Next, click on the word "Product Registration" located on the left side of the Warranty page and complete the forms in the manner indicated on the Product Registration page.

To register your Amana® brand unit, go to www.amana-hac.com. Click on the word "Warranty" located on the top right of the home page. Next, click on the word "Product Registration" located on the left side of the Warranty page and complete the forms in the manner indicated on the Product Registration page.

Product limited warranty certificates for models currently in production can be viewed at www.goodmanmfg.com or www.amana-hac.com. If your model is not currently in production or does not appear on the website, please contact your installing contractor or contact customer service (877-254-4729) to obtain a copy of your warranty certificate.

Each product overview page contains a Product Warranty link; by clicking on it you will be able to view the limited warranty coverage for that specific product. To view warranty registration information, click on the Product Warranty text on the left navigation panel on the home page of each website. The Online Product Registration pages are located in this same section.

Keep this literature in a safe place for future reference.

Shipping Inspection

Always keep the unit upright; laying the unit on its side or top may cause equipment damage. Shipping damage, and subsequent investigation is the responsibility of the carrier. Verify the model number, specifications, electrical characteristics, and accessories are correct prior to installation. The distributor or manufacturer will not accept claims from dealers for transportation damage or installation of incorrectly shipped units.

Codes & Regulations

This product is designed and manufactured to comply with national codes. Installation in accordance with such codes and/or prevailing local codes/regulations is the responsibility of the installer. The manufacturer assumes no responsibility for equipment installed in violation of any codes or regulations.

The United States Environmental Protection Agency (EPA) has issued various regulations regarding the introduction and disposal of refrigerants. Failure to follow these regulations may harm the environment and can lead to the imposition of substantial fines. Should you have any questions please contact the local office of the EPA.

Replacement Parts

When reporting shortages or damages, or ordering repair parts, give the complete product model and serial numbers as stamped on the product. Replacement parts for this product are available through your contractor or local distributor. For the location of your nearest distributor consult the white business pages, the yellow page section of the local telephone book or contact:

CONSUMER AFFAIRS
GOODMAN MANUFACTURING COMPANY, L.P.
7401 SECURITY WAY
HOUSTON, TEXAS 77040
(877) 254-4729

If replacing an air handler, the system must be manufacturer approved and Air-Conditioning, Heating, and Refrigeration Institute (AHRI) matched. **NOTE:** Installation of unmatched systems is strongly discouraged.

Pre-Installation Instructions

Carefully read all instructions for the installation prior to installing product. Make sure each step or procedure is understood and any special considerations are taken into account before starting installation. Assemble all tools, hardware and supplies needed to complete the installation. Some items may need to be purchased locally. Make sure everything needed to install the product is on hand before starting.

Location

NOTE: Air handlers are designed for *indoor installation only*.

Give special consideration to minimizing the length of refrigerant tubing when installing air handlers. Refer to Remote Cooling/Heat Pump Service Manual, TP-106 Long Line Set Application R-22 or TP-107 Long Line Set Application R-410A for guidelines. The unit clearance from a combustible surface may be 0". However, service clearance is to take precedence. In addition allow a minimum of 24" in front of the unit for service clearance.

Do not install the air handler in a location that violates the instructions provided with the condenser.

If the unit is located in an area with high ambient temperature and/or high humidity the air handler maybe subject to nuisance sweating of the casing. On these installations a wrap of 2" fiberglass insulation with a vapor barrier is recommended.

Consult all appropriate regulatory codes prior to determining final clearances. When installing this unit in an area that may become wet, elevate the unit with a sturdy, non-porous material. In installations that may lead to physical damage (i.e. a garage) it is advised to install a protective barrier to prevent such damage.

Ductwork

This air handler is designed for a complete supply and return ductwork system.



CAUTION

Do not operate this product without all the ductwork attached.

To ensure correct system performance, the ductwork is to be sized to accommodate 375-425 CFM per ton of cooling with the static pressure not to exceed .5" WC. Inadequate duct work that restricts airflow can result in improper performance and compressor or heater failure. Ductwork is to be constructed in a manner that limits restrictions and maintains suitable air velocity. Ductwork is to be sealed to the unit in a manner that will prevent leakage.

Return Ductwork

DO NOT TERMINATE THE RETURN DUCTWORK IN AN AREA THAT CAN INTRODUCE TOXIC, OR OBJECTIONABLE FUMES/ODORS INTO THE DUCTWORK. The return ductwork is to be introduced into the air handler bottom (upflow configuration).

Return Air Filters

Each installation must include a return air filter. This filtering may be performed at the air handler or externally such as a

return air filter grille. Air handlers mounted in the downflow orientation, including "B" series, require external filtering. A washable filter is available as an accessory. To ensure optimum performance frequent filter cleaning is advised. Refer to **Table 1** for the appropriate filter.

ATUF	ARUF ARPF	ADPF	ASPF	Filter Number	Qty Required
1824	1729 1824	1824	N/A	FIL 18-32	1
3030 1931 3636	3030 1931 3636	3030	1830	FIL 36-42	1
3642 3743 4860	3642 3743 4860	3042 4860	3036 3137 4260	FIL 48-61	1

Table 1

Electric Heat

Refer to this manual in combination with the instructions provided with the heat kit for the correct installation procedure.

The air handlers listed in this manual do not have factory installed electric heat. Electric heat is available as an accessory. If installing this option, the **ONLY** heat kits that can be used are the HKR series.

NOTE: The Amana® brand EHK, ECB, EDB, and EDK kits are **NOT** approved for use with these air handlers.

The heating mode temperature rise is dependent upon the system airflow, the supply voltage, and the heat kit size (kW) selected. Use **Tables 2, 3, and 4** to determine the temperature rise (°F).

CFM	HEAT KIT NOMINAL kW							
	3	5	6	8	10	15	20	21
600	18	28	35	41				
800	13	21	26	31	42			
1000	11	17	21	25	34	50		
1200	9	14	18	21	28	42	56	62
1400	8	12	15	18	24	36	48	53
1600	7	10	13	15	21	31	42	46
1800	6	9	12	14	19	28	37	41
2000	5	8	11	12	17	25	34	37

Table 2

230/1/60 Supply Voltage - Temperature Rise Table °F

CFM	HEAT KIT NOMINAL kW							
	3	5	6	8	10	15	20	21
600	17	27	34	39				
800	13	20	25	30	40			
1000	10	16	20	24	32	48		
1200	8	13	17	20	27	40	53	59
1400	7	11	14	17	23	34	46	51
1600	6	10	13	15	20	30	40	44
1800	6	9	11	13	18	27	36	39
2000	5	8	10	12	16	24	32	35

Table 3

220/1/60 Supply Voltage - Temperature Rise Table °F

CFM	HEAT KIT NOMINAL kW							
	3	5	6	8	10	15	20	21
600	16	25	32	37				
800	12	19	24	38	38			
1000	10	15	19	22	30	46		
1200	8	13	16	19	25	38	51	56
1400	7	11	14	16	22	33	43	48
1600	6	9	12	14	19	28	38	42
1800	5	8	11	12	17	25	34	37
2000	5	8	10	11	15	23	30	34

Table 4
208/1/60 Supply Voltage - Temperature Rise Table °F

NOTE: For installations not indicated above the following formula is to be used:

$$TR = (kW \times 3412) \times (\text{Voltage Correction}) \times 1.08 / CFM$$

Where: TR = Temperature Rise
 kW = Heater Kit Actual kW
 3412 = Btu per kW
 Voltage Correction = .96 (230 Supply Volts)
 = .92 (220 Supply Volts)
 = .87 (208 Supply Volts)
 1.08 = Constant
 CFM = Measured Airflow

NOTE: The Temperature Rise Tables can also be used to determine the air handler airflow delivery. When using these tables for this purpose set the room thermostat to maximum heat and allow the system to reach steady state conditions. Insert two thermometers, one in the return air and one in the supply air. The temperature rise is the supply air temperature minus the room air temperature. Use HKR specification sheets to determine the HKR available for a given air handler.

HKR Installation

Follow instructions listed in Installation and Operating Instructions shipped with the heat kit.

Electrical Supply Wire and MOP

CAUTION
FIRE HAZARD!
 To avoid the risk of property damage, personal injury or fire, use only copper conductors.

WARNING
HIGH VOLTAGE!
 Disconnect ALL power before servicing. Multiple power sources may be present. Failure to do so may cause property damage, personal injury or death.

WARNING
HIGH VOLTAGE!
 To avoid property damage, personal injury or death due to electrical shock, this unit **MUST** have an uninterrupted, unbroken electrical ground. The electrical ground circuit may consist of an appropriately sized electrical wire connecting the ground lug in the unit control box to the building electrical service panel. Other methods of grounding are permitted if performed in accordance with the National Electric Code (NEC)/American National Standards Institute (ANSI)/National Fire Protection Association (NFPA) 70 and local/state codes. In Canada, electrical grounding is to be in accordance with the Canadian Electric Code (CSA) C22.1.

Building Electrical Service Inspection

This unit is designed for single-phase electrical supply. DO NOT OPERATE ON A THREE-PHASE POWER SUPPLY. Measure the power supply to the unit. The supply voltage **must** be in agreement with the unit nameplate power requirements and within the range shown in **Table 5**.

Nominal Input	Minimum Voltage	Maximum Voltage
208/240	187	253

Table 5

Wire Sizing

Wire size is important to the operation of your equipment. Use the following check list when selecting the appropriate wire size for your unit.

- **Wire size must carry the Minimum Circuit Ampacity (MCA).**
- Refer to the NEC (USA) or CSA (Canada) for wire sizing. The unit MCA for the air handler and the optional electric heat kit can be found on the unit Series and Rating Plate.
- **Wire size allows for no more than a 2% voltage drop from the building breaker/fuse panel to the unit.**

Refer to the latest edition of the National Electric Code or in Canada the Canadian Electric Code when determining the correct wire size. The following table shows the current carrying capabilities for copper conductors rated at 75°C with a 2% voltage drop. Use **Table 6** to determine the voltage drop per foot of various conductors.

Wire Size (AWG)	Maximum Allowable Length in Feet to Limit Voltage Drop to 2%*							
	Minimum Circuit Ampacity (MCA)							
	10	15	20	25	30	35	40	45
14	75	50	37	NR	NR	NR	NR	NR
12	118	79	59	47	NR	NR	NR	NR
10	188	125	95	75	63	54	NR	NR
8	301	201	150	120	100	86	75	68
6	471	314	235	188	157	134	118	110

*Based on NEC 1996

Table 6

Maximum Overcurrent Protection (MOP)

Every installation must include an NEC (USA) or CEC (Canada) approved overcurrent protection device. Also, check with local or state codes for any special regional requirements.

Protection can be in the form of fusing or HACR style circuit breakers. The Series and Rating Plate can be used as a guide for selecting the MAXIMUM overcurrent device.

NOTE: Fuses or circuit breakers are to be sized larger than the equipment MCA but not to exceed the MOP.

Electrical Connections – Supply Voltage

USE COPPER CONDUCTORS ONLY.

A knockout is provided on the air handler top panel or side to allow for the entry of the supply voltage conductors. If the knockouts on the cabinet sides are used for electrical conduit, an adapter ring must be used in order to meet UL1995 safety requirements. An NEC or CEC approved strain relief is to be used at this entry point. The wire is to be sized in accordance with the “Electrical Wire and MOP” section of this manual. Some areas require the supply wire to be enclosed in conduit. Consult your local codes.

Air Handler Only (Non-Heat Kit Models)

The building supply connects to the stripped black and red wires contained in the air handler electrical compartment cavity. A ground screw is also contained in this area. Attach the supply wires to the air handler conductors as shown in the unit wiring diagram using appropriately sized solderless connectors or other NEC or CEC approved means.

Air Handler With Non-Circuit Breaker Heat Kits

A terminal block is provided with the HKR kit to attach the power supply and air handler connections. Follow the HKR Installation Manual and wiring diagram for complete wiring details.

Air Handler With Heat Kits Containing a Circuit Breaker

HKR models with a “C” suffix contain a circuit breaker(s). The air handler has a plastic cover on the access panel that will require either one or both sections to be removed to allow the heat kit circuit breaker(s) to be installed. See the HKR Installation Instructions for further details. The air handler wires and supply wires are installed directly onto the HKR circuit breaker(s) as shown in the HKR Installation Manual and wiring diagram.

Low Voltage Connections

Several combinations of low voltage schemes are available, depending on the presence of a heat kit and whether the heat kit is single-stage or multi-staging. The low voltage connections are determined by whether the outdoor unit is a condenser or heat pump. The 24V-control voltage connects the air handler to the room thermostat and condenser. Low voltage wiring is to be copper conductors. A minimum of 18AWG must be used for installations up to 50’ and 16AWG for installations over 50’. Low voltage wiring can be connected through the top of the cabinet or either side. See the “Thermostat Wiring” section of this manual for typical low voltage wiring connections.

Refrigerant Lines



WARNING

This product is factory-shipped under pressure. Follow these instructions to prevent injury.



WARNING

A quenching cloth is strongly recommended to prevent scorching or marring of the equipment finish when welding close to the painted surfaces. Use brazing alloy of 5% minimum silver content.

Tubing Preparation

All cut ends are to be round, burr free, and clean. Failure to follow this practice increases the chances for refrigerant leaks. The suction line is spun closed and requires pipe cutters to remove the closed end.

Post Brazing

Quench all welded joints with water or a wet rag.

Piping Size

For the correct tubing size, follow the specification for the condenser/heat pump.



CAUTION

Applying too much heat to any tube can melt the tube. Torch heat required to braze tubes of various sizes must be proportional to the size of the tube. Service personnel must use the appropriate heat level for the size of the tube being brazed.

Special Instructions

This coil comes equipped with a check style flowrator for refrigerant management. For most installations with matching applications, no change to the flowrator piston is required. However, in mix-matched applications, a flowrator piston change may be required. See the Goodman® piston kit chart or consult your local distributor for details regarding mix-matched piston sizing. If the mix-match application requires a different piston size, change the piston in the flowrator on the indoor coil before installing the coil and follow the procedure shown below.

IMPORTANT NOTE: Torch heat required to braze tubes of various sizes is proportional to the size of the tube. Tubes of smaller size require less heat to bring the tube to brazing temperature before adding brazing alloy. Applying too much heat to any tube can melt the tube. Service personnel must use the appropriate heat level for the size of the tube being brazed.

NOTE: The use of a heat shield when brazing is recommended to avoid burning the serial plate or the finish on the unit. Heat trap or wet rags should be used to protect heat sensitive components such as service valves and TXV valves.

1. Loosen the 13/16 nut **1 TURN ONLY** to allow high pressure tracer gas to escape. No gas indicates a possible leak.

2. After the gas has escaped, remove the nut and discard the black or brass cap.
3. Remove the check piston to verify it is correct and then replace the piston. See piston kit chart in instructions.
4. Use a tube cutter to remove the spin closure on the suction line.
5. Remove the tailpiece clamped to the exterior and **slide the 13/16 nut into place.**
6. Braze tailpiece to the line set liquid tube.

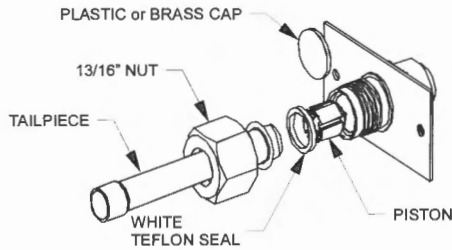


Figure 1

7. Insert the suction line into the connection, slide the insulation and the rubber grommet at least 18" away from the braze joint. Braze suction line.
8. **AFTER THE TAILPIECE HAS COOLED**, confirm position of the white Teflon® seal and hand tighten the 13/16 nut.
9. Torque the 13/16 nut to 10-25 ft-lbs. or tighten 1/6 turn.



CAUTION

Excessive torque can cause orifices to stick. Use the proper torque settings when tightening orifices.

10. Replace suction line grommet and insulation.

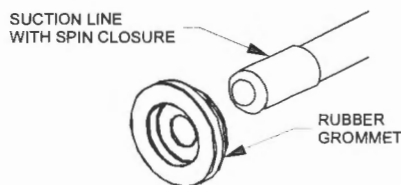


Figure 2

Downflow Conversion

NOTE: ATUF models should not be converted to Downflow applications.

"D" nomenclature models are factory equipped for "Dedicated Downflow" operation and no field conversion is required.

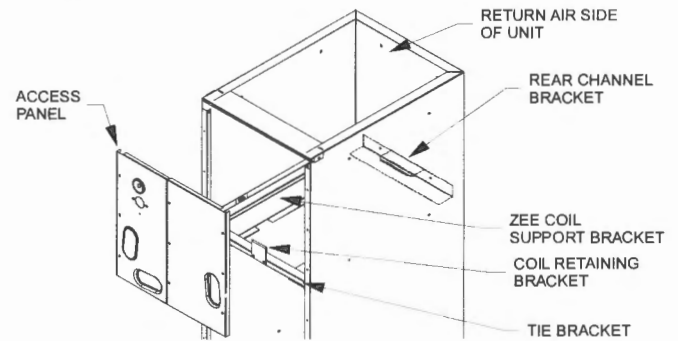
Conversion to downflow **MUST** be performed in an area that allows access to all sides prior to placing the air handler in its final location. To prevent the evaporator coil pan from "sweating" the DPI accessory insulation kit is to be used when performing this conversion. **NOTE:** The DPI kit is not supplied with this product and is to be purchased separately. See **Table 7** for the correct DPI kit.

ARUF, ATUF or ARPF Model	Insulation Kit
1729 / 1824	DPI18-30/20
3030 / 1931 / 3636	DPI36-42/20
3642 / 3743 / 4860 / 4961	DPI48-61/20

Table 7

Refer to **Figures 3 through 5** for the location of the components referenced in the following steps. **Figure 3** illustrates the new installation location for the removed components.

1. Before inverting the air handler, remove all access panels, the coil rear channel bracket, and the filter close-off panel.
2. Remove the evaporator coil and the horizontal drain pan. Discard horizontal drain pan.
3. Install the provided plastic plug into the vacated access panel.
4. Remove the two (2) zee coil support brackets and insulation retaining brackets.
5. Remove the tie bracket.
6. Install the DPI Insulation Kit onto the bottom of the drain pan.



NOTE: The filter provision is not applicable in THIS downflow application.

Figure 3

7. Install the zee coil supports and the wrapper stiffeners.
8. Install the tie bracket.
9. Install the rear channel bracket.
10. To prevent possible condensate "blow off" the insulation retainers are to be laid into the evaporator coil pan as shown in **Figure 4**.

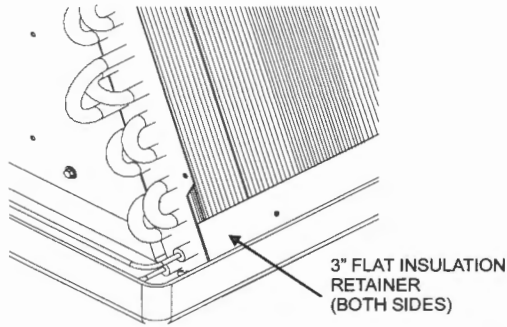


Figure 4

To complete the conversion, slide the evaporator coil into the chassis and attach the three (3) access panels. (Figure 5).

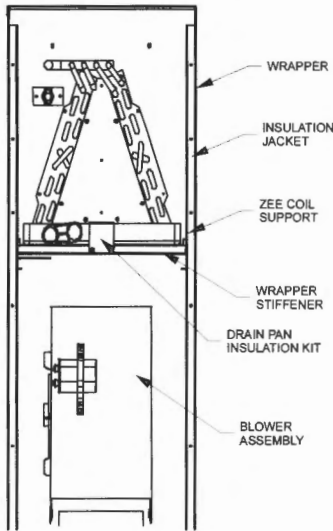


Figure 5

NOTE: When converted to downflow position, the coil may protrude above the cabinet on some models.

Horizontal Conversion

Dedicated Downflow models are not suitable for horizontal application and must not be used for this type of installation. The only field modification required for conversion to "Horizontal Right-Hand" is the removal of the plastic knockouts in the horizontal panel drain connections. To prevent the horizontal drain pan from sweating in high humidity applications, it is recommended that a DPIH insulation accessory kit be used. **NOTE:** The DPIH insulation kit is not supplied with this product and should be purchased separately. See Table 8 for the correct DPIH kit.

ARUF, ATUF or ARPF Model	Insulation Kit
1729 / 1824	DPIH18-32
3030 / 1931 / 3636	DPIH36-42
3642 / 3743 / 4860 / 4961	DPH48-61

Table 8

The following describes converting to "Horizontal Left-Hand". Conversion to downflow **MUST** be performed in an area that allows access to all sides prior to placing the air handler in its final location (See Figure 6).

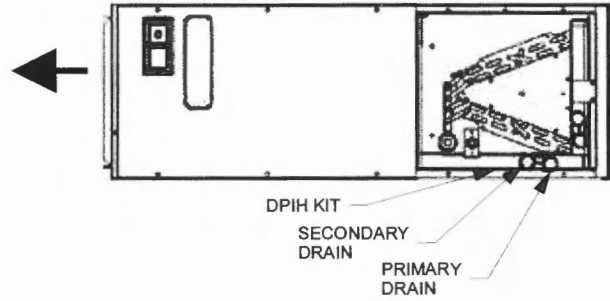


Figure 6

1. Remove the (3) air handler access panels.
2. Remove the "J" shaped bracket that retains the evaporator coil.
3. Remove the flowrator from the lower left side access panel and slide out the evaporator coil and horizontal drain pan.
4. Remove the gasket from the horizontal pan drain connections.
5. Remove the oval shaped plastic plug from the left side access panel. Remove the oval shaped rubber gasket seal from the lower right side access panel.
6. The drain connections for the horizontal pan are sealed with a thin coating of plastic. Carefully knock out this plastic seal with a screwdriver and hammer. **Note: The upper drain will become the secondary drain which is mandatory in many municipalities .**
7. Install the plastic plug removed in step 5 to the right side lower access panel and the oval shaped rubber gasket to the lower left access panel.
8. Reinstall the evaporator coil with the horizontal panel on the left side. Note: Push the assembly completely to the rear to ensure the engagement of the upflow pan with the rear channel bracket.
9. Install the "J" bracket (removed in step 2) to support the upflow pan to the tie channel.
10. Attach all panels and the metering device.

Condensate Removal

The coil drain pan has a primary and a secondary drain with 3/4" NPT female connections. The connectors required are 3/4" NPT male, either PVC or metal pipe, and should be hand tightened to a torque of approximately 37 in-lbs. to prevent damage to the drain pan connection. An insertion depth between .355 to .485 inches (3-5 turns) should be expected at this torque. Use the female (3/4 NPT) threaded fitting that protrudes outside of the enclosure for external connections.

1. Ensure drain pan hole is NOT obstructed.

- To prevent potential sweating and dripping on to finished space, it may be necessary to insulate the condensate drain line located inside the building. Use Armaflex® or similar material.

A Secondary Condensate Drain Connection has been provided for areas where the building codes require it. Pitch the drain line 1/4" per foot to provide free drainage. Insulate drain lines located inside the building to prevent sweating. Install a condensate trap to ensure proper drainage. If the secondary drain line is required, run the line separately from the primary drain and end it where it can be easily seen.

NOTE: Water coming from this line means the coil primary drain is plugged and needs clearing.



CAUTION

If secondary drain is not installed, the secondary access must be plugged.

The installation must include a "P" style trap that is located as close as is practical to the evaporator coil. See **Figure 7** for details of a typical condensate line "P" trap.

NOTE: Trapped lines are required by many local codes. In the absence of any prevailing local codes, please refer to the requirements listed in the Uniform Mechanical Building Code.

A drain trap in a **draw-through** application prevents air from being drawn back through the drain line during fan operation thus preventing condensate from draining, and if connected to a sewer line to prevent sewer gases from being drawn into the airstream during blower operation.

Field experience has shown condensate drain traps with an open vertical Tee between the air handler and the condensate drain trap can improve condensate drainage in some applications, but may cause excessive air discharge out of the open Tee. Goodman® does not prohibit this type of drain but we also do not recommend it due to the resulting air leakage. Regardless of the condensate drain design used, it is the installer's responsibility to ensure the condensate drain system is of sufficient design to ensure proper condensate removal from the coil drain pan.

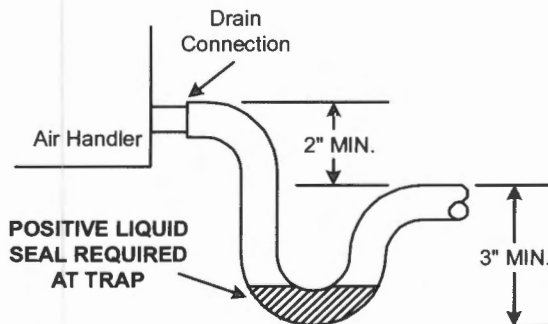


Figure 7

Use of a condensate removal pump is permitted when necessary. This condensate pump should have provisions for shutting off the control voltage should a blocked drain occur. A trap must be installed between the unit and the condensate pump.

IMPORTANT NOTE: The evaporator coil is coated with oils that may dissolve styrofoam and certain types of plastics. Therefore, a removal pump or float switch must not contain any of these materials.

Tip: Priming the "P" trap may avoid improper draining at the initial installation and at the beginning of the cooling season.

When coils are installed above ceilings, or in other locations where damage from condensate overflow may occur, it is **MANDATORY** to install a field fabricated auxiliary drain pan under the coil cabinet enclosure. Drain lines from the auxiliary pan must be installed and terminated so that the homeowner can see water discharges.

ACHIEVING 2% LOW LEAKAGE RATE

Ensure that the Neoprene gasket with PSA remains intact on all surfaces that the access panels are secured to. These surfaces are the entire length of the wrapper and areas between the upper tie plate, upper and lower access panels. Be sure that upper access panel breaker insert gasket is intact and also flowrator gasket is installed on the lower access panel. An additional drain hole cover is required.

ATUF/ARUF/ARPF/ADPF MOTOR

(Motor Speed Adjustment)

The motors in all ATUF, ARUF, ARPF and ADPF motors are multi-speed PSC motors. The color of the wire coming from the motor to the "COM" terminal on the control board defines in which speed the motor will operate. The black wire represents high speed, the red wire represents low speed, and the blue wire (select models only) represents medium speed. To change speeds, remove the wire attached to the "COM" terminal on the control board, and swap it with the wire (on terminal "M1" or "M2") with the color that will give the desired speed.

NOTE: In some models, not all speed taps are allowable for certain electric heat applications. Refer to air handler Series and Ratings plate for minimum speed.

Model	Speed	CFM delivered against External Static Pressure				
		0.1"	0.2"	0.3"	0.4"	0.5"
ARUF172916	High	1155	1090	1025	950	895
	Med.	940	890	860	815	755
	Low	695	665	650	610	550
ARUF182416	High	1155	1090	1025	950	895
	Med.	940	890	860	815	755
	Low	695	665	650	610	550
ARUF193116	High	1135	1085	1025	965	915
	Med.	860	825	780	750	680
	Low	600	570	545	500	465
ARUF303016	High	1385	1315	1240	1155	1065
	Med.	1340	1290	1230	1140	1050
	Low	1075	1030	980	910	840
ARUF363616	High	1310	1240	1155	1090	1020
	Med.	1270	1210	1140	1075	980
	Low	1045	1005	955	885	805
ARUF364216	High	1700	1660	1625	1545	1505
	Med.	1500	1440	1400	1350	1345
	Low	1330	1300	1250	1230	1220
ARUF374316	High	2065	2000	1925	1860	1780
	Med.	1685	1635	1550	1470	1410
	Low	1490	1425	1345	1280	1205
ARUF486016	High	2150	2120	2070	2000	1940
	Med.	1940	1930	1905	1860	1790
	Low	1610	1600	1590	1575	1550
ARUF496116	High	2150	2105	2040	1970	1880
	Med.	1960	1935	1895	1825	1750
	Low	1670	1625	1585	1525	1455

NOTE: Assumes dry coil with filter in place; SCFM correction for wet coil = 4% (208V/240V)

Model	Speed	CFM delivered against External Static Pressure				
		0.1"	0.2"	0.3"	0.4"	0.5"
ARPF18241*	High	1155	1090	1025	950	895
	Med.	940	890	860	815	755
	Low	695	665	650	610	550
ARPF19311*	High	1135	1085	1025	965	915
	Med.	860	825	780	750	680
	Low	600	570	545	500	465
ARPF30301*	High	1385	1315	1240	1155	1065
	Med.	1340	1290	1230	1140	1050
	Low	1075	1030	980	910	840
ARPF36361*	High	1310	1240	1155	1090	1020
	Med.	1270	1210	1140	1075	980
	Low	1045	1005	955	885	805
ARPF36421*	High	1700	1660	1625	1545	1505
	Med.	1500	1440	1400	1350	1345
	Low	1330	1300	1250	1230	1220
ARPF37431*	High	2065	2000	1925	1860	1780
	Med.	1685	1635	1550	1470	1410
	Low	1490	1425	1345	1280	1205
ARPF48601*	High	2150	2120	2070	2000	1940
	Med.	1940	1930	1905	1860	1790
	Low	1610	1600	1590	1575	1550
ARPF49611*	High	2150	2105	2040	1970	1880
	Med.	1960	1935	1895	1825	1750
	Low	1670	1625	1585	1525	1455

NOTE: Assumes dry coil with filter in place; SCFM correction for wet coil = 4% (208V/240V)

Model	Speed	CFM delivered against External Static Pressure				
		0.1"	0.2"	0.3"	0.4"	0.5"
ADPF18241/16	High	1,155	1,090	1,025	950	895
	Med.	940	890	860	815	755
	Low	695	665	650	610	550
ADPF30421/16	High	1,700	1,660	1,625	1,545	1,505
	Med.	1,500	1,440	1,400	1,350	1,345
	Low	1,370	1,300	1,250	1,230	1,220
ADPF48601/16	High	2,150	2,120	2,070	2,000	1,940
	Med.	1,940	1,930	1,905	1,860	1,790
	Low	1,610	1,600	1,590	1,575	1,550

NOTE: Assumes dry coil with filter in place; SCFM correction for wet coil = 4% (208V/240V)

Model	Speed	CFM delivered against External Static Pressure				
		0.1"	0.2"	0.3"	0.4"	0.5"
ATUF182416	High	1155	1090	1025	950	895
	Med.	875	830	790	750	715
	Low	640	610	570	535	490
ATUF193116	High	1135	1085	1025	965	915
	Med.	860	825	780	750	680
	Low	600	570	545	500	465
ATUF303016	High	1455	1385	1330	1205	1090
	Med.	1340	1290	1230	1140	1050
	Low	1075	1030	980	910	840
ATUF363616	High	1345	1290	1230	1150	1070
	Med.	1270	1210	1140	1075	980
	Low	1045	1005	955	885	805
ATUF364216	High	1700	1680	1645	1610	1535
	Med.	1500	1480	1440	1380	1325
	Low	135	1320	1275	1230	1195
ARUF374316	High	2065	2000	1925	1860	1780
	Med.	1685	1635	1550	1470	1410
	Low	1490	1425	1345	1280	1205
ATUF486016	High	2135	2080	1985	1900	1805
	Med.	1975	1935	1875	1775	1675
	Low	1715	1670	1650	1590	1530

NOTE: Assumes dry coil with filter in place; SCFM correction for wet coil = 4% (208V/240V)

ASPF Motor

The ASPF air handler features an energy efficient blower motor. The motor is a constant torque motor with very low power consumption. The motor is energized by 24 VAC. Adjust the CFM by changing the 24 VAC leads to the desired speed on the terminal block.

The ASPF motor blower speed is programmed to deliver adequate airflow at rated external static pressure and with 60 second off time delay. For details, refer to the specification sheet applicable to your model.

CFM Delivery

Table 13 shows the CFM speed tap settings for the ASPF.

Thermostats

NOTE: Second Stage heat can be accomplished by multi-stage heating thermostat or the addition of an outdoor thermostat as shown in **Figures 10 and 11**.

Goodman® part number CHT18-60 is a single-stage cool and single-stage heat thermostat.

Goodman® part number HPT18-60 is a single-stage cool, two-stage heat pump thermostat. The first stage is heat pump heating and the second stage is optional electric heat.

If additional features are desired, such as digital or programmable capabilities, these thermostats are commercially available. Follow the thermostat manufacturer's instruction for installation.

Start-Up Procedure

- Prior to start-up, ensure that all electrical connections are properly sized and tightened.
- All panels must be in place and secured. For Air Tight application, neoprene gasket must be positioned at prescribed locations to achieve 2% leakage.
- Tubing must be leak free.
- Unit should be elevated, trapped and pitched to allow for drainage.
- Low voltage wiring is connected.
- Auxiliary drain is installed when necessary and pitched to allow for drainage.

- Drain pan and drain tubing has been leak checked.
- Return and supply ducts are sealed.
- Unit is elevated when installed in a garage or where flammable vapors may be present.
- Unit is protected from vehicular or other physical damage.
- Return air is not obtained from any areas where there may be objectionable odors, flammable vapors or products of combustion such as carbon monoxide (CO), which may cause serious personal injury or death.

Regular Maintenance



WARNING

HIGH VOLTAGE!

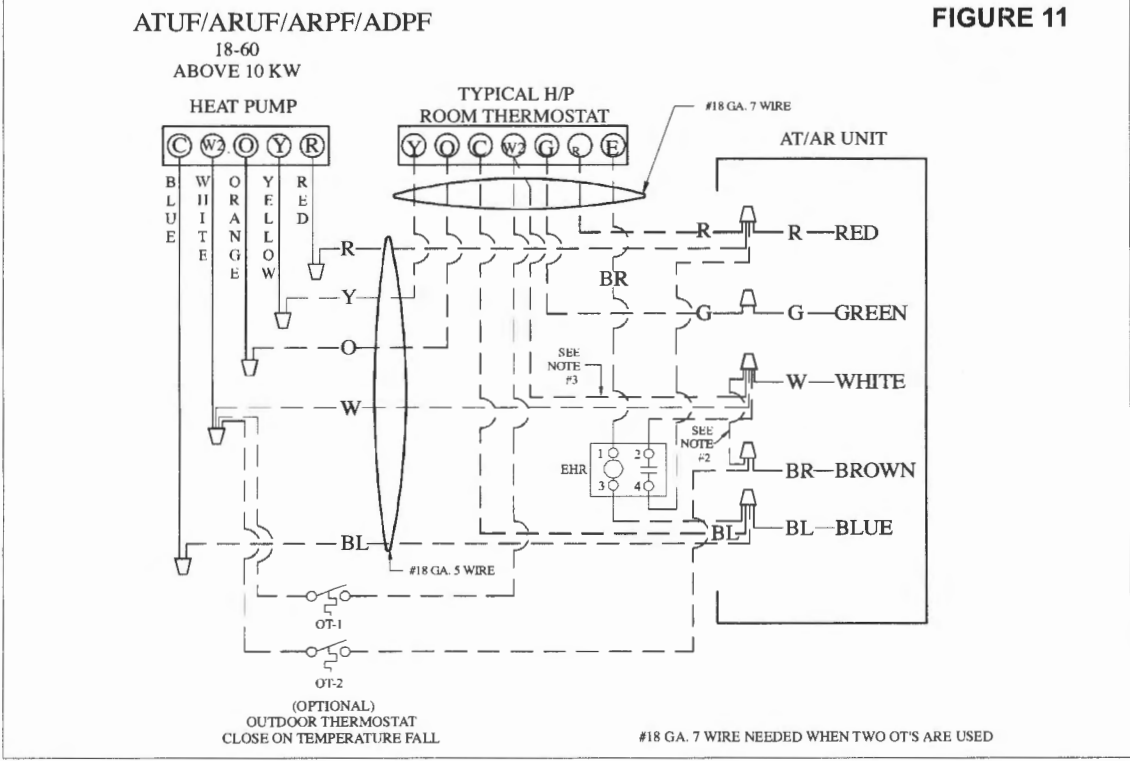
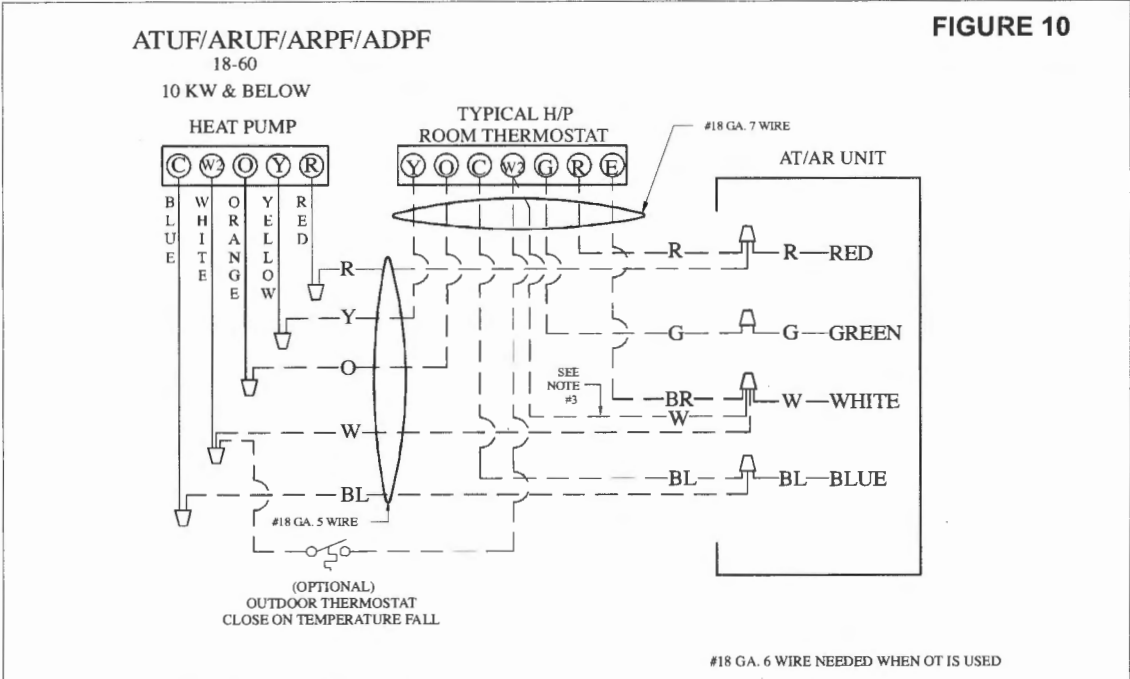
Disconnect ALL power before servicing or installing this unit. Multiple power sources may be present. Failure to do so may cause property damage, personal injury or death.



The only item to be maintained on a regular basis by the user is the circulating air filter(s). Filter should be cleaned or replaced regularly. A certified service technician must perform all other services.

NOTE: DO **NOT** USE THESE DIAGRAMS FOR AEPF MODELS. SEE INSTALLATION AND OPERATING INSTRUCTIONS SPECIFICALLY FOR AEPF MODELS.

WARNING HIGH VOLTAGE! DISCONNECT ALL POWER BEFORE SERVICING. MULTIPLE POWER SOURCES MAY BE PRESENT. FAILURE TO DO SO MAY CAUSE PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.



- NOTES:**
- 1) OUTDOOR THERMOSTAT (OT-1) SHOULD BE THE FIRST TO CLOSE AND THE LAST TO OPEN.
 - 2) CONNECT WHITE AND BROWN WIRES FROM AIR-HANDLER TOGETHER IF OT-2 IS NOT USED.
 - 3) REMOVE WIRE WHEN USING OUTDOOR THERMOSTAT

NOMENCLATURE
OT ---OUTDOOR THERMOSTAT (OPTIONAL)
EHR -EMERGENCY HEAT RELAY (OPTIONAL)

COLOR CODES
R --RED
Y --YELLOW
BL-BLUE
BR-BROWN
O --ORANGE
W -WHITE
G --GREEN

IMPORTANT: If outdoor thermostat is not used, tie white and brown wires from Air Handler together.

Wiring is subject to change. Always refer to the wiring diagram on the unit for the most up-to-date wiring.

ASPF THERMOSTAT CONNECTIONS

The following composite wiring diagrams detail various configurations in which the ASPF air handlers can be used. Examples include single-stage cooling and heat pump with single or two-stage electric heating. All these configurations can be applied with convenient connections to outdoor thermostat applications.

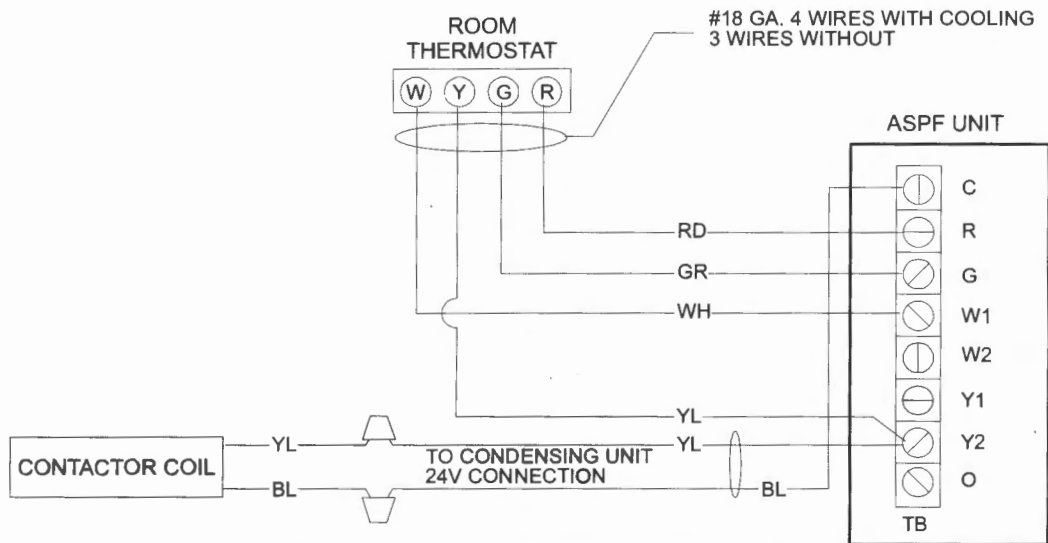
The following sections will be detailed:

- Single-Stage Cooling (GMC Thermostat Part #CHT18-60 or equivalent.)
- Heat Pump (GMC Thermostat Part #18-60 or equivalent)

Each diagram details the connections between room thermostat and ASPF air handlers, and the connections between the ASPF air handlers and the Condensing Unit (or Heat Pump) with optional connections to Outdoor Thermostats. For each configuration, refer to the explanation of the proper jumper(s) to remove for the corresponding blower speed that will result in the programmed ECM™ motor.

IMPORTANT: WHEN MATCHING THE ASPF AIR HANDLERS TO A SINGLE SPEED COOLING OR HEAT PUMP UNIT, REMEMBER TO CONNECT "Y" FROM THE THERMOSTAT TO THE "Y2" ON THE LOW VOLTAGE TERMINAL BOARD.

An equivalent thermostat can be used in place of the Goodman thermostat part number. The GMC thermostats that listed are mercury type thermostats.



COOLING UNIT WITH OPTIONAL HEAT KITS OF 10 kW AND BELOW

NOTES:

- 1) OUTDOOR THERMOSTAT (OT-1) SHOULD BE THE FIRST TO CLOSE AND THE LAST TO OPEN.
- 2) JUMPER W1 AND W2 TOGETHER IF OT-2 IS NOT USED.
- 3) REMOVE WIRE WHEN USING OUTDOOR THERMOSTAT.

NOMENCLATURE:

OT - OUTDOOR THERMOSTAT (OPTIONAL)
 EHR - EMERGENCY HEAT RELAY (OPTIONAL)

COLOR CODES

RD - RED
 YL - YELLOW
 BL - BLUE
 BR - BROWN
 OR - ORANGE
 WH - WHITE

Wiring is subject to change. Always refer to the wiring diagram on the unit for the most up-to-date wiring.



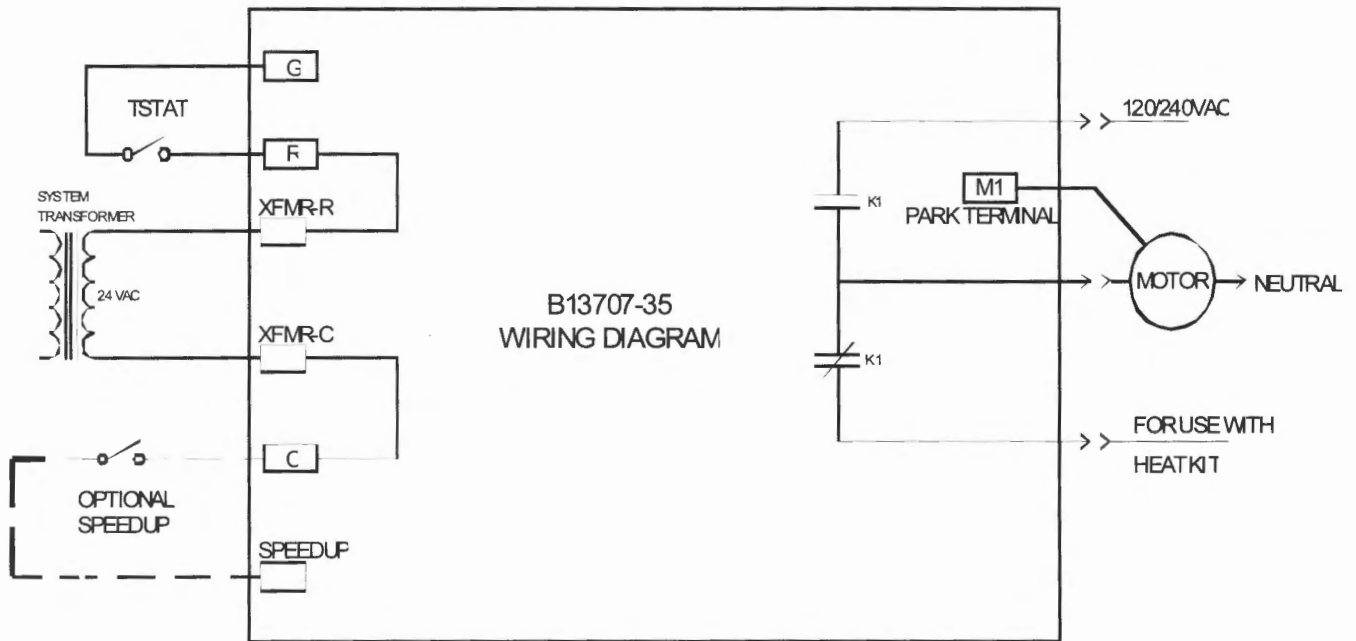
WARNING

HIGH VOLTAGE! DISCONNECT ALL POWER BEFORE SERVICING. MULTIPLE POWER SOURCES MAY BE PRESENT. FAILURE TO DO SO MAY CAUSE PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.



NOTE: This is not applicable to ASPF models.

ELECTRONIC BLOWER TIME DELAY RELAY



The Electronic Blower Time Delay Relay provides power to the blower motor with a delay of 7 seconds after 24VAC is applied to "G". After 24VAC is removed from "G", the blower motor output is de-energized after a delay of 65 seconds.

Normal Time Delays	60Hz	50Hz
Turn On Delay	7.0 SEC.±1%	8.4 SEC. ±1%
Turn Off Delay	65.0 SEC.±1%	78.0 SEC. ±1%

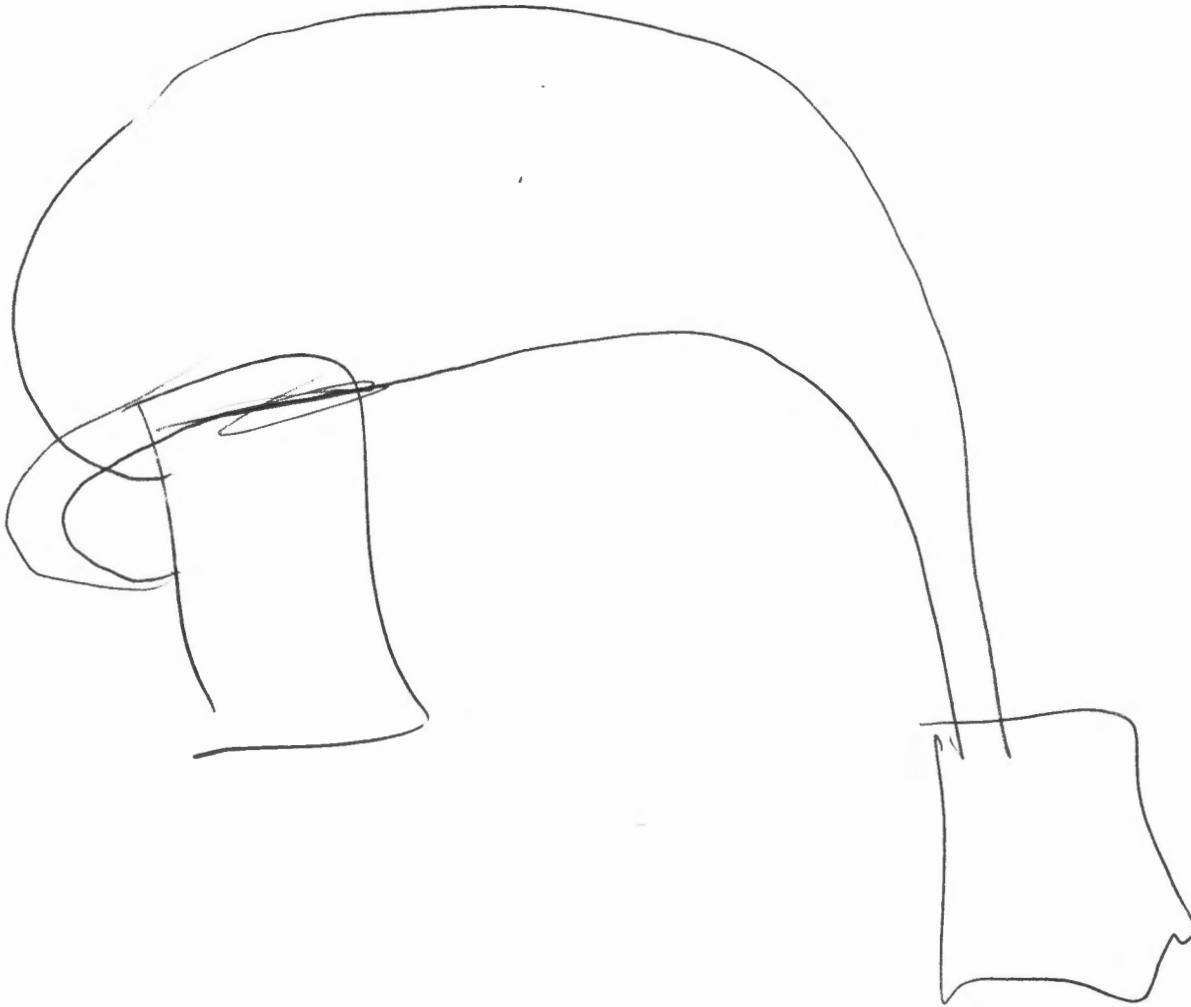
Field test mode: Shorting the "speedup" quick connect to "C" decrease times as follows:

Speedup Times	60Hz	50Hz
Turn On Delay	3.0 SEC.±1%	3.6 SEC. ±1%
Turn Off Delay	5.0 SEC.±1%	6.0 SEC. ±1%

Field test mode is cancelled when the "speedup" quick connect to "C" short is removed.

Wiring is subject to change. Always refer to the wiring diagram on the unit for the most up-to-date wiring.

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