

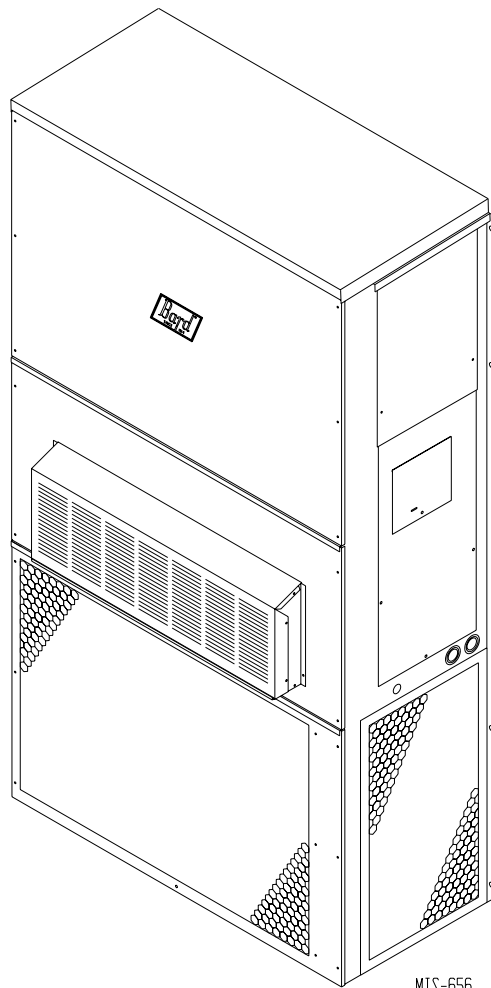
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# INSTALLATION INSTRUCTIONS

# WALL MOUNTED PACKAGED HEAT PUMP

Models: **WH301, WH361**

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MIS-656



Bard Manufacturing Company, Inc.  
Bryan, Ohio 43506  
*Since 1914. . .Moving ahead just as planned.*

Manual No.: 2100-1930  
Supersedes: 2100-193N  
File: Volume III, Tab 17  
Date: 05-04-07

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# Getting Other Information and Publications

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These publications can help you install the air conditioner or heat pump. You can usually find these at your local library or purchase them directly from the publisher. Be sure to consult current edition of each standard.

National Electrical Code ..... ANSI/NFPA 70

Standard for the Installation ..... ANSI/NFPA 90A  
of Air Conditioning and Ventilating Systems

Standard for Warm Air ..... ANSI/NFPA 90B  
Heating and Air Conditioning Systems

Load Calculation for ..... ACCA Manual J  
Residential Winter and Summer Air Conditioning

Duct Design for Residential ..... ACCA Manual D  
Winter and Summer Air Conditioning and Equipment  
Selection

## FOR MORE INFORMATION, CONTACT THESE PUBLISHERS:

**ACCA**    **Air Conditioning Contractors of America**  
1712 New Hampshire Avenue NW  
Washington, DC 20009  
Telephone: (202) 483-9370  
Fax: (202) 234-4721

**ANSI**    **American National Standards Institute**  
11 West Street, 13th Floor  
New York, NY 10036  
Telephone: (212) 642-4900  
Fax: (212) 302-1286

**ASHRAE** **American Society of Heating Refrigerating,  
and Air Conditioning Engineers, Inc.**  
1791 Tullie Circle, N.E.  
Atlanta, GA 30329-2305  
Telephone: (404) 636-8400  
Fax: (404) 321-5478

**NFPA**    **National Fire Protection Association**  
Batterymarch Park  
P.O. Box 9101  
Quincy, MA 02269-9901  
Telephone: (800) 344-3555  
Fax: (617) 984-7057

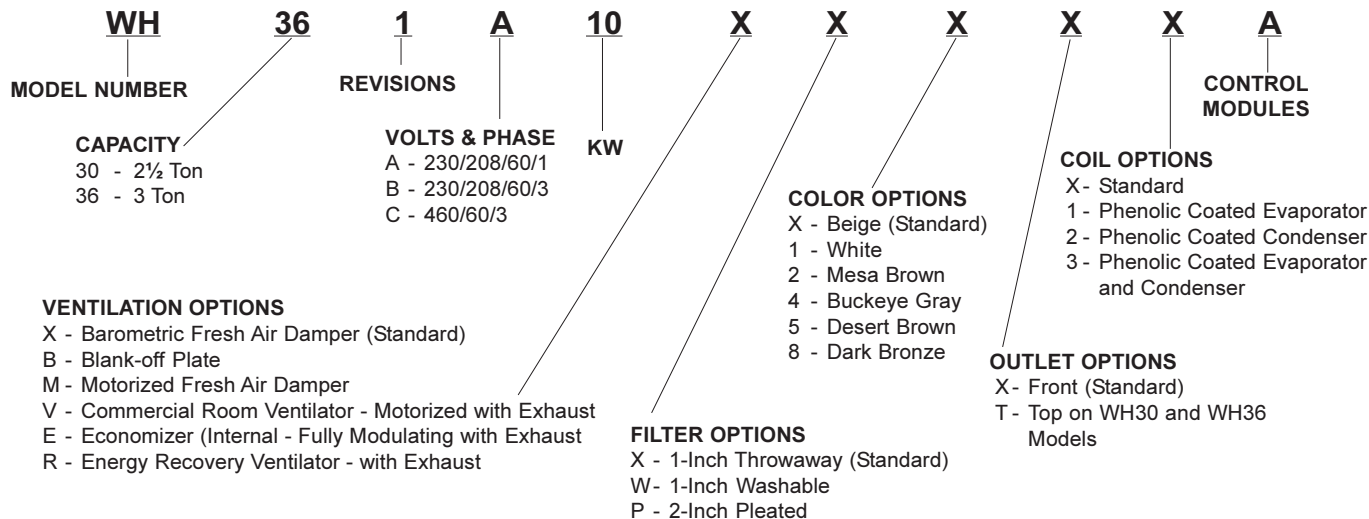
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Manufactured under the following U.S. patent numbers:

5,485,878; 5,301,744; 5,002,116; 4,924,934;  
4,875,520; 4,825,936

# WALL MOUNT GENERAL INFORMATION

## HEAT PUMP WALL MOUNT MODEL NOMENCLATURE



*NOTE: For 0 KW and circuit breakers (230/208 Volt) or pull disconnects (460 Volt) applications, insert 0Z in the KW field of model number.*

## SHIPPING DAMAGE

Upon receipt of equipment, the carton should be checked for external signs of shipping damage. If damage is found, the receiving party must contact the last carrier immediately, preferably in writing, requesting inspection by the carrier's agent.

## GENERAL

The equipment covered in this manual is to be installed by trained, experienced service and installation technicians.

The refrigerant system is completely assembled and charged. All internal wiring is complete.

The unit is designed for use with or without duct work. Flanges are provided for attaching the supply and return ducts.

These instructions explain the recommended method to install the air cooled self-contained unit and the electrical wiring connections to the unit.

These instructions and any instructions packaged with any separate equipment required to make up the entire heat pump system should be carefully read before beginning the installation. Note particularly "Starting Procedure" and any tags and/or labels attached to the equipment.

While these instructions are intended as a general recommended guide, they do not supersede any national and/or local codes in any way. Authorities having jurisdiction should be consulted before the installation is made. See Page 3 for information on codes and standards.

Size of unit for a proposed installation should be based on heat loss calculations made according to methods of Air Conditioning Contractors of America (ACCA). The air duct should be installed in accordance with the Standards of the National Fire Protection Association for the Installation of Air Conditioning and Ventilating Systems of Other Than Residence Type, NFPA No. 90A, and Residence Type Warm Air Heating and Air Conditioning Systems, NFPA No. 90B. Where local regulations are at a variance with instructions, installer should adhere to local codes.

## DUCT WORK

Any heat pump is more critical of proper operating charge and an adequate duct system than a straight air conditioning unit. All duct work, supply and return, must be properly sized for the design airflow requirement of the equipment. Air Conditioning Contractors of America (ACCA) is an excellent guide to proper sizing. All duct work or portions thereof not in the conditioned space should be properly insulated in order to both conserve energy and prevent condensation or moisture damage.

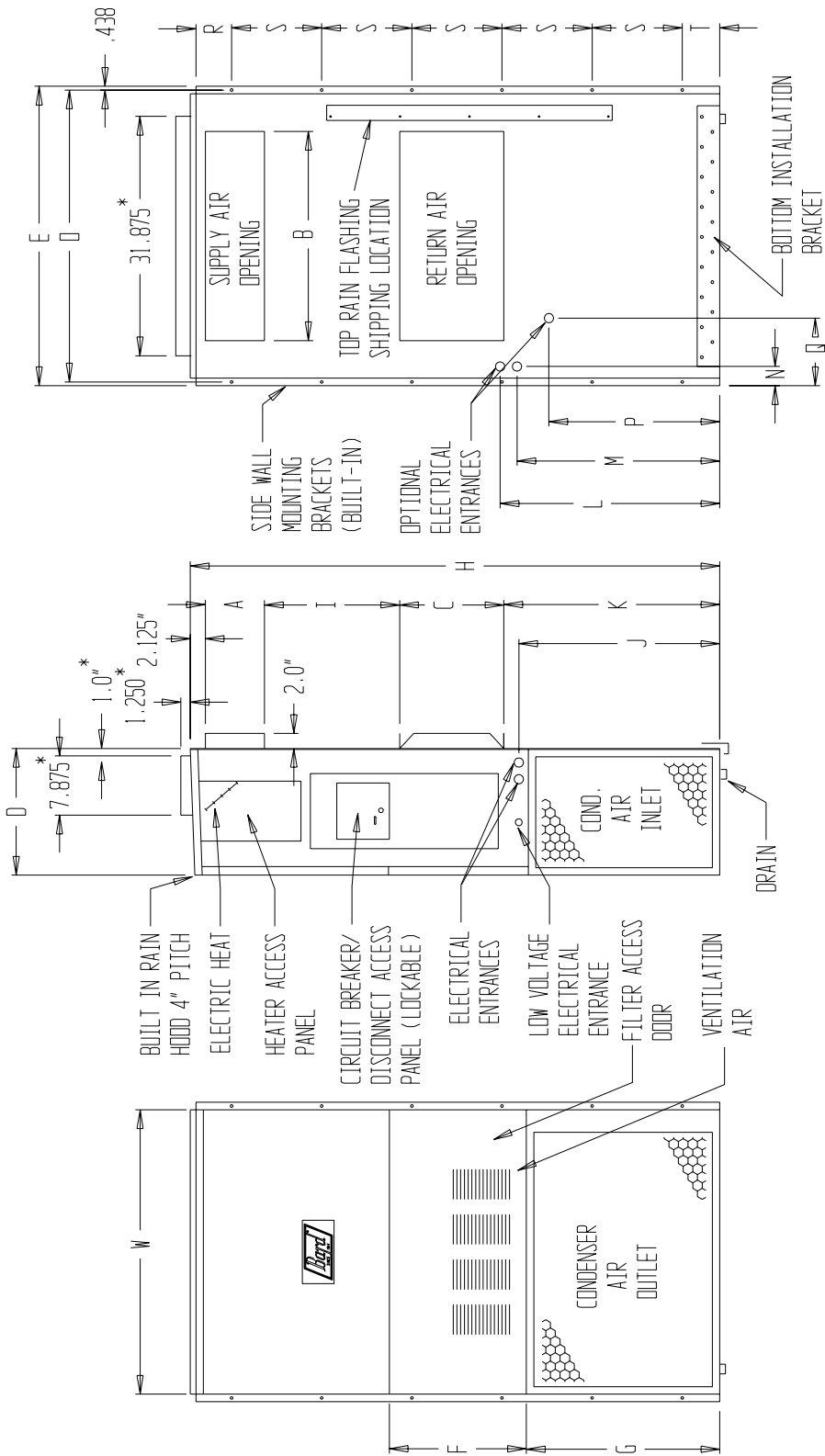
**TABLE 1  
ELECTRIC HEAT TABLE**

Models	WH301-A			WH301-B			WH301-C			WH361-A			WH361-B			WH361-C		
	240-1		208-1	240-3		208-3	240-3		460-3	240-1		208-1	240-3		208-3	460-3		
	A	BTU	A	BTU	A	BTU	A	BTU	A	BTU	A	BTU	A	BTU	A	BTU	A	BTU
5	20.8	17065	18.1	12800														
10	41.6	34130	36.2	25600														
15																		
6					14.4	20500	12.5	15360	7.2	20475			14.4	20500	12.5	15360	7.2	20475
9					21.7	30600	18.7	23030	10.8	30700			21.7	30600	18.7	23030	10.8	30700
15									18.0	51200			36.2	51200	31.2	38400	18.0	51200

**TABLE 2  
DIMENSIONS OF BASIC UNIT (NOMINAL)**

Model	Width (W)	Depth (D)	Height (H)	Supply		Return		E	F	G	I	J	K	L	M	N	O	P	Q	R	S	T	
				A	B	C	B																
WH30	38.200	17.125	70.563	7.88	27.88	13.88	27.88	40.00	18.50	25.75	17.93	26.75	28.75	29.25	27.00	2.75	39.19	22.75	9.14	4.19	12.00	5.00	
WH36																							

**FIGURE 1  
UNIT DIMENSIONS**



MIS-1262

**BACK VIEW**

**SIDE VIEW**

**FRONT VIEW**

\* OPTIONAL TOP OUTLET (FACTORY INSTALLED ONLY) FOR WH30 AND WH36 MODELS ONLY.

**TABLE 3  
ELECTRICAL SPECIFICATIONS**

Model	Rated Volts And Phase	No. Field Power Circuits	④ Minimum Circuit Ampacity	① Maximum External Fuse or Circuit Breaker	② Field Power Wire Size	② Ground Wire Size	④ Minimum Circuit Ampacity		① Maximum External Fuse or Circuit Breaker		② Field Power Wire Size		② Ground Wire Size	
							CKT A	CKT B	CKT A	CKT B	CKT A	CKT B	CKT A	CKT B
WH301-A00, -A0Z -A05 -A10 ③	230/208-1	1	24	35	8	10	---	---	---	---	---	---	---	---
			50	50	8	10	---	---	---	---	---	---	---	
			76	80	4	8	50	26	30	8	10	10	10	
WH301-B00, -B0Z -B06 -B09 ③	230/208-3	1	19	25	10	10	---	---	---	---	---	---	---	---
			37	40	8	10	---	---	---	---	---	---	---	
			46	50	8	10	---	---	---	---	---	---	---	
WH301-C00, -C0Z -C06 -C09 ③ ⑤	460-3	1	10	15	14	14	---	---	---	---	---	---	---	---
			19	20	12	12	---	---	---	---	---	---	---	
			24	25	10	10	---	---	---	---	---	---	---	
			26	30	10	10	---	---	---	---	---	---	---	
			27	40	10	10	---	---	---	---	---	---	---	
WH361-A00, -A0Z -A05 -A10 ③ ⑤	230/208-1	1 1 or 2 1 or 2	53	60	6	10	---	---	---	---	---	---	---	---
			79	80	4	8	53	26	60	6	10	10	10	
			83	90	4	8	53	52	60	6	6	10	10	
			20	25	10	10	---	---	---	---	---	---	---	---
			38	40	8	10	---	---	---	---	---	---	---	---
WH361-B00, -B0Z -B06 -B09 ③ ⑤	230/208-3	1 1 1 1	47	50	8	10	---	---	---	---	---	---	---	---
			50	50	8	10	---	---	---	---	---	---	---	
			11	15	14	14	---	---	---	---	---	---	---	
			20	20	12	12	---	---	---	---	---	---	---	
			25	25	10	10	---	---	---	---	---	---	---	
WH361-C00, -C0Z -C06 -C09 ③ ⑤	460-3	1	26	30	10	10	---	---	---	---	---	---	---	---

① Maximum size of the time delay fuse or HACR type circuit breaker for protection of field wiring conductors.

② Based on 75° copper wire. All wiring must conform to the National Electrical Code and all local codes.

③ Maximum KW that can operate with heat pump on these "Minimum Circuit Ampacity" values are to be used for sizing the field power conductors. Refer to the National Electric Code (latest revision), Article 310 for power conductor sizing.

④ These "Minimum Circuit Ampacity" values are to be used for sizing the field power conductors. Refer to the National Electrical Code (latest version), Article 310 for power conductor sizing.

⑤ Not available on dehumidification models.

**CAUTION:** When more than one field power conductor circuit is run through one conduit, the conductors must be derated. Pay special attention to note 8 of table 310 regarding Ampacity Adjustment Factors when more than three conductors are in a raceway.


Not available in top outlet version.

Refer to Table 12 for maximum static pressure available for duct design.

Design the duct work according to methods given by the Air Conditioning Contractors of America (ACCA). When duct runs through unheated spaces, it should be insulated with a minimum of one inch of insulation. Use insulation with a vapor barrier on the outside of the insulation. Flexible joints should be used to connect the duct work to the equipment in order to keep the noise transmission to a minimum.

A 1/4 inch clearance to combustible material for the first three (3) feet of duct attached to the outlet air frame is required. See Wall Mounting Instructions and Figures 3, 4, 7 & 8 for further details.

Ducts through the walls must be insulated and all joints taped or sealed to prevent air or moisture entering the wall cavity.

	<h1>CAUTION</h1>
<p>Some installations may not require any return air duct. A metallic return air grille is required with installations not requiring a return air duct. The spacing between louvers on the grille shall not be larger than 5/8 inches.</p>	

Any grille that meets the 5/8 inch louver criteria may be used. It is recommended that Bard Return Air Grille Kit RG-2 through RG-5 or RFG-2 through RFG-5 be installed when no return duct is used. Contact distributor or factory for ordering information. If using a return air filter grille, filters must be of sufficient size to allow a maximum velocity of 400 fpm.

*NOTE: If no return air duct is used, applicable installation codes may limit this cabinet to installation only in a single story structure.*

## FILTERS

A 1-inch throwaway filter is supplied with each unit. The filter slides into position making it easy to service. This filter can be serviced from the outside by removing the service door. A 1-inch washable filter and a 2-inch pleated filter are also available as optional accessories. The internal filter brackets are adjustable to accommodate the two inch filter by loosening two screws in each bracket assembly and sliding the brackets apart to the required width and retightening the four screws.

## FRESH AIR INTAKE

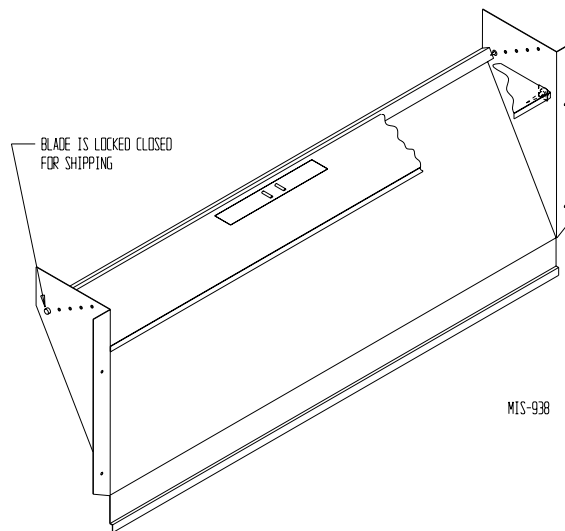
All units are built with fresh air inlet slots punched in the service panel.

If the unit is equipped with a fresh air damper assembly, the assembly is shipped already attached to the unit. The damper blade is locked in the closed position. To allow the damper to operate, the maximum and minimum blade position stops must be installed. See Figure 2.

All capacity, efficiency and cost of operation information as required for Department of Energy "Energyguide" Fact Sheets is based upon the fresh air blank-off plate in place and is recommended for maximum energy efficiency.

The blank-off plate is available upon request from the factory and is installed in place of the fresh air damper shipped with each unit.

**FIGURE 2  
FRESH AIR DAMPER ASSEMBLY**



## CONDENSATE DRAIN

A plastic drain hose extends from the drain pan at the top of the unit down to the unit base. There are openings in the unit base for the drain hose to pass through. In the event the drain hose is connected to a drain system of some type, it must be an open or vented type system to assure proper drainage.



# INSTALLATION INSTRUCTIONS

## WALL MOUNTING INFORMATION

1. Two holes, for the supply and return air openings, must be cut through the wall as shown in Figure 3.
2. On wood-frame walls, the wall construction must be strong and rigid enough to carry the weight of the unit without transmitting any unit vibration.

### **WARNING**

Fire hazard can result if 1/4 inch clearance to combustible materials for supply air duct is not maintained. See Figure 3.

3. Concrete block walls must be thoroughly inspected to insure that they are capable of carrying the weight of the unit installed.

## MOUNTING THE UNIT

1. These units are secured by wall mounting brackets which secure the unit to the outside wall surface at both sides. A bottom mounting bracket is provided for ease of installation, but is not required.
2. The unit itself is suitable for "0" inch clearance, but the supply air duct flange and the first 3 feet of supply air duct require a minimum of 1/4 inch clearance to combustible material. If a combustible wall, use a minimum of 28½" x 8½" dimensions for sizing. However, it is generally recommended that a 1-inch clearance is used for ease of installation and maintaining the required clearance to combustible material. The supply air opening would then be 30" x 10". See Figures 3, 4, 7 and 8 for details.

### **WARNING**

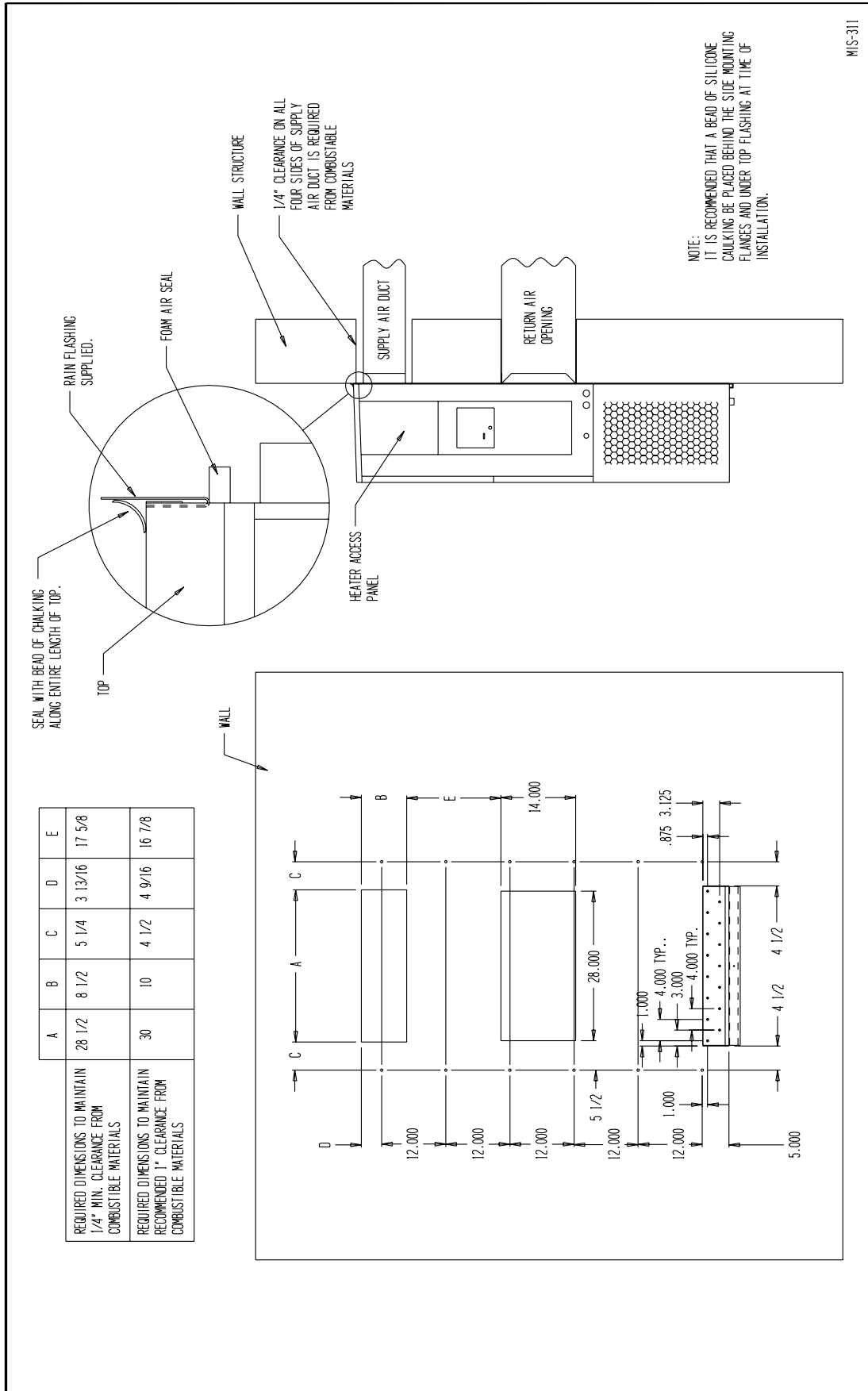
Failure to provide the 1/4 inch clearance between the supply duct and a combustible surface for the first 3 feet of duct can result in fire.

3. Locate and mark lag bolt locations and bottom mounting bracket location. See Figure 3.
4. Mount bottom mounting bracket, if used.
5. Hook top rain flashing under back bend of top. Top rain flashing is shipped secured to the back of the unit on the right side.
6. Position unit in opening and secure with 5/16 lag bolts; use 7/8 inch diameter flat washers on the lag bolts.
7. Secure rain flashing to wall and caulk across entire length of top. See Figure 3.
8. For additional mounting rigidity, the return air and supply air frames or collars can be drilled and screwed or welded to the structural wall itself (depending upon wall construction). Be sure to observe required clearance if combustible wall.
9. On side-by-side installations, maintain a minimum of 20 inches clearance on right side to allow access to heat strips and control panel and to allow proper airflow to the outdoor coil. Additional clearance may be required to meet local or national codes.

## TOP OUTLET ONLY

1. Remove airframe angles from the back of the unit.
2. Coat angles with two 1/8" beads of silicone as shown. Silicone is shipped in the control panel. See Figure 5.
3. Secure angles to the top of the unit with 14 screws provided. Use prepunched holes provided. Do not relocate. See Figure 5.
4. After installation of duct work, seal around airframe and duct work to provide a rain tight seal.
5. It is strongly recommended, but not required, that this unit be installed under a soffit area large enough to shield the top of the unit. See Figure 6.

**FIGURE 3  
MOUNTING INSTRUCTIONS**

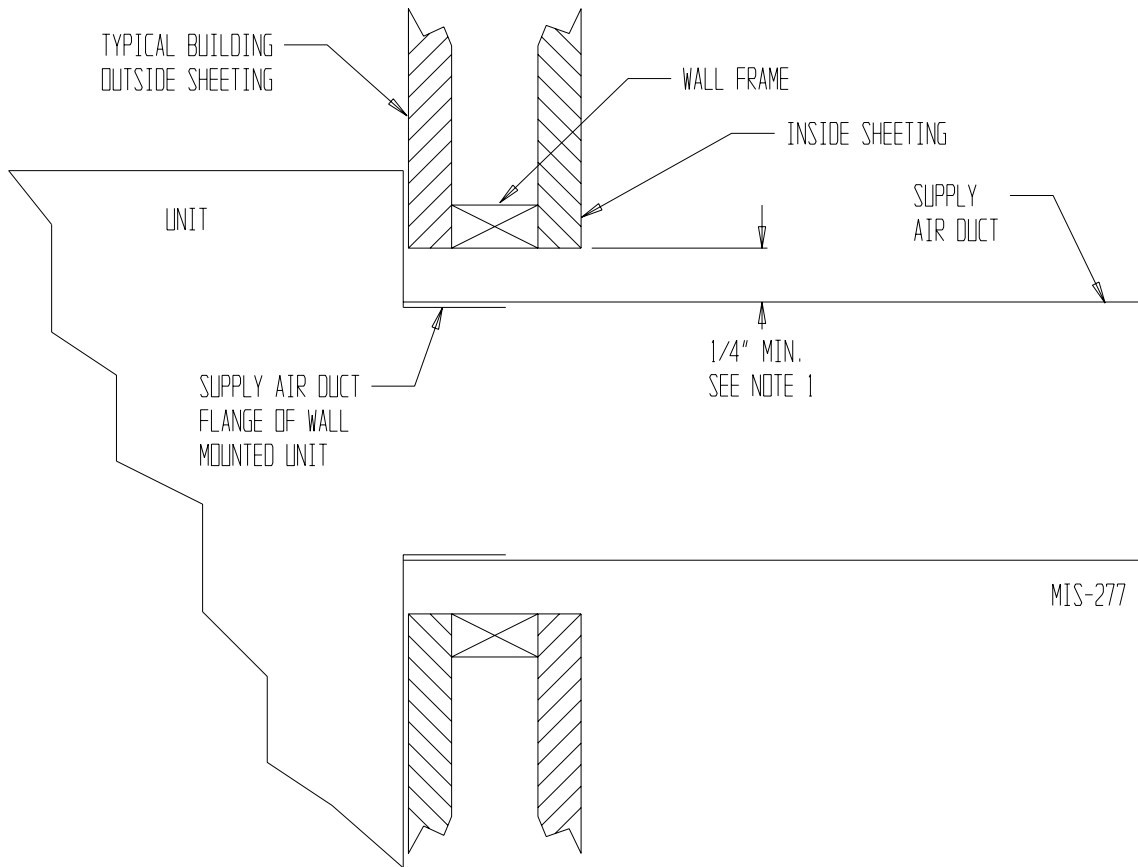


	A	B	C	D	E
REQUIRED DIMENSIONS TO MAINTAIN 1/4" MIN. CLEARANCE FROM COMBUSTIBLE MATERIALS	28 1/2	8 1/2	5 1/4	3 13/16	17 5/8
REQUIRED DIMENSIONS TO MAINTAIN RECOMMENDED 1" CLEARANCE FROM COMBUSTIBLE MATERIALS	30	10	4 1/2	4 9/16	16 7/8

NOTE:  
IT IS RECOMMENDED THAT A BEAD OF SILICONE CAULKING BE PLACED BEHIND THE SIDE MOUNTING FLANGES AND UNDER TOP FLASHING AT TIME OF INSTALLATION.

MIS-311

**FIGURE 4  
ELECTRIC HEAT CLEARANCE**



Side section view of supply air duct for wall mounted unit showing 1/4" clearance to combustible surfaces.



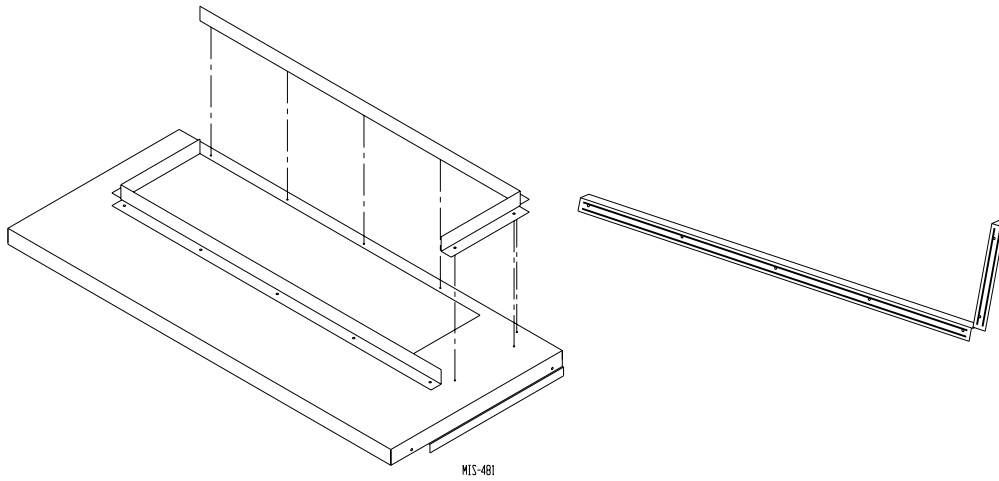
## **WARNING**

A minimum of 1/4" clearance must be maintained between the supply air duct and combustible materials. This is required for the first three (3) feet of ducting.

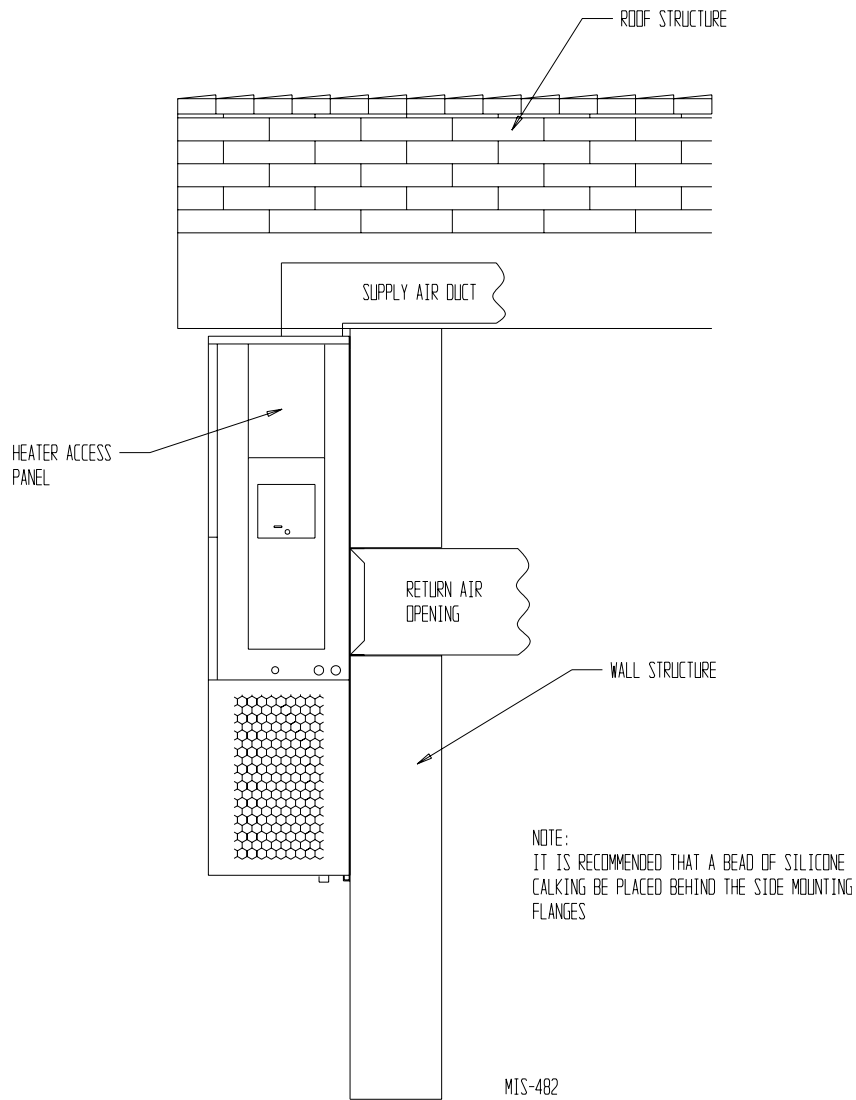
It is important to insure that the 1/4" minimum spacing is maintained at all points.

Failure to do this could result in overheating the combustible material and may result in a fire.

**FIGURE 5  
ATTACHING TOP OUTLET AIRFRAMES TO UNIT**

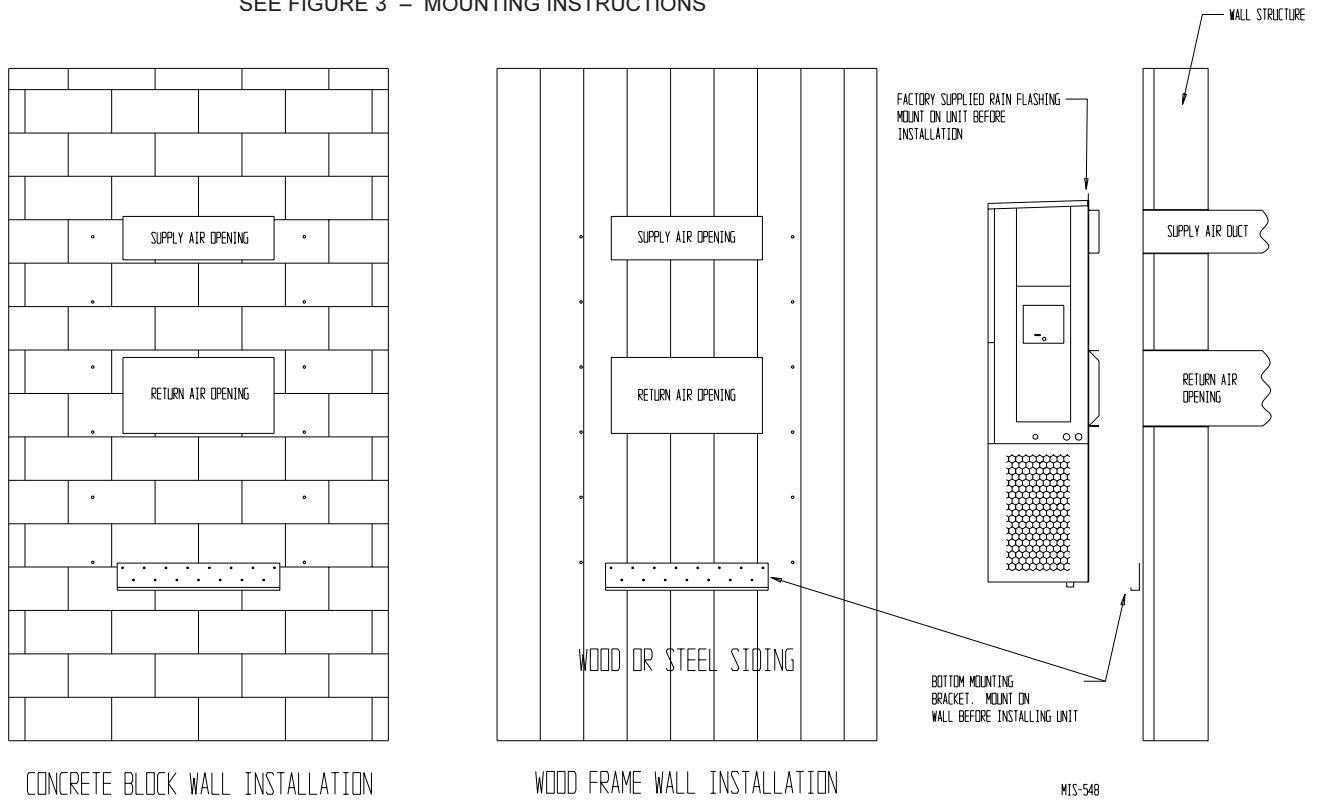


**FIGURE 6  
UNIT WITH TOP OUTLET MOUNTED UNDER OVERHANG**



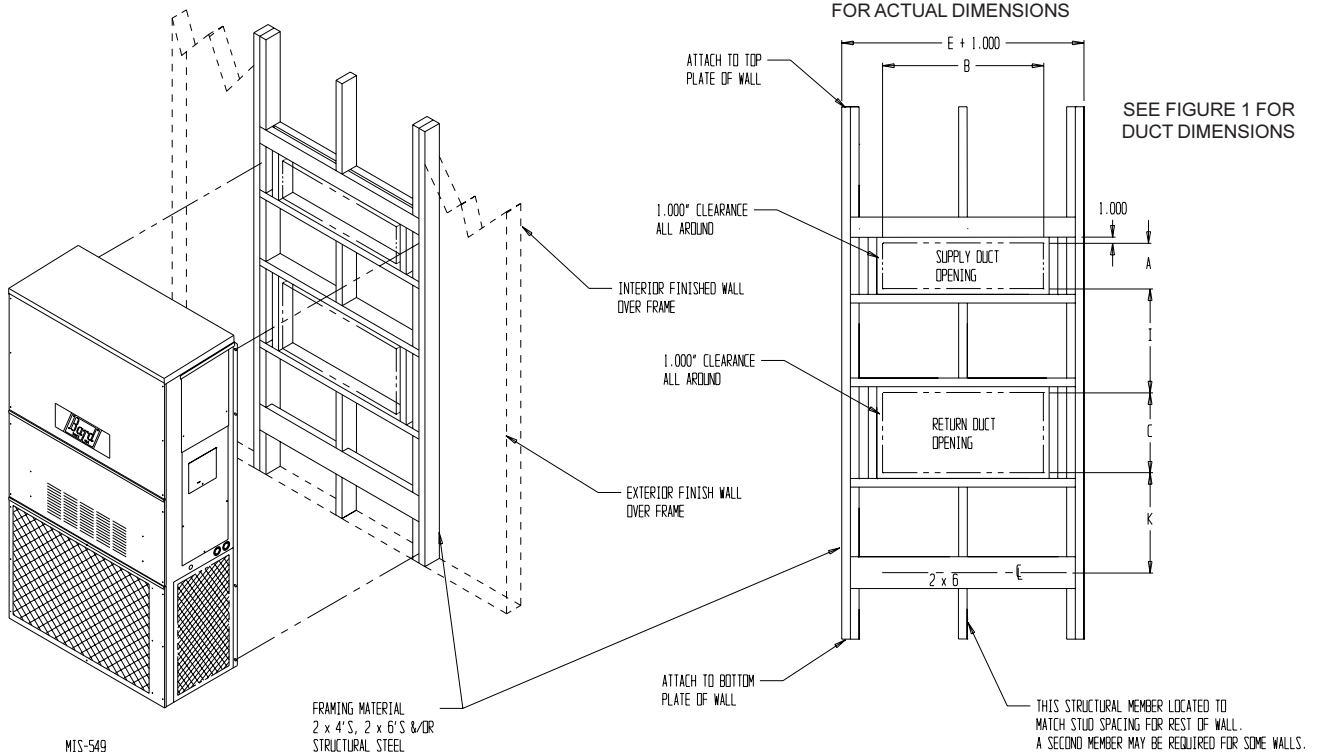
## FIGURE 7 WALL-MOUNTING INSTRUCTIONS

SEE FIGURE 3 – MOUNTING INSTRUCTIONS

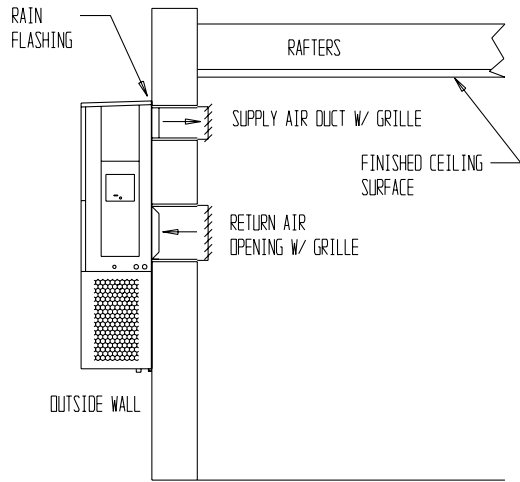


## FIGURE 8 WALL-MOUNTING INSTRUCTIONS

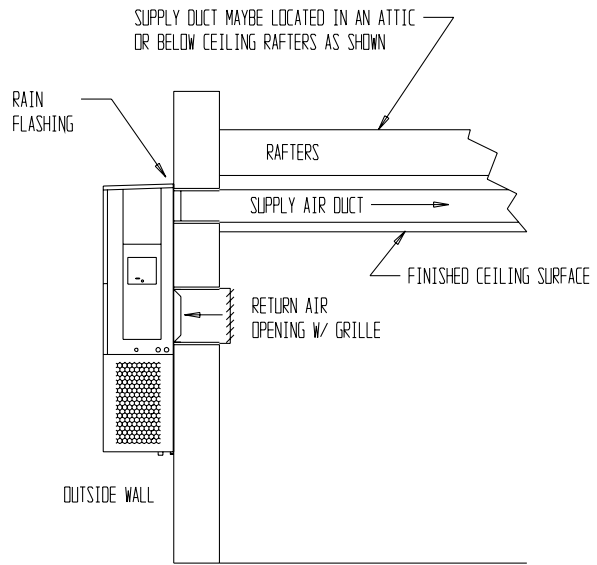
SEE UNIT DIMENSIONS, FIGURE 1,  
FOR ACTUAL DIMENSIONS



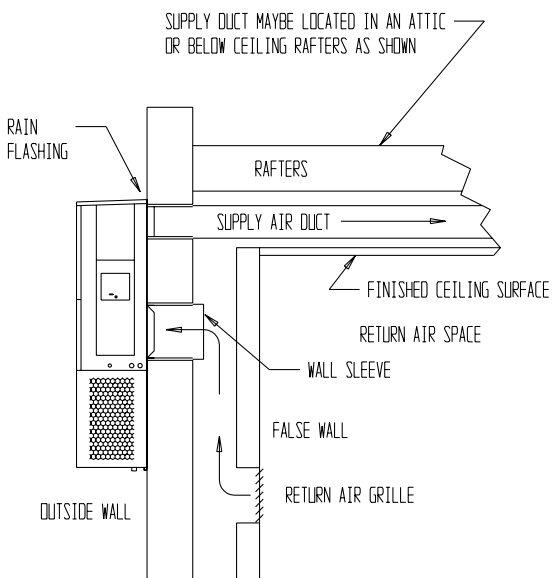
**FIGURE 9  
COMMON WALL-MOUNTING INSTALLATIONS**



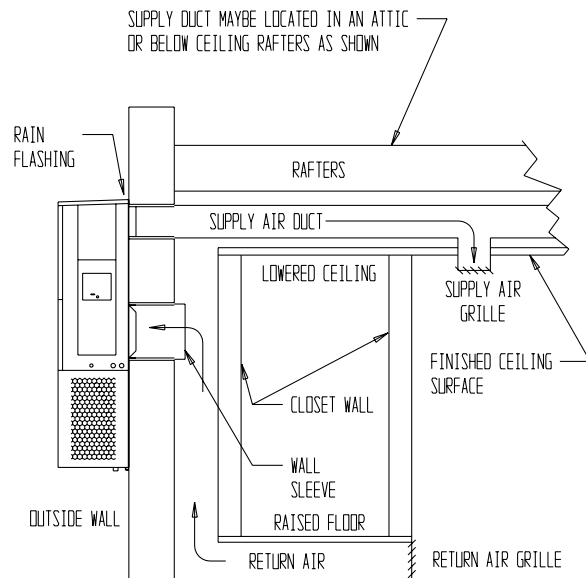
FREE AIR FLOW  
NO DUCT



DUCTED SUPPLY  
RETURN AT UNIT



FALSE WALL INSTALLATION



CLOSET INSTALLATION

MIS-550

## WIRING — MAIN POWER

Refer to the unit rating plate for wire sizing information and maximum fuse or “HACR Type” circuit breaker size. Each outdoor unit is marked with a “Minimum Circuit Ampacity”. This means that the field wiring used must be sized to carry that amount of current. Depending on the installed KW of electric heat, there may be two field power circuits required. If this is the case, the unit serial plate will so indicate. All models are suitable only for connection with copper wire. Each unit and/or wiring diagram will be marked “Use Copper Conductors Only”. These instructions **must be** adhered to. Refer to the National Electrical Code (NEC) for complete current carrying capacity data on the various insulation grades of wiring material. All wiring must conform to NEC and all local codes.

The electrical data lists fuse and wire sizes (75°C copper) for all models, including the most commonly used heater sizes. Also shown are the number of field power circuits required for the various models with heaters.

The unit rating plate lists a “Maximum Time Delay Relay Fuse” or “HACR Type” circuit breaker that is to be used with the equipment. The correct size must be used for proper circuit protection and also to assure that there will be no nuisance tripping due to the momentary high starting current of the compressor motor.

The disconnect access door on this unit may be locked to prevent unauthorized access to the disconnect. To convert for the locking capability, bend the tab located in the bottom left hand corner of the disconnect opening under the disconnect access panel straight out. This tab will now line up with the slot in the door. When shut, a padlock may be placed through the hole in the tab preventing entry.

## WIRING — LOW VOLTAGE WIRING

230/208V, 1 phase and 3 phase equipment dual primary voltage transformers. All equipment leaves the factory wired on 240V tap. For 208V operation, reconnect from 240V to 208V tap. The acceptable operating voltage range for the 240 and 208V taps are shown in Table 4:

**TABLE 4  
OPERATING VOLTAGE RANGE**

TAP	RANGE
240V	253 - 216
208V	220 - 187

*NOTE: The voltage should be measured at the field power connection point in the unit and while the unit is operating at full load (maximum amperage operating condition.)*

If no motorized vent option is used, nine (9) wires should be run from the thermostat subbase to the 24V terminal board in the unit. A nine (9) conductor, 18 gauge copper color-coded thermostat cable is recommended. If a motorized vent option is used, terminal O1 on the unit low voltage terminal block will also be used. This requires a ten (10) conductor thermostat cable to be run. The connection points are shown in Figure 10.

## LOW VOLTAGE CONNECTIONS

These units use a grounded 24 volt AC low voltage circuit.

The “R” terminal is the *hot* terminal and the “C” terminal is *grounded*.

“G” terminal is the *fan input*.

“Y” terminal is the *compressor input for cooling and heat pump*.

“B/W1” terminal is the *reversing valve input*. The reversing valve must be energized for heating mode.

“R” terminal is *24 VAC hot*.

“C” terminal is *24 VAC grounded*.

“L” terminal is *compressor lockout output*. This terminal is activated on a high or low pressure trip by the electronic heat pump control. This is a 24 VAC output.

“W2” terminal is *second stage heat* (if equipped).

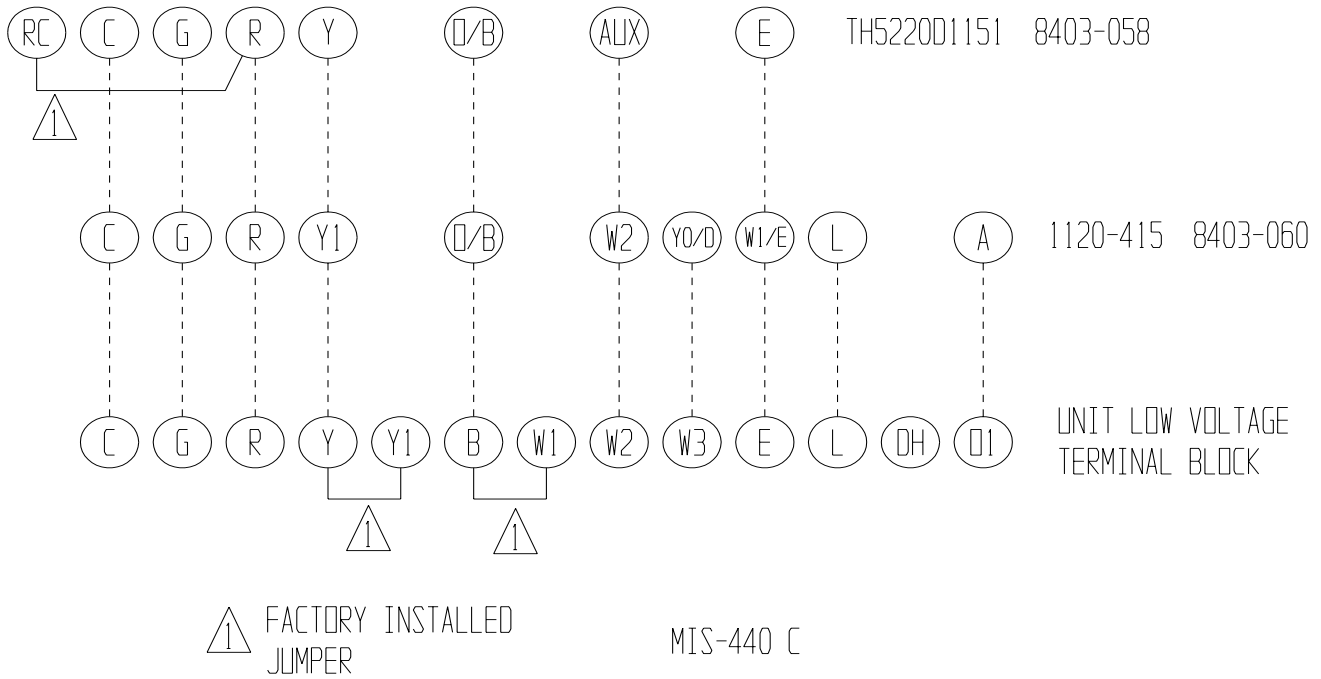
“O1” terminal is the *ventilation input*. This terminal energizes any factory installed ventilation option.

“E” terminal is the *emergency heat input*. This terminal energizes the emergency heat relay.

### LOW VOLTAGE CONNECTIONS FOR DDC CONTROL

Fan Only	Energize G
Cooling Mode	Energize Y, G
Heat Pump Heating	Energize Y, G, B
2nd Stage Heating (if employed)	Energize G, W2, Y, B/W1
Ventilation	Energize G, O1
Emergency Heat	Energize B, W2, E, G

**FIGURE 10  
LOW VOLTAGE WIRING**



**TABLE 5  
THERMOSTAT WIRE SIZE**

Transformer VA	FLA	Wire Gauge	Maximum Distance In Feet
55	2.3	20 gauge	45
		18 gauge	60
		16 gauge	100
		14 gauge	160
		12 gauge	250



## OPTIONAL OUTDOOR THERMOSTAT APPLICATIONS

Since most equipment at the time of manufacture is not designated for any specific destination of the country and are installed in areas not approaching the lower outdoor temperature range, outdoor thermostats are not factory installed as standard equipment, but are offered as an option. There are also different applications for applying outdoor thermostats. The set point of either type of outdoor thermostat application is variable with geographic region and sizing of the heating equipment to the individual structure. Utilization of the heating Application Data, and the heat loss calculation of the building are useful in determining the correct set points.

Temperature and Humidity Controller #8403-060, along with the Outdoor Sensor option Part #8403-061, can be used to:

- Limit minimum outdoor temperature for cooling option.
- Limit minimum outdoor temperature for heat pump option.
- Inhibit electric heat operation for heat pumps above selected outdoor temperature.

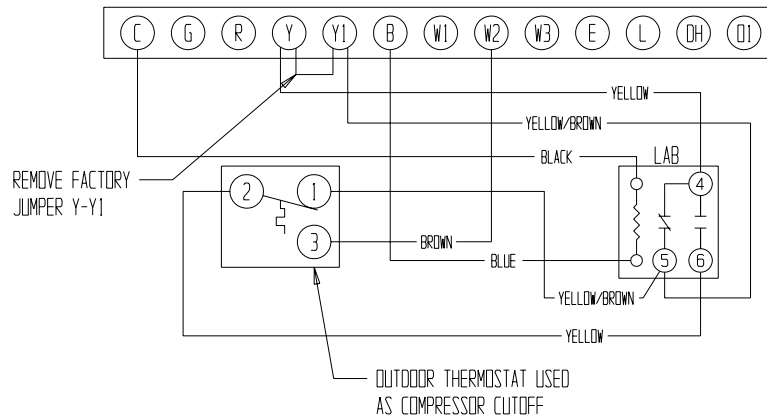
Thus, not requiring the optional compressor cut-off thermostat or the electric heat cut-off thermostat option.

## OPTIONAL COMPRESSOR CUTOFF THERMOSTAT (See Figures 11 and 12)

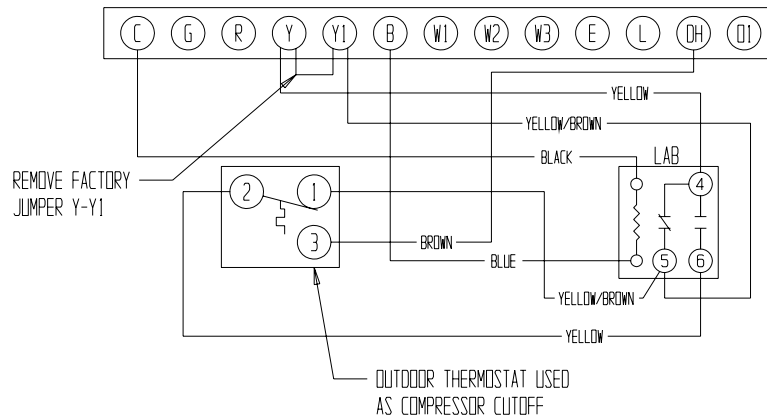
Heat pump compressor operation at outdoor temperatures below 0°F are neither desirable nor advantageous in term of efficiency. An outdoor thermostat can be applied to take the mechanical heating (compressor) off line, and send the (compressor) signal to energize electric heat in its place (to make electric heat first stage heating). This can also be applied to bank the quantity of available electric heat. For example: A heat pump operates with 10KW second stage heat – once the outdoor thermostat has switched then operates 15KW without the compressor as first stage heat.

*NOTE: The additional LAB (low ambient bypass) relay is required to prevent heater operation during low temperature cooling operation.*

**FIGURE 11  
COMPRESSOR CUTOFF THERMOSTAT WIRING  
4 & 10KW 1 PH — 6 & 9KW 3 PH**



**FIGURE 12  
COMPRESSOR CUTOFF THERMOSTAT WIRING  
15KW 1 PH & 3 PH**

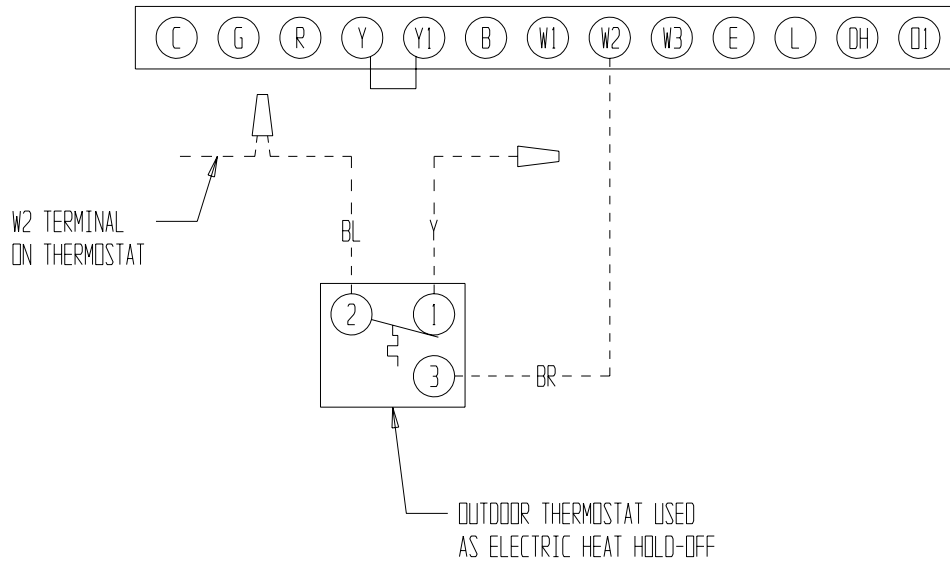


**ELECTRIC HEAT HOLD-OFF (See Figures 13 and 14)**

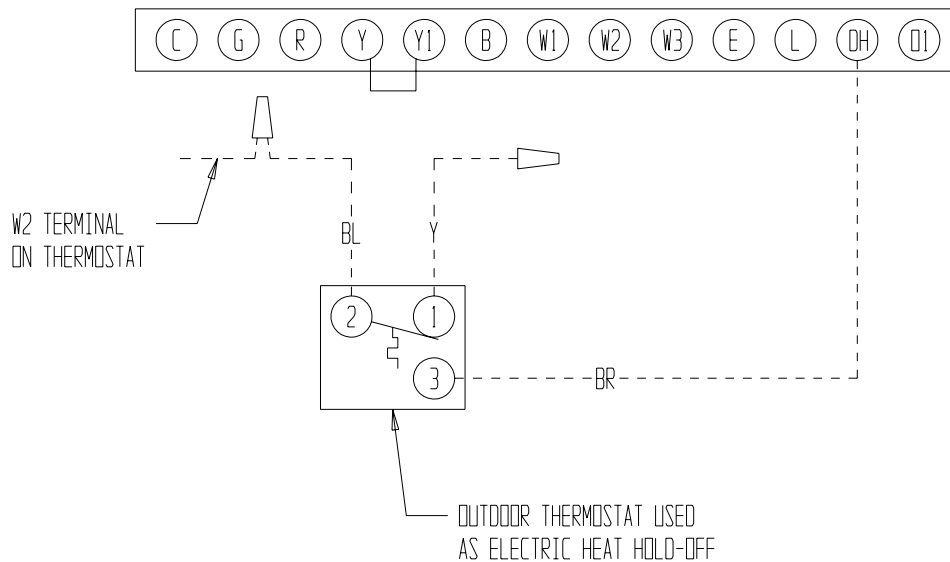
In other applications, it is desirable to disable the operation of the electric heat until outdoor temperatures have reached a certain design point. This won't allow the electric heat to come on as second stage heating unless the outdoor temperature is below the set point of the outdoor thermostat. This is done to maximize

efficiency by utilizing the heat pump to bring the conditioned space temperature up, rather than cycling on the electric heat due a second stage call for heat from the thermostat on start-up coming off a night setback condition or someone increasing the thermostat set point. (NOTE: Some programmable thermostats do have a built-in time delay for pulling in second stage heat when coming off setback conditions.)

**FIGURE 13  
ELECTRIC HEAT HOLD-OFF WIRING  
4 & 10KW 1 PH — 6 & 9KW 3 PH**



**FIGURE 14  
ELECTRIC HEAT HOLD-OFF WIRING  
15KW 1 PH & 3 PH**



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**TABLE 6  
WALL THERMOSTAT**

<b>Thermostat</b>	<b>Predominate Features</b>
8403-058 (TH5220D1151)	2 stage cool, 2 stage heat Electronic Non-Programmable Auto or Manual changeover
8403-060 (1120-445)	2 stage cool, 3 stage heat Programmable Electronic Auto or Manual changeover with built-in Humidistat

# START UP

## IMPORTANT INSTALLER NOTE

For improved start-up performance, wash the indoor coil with a dishwashing detergent.

## CRANKCASE HEATERS

All units are provided with some form of compressor crankcase heat.

All single and three phase models have an insertion well-type heater located in the lower section of the compressor housing. This is a self-regulating type heater that draws only enough power to maintain the compressor at a safe temperature.

Some form of crankcase heat is essential to prevent liquid refrigerant from migrating to the compressor, causing oil pump out on compressor start up and possible valve failure due to compressing a liquid.

The decal in Figure 15 is affixed to all outdoor units detailing start up procedure. This is very important. Please read carefully.

## SERVICE HINTS

1. Caution owner/operator to maintain clean air filters at all times. Also, not to needlessly close off supply and return air registers. This reduces airflow through the system, which shortens equipment service life as well as increasing operating costs.
2. Switching to heating cycle at 75°F or higher outside temperature may cause a nuisance trip of the remote reset high pressure switch. Turn thermostat off then on to reset the high pressure switch.
3. The heat pump wall thermostats perform multiple functions. Be sure that all function switches are correctly set for the desired operating mode before trying to diagnose any reported service problems.
4. Check all power fuses or circuit breakers to be sure they are the correct rating.
5. Periodic cleaning of the outdoor coil to permit full and unrestricted airflow circulation is essential.

## SEQUENCE OF OPERATION

**COOLING** – Circuit R-Y makes at thermostat pulling in compressor contactor, starting the compressor and outdoor motor. The G (indoor motor) circuit is automatically completed on any call for cooling operation or can be energized by manual fan switch on subbase for constant air circulation.

FIGURE 15  
START UP LABEL

## **IMPORTANT**

**THESE PROCEDURES MUST BE FOLLOWED AT INITIAL START UP AND AT ANY TIME POWER HAS BEEN REMOVED FOR 12 HOURS OR LONGER.**

TO PREVENT COMPRESSOR DAMAGE WHICH MAY RESULT FROM THE PRESENCE OF LIQUID REFRIGERANT IN THE COMPRESSOR CRANKCASE:

1. Make certain the room thermostat is in the "off" position (the compressor is not to operate).
2. Apply power by closing the system disconnect switch. This energizes the compressor heater which evaporates the liquid refrigerant in the crankcase.
3. Allow 4 hours or 60 minutes per pound of refrigerant in the system as noted on the unit rating plate, whichever is greater.
4. After properly elapsed time, the thermostat may be set to operate the compressor.
5. Except as required for safety while servicing. **Do not open system disconnect switch.**

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**HEATING** – A 24V solenoid coil on reversing valve controls heating cycle operation. Two thermostat options, one allowing "Auto" changeover from cycle to cycle and the other constantly energizing solenoid coil during heating season and thus eliminating pressure equalization noise except during defrost, are to be used. On "Auto" option, a circuit is completed from R-W1 and R-Y on each heating "on" cycle, energizing reversing valve solenoid and pulling in compressor contactor starting compressor and outdoor motor. R-G also make starting indoor blower motor. Heat pump heating cycle now in operation. The second option has no "Auto" changeover position, but instead energizes the reversing valve solenoid constantly whenever the system switch on subbase is placed in "Heat" position, the "B" terminal being constantly energized from R. A thermostat demand for heat completes R-Y circuit pulling in compressor contactor starting compressor and outdoor motor.

R-G make starting indoor blower motor.

## PRESSURE SERVICE PORTS

High and low pressure service ports are installed on all units so that the system operating pressures can be observed. Pressure tables can be found on Page 25 covering all models. It is imperative to match the correct pressure table to the unit by model number.

## DEFROST CYCLE

The defrost cycle is controlled by temperature and time on the solid state heat pump control. See Figure 16.

When the outdoor temperature is in the lower 40° F temperature range or colder, the outdoor coil temperature is 32° F or below. This coil temperature is sensed by the coil temperature sensor mounted near the bottom of the outdoor coil. Once coil temperature reaches 30° F or below, the coil temperature sensor sends a signal to the control logic of the heat pump control and the defrost timer will start.

After 60 minutes at 30° F or below, the heat pump control will place the system in the defrost mode.

During the defrost mode, the refrigerant cycle switches back to the cooling cycle, the outdoor motor stops, electric heaters are energized, and hot gas passing through the outdoor coil melts any accumulated frost. When the temperature rises to approximately 57° F, the coil temperature sensor will send a signal to the heat pump control, which will return the system to heating operations automatically.

If some abnormal or temporary condition such as a high wind causes the heat pump to have a prolonged defrost cycle, the heat pump control will restore the system to heating operation automatically after 10 minutes.

The heat pump defrost control board has an option of 30, 60 or 90-minute setting. All models are shipped from the factory on the 60-minute pin. If special

circumstances require a change to another time, remove the wire from the 60 minute terminal and reconnect to the desired terminal. The manufacturer's recommendation is for 60 minute defrost cycles. Refer to Figure 16.

There is a cycle speed up jumper on the control. This can be used to reduce the time between defrost cycle operation without waiting for time to elapse.

Use a small screwdriver or other metallic object, or another 1/4 inch QC, to short between the *SPEEDUP* terminals to accelerate the HPC timer and initiate defrost.

Be careful not to touch any other terminals with the instrument used to short the *SPEEDUP* terminals. It may take up to 10 seconds with the *SPEEDUP* terminals shorted for the speedup to be completed and the defrost cycle to start.

***As soon as the defrost cycle kicks in remove the shorting instrument from the SPEEDUP terminals.*** Otherwise the timing will remain accelerated and run through the 1-minute minimum defrost length sequence in a matter of seconds and will automatically terminate the defrost sequence.

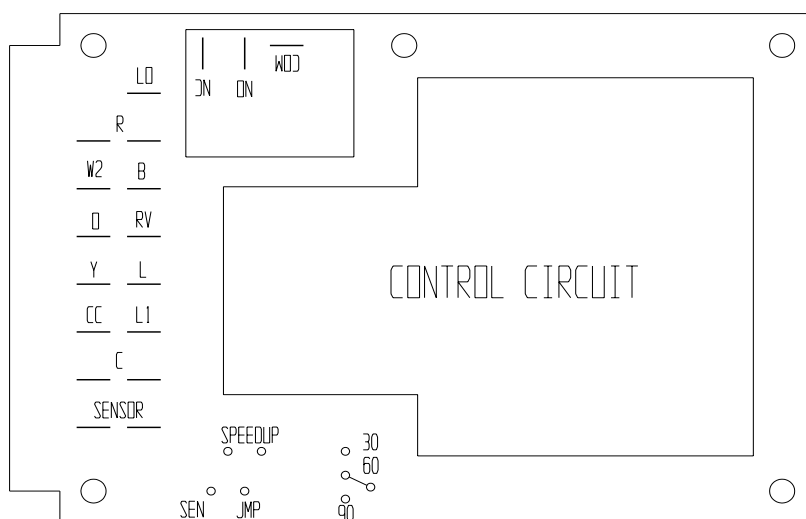
There is an initiate defrost jumper (sen jump) on the control that can be used at any outdoor ambient during the heating cycle to simulate a 0° coil temperature. This can be used to check defrost operation of the unit without waiting for the outdoor ambient to fall into the defrost region.

By placing a jumper across the *SEN JMP* terminals (a 1/4 inch QC terminal works best) the defrost sensor mounted on the outdoor coil is shunted out and will activate the timing circuit. This permits the defrost cycle to be checked out in warmer weather conditions without the outdoor temperature having to fall into the defrost region.

In order to terminate the defrost test the *SEN JMP* jumper must be removed. If left in place too long the compressor could stop due to the high pressure control opening because of high pressure condition created by operating in the cooling mode with outdoor fan off. Pressure will rise fairly fast as there is likely no actual frost on the outdoor coil in this artificial test condition.

There is also a 5-minute compressor time delay function built into the HPC. This is to protect the compressor from short cycling conditions. In some instances it is helpful to the service technician to override or speed up this timing period, and shorting out the *SPEEDUP* terminals for a few seconds can do this.

**FIGURE 16  
DEFROST CONTROL BOARD**



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# TROUBLESHOOTING

## SOLID STATE HEAT PUMP CONTROL TROUBLESHOOTING PROCEDURE

1. Turn on AC power supply to indoor and outdoor units.
2. Turn thermostat blower switch to “Fan On” – the indoor blower should start. (If it doesn't, troubleshoot indoor unit and correct problem).

3. Turn thermostat blower switch to “Auto” position. Indoor blower should stop.
4. Set system switch to heat or cool. Adjust thermostat to call for “Heat” or “Cool” – the indoor blower, compressor and outdoor fan should start.

*NOTE: If there was no power to 24 volt transformer, the compressor and outdoor fan motor will not start for 5 minutes. This is because of the compressor short cycle protection.*

**TABLE 7  
TROUBLESHOOTING**

SYMPTOM	POSSIBLE CAUSES	WHAT TO CHECK	HOW TO CHECK OR REPAIR
Compressor contactor does not energize (cooling or heating)	Control circuit wiring	Check for R connection at unit, and 24V between R-C	Run R connection to outdoor unit to power heat pump control
	Compressor lock out	1. Check for 24V between L1-C on heat pump control 2. Check across high pressure switch.	1. If no voltage between L-C turn thermostat off and on again to reset high pressure switch. 2. If high pressure switch is open and will not reset, replace high pressure switch.
	Compressor short cycle protection	Check for 24V between CC-C and Y-C on heat pump control	If no voltage between CC-C, jumper speed up terminal and within 10 seconds power should appear between CC-C. Remove speed up jumper after 10 seconds
	Heat pump control defective	Check all other possible causes. Manual 2100-065	Replace heat pump control
	Contactors defective	Check for open or shorted coil winding	Replace contactor
	Power phasing not correct.	Check for red LED on phase monitor. (3 phase units only.)	Switch two power leads to the unit.
Fan outdoor motor does not run (cooling or heating except during defrost)	Motor defective	Check for open or shorted motor winding	Replace motor
	Motor capacitor defective	Check capacitor rating. Check for open or shorted capacitor.	Replace capacitor
	Heat pump control defective	Check across fan relay on heat pump control (Com-NC)	Replace heat pump control
Reversing valve does not energize (heating only)	Reversing valve solenoid coil defective	Check for open or shorted coil	Replace solenoid coil
	Heat pump control defective	Check for 24V between RV-C and B-C	1. Check control circuit wiring 2. Replace heat pump control
Unit will not go into defrost (heating only)	Temperature sensor or heat pump control defective	Disconnect temperature sensor from board and jumper across speed up terminals and sensor terminals. This should cause the unit to go through a defrost cycle within one minute.	1. If unit goes through defrost cycle, replace temperature sensor 2. If unit does not go through defrost cycle, replace heat pump control.
Unit will not come out of defrost (heating only)	Temperature sensor or heat pump control defective	Jumper across speed up terminals. This should cause the unit to come out of defrost within one minute.	1. If unit comes out of defrost cycle, replace temperature sensor. 2. If unit does not come out of defrost cycle, replace heat pump control.

## CHECKING TEMPERATURE SENSOR OUTSIDE UNIT CIRCUIT

1. Disconnect temperature sensor from board and from outdoor coil.
2. Use an ohmmeter and measure the resistance of the sensor. Also use ohmmeter to check for short or open.
3. Check resistance reading to chart of resistance use sensor ambient temperature. (Tolerance of part is  $\pm 10\%$ .)
4. If sensor resistance reads very low, then sensor is shorted and will not allow proper operation of the heat pump control.
5. If sensor is out of tolerance, shorted, open or reads very low ohms then it should be replaced.

### TEMPERATURE "F" VS. RESISTANCE "R" OF TEMPERATURE SENSOR

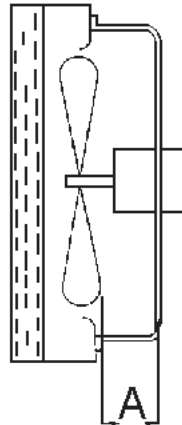
F	R	F	R	F	R	F	R
-25.0	196871	13.0	56985	53.0	19374	89.0	7507
-24.0	190099	14.0	55284	52.0	18867	90.0	7334
-23.0	183585	15.0	53640	53.0	18375	91.0	7165
-22.0	177318	16.0	52051	54.0	17989	92.0	7000
-21.0	171289	17.0	50514	55.0	17434	93.0	6840
-20.0	165487	18.0	49028	56.0	16984	94.0	6683
-19.0	159904	19.0	47590	57.0	16547	95.0	6531
-18.0	154529	20.0	46200	58.0	16122	96.0	6383
-17.0	149355	21.0	44855	59.0	15710	97.0	6239
-16.0	144374	22.0	43554	60.0	15310	98.0	6098
-15.0	139576	23.0	42295	61.0	14921	99.0	5961
-14.0	134956	24.0	41077	62.0	14544	100.0	5827
-13.0	130506	25.0	39898	63.0	14177	101.0	5697
-12.0	126219	26.0	38757	64.0	13820	102.0	5570
-11.0	122089	27.0	37652	65.0	13474	103.0	5446
-10.0	118108	28.0	36583	66.0	13137	104.0	5326
-9.0	114272	29.0	35548	67.0	12810	105.0	5208
-8.0	110575	30.0	34545	68.0	12492	106.0	5094
-7.0	107010	31.0	33574	69.0	12183	107.0	4982
-6.0	103574	32.0	32634	70.0	11883	108.0	4873
-5.0	100260	33.0	31723	71.0	11591	109.0	4767
-4.0	97064	34.0	30840	72.0	11307	110.0	4663
-3.0	93981	35.0	29986	73.0	11031	111.0	4562
-2.0	91008	36.0	29157	74.0	10762	112.0	4464
-1.0	88139	37.0	28355	75.0	10501	113.0	4367
0.0	85371	38.0	27577	76.0	10247	114.0	4274
1.0	82699	39.0	26823	77.0	10000	115.0	4182
2.0	80121	40.0	26092	78.0	9760	116.0	4093
3.0	77632	41.0	25383	79.0	9526	117.0	4006
4.0	75230	42.0	24696	80.0	9299	118.0	3921
5.0	72910	43.0	24030	81.0	9077	119.0	3838
6.0	70670	44.0	23384	82.0	8862	120.0	3757
7.0	68507	45.0	22758	83.0	8653	121.0	3678
8.0	66418	46.0	22150	84.0	8449	122.0	3601
9.0	64399	47.0	21561	85.0	8250	123.0	3526
10.0	62449	48.0	20989	86.0	8057	124.0	3452
11.0	60565	49.0	20435	87.0	7869		
12.0	58745	50.0	19896	88.0	7686		

## FAN BLADE SETTING DIMENSIONS

Shown in Figure 17 are the correct fan blade setting dimensions for proper air delivery across the outdoor coil.

Any service work requiring removal or adjustment in the fan and/or motor area will require that the dimensions below be checked and blade adjusted in or out on the motor shaft accordingly.

**FIGURE 17  
FAN BLADE SETTING**



**TABLE 8  
FAN BLADE DIMENSION**

Model	Dimension A
WH301 WH361	1.25"

## REMOVAL OF FAN SHROUD

1. Disconnect all power to unit.
2. Remove the screws holding both grilles, one on each side of unit, and remove grilles.
3. Remove screws holding fan shroud to condenser and bottom – nine (9) screws.
4. Unwire condenser fan motor.
5. Slide complete motor, fan blade, and shroud assembly out the left side of the unit.
6. Service motor/fan as needed.
7. Reverse steps to reinstall.

## REFRIGERANT CHARGE

The correct system R-22 charge is shown on the unit rating plate. Optimum unit performance will occur with a refrigerant charge resulting in a suction line temperature (6 inches from compressor) as shown in Table 9.

**TABLE 9  
SUCTION LINE TEMPERATURES**

Model	Rated Airflow	95 F OD Temperature	82 F OD Temperature
WH301	1,100	56 - 58	63 - 65
WH361	1,100	49 - 51	66 - 68

The suction line temperatures in Table 9 are based upon 80°F dry bulb/67°F wet bulb (50 percent R.H.) temperature and rated airflow across the evaporator during cooling cycle.

**TABLE 10  
INDOOR BLOWER PERFORMANCE  
CFM AT 230 VOLTS**

E.S.P. In H <sub>2</sub> O	WH301, WH361	
	Low Speed	High Speed
	Dry Coil / Wet Coil	Dry Coil / Wet Coil
.0	950 / 935	1,395 / 1,315
.1	930 / 915	1,340 / 1,270
.2	910 / 885	1,285 / 1,190
.3	855 / 830	1,205 / 1,100
.4	800 / 755	1,110 / 1,000
.5	--- / ---	1,005 / 870
.6	--- / ---	--- / ---

**TABLE 11  
CFM AND ESP**

Model	① Rated CFM	① Rated ESP	Recommended Airflow Range
WH301	1,000	.30	930 - 1,300
WH361	1,100	.30	930 - 1,350

① Rated CFM and ESP on high speed tap

**TABLE 12  
MAXIMUM ESP OF OPERATION  
ELECTRIC HEAT ONLY**

Model	Front Outlet		Top Outlet		
	Low Speed	High Speed	Low Speed	High Speed	
WH301	A00	.50	.50	.50	
	A05	.40	.50	.40	
	A10	.35	.40	.25	
WH361	A15	.35	.40	NA	
	B00	.50	.50	.50	
	B06	.40	.50	NA	
WH361	B09	.35	.45	.30	
	B15	.35	.45	NA	
	C00	.50	.50	.50	
WH301	C06	.50	.50	NA	
	WH361	C09	.30	.40	.35
	C15	.30	.40	NA	

Values shown are for units equipped with standard 1" throwaway filter or 1" washable filter. Derate ESP by .15 for 2" pleated filter.



**TABLE 13  
COOLING PRESSURE (PSI) – OUTDOOR TEMPERATURE °F**

AIR TEMPERATURE ENTERING OUTDOOR COIL °F

Model	Return Air Temperature	Pressure	75	80	85	90	95	100	105	110	115
WH301	75 deg DB 62 deg WB	Low Side High Side	76 235	78 249	80 263	81 277	83 291	84 305	85 319	87 333	88 347
	80 deg DB 67 deg WB	Low Side High Side	81 241	83 255	85 269	87 284	88 298	90 312	91 327	93 341	94 356
	85 deg DB 72 deg WB	Low Side High Side	88 250	90 264	92 279	93 294	95 308	97 323	98 338	100 353	101 368
WH361	75 deg DB 62 deg WB	Low Side High Side	69 210	71 226	73 242	75 257	76 273	78 290	80 306	82 323	83 339
	80 deg DB 67 deg WB	Low Side High Side	73 216	76 232	78 248	80 264	82 281	84 297	85 314	87 331	89 348
	85 deg DB 72 deg WB	Low Side High Side	79 223	81 240	84 256	86 273	88 290	90 308	92 325	94 342	95 360

**TABLE 14  
HEATING PRESSURE (PSI) – OUTDOOR TEMPERATURE °F**

AIR TEMPERATURE ENTERING OUTDOOR COIL °F

Model	Return Air Temperature	Pressure	0	5	10	15	20	25	30	35	40	45	50	55	60
WH301	70°	Low Side	21	25	28	32	36	39	43	47	51	55	59	63	67
		High Side	143	148	153	159	165	172	180	188	197	207	217	228	239
WH361	70°	Low Side	22	25	28	31	34	38	42	46	50	55	60	65	70
		High Side	145	152	159	167	177	186	197	208	220	233	246	260	275

Low side pressure ± 2 psig

High side pressure ± 5 psig

Tables are based upon rated CFM (airflow) across the evaporator coil and should be found under section titled “Refrigerant Charge” on Page 24 in manual. If there is any doubt as to correct charge being in the system, the charge should be removed, system evacuated and recharged to serial plate instructions.

**TABLE 15  
OPTIONAL ACCESSORIES**

<b>MODEL</b>	<b>DESCRIPTION</b>	<b>WH301-A</b>	<b>WH301-B</b>	<b>WH301-C</b>	<b>WH361-A</b>	<b>WH361-B</b>	<b>WH361-C</b>
EHWH30-A05	Heater Packages ①	X					
EHWH30-A10	Heater Packages ①	X					
EHWH36-A05	Heater Packages ①				X		
EHWH36-A10	Heater Packages ①				X		
EHWH36-A15	Heater Packages ①				X		
EHWH03-B06	Heater Packages ①		X			X	
EHWH03-B09	Heater Packages ①		X			X	
EHWH03-B15	Heater Packages ①						X
EHWH03-C06	Heater Packages ①			X			X
EHWH03-C09	Heater Packages ①			X			X
EHWH03-C15	Heater Packages ①			X			X
BOP-3	Blank Off Plate	X	X	X	X	X	X
BFAD-3	Barometric Fresh Air Damper	X	X	X	X	X	X
MFAD-3	Motorized Fresh Air Damper	X	X	X	X	X	X
CRV-3	Commercial Ventilator with Exhaust	X	X	X	X	X	X
EIFM-3	Economizer with Exhaust	X	X	X	X	X	X
WERV-A3A	Energy Recovery Ventilator	X	X		X	X	
WERV-C3A	Energy Recovery Ventilator			X			X
CMH-3	Low Pressure Control (LPC)	X	X	X	X	X	X
CMH-7	Low Ambient Control (LAC)	X	X	X	X	X	X
CMH-9	LAC + LPC	X	X	X	X	X	X
CMH-14A	Outdoor Thermostat (ODT)	X	X	X	X	X	X
CMC-15	Start Kit (SK)	X			X		
WMCB-05A	Circuit Breaker Kit	X					
WMCB-03B	Circuit Breaker Kit		X			X	
WMPD-01	Circuit Breaker Kit			X			X
WMCB-06A	Circuit Breaker Kit				X		