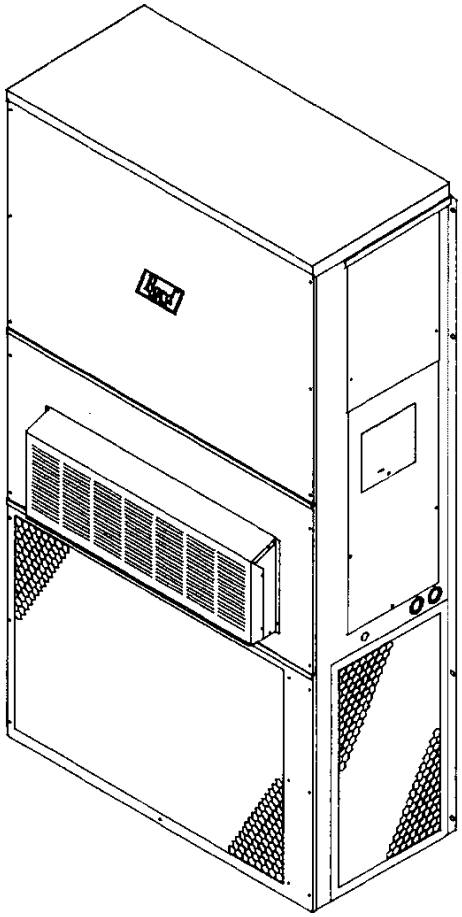
INSTALLATION INSTRUCTIONS

WALL MOUNTED PACKAGED HEAT PUMP

Model: WH301, WH361



MIS-656

Bard Manufacturing Company
Bryan, Ohio 43506

Since 1914...Moving ahead, just as planned.

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Getting Other Information and Publications

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 of Air Conditioning and Ventilating Systems	ANSI/NFPA 90A
Standard for Warm Air Heating and Air Conditioning Systems	ANSI/NFPA 90B
Load Calculation for Residential Winter and Summer Air Conditioning	ACCA Manual J
Duct Design for Residential Winter and Summer Air Conditioning and Equipment Selection	ACCA Manual D

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

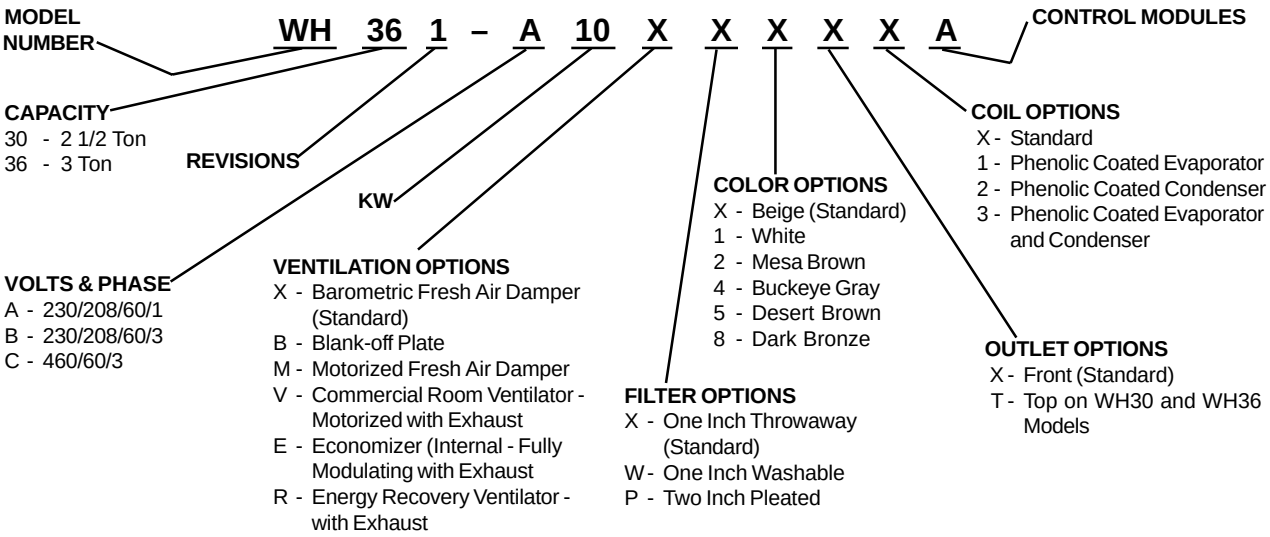
NFPA **National Fire Protection Association**
Batterymarch Park
P.O. Box 9101
Quincy, MA 02269-9901
Telephone: (800) 344-3555
Fax: (617) 984-7057

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; 4,432,409.

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 1 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 air flow 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.

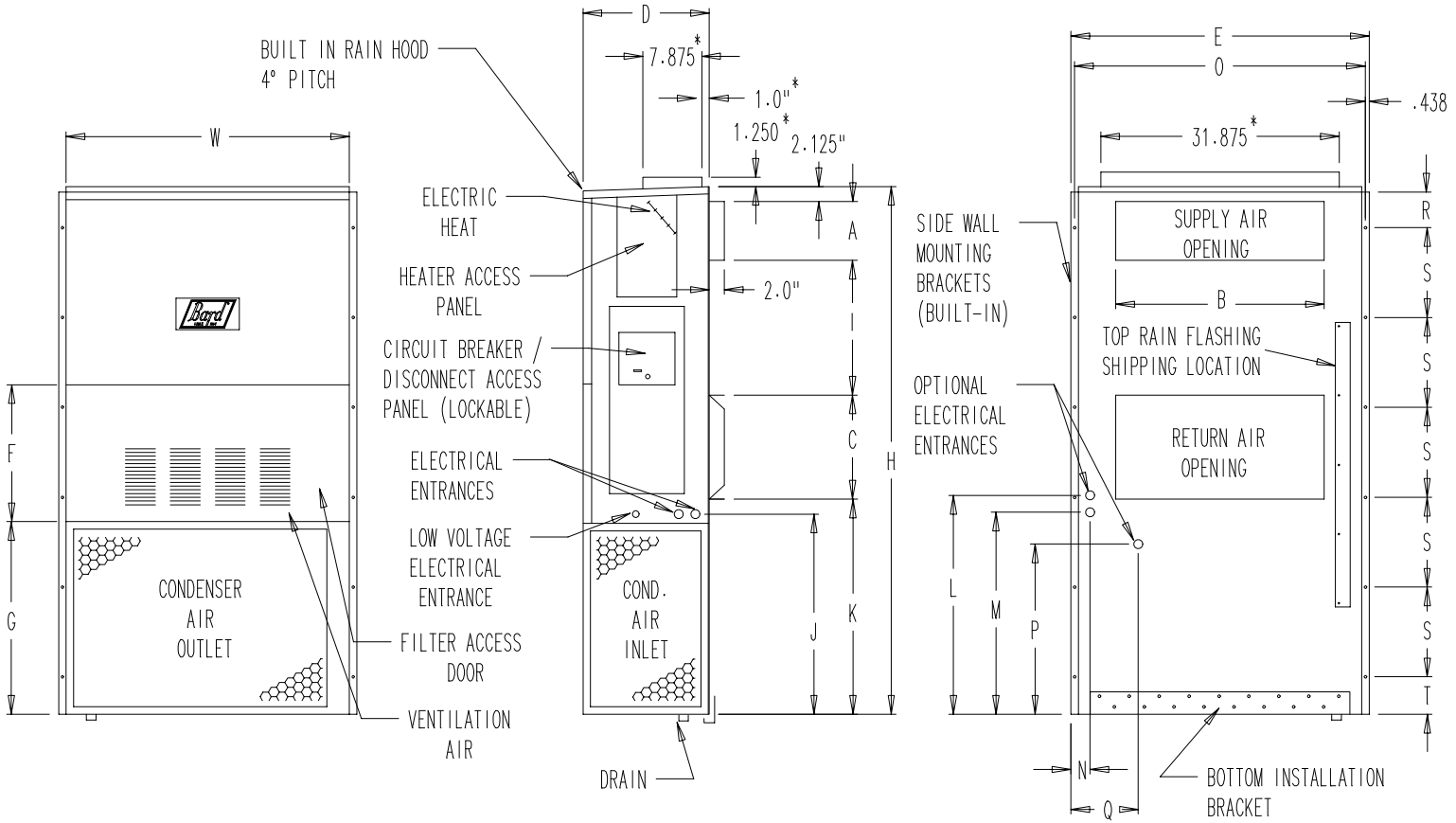
TABLE 1
ELECTRIC HEAT TABLE

Models	WH301-A				WH301-B				WH301-C		WH361-A				WH361-B				WH361-C	
	240-1		208-1		240-3		208-3		460-3		240-1		208-1		240-3		208-3		460-3	
KW	A	BTU	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							20.8	17065	18.1	12800						
10	41.6	34130	36.2	25600							41.6	34130	36.2	25600						
15											62.5	51200	54.1	38400						
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 WH36	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

FIGURE 1
UNIT DIMENSIONS



FRONT VIEW **SIDE VIEW** **BACK VIEW**

MIS-1262

* 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	230/208-1	1	24	35	8	10	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
-A05		1	50	50	8	10	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
③ -A10		1	76	80	4	8	50	26	50	30	8	10	10	10
WH301-B00,-B0Z	230/208-3	1	19	25	10	10	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
⑤ -B06		1	37	40	8	10	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
③ -B09		1	46	50	8	10	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
WH301-C00,-C0Z	460-3	1	10	15	14	14	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
⑤ -C06		1	19	20	12	12	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
③ -C09		1	24	25	10	10	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
⑤ -C15		1	26	30	10	10	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
WH361-A00,-A0Z	230/208-1	1	27	40	10	10	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
-A05		1	53	60	6	10	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
③ -A10		1 or2	79	80	4	8	53	26	60	30	6	10	10	10
⑤ -A15		1 or 2	83	90	4	8	53	52	60	60	6	6	10	10
WH361-B00,-B0Z	230/208-3	1	20	25	10	10	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
⑤ -B06		1	38	40	8	10	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
③ -B09		1	47	50	8	10	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
⑤ -B15		1	50	50	8	10	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
WH361-C00,-C0Z	460-3	1	11	15	14	14	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
⑤ -C06		1	20	20	12	12	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
③ -C09		1	25	25	10	10	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
⑤ -C15		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

④ 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. *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.*

⑤ 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 and 4 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.

⚠ CAUTION

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.

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 one (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 one (1) inch washable filter and a two (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 (2) screws in each bracket assembly and sliding the brackets apart to the required width and retightening the four (4) screws.

FRESH AIR INTAKE

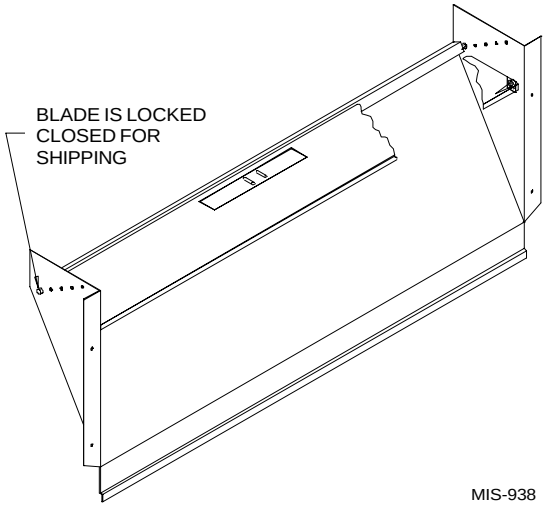
All units are built with fresh air inlet slots punched in the service panel.

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.

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 28-1/2" x 8-1/2" 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, 5 and 6 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.

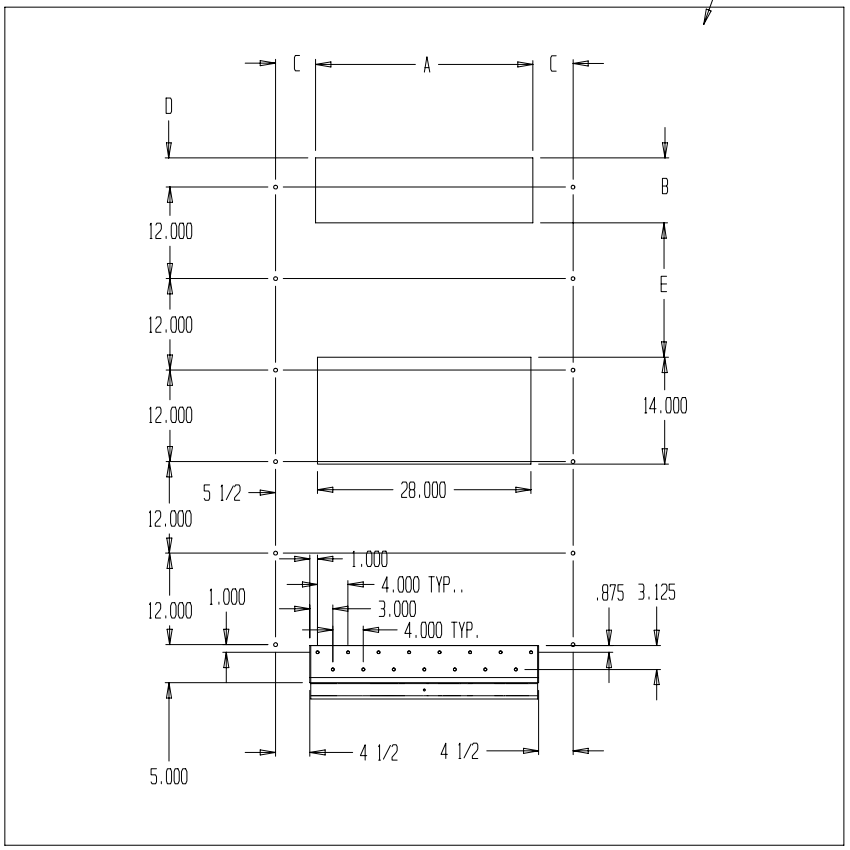
3. Locate and mark lag bolt locations and bottom mounting bracket location. See Figure 3.
4. Mount bottom mounting bracket, if used.
5. Hook top rain flashing under back bend of top. Top rain flashing is shipped secured to the back of the unit on the right side.
6. Position unit in opening and secure 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.

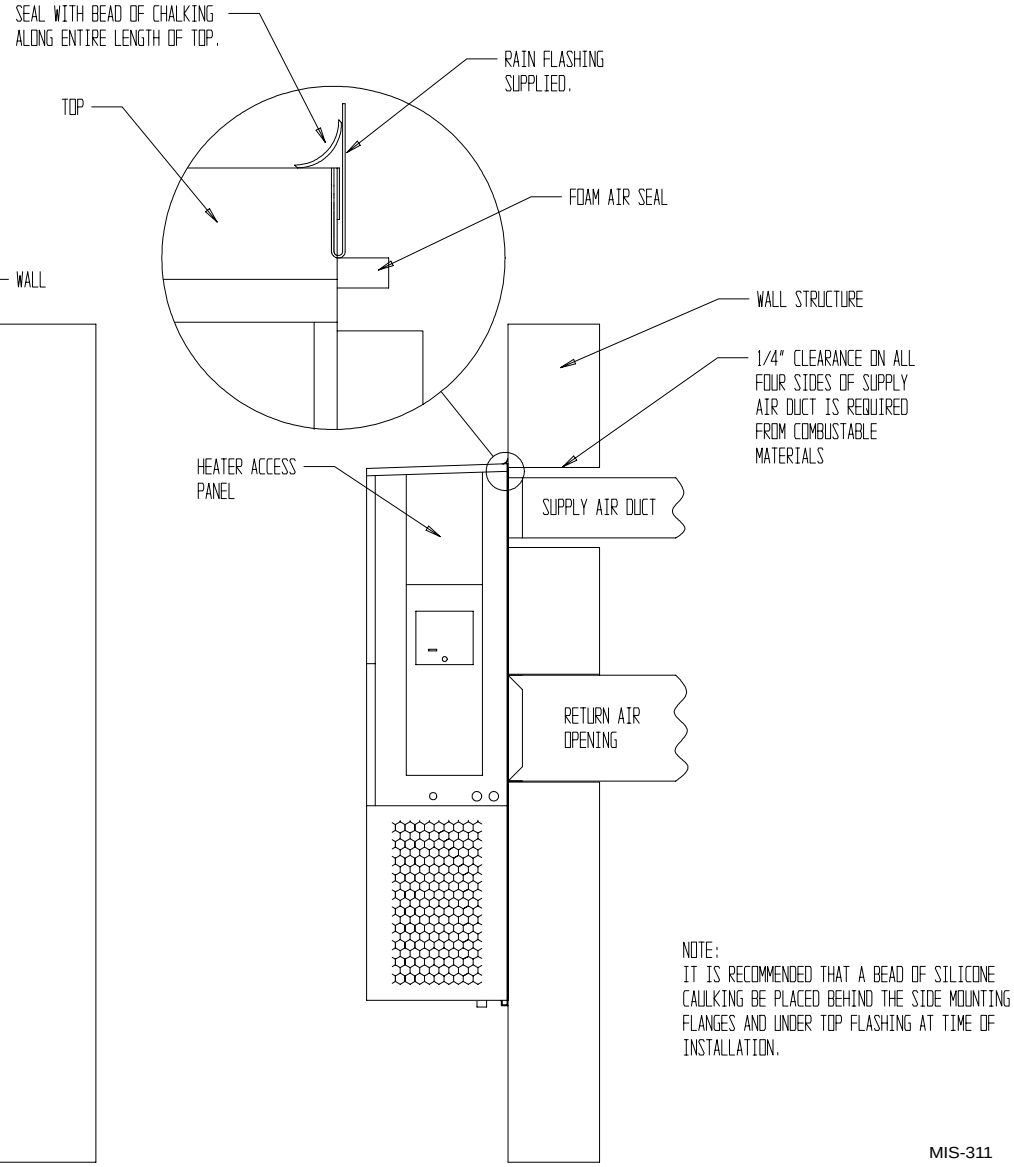
TOP OUTLET ONLY

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	3 1/16	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.

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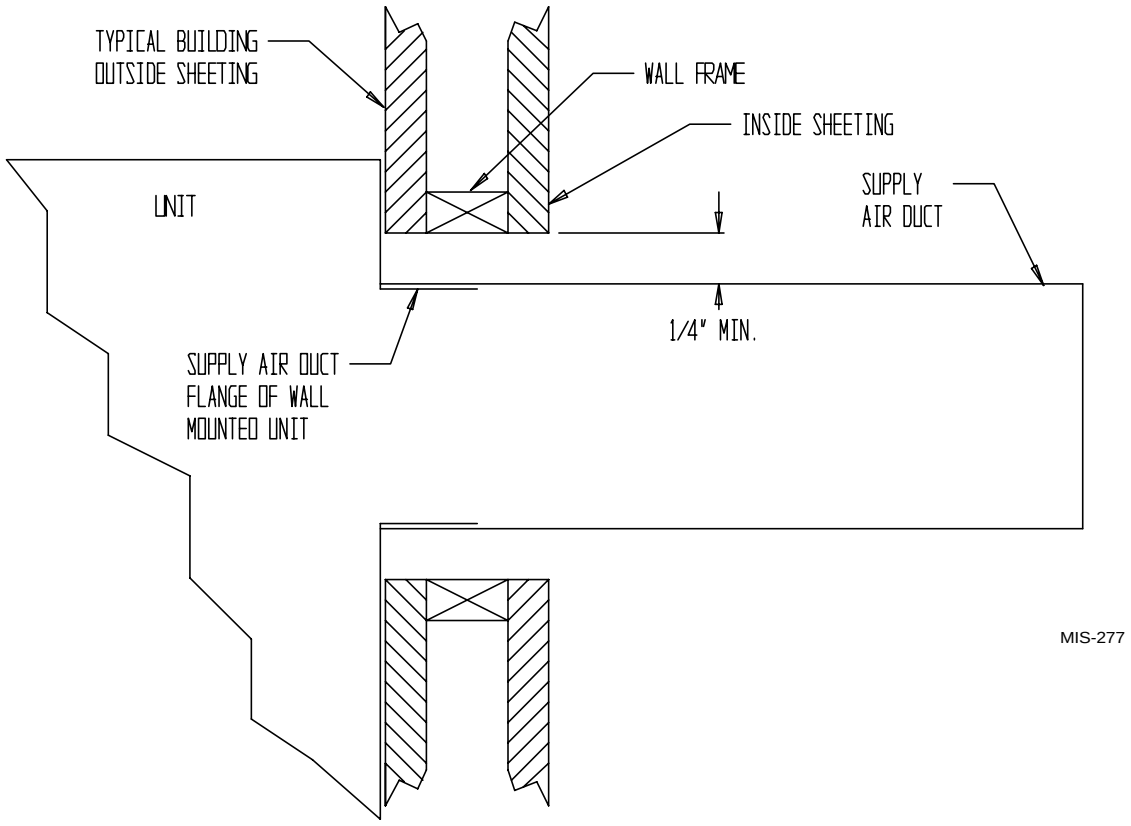
FIGURE 4
ELECTRIC HEAT CLEARANCE



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 fist 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

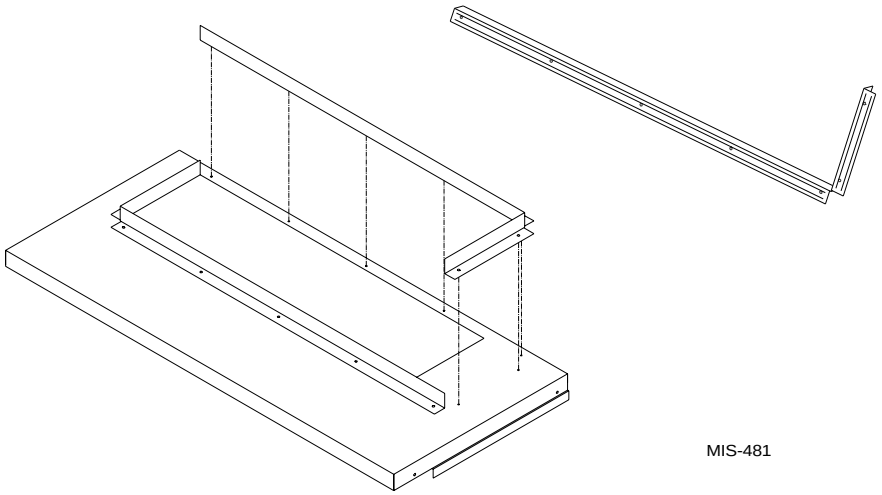


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FIGURE 6
UNIT WITH TOP OUTLET MOUNTED UNDER OVERHANG

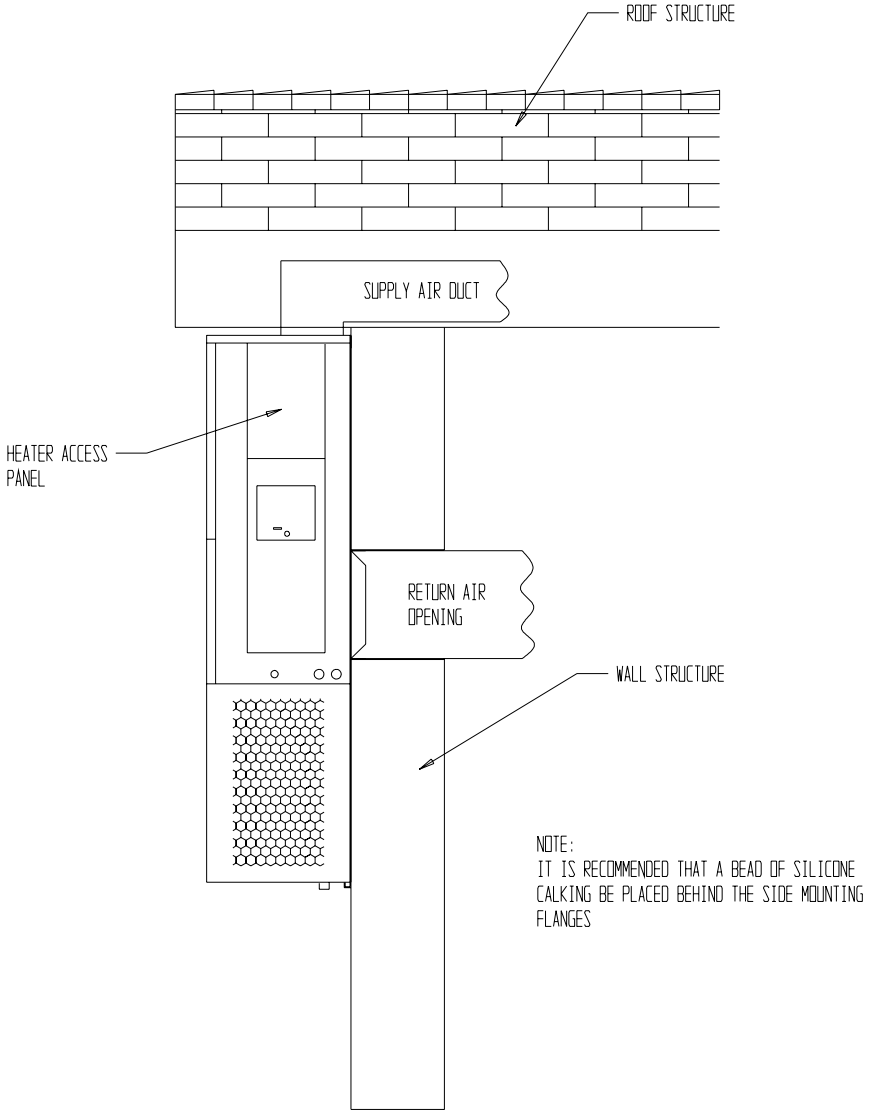

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FIGURE 7
WALL-MOUNTING INSTRUCTIONS

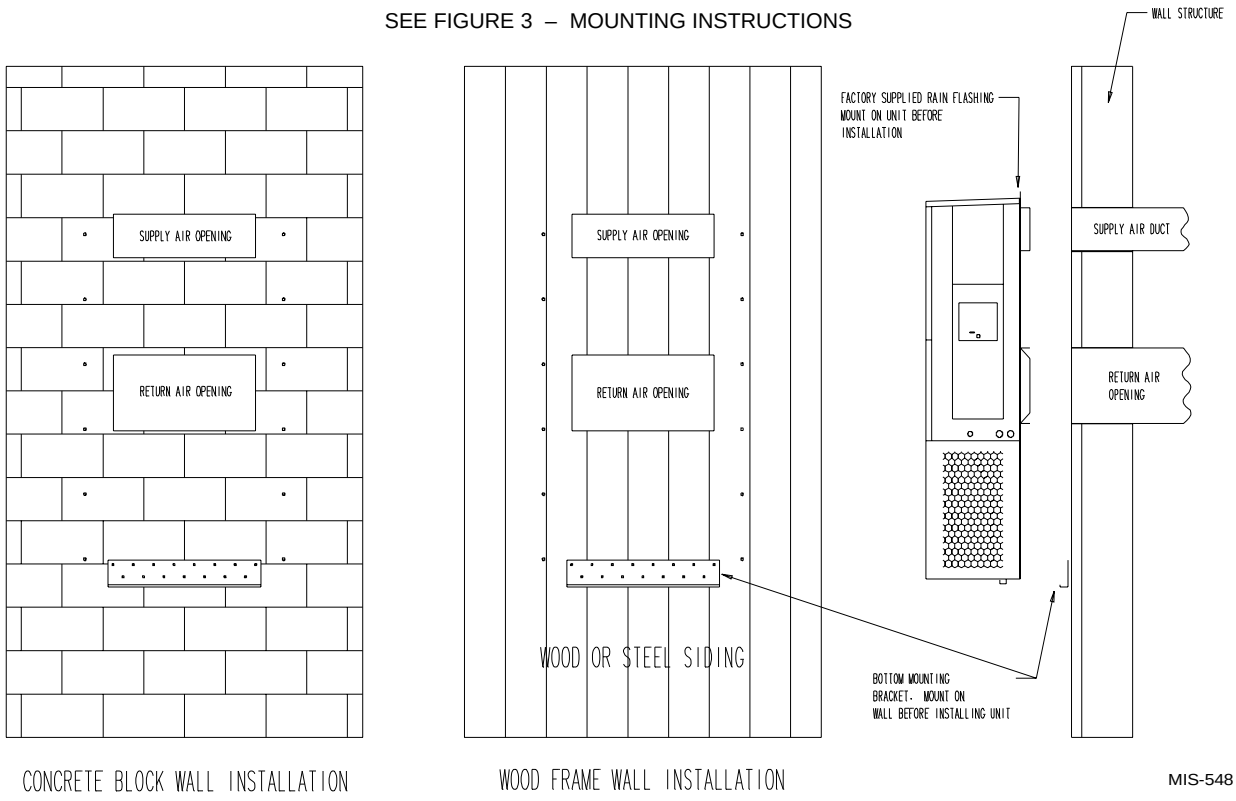


FIGURE 8
WALL-MOUNTING INSTRUCTIONS

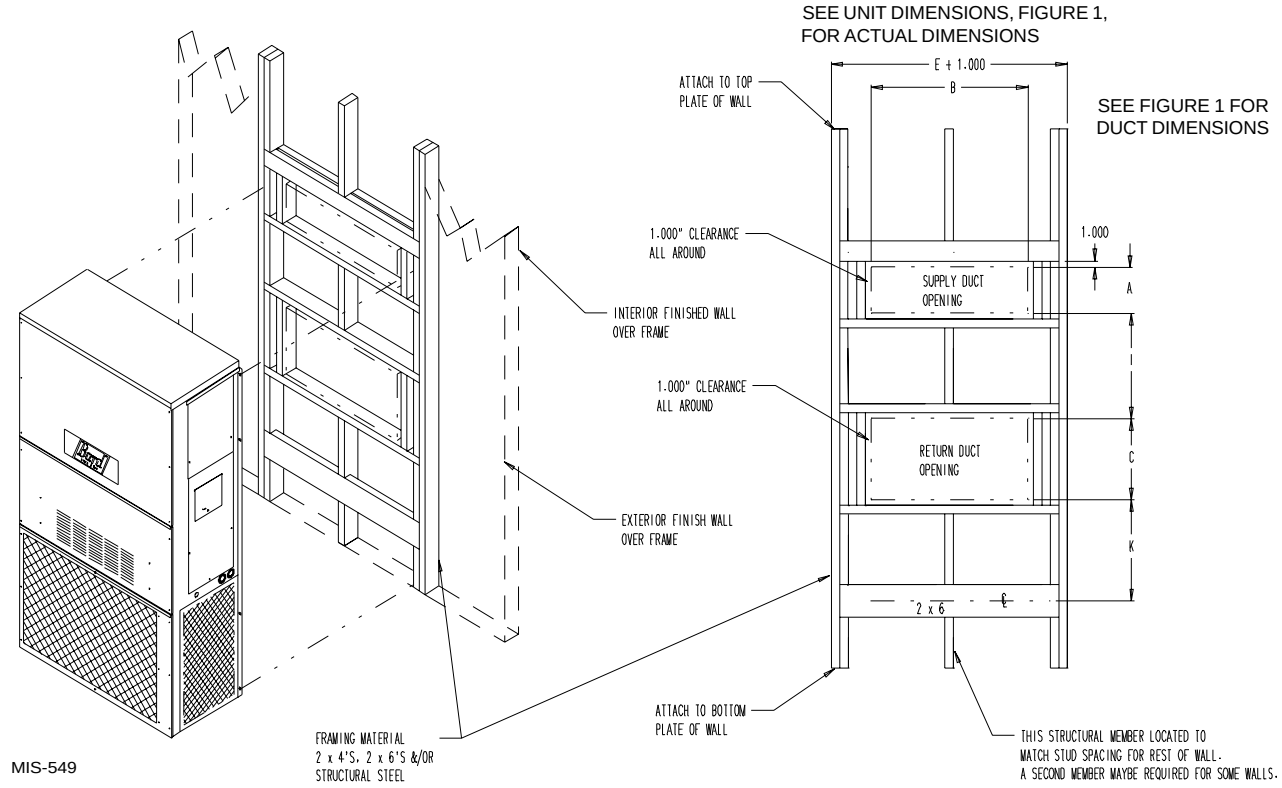
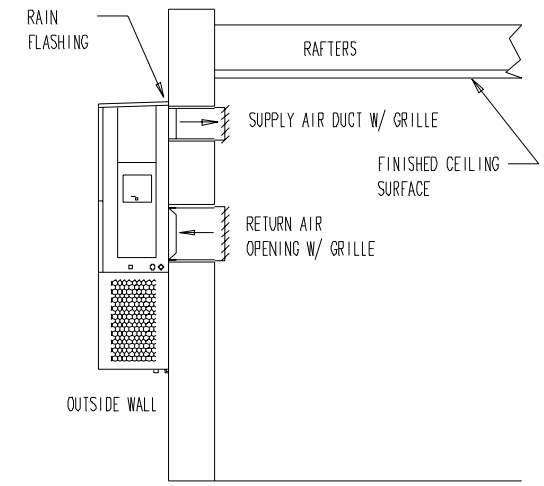
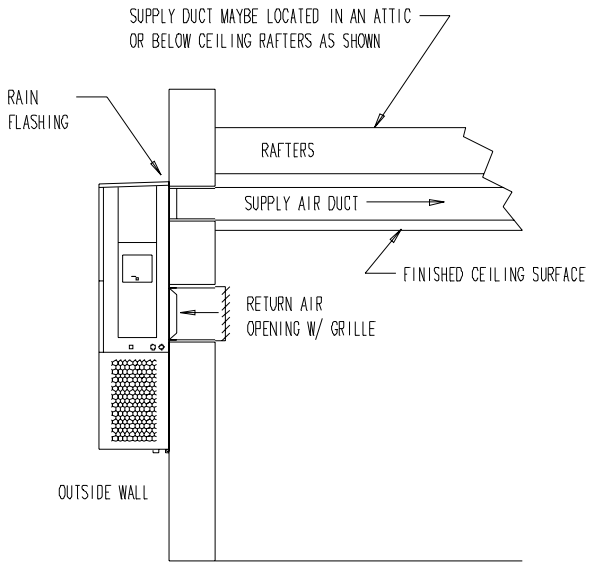


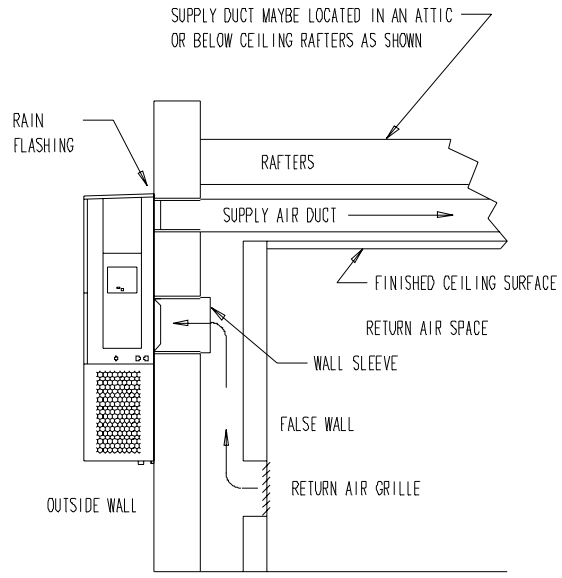
FIGURE 9
COMMON WALL-MOUNTING INSTALLATIONS



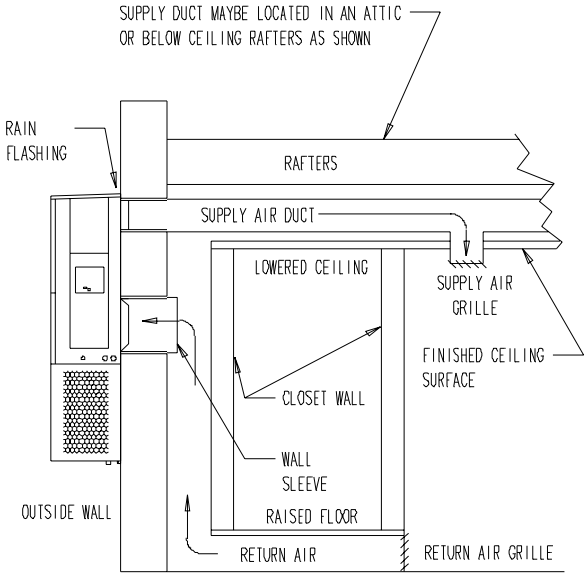
FREE AIR FLOW
NO DUCT



DUCTED SUPPLY
RETURN AT UNIT



FALSE WALL INSTALLATION



CLOSET INSALLATION

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 (75ºC 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.)

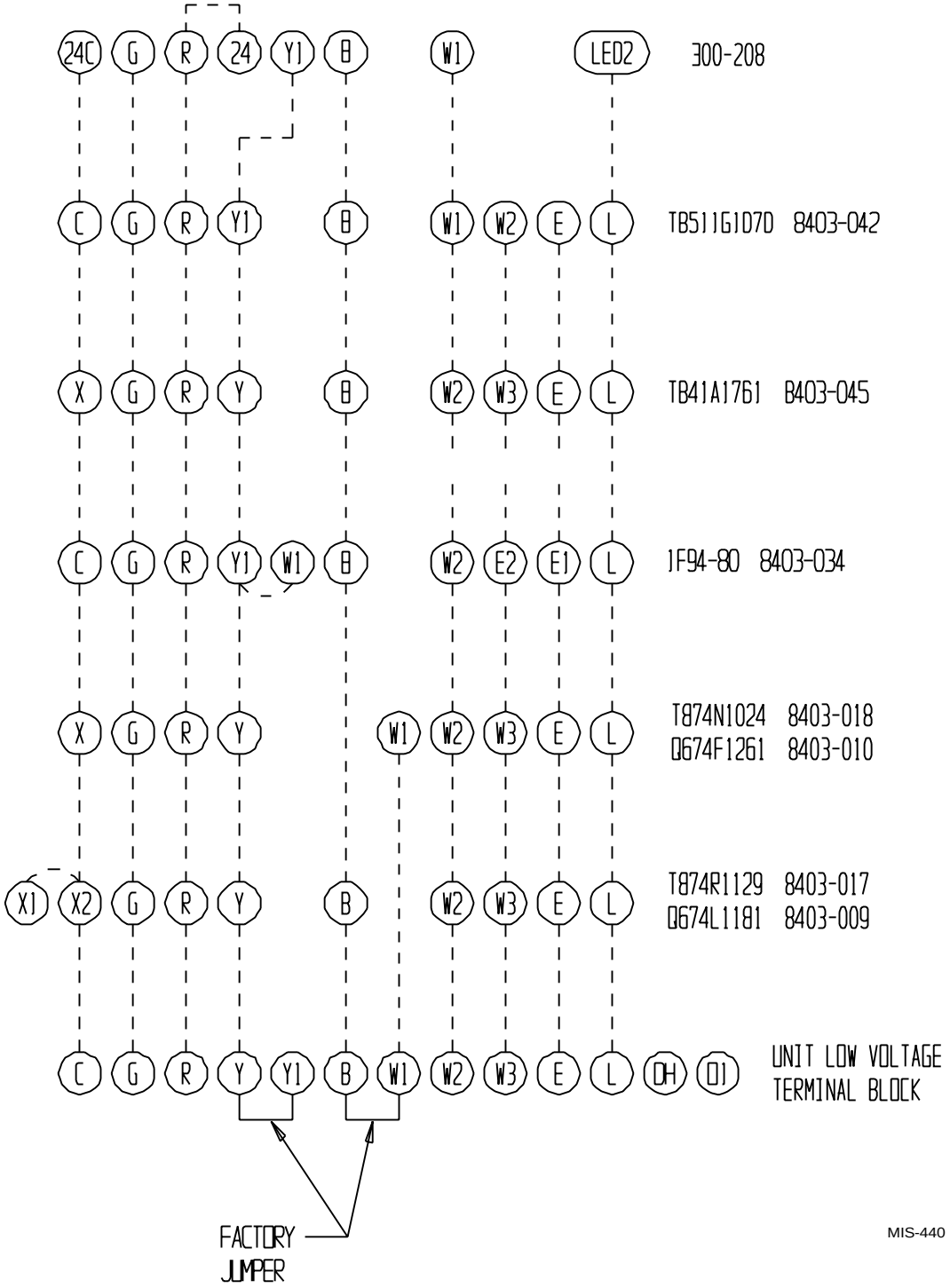
Nine (9) wires should be run from thermostat subbase to the 24V terminal board in the unit. A nine conductor, 18 gauge copper, color-coded thermostat cable is recommended. The connection points are shown in Figure 7.

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

FIGURE 10
LOW VOLTAGE WIRING



COMPRESSOR CUTOFF THERMOSTAT AND OUTDOOR THERMOSTATS

Heat pump compressor operation at outdoor temperatures below 0° F are neither desirable nor advantageous in terms of efficiency. Since most equipment at the time of manufacture is not designated for any specific destination of the country and most of the equipment is installed in areas not approaching the lower outdoor temperature range, the compressor cutoffs are not factory installed.

Outdoor thermostats are available to hold off various banks of electric heat until needed as determined by outdoor temperature. The set point of either type of thermostat is variable with geographic region and sizing of the heating equipment to the structure. Utilization of the Heating Application Data and the heat loss calculation of the building are useful in determining the correct set points.

COMPRESSOR CUTOFF AND OUTDOOR THERMOSTAT WIRING

Shown in Figures 11 and 12.

FIGURE 11

4 & 10KW 1-PH - - - 6 & 9KW 3-PH

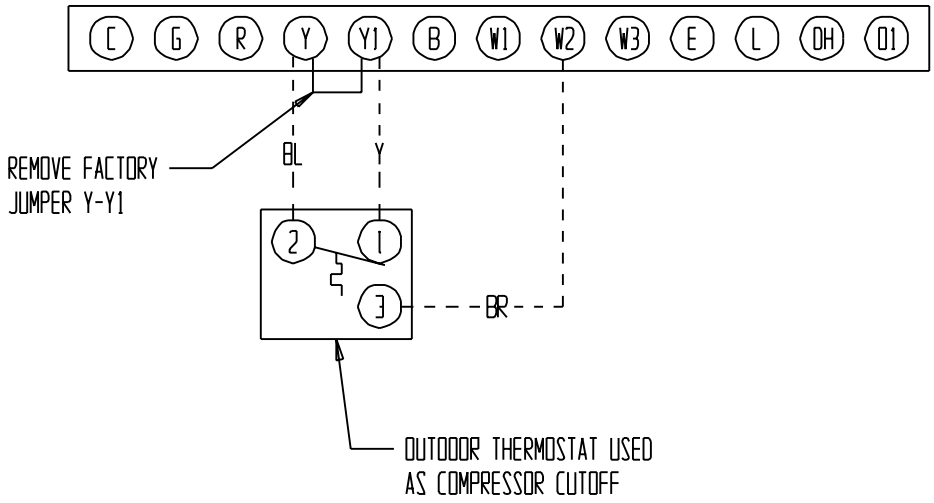


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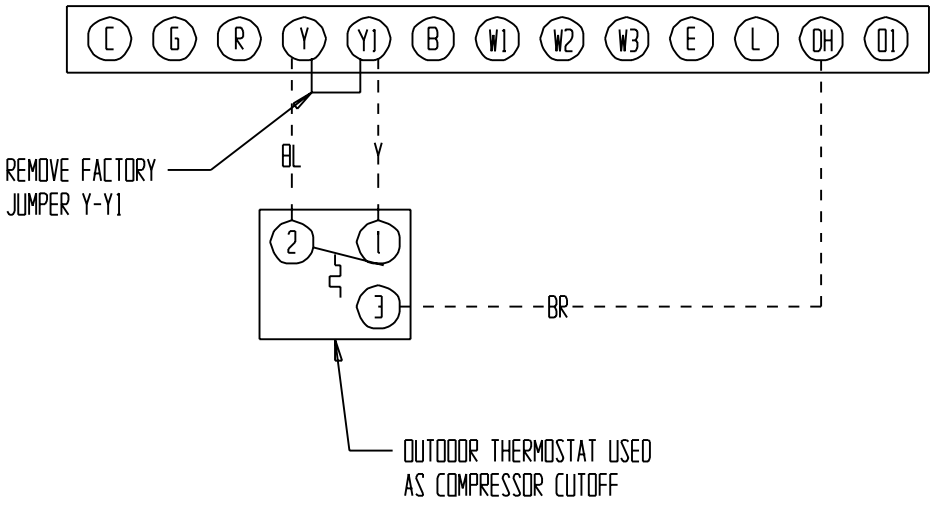
FIGURE 12

15KW 1-PH & 3-PH



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HEAT ANTICIPATION

The thermostats shown below have a fixed heat anticipator for stage 1 with no adjustment required. Stage 2 has an adjustable anticipator for the W2 connection and fixed for the W3 connection. Both the W2 and W3 circuits are controlled by the stage 2 bulb. The only heat anticipator that needs to be checked is stage 2 and it should be set to match the load carried by the W2 circuit. The normal factory wiring provides for only one electric heat contactor to be controlled by W2, and the anticipator should be set at .40A. If special field wiring is done, it is best to actually measure the load but a good rule is .40A for EACH heat contactor controlled by W2.

TABLE 6

WALL THERMOSTAT and SUBBASE COMBINATIONS

Group	Thermostat	Subbase	Predominant Features
A	8403-017 (T874R1129)	8404-009 (Q674L1181)	Heat or Cool ① No Auto
B	8403-018 (T874N1024)	8404-010 (Q674F1261)	Automatic Heat - Cool ② Changeover Position
	8403-034 (1F94-80)		Programmable Electronic
	8403-042 (T8511G1070		1 stage cool, 2 stage heat Electronic Automatic Changeover
	8403-045 (T841A1761)		1 stage cool, 2 stage heat Manual

① No automatic changeover position - must manually place in heat or cool. Reversing valve remains energized at all times system switch is in heat position (except during defrost cycle). No pressure equalization noise when thermostat is satisfied on either heating or cooling.

② Allows thermostat to control both heating and cooling operation when set in "Auto" position. Reversing valve de-energizes at end of each "On" heating cycle.

IMPORTANT NOTE: Both thermostat and subbase combinations shown above incorporate the following features: Man-Auto fan switch, Off-Heat-Cool-EM. Heat Switch, and two (2) indicator lamps - one for emergency heat and one for compressor malfunction.

THERMOSTAT INDICATOR LAMPS

The red lamp marked "Em. Ht." comes on and stays on whenever the system switch is placed in emergency heat position. The green lamp marked "check" will come on if there is any problem that prevents the compressor from running when it is supposed to.

EMERGENCY HEAT POSITION

The operator of the equipment must manually place the system switch in this position. This is done when there is a known problem with the unit, or when the green "check" lamp comes on indicating a problem.

COMPRESSOR MALFUNCTION LIGHT

Actuation of the green "check" lamp is accomplished by a relay output from the heat pump control board which is factory installed. Any condition such as loss of charge, high head pressure, etc., that will prevent compressor from operating will cause green lamp to activate. This is a signal to the operator of the equipment to place system in emergency heat position.

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 9 is affixed to all outdoor units detailing start up procedure. This is very important. Please read carefully.

SERVICE HINTS

1. Caution homeowner to maintain clean air filters at all times. Also, not to needlessly close off supply and return air registers. This reduces air flow 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 13
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 poind 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 22 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.

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 sensor mounted near the bottom of the outdoor coil. Once coil temperature reaches 30°F or below, the coil sends a signal to the control logic of the heat pump control and the defrost timer will start.

After 60 (90 or 30) 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 sensor will send a signal to the heat pump control which will return the system to heating operations automatically.

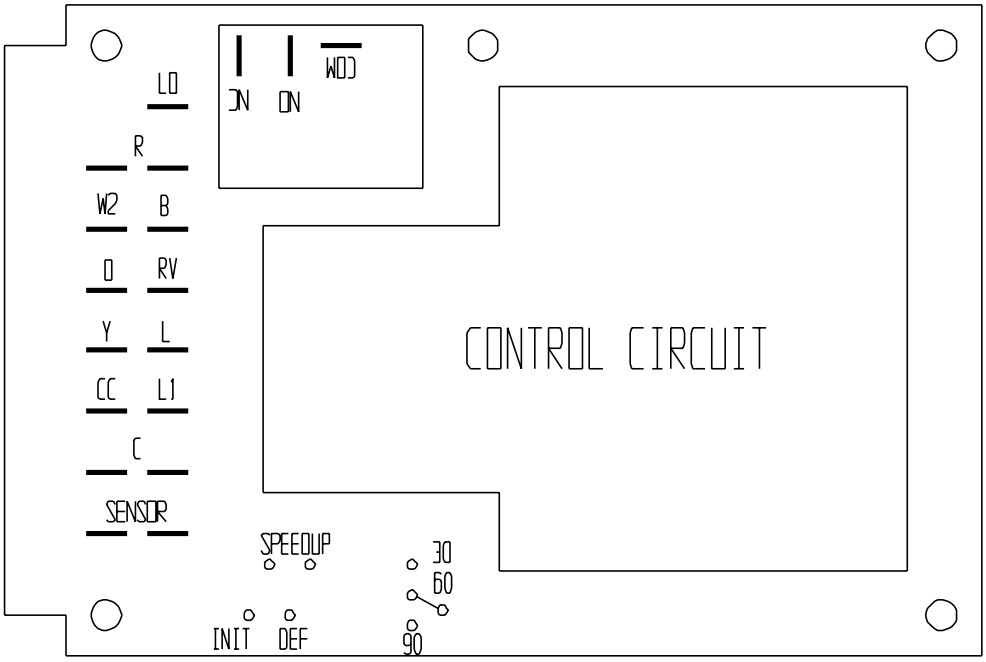
If some abnormal or temporary condition such as a high wind causes the heat pump to have a prolonged defrost cycle, the heat pump control will restore the system to heating operation automatically after 10 minutes.

There are three settings on the heat pump control – 30 minutes 60 minutes and 90 minutes. Most models are shipped wired on the 60 minute setting for greatest operating economy. If special circumstances require a change to another time, remove wire connected to terminal "60" and reconnect to desired terminal.

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 the time to elapse.

There is an initial defrost (INIT DEF) jumper 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.

FIGURE 14
DEFROST CONTROL BOARD



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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 L1-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 betwwn 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.
	Contactor defective	Check for open or shorted coil winding.	Replace contactor.
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 init. def. 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 ± 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 the drawing below 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 15
FAN BLADE SETTING

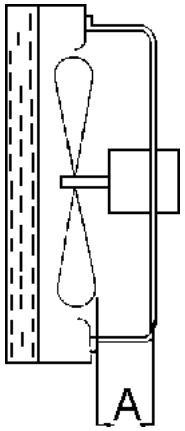

TABLE 8
FAN BLADE DIMENSION

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 80ºF dry bulb/67ºF 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_2O	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
A00	.50	.50	.50	.50
WH301 A05	.40	.50	.40	.50
WH361 A10	.35	.40	.25	.40
A15	.35	.40	NA	NA
B00	.50	.50	.50	.50
WH301 B06	.40	.50	NA	NA
WH361 B09	.35	.45	.30	.40
B15	.35	.45	NA	NA
C00	.50	.50	.50	.50
WH301 C06	.50	.50	NA	NA
WH361 C09	.30	.40	.35	.45
C15	.30	.40	NA	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 High Side	21 143	25 148	28 153	32 159	36 165	39 172	43 180	47 188	51 197	55 207	59 217	63 228	67 239
WH361	70°	Low Side High Side	22 145	25 152	28 159	31 167	34 177	38 186	42 197	46 208	50 220	55 233	60 246	65 260	70 275

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 21 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

MODEL	DESCRIPTION	WH301-A	WH301-B	WH301-C	WH361-A	WH361-B	WH361-C
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	
CMH-9	LAC + LPC	X	X		X	X	
CMH-14	Outdoor Thermostat (ODT)	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		