

## INSTALLATION INSTRUCTIONS FOR 'M' SERIES MODULAR HEAT PUMP SYSTEMS

### General

This bulletin provides installation and design information specifically for heat pump applications. It is meant to supplement the basic air handler installation instructions found in *Bulletin 30-20 Installation Manual for "M" Series Modular Air Handler Units*.

When an electric furnace is required for auxiliary heat, consult *Bulletin 30-34 Installation Instructions for Electric Duct Heaters, Bulletin 30-34* for sizing, mounting, and wiring instructions.

In addition, a hot water coil is available as an alternate heat source if the heat pump will not satisfy the complete heating load. Consult *Bulletin 30-30 Installation Manual for 'M' Series Slide-in Heating Coil* for instructions on mounting, piping, and wiring for hot water coils.

All external wiring must be sized and installed in accordance with local building codes and regulations.

### Introduction

The *Unico System* heat pump is an excellent source of heat. It is always more efficient than electric heat and, depending on the utility rates, can be more efficient than gas heat.

Heat pumps are very popular in mild climates where the heat pump is able to satisfy the full heating load by itself or with a small amount of auxiliary electric heat. However, it is also an excellent choice for Northern climates as a between-season heating system to knock off the chill in the spring and autumn and avoid starting up the primary heating system which typically would be a boiler.

As with any heating and cooling system it is necessary to do both HEAT GAIN and HEAT LOSS calculations in accordance with *Bulletin 40-40 System Sizing and Layout Procedure*. This bulletin describes how to determine the 'balance point' for heat pump systems which is needed to size the auxiliary heat (see Table 1 for typical sizes available).

**Table 1. Electric Duct Furnace Models (Auxiliary Heat)**

Model Number	Rated Size, kW	Unico System Matchup	Min. Airflow, CFM (m <sup>3</sup> /s)
WON 0202*	2	1218, 2430, 3642 and 4860	200 (0.09)
WON 0502*	5		400 (0.19)
WON 0752*	7.5		400 (0.19)
WON 1002*	10	2430, 3642 and 4860	500 (0.24)
WON 1502*	15		600 (0.28)
WON 2002*	20	3642 and 4860	800 (0.38)

\* European models have an 'E'.

### Wiring

The wiring diagram in this instruction is for heat pump systems without electric heating. Refer to *Installation Instructions for Electric Duct Heaters, Bulletin 30-34* for wiring instructions if unit is installed with an electric duct heater.

The blower electric circuit must be separate from other loads and protected with a fuse or circuit breaker. The blower motor requires either a 15 amp circuit breaker or a fuse sized for the motor (refer to the blower specifications in *Bulletin 20-20.1* for the minimum fuse size). Most local codes also require a disconnect switch near the unit for service protection (consult the local code authority for specific information).

For convenience, the electric furnace has a separate motor circuit breaker meets the dual requirements for circuit protection and disconnect.

The electric power lines are connected inside the blower control box. If it has a circuit board, the power is connected to a set of leads as shown in Figure 1. If the blower control does not include a circuit board, then the power leads are connected to two terminals on a terminal block as shown in Figure 2.

#### WARNING!

**DISCONNECT ELECTRICAL SUPPLY BEFORE WIRING UNIT TO PREVENT INJURY OR DEATH FROM ELECTRICAL SHOCK.**

Connect power supply to terminals L1 and L2 on the high voltage terminal block. Connect a ground wire to equipment grounding on the side of the control box near the incoming power opening.

The low voltage transformer is factory set for a primary voltage of 240V. If power supply is 208V remove ORANGE lead from L2 terminal and connect RED lead to L2. Insulate the red wire terminal connector with electrical tape.

#### WARNING!

**BE SURE TO INSULATE THE UNUSED TRANSFORMER LEAD TO PREVENT INJURY OR DEATH FROM ELECTRICAL SHOCK.**

The heat pump module includes a relay switch with lead wires (shipped in the Cooling Module carton). This relay must be installed in the control box. A space for mounting the relay is provided behind the low voltage terminal block in the control box as shown in Fig. 2. The relay prevents the unit from cycling during the defrost cycle

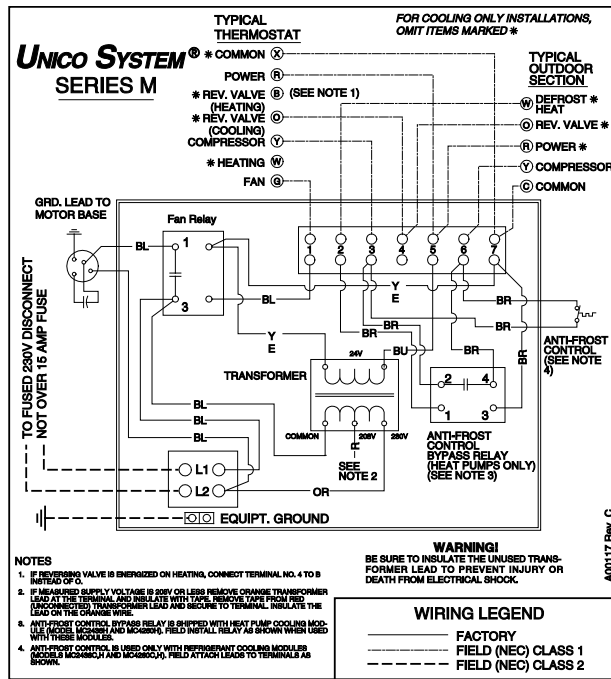


Figure 1. Wiring Diagram

while in the heating mode by bypassing the anti-frost switch on the cooling coil.

If auxiliary electric heat is used, it may be necessary to install an outdoor thermostat to cycle the last stage of heating elements. Refer to Table 2 for your specific arrangement. The thermostat should be set at approximately 30°F (-1°C) outdoor air temperature. Without a thermostat the heaters may cycle on high limit during mild weather.

The control box should be internally wired as follows:

1. Connect the motor leads to L2 and terminal #1 on the fan relay.
2. Connect the anti-frost switch leads to low voltage

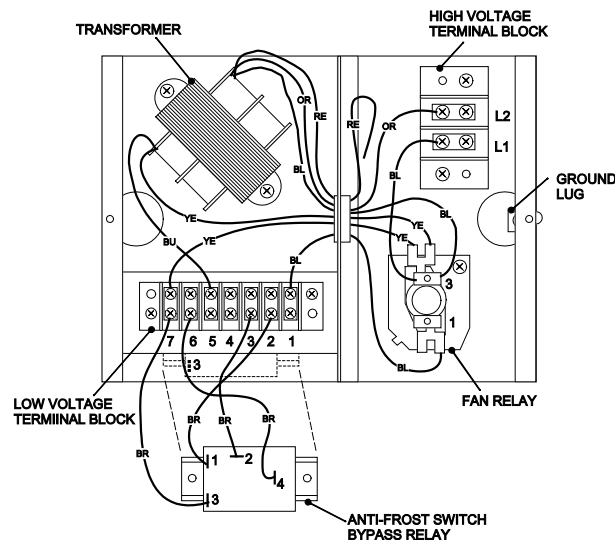


Figure 2. Electrical Control Box

terminals #6 and #3.

3. Connect the anti-frost switch bypass relay as shown in Figs. 1 and 2. Be sure the wire terminals do not contact any sheet metal. If necessary, bend the spades at a 45° angle.

**CAUTION**

**TO PREVENT DAMAGE TO UNIT, BE SURE THAT THE UNINSULATED PORTION OF THE WIRE TERMINALS DO NOT TOUCH ANYTHING.**

4. Connect the thermostat and outdoor unit as shown in Fig. 3. Refer to *Installation Instructions for Electric*

Table 2. When to use outdoor thermostat for last stage heaters.

Airflow CFM (m <sup>3</sup> /s)	kW Rating of Electric Duct Heaters				
	5	7.5	10	15	20
400 (.19)	Diagonal lines	Diagonal lines	N/A	N/A	N/A
500 (.24)	Diagonal lines	Diagonal lines		N/A	N/A
600 (.28)	Diagonal lines	Diagonal lines			N/A
700 (.33)	Diagonal lines	Diagonal lines			N/A
800 (.38)	Diagonal lines	Diagonal lines			
900 (.42)	Diagonal lines	Diagonal lines		Diagonal lines	
1000 (.47)	Diagonal lines	Diagonal lines		Diagonal lines	

No thermostat required  
 Use outdoor thermostat to limit last stage

Heaters, Bulletin 30-34 for wiring instructions with auxiliary electric heaters.

**Checking Airflow**

Check that the restrictor plate is properly set, especially if auxiliary heat is provided. Then check the airflow (see Bulletin 30-20 or 30-10, checking airflow) with thermostat set to FAN-ON and no heating or cooling.

*Note: In heating mode, the system external static pressure will be .10 to .20 inch water (0.02 to 0.05 kPa) lower.*

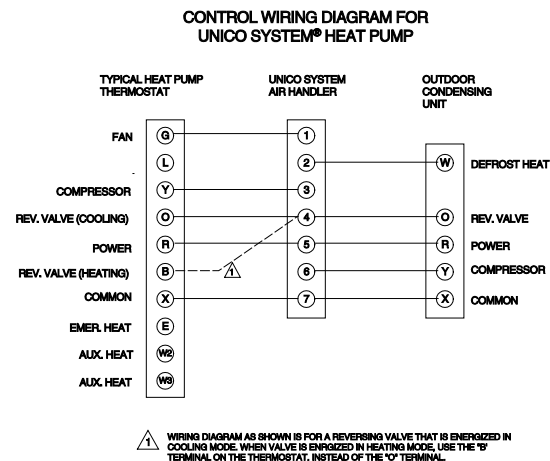


Figure 3. Control Wiring Diagram (without electric Heaters)

**Table 3. Lennox HP19 Series Normal Operating Pressures (English units)**

MODE	OUTDOOR COIL ENTERING AIR TEMPERATURE	HP19-211		HP19-261		HP19-311		HP19-411 HP19-413		HP19-461 HP19-463		HP19-511 HP19-513		HP19-651 HP19-653	
		LIQ. ± 10 PSIG	SUC. ± 5 PSIG	LIQ. ± 10 PSIG	SUC. ± 5 PSIG	LIQ. ± 10 PSIG	SUC. ± 5 PSIG	LIQ. ± 10 PSIG	SUC. ± 5 PSIG	LIQ. ± 10 PSIG	SUC. ± 5 PSIG	LIQ. ± 10 PSIG	SUC. ± 5 PSIG	LIQ. ± 10 PSIG	SUC. ± 5 PSIG
COOLING — EXPANSION VALVE ONLY	75 °F	167	77	180	75	169	76	171	73	182	78	172	76	177	75
	85 °F	196	80	209	77	196	78	201	75	212	80	202	78	206	77
	95 °F	225	82	238	79	223	80	232	77	242	82	232	80	235	79
	105 °F	257	85	270	81	253	82	266	79	275	84	265	82	267	81
HEATING — ALL UNITS	20 °F	168	35	175	33	177	33	181	32	177	32	185	33	183	29
	30 °F	178	44	188	42	190	42	195	40	194	41	201	42	195	37
	40 °F	190	54	201	51	203	51	210	49	210	50	217	51	207	45
	50 °F	202	64	214	61	216	61	225	58	228	60	232	60	219	53

NOTE — Liquid line pressure in heating mode may vary more than ±10 PSIG depending on unit matchup.

**Table 4. Lennox HP19 Series Normal Operating Pressures (SI units)**

MODE	OUTDOOR COIL ENTERING AIR TEMPERATURE	HP19-211		HP19-261		HP19-311		HP19-411 HP19-413		HP19-461 HP19-463		HP19-511 HP19-513		HP19-651 HP19-653	
		LIQ. ± 70 kPa	SUC. ± 35 kPa	LIQ. ± 70 kPa	SUC. ± 35 kPa	LIQ. ± 70 kPa	SUC. ± 35 kPa	LIQ. ± 70 kPa	SUC. ± 35 kPa	LIQ. ± 70 kPa	SUC. ± 35 kPa	LIQ. ± 70 kPa	SUC. ± 35 kPa	LIQ. ± 70 kPa	SUC. ± 35 kPa
COOLING — EXPANSION VALVE ONLY	23.9 °C	1151	531	1241	517	1165	524	1179	503	1255	538	1186	524	1220	517
	29.4 °C	1351	552	1441	531	1351	538	1386	517	1462	552	1393	538	1420	531
	35.0 °C	1551	565	1641	545	1538	552	1600	531	1669	565	1600	552	1620	545
	40.6 °C	1772	586	1862	558	1744	565	1834	545	1896	579	1827	565	1841	558
HEATING — ALL UNITS	-6.7 °C	1158	241	1207	228	1220	228	1248	221	1220	221	1276	228	1262	200
	-1.1 °C	1227	303	1296	290	1310	290	1345	276	1338	283	1386	290	1345	255
	4.4 °C	1310	372	1386	352	1400	352	1448	338	1448	345	1496	352	1427	310
	10.0 °C	1393	441	1476	421	1489	421	1551	400	1572	414	1600	414	1510	365

NOTE — Liquid line pressure in heating mode may vary more than ±.07 PSIG depending on unit matchup.  
All pressures are gauge.

### Charging

Charge and operate the heat pump in accordance with these instructions and the instructions provided by the manufacturer of the outdoor unit.

Charging a heat pump, by its nature, is more difficult than a cooling-only refrigerant system. Quite often the ideal charge for cooling is different than the ideal charge for heating, making the system much more sensitive to the amount of charge. In some cases, the compressor will trip on high head pressure during the heating mode because it is overcharged if the system was charged during cooling. Likewise, the system may cycle on the anti-frost control because of a low refrigerant charge if the system was charged during heating.

To compensate for this charge difference some outdoor unit manufacturers have a charge compensator device that stores charge while in heating mode. Unfortunately there

are no add-on devices to accomplish the same thing and only a few (usually the most expensive) model lines will have one. For this reason, it is often necessary to compromise the charge.

Although the unit can be charged in the heating mode, it is best to charge the unit during the cooling mode as described in the *Installation Manual for "M" Series Modular Air Handler Units – Bulletin 30-20*. Then recheck the charge during the heating season to be sure the system is not over charged.

**Charging – Heat Mode.** If the system is started up on heating where the return air temperature is significantly lower than the normal operating range of 65 to 75°F (18.2 to 23.8°C), the suction pressure can be very low. Operate the system to bring up the return air temperature, using auxiliary heat if necessary, before checking system charge.

Table 3 is an example of an operating pressure chart for both heating and cooling for the Lennox HP19 Series outdoor heat pump units. Do not use Table 3 as a general

charging guide. Different models of outdoor heat pumps may have different operating pressures.

Typically, in the heating mode, the *Unico System* will have a slightly higher discharge (LIQ.) pressure, and in cooling mode the *Unico System* will have a slightly lower suction (SUC.) pressure.

Some outdoor heat pump units include a manual high-pressure switch. With the *Unico System* lower airflow and higher temperatures, the discharge pressure will typically run higher than a conventional system. It is important that the system be operated at pressures below the trip pressure of the high-pressure switch to avoid nuisance shut downs. If this occurs, use a high head kit as described below.

**Charging – Cooling Mode.** If the system is charged in the cooling mode using the methods described in *Bulletin 30-20*, it is important that the system be

rechecked during the heating season for proper charge and operation. Refer to the heat pump manufacturer's instructions for proper charging during both the heating and cooling seasons.

#### High Head Heat (Mild Weather Kit)

When any heat pump is operated during mild weather (temperatures above 50°F [10°C]), the compressor may trip out on the high-pressure limit. The *Unico System* is particularly sensitive to this since it operates with a lower airflow.

To overcome this problem, install a control to cycle or modulate the outdoor fan based on the compressor discharge pressure. Such a control is available from Unico, Inc. as UPC-65, Mild Weather Kit. Be sure this control is compatible with the outdoor heat pump section being used.