

Installation Instructions

Smart Heat Heat Pump Heater Packages

KFCEH

NOTE: Read the entire instruction manual before starting the installation.
This symbol → indicates a change since last issue.

SAFETY CONSIDERATIONS

Installing and servicing of heating and air conditioning equipment can be hazardous due to system pressures and electrical components. Only trained personnel should install or service heating and air conditioning equipment.

Untrained personnel can perform basic maintenance functions such as cleaning coils, or cleaning and replacing filters. All other operations should be performed by trained personnel. When working on heating and air conditioning equipment, observe precautions in literature, on tags, and on labels attached to the unit.

Follow all safety codes. Wear safety glasses and work gloves. Have a fire extinguisher available.

Recognize safety information. This is the safety-alert symbol .

When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury.

Understand the signal words DANGER, WARNING, and CAUTION. These words are used with the safety-alert symbol. DANGER identifies the most serious hazards which **will** result in severe personal injury or death. WARNING signifies hazards which **could** result in personal injury or death. CAUTION is used to identify unsafe practices, which **would** result in minor personal injury or product and property damage. NOTE is used to highlight suggestions which will result in enhanced installation, reliability, or operation.

INTRODUCTION

This instruction covers installation of Smart Heat electric heater packages Part No. KFCEH0101H10, KFCEH0201H15, and KFCEH0301H20 into FA4, FB4, FC4, and FX4 fan coils. Check unit rating plates for compatibility of fan coil and electric heater combinations. See Table 1 for heater package usage.

NOTE: The Smart Heat option is for use only on heat pumps, and is not approved for any other application.

Table 1—Accessory Heater Usage

ELECTRIC HEATER PART NO.	DESCRIPTION	MODELS FA4, FB4, FC4, FX4 SIZE
KFCEH0101H10	10 kw, Non-Fused	018-036
KFCEH0201H15	15 kw, Fused	024-048
KFCEH0301H20	20 kw, Fused	030-070


DESCRIPTION AND USAGE

The Smart Heat electric heater package options allow the addition of accessory heaters and related controls to models FA4, FB4, FC4, and FX4 fan coils with heat pump outdoor units only. See Table 1 for heater package usage.

The Smart Heat electric heater package options enhance performance of heat pump by managing the electric heat. Heating elements are staged on individually as required to maintain dwelling set point temperature. The controller will adjust the indoor blower speed tap to reduce airflow in the ultra comfort mode.

The controller is not a substitute for good installation and ductwork practices. All ductwork should be free of air leakage and insulated. Performance may not be satisfactory if good practices are not followed.

NOTE: Electric heaters require a minimum airflow. See Table 2 for minimum motor speed selection before installing. There is a 1-in. minimum clearance to combustible materials for the first 36 in. of ductwork on all fan coils with 20-kw packages, and 024, 033, and 038 size fan coils with 15-kw heater packages.

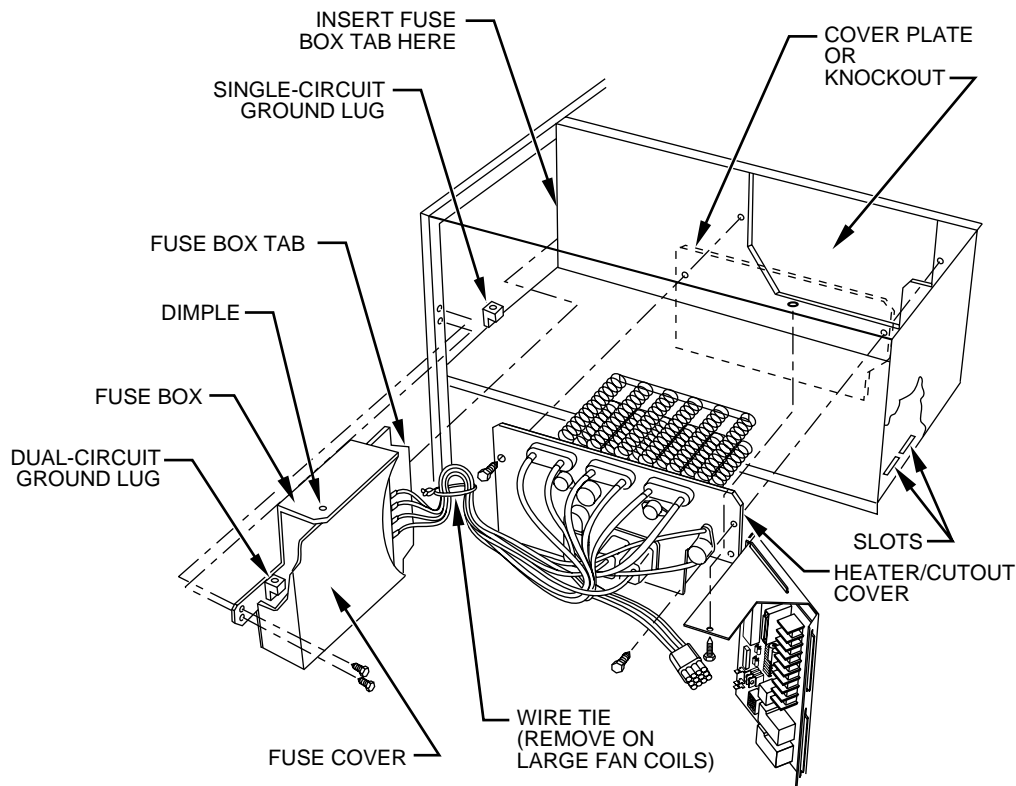
 **WARNING:** Before beginning any installation or modification, be sure the main electrical disconnect switch(es) is in the OFF position. Tag the disconnect with a suitable warning label. Electrical shock can cause personal injury or death.

INSTALLATION

PROCEDURE 1—INSTALL ELECTRIC HEATER ASSEMBLY

NOTE: Ensure heater coils are not deformed or damaged during heater installation.

1. Make sure power is off.
2. Remove blower access panel of fan coil unit.



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Fig. 1—Installation of Heater Package and Printed-Circuit Board

3. Disconnect power leads, pigtail leads (black and yellow), fan leads (yellow, red, blue, and black), primary and secondary transformer leads, and all low-voltage control wires. Remove existing printed-circuit board (PCB). Remove existing heater package or cooling control plate from fan coil. (See Fig. 1.)
4. Insert heater assembly into front of fan coil until element rods engage holes in heat shield.
5. Attach heater control plate to fan coil using 2 screws. (See Fig. 1.)

Table 2—Minimum Motor Low-Speed Tap Selection

FAN COIL		HEATER KW		
FA4, FB4, FC4	FX4	10	15	20
018	—	Med*	—	—
024	—	Low	Med†	—
030	030	Low	Low	Med†
033	—	Low	Med†	Low†
036	036	Low	Low	Low†
038	—	—	Low†	Low†
042	042	—	Low	Low†
048	048	—	Low	Low†
060	060	—	—	Low†
070	—	—	—	Low†

* High speed with 208v.

† Requires a minimum 1-in. clearance to combustible materials for the first 36 in. of ductwork. On 2-speed fan models, low speed may be used in place of medium (Med) speed.

PROCEDURE 2—ATTACH FUSE BOX

For 15- and 20-kw fused heater:

1. After installing heater assembly, attach fuse assembly to side of fan coil unit by inserting fuse box tab between insulation and left side of unit and fan deck, if necessary.
2. Mount front of assembly to side flange with 2 screws provided. On fan coil units size 042 and larger, remove wire tie that shortens wire length between heater and fuses.
3. Close cover by engaging dimples in fuse box. (See Fig. 1.)

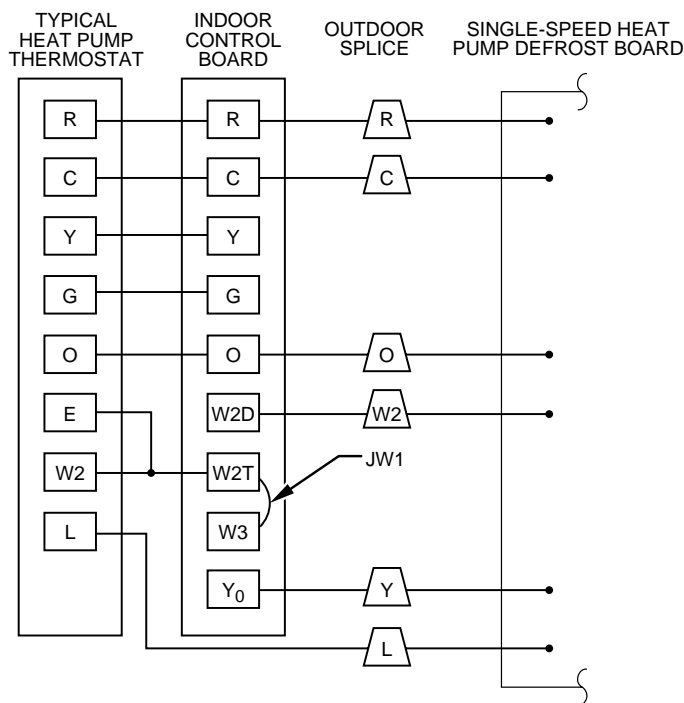
PROCEDURE 3—PRINTED-CIRCUIT BOARD (PCB) AND BRACKET INSTALLATION

⚠ CAUTION: Avoid direct contact with the PCB. The PCB is a static sensitive device. Handle by the sheet metal bracket only. Static discharge can damage the PCB.

Table 3—Electric Heater Package Data

KFCEH0101H10	WATTS @ 240V: 9000		
	230-v	208-v	
	SINGLE CIRCUIT		
HEATER AMPS	35.9	32.5	
MCA*	48.3	44.0	
MOP†	50	45	
75°C WIRE SIZE (AWG)	8	8	
MAXIMUM WIRE LENGTH (FT)	61	60	
KFCEH0201H15	WATTS @ 240v: 15,000		
	230v	208v	
	SINGLE CIRCUIT		
HEATER AMPS	59.9	54.2	
MCA	80.3	73.2	
MOP	90	80	
75°C WIRE SIZE (AWG)	4	4	
MAXIMUM WIRE LENGTH (FT)	92	92	
L1/L2	DUAL CIRCUIT		
	WATTS @ 240v: 11,000		
	HEATER AMPS	43.9	39.7
MCA	54.9	49.7	
MOP	60	50	
75°C WIRE SIZE (AWG)	6	8	
MAXIMUM WIRE LENGTH (FT)	85	53	
L3/L4	WATTS @ 240v: 4000		
	HEATER AMPS	16.0	14.4
	MCA	25.4	23.4
MOP	30	25	
75°C WIRE SIZE (AWG)	10	10	
MAXIMUM WIRE LENGTH (FT)	74	73	
KFCEH0301H20	WATTS @ 240v: 20,000		
	230v	208v	
	SINGLE CIRCUIT		
HEATER AMPS	79.9	72.3	
MCA	106.7	97.2	
MOP	110	100	
75°C WIRE SIZE (AWG)	2	3	
MAXIMUM WIRE LENGTH (FT)	111	87	
L1/L2	DUAL CIRCUIT		
	WATTS @ 240v: 10,000		
	HEATER AMPS	40.0	36.2
MCA	56.8	52.0	
MOP	60	60	
75°C WIRE SIZE (AWG)	6	6	
MAXIMUM WIRE LENGTH (FT)	82	81	
L3/L4	WATTS @ 240v: 10,000		
	HEATER AMPS	40.0	36.2
	MCA	50.0	45.3
MOP	50	50	
75°C WIRE SIZE (AWG)	8	8	
MAXIMUM WIRE LENGTH (FT)	93	93	

*MCA — Minimum Circuit Ampacity
 †MOP — Maximum Overcurrent Protection



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Fig. 3—System Wiring Diagram Using A Typical Indoor Thermostat, With No Outdoor Thermostat

a. Nonprotected heaters

- (1.) The 10-kw heater can be wired for single supply only. Supply circuits connect to heater pigtail leads.
- (2.) The 10-kw heaters can use separate field-installed, factory-authorized disconnect kit Part No. KFADK0101DSC which installs in fan coil.

b. Fused heater

- (1.) The 15- and 20-kw heaters can be wired for single- or dual-supply circuits.
- (2.) Single supply circuit wiring requires a factory-authorized, single point adapter kit Part No. KFASP0101SPK.

Table 4—Color Code For Motor Lead Wires

MOTOR SPEED TAP	WIRE COLOR
Common	Yellow
High	Black
Medium	Blue (3-speed only)
Low	Red (Blue — 2-speed motors)

Table 5—Fan Motor Speed Taps

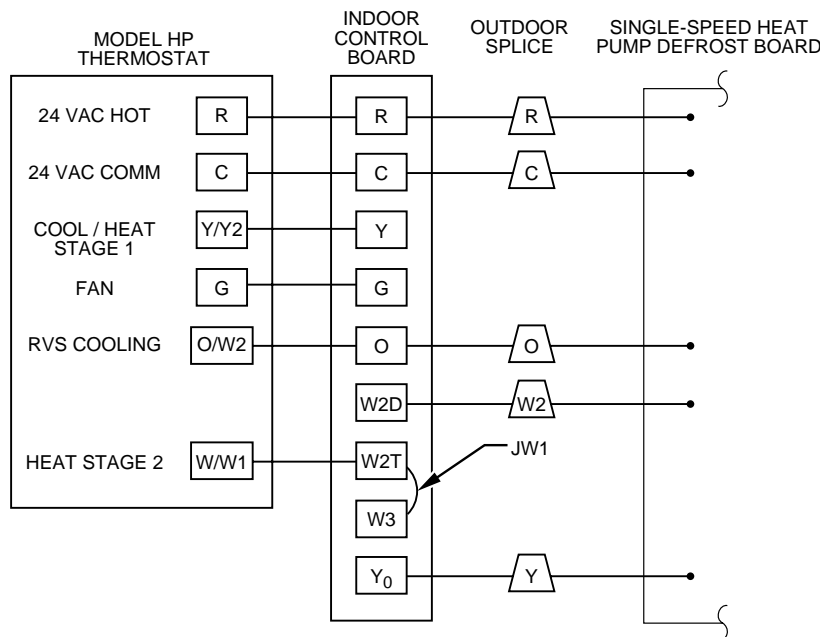
UNIT	MOTOR SPEED	COOL SPEED
FA4A018-036	2	High
FA4A042-070	3	Medium
FB4A, FC4B, FX4A (All Sizes)	3	Medium

9. Ground Connections

→ **⚠ WARNING:** According to NEC, ANSI/NFPA 70, and local codes, the cabinet must have an uninterrupted or unbroken ground to minimize personal injury if an electrical fault should occur. The ground may consist of electrical wire or metal conduit when installed in accordance with existing electrical codes. (See Ground/Conduit Note below.) Failure to follow this warning could result in electrical shock, fire, or death.

NOTE: Use UL-listed conduit and conduit connector for connecting supply wire(s) to unit to obtain proper grounding. If conduit connection uses reducing washers, a separate ground wire must be used. Grounding may also be accomplished by using grounding lugs provided in control box.

- a. For non-protected or single-circuit heaters, 1 equipment ground connection is provided on fan coil units. (See Fig. 1.)



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Fig. 4—System Wiring Diagram Using A Corporate Model Heat Pump Indoor Thermostat, With No Outdoor Thermostat

b. For 15- and 20-kw fused heaters, an additional ground lug is provided on fuse mounting bracket for dual-circuit grounding. (See Fig. 1.)

10. Mode Selection

- a. In some cases it is desirable for the PCB to operate in efficiency mode. This is accomplished by cutting jumper JW2. (See Fig. 2.) Jumper JW2 is labeled. Cut jumper for high speed fan only. In this mode, the PCB only energizes the HI speed tap selection. With jumper JW2 cut, fan speed tap terminal LO becomes a dummy terminal.
- b. In some instances when fan coil heater calls for a minimum speed selection of MED (blue) and desired cooling speed is MED (blue), fan speed tap MED (blue) should be located on PCB fan terminal labeled HI, and JW2 jumper must be cut. Store unused fan taps on terminals DUMMY and LO.
- c. When 018 size fan coil unit is used on 208v, black speed tap must be connected to HI and JW2 must be cut.

11. Accessories

Use accessory kit Part No. KFAIR0101ACR to attach electronic air cleaner (EAC) or humidifier. (See Fig. 9.) Follow accessory kit Installation Instructions.

PROCEDURE 5—ATTACH WIRING DIAGRAM AND RATING LABEL

- 1. Attach new wiring label to fan coil blower. Completely cover old wiring label. (See Fig. 12.)
- 2. Attach new heater rating label over existing electrical information rating label located on front access door of fan coil unit. (See Fig. 10.)

PROCEDURE 6—INSTALLATION VERIFICATION

- 1. After completion of heater installation, check to ensure proper connections and routings have been made.
- 2. Ensure all electrical covers are in place, and proper labels have been applied.
- 3. Reinstall blower access door before turning on unit power.

PROCEDURE 7—SMART HEAT OPERATION

A. Cooling

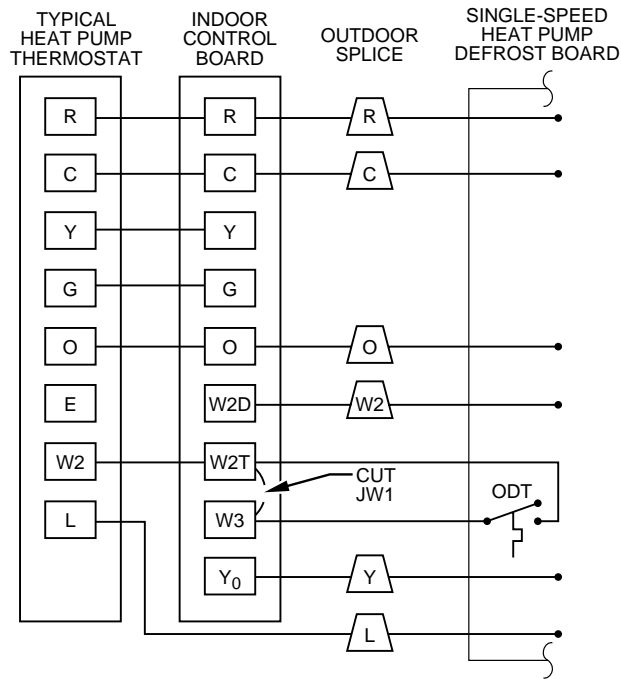
Smart Heat option controls the cooling mode in the same manner as conventional heat pumps are controlled. The fan has a 90 sec blower off delay at the end of a cooling cycle.

B. Heat Pump Heating

Smart Heat option does not control heating in the conventional method. The PCB energizes the compressor 30 sec before the indoor fan is energized. This allows the indoor coil to heat up eliminating cold-blow on start-up.

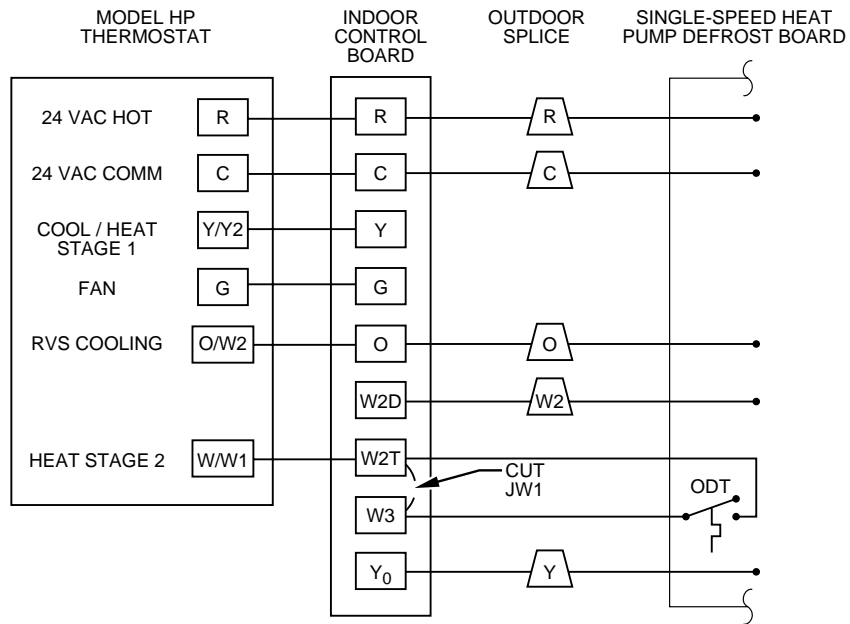
The electric heat is staged-on to allow continuous operation of heat pump and electric resistance heat below the balance point (below the point where the heat pump cannot maintain dwelling temperature without supplemental heat) independent of outdoor thermostats.

Although the PCB has provisions for an outdoor thermostat, it is not needed for staging. On cycle down, indoor fan remains on 60 sec to recover heat stored in indoor coil.



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Fig. 5—System Wiring Diagram Using A Typical Indoor Heat Pump Thermostat, With 1 Outdoor Thermostat



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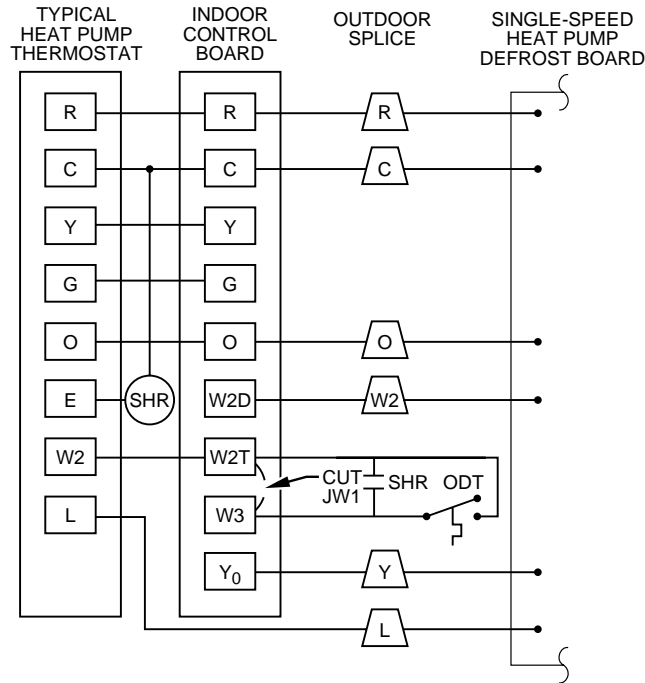
Fig. 6—System Wiring Diagram Using A Corporate Model Heat Pump Indoor Thermostat, With 1 Outdoor Thermostat

C. Defrost

The Smart Heat PCB stages the correct amount of supplemental heat during defrost. If too much heat is added, the system will stay in defrost for the completion of the defrost cycle even though the thermostat is satisfied. On the next cycle, 1 less element will be energized during the next defrost period.

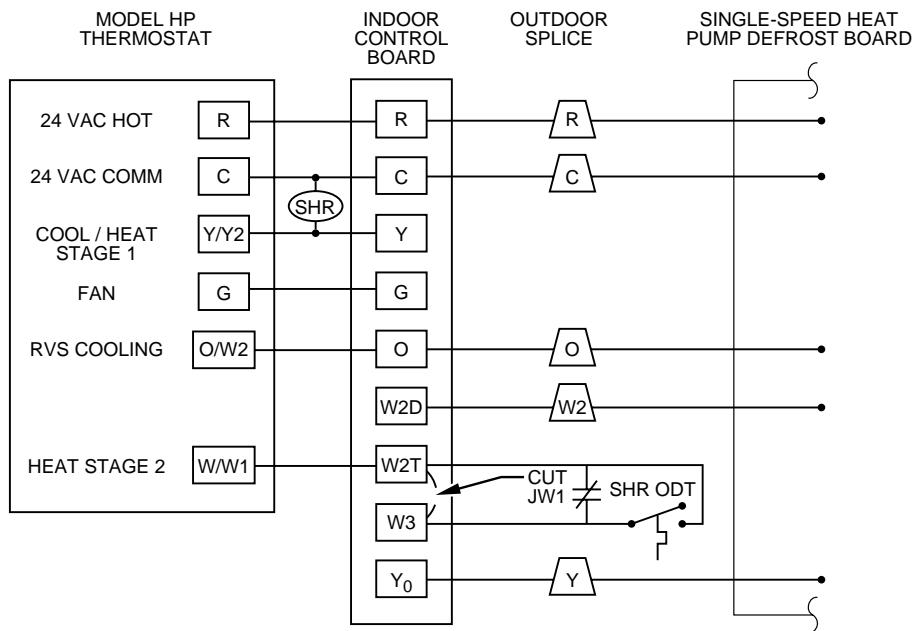
D. Diagnostic LED

The PCB of the Smart Heat option heater package contains a microprocessor which controls fan operation, fan speed, outdoor unit, and heater elements. For troubleshooting, a service LED indicates the condition of the PCB. See Table 7 for LED flash codes.



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Fig. 7—System Wiring Diagram Using A Typical Indoor Heat Pump Thermostat, With Supplemental Heat Relay



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Fig. 8—System Wiring Diagram Using A Corporate Model Heat Pump Indoor Thermostat, With Supplemental Heat Relay

PROCEDURE 8—OPERATING AND INSTALLING CHARACTERISTICS

A. PCB Component Layout, Description, and Function

1. Low-voltage terminal board is used to connect indoor thermostat to 24-v secondary side of transformer, and to serve as a junction between indoor thermostat and outdoor unit. (See Fig. 2.)
 - a. R is used to connect secondary side of transformer to thermostat and outdoor unit. R is fused.
 - b. C is used to connect transformer secondary common for thermostat and outdoor unit.
 - c. Y is input signal from thermostat signaling heat pump operation.
 - d. G is input signal from thermostat, signaling continuous fan operation.
 - e. O is input and junction terminal for reversing valve signal.
 - f. W2D is input from outdoor unit (heat pump), signaling control board that heat pump is in defrost.

Table 6—Electric Heater Stage Limiting

HEATER PART NO.	Heater Stage	STAGES (KW OPERATING)			
		W2T Only (JW1 cut)		W2T and W3	
		1	2	3	4
KFCEH0101H10	10 kw Non-Fused	3	6	9	9
KFCEH0201H15	15 kw Fused	3	8	11	15
KFCEH0301H20	20 kw Fused	5	10	15	20

Table 7—LED Flash Code

FLASH CONDITION	INPUT SIGNAL	PROBLEM INDICATION
NO LIGHT/FLASH	—	No Power or Board Failure
STEADY LIGHT	—	Board Failure
STEADY FLASH	—	Stand By Condition or Fan Only
1 FLASH	Y only	Heat Pump Only Operating
2 FLASHES	Y and/or W2T	Heat Pump Plus 1 Relay
3 FLASHES	Y and/or W2T	Heat Pump Plus 2 Relays
4 FLASHES	Y and/or W2T	Heat Pump Plus 3 Relays
5 FLASHES	Y, O	Cool Mode
6 FLASHES	Y, W2D, and/or W2T	Defrost Mode
7 FLASHES	W2T	Emergency Heat Mode

- g. W2T is input from thermostat signaling for supplemental or emergency heat.
 - h. W3 is input from outdoor thermostat. JW1 connects W3 to W2T as wired at factory. This input is used only if an outdoor thermostat is required by local codes.
 - i. Y_o is output from control board to energize outdoor unit (heat pump) contactor.
2. Jumper wires (JW1 and JW2)
 - a. JW1 connects W2T to W3 to limit staging of electric heat with use of an outdoor thermostat. See Table 6 for staging. PCB controls staging to extent that this feature is unnecessary unless required by local codes or regulations.
 - b. Cutting JW2 sets the PCB in efficiency mode. With JW2 cut, there is no loss of performance due to reduced indoor blower speed when heat pump is operating near balance point. This jumper may be required to be cut if selected cooling fan speed is same as required minimum motor LO speed tap selection as listed in Table 2. With JW2 cut, fan terminal LO becomes a dummy terminal.
 3. A fuse is used to protect low-voltage transformer and PCB.
 4. AUX+ and AUX- are connections for air conditioning accessories (EAC, humidifier, etc.).
 5. F1, F2, HI, and LO are connections for indoor fan.
 6. The 9-pin receptacle connects heater package wiring harness.
 7. SEC1 and SEC2 are used to connect secondary side of transformer to PCB. SEC1 is connected to equipment ground.

B. Transformer

The proper wiring of the transformer on the PCB is illustrated in Fig. 11.

NOTE: Terminals T1, T2 (if used), and T3 are wired to primary or high side of transformer. The 208-v terminal (or blue wire if the transformer has primary leads) is used on T3 for 208-v applications. The 230-v terminal (or red wire) is used on T3 for 230-v applications. The T2 is a dummy terminal.

C. Electric Heat

1. When thermostat calls for electric heat, 24-v signal is sent to PCB through W2T. PCB will energize first stage of electric heat.
2. First 2 stages will come on if W2T and Y are energized at same time. After each 10 minutes W2T is energized, another stage of electric heat will energize.
3. As W2T is de-energized, electric heat will stage down in 8 minute steps with exception of first step. First step will be on only half as long as it was prior to W2T de-energizing.
4. When W2T is energized by itself, JW1 is cut, and an outdoor thermostat is used and is open. Staging is limited as listed in Table 6.
5. When both W3 and W2T are energized without JW1 being cut, or with outdoor thermostat closed, system operation will stage heat up to maximum level if signal is energized for proper amount of time.
6. If only W3 is energized, there is no effect on the PCB. No heat will be energized.

D. Accessories

Terminals AUX+ and AUX- are energized with 24vdc when fan is energized. The accessory kit Part No. KFAIR0101ACR is used to connect an EAC or humidifier.

NOTE: Loads cannot be connected directly to AUX+ and AUX-. Use the specified kit only.

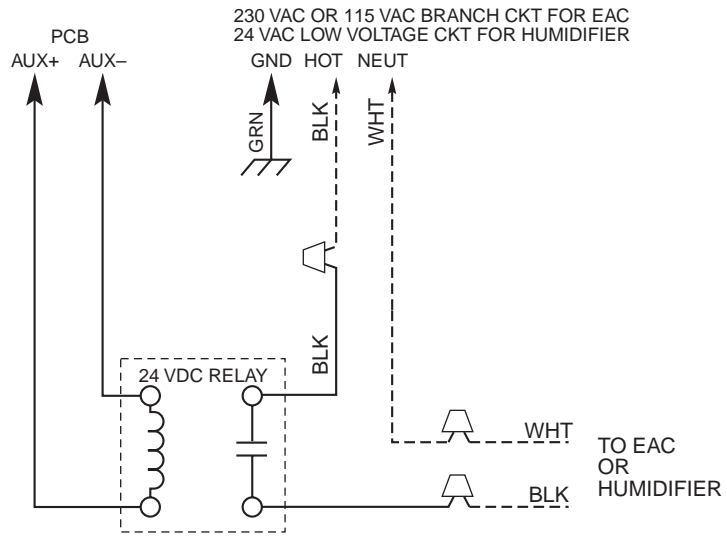


Fig. 9—Wiring Layout of KFAIR0101ACR

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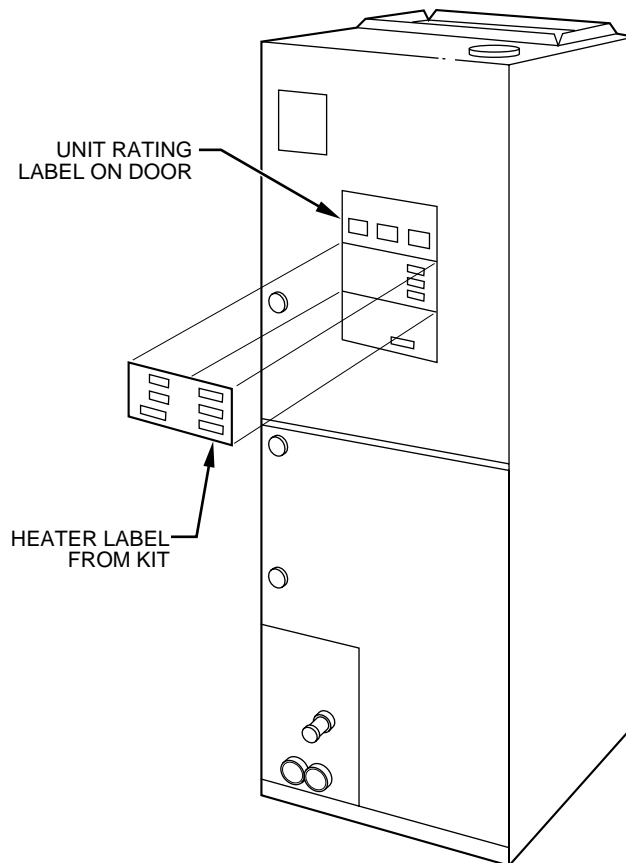


Fig. 10—Heater Rating Label Location on Fan Coil Rating Plate

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INTERNAL FUNCTION

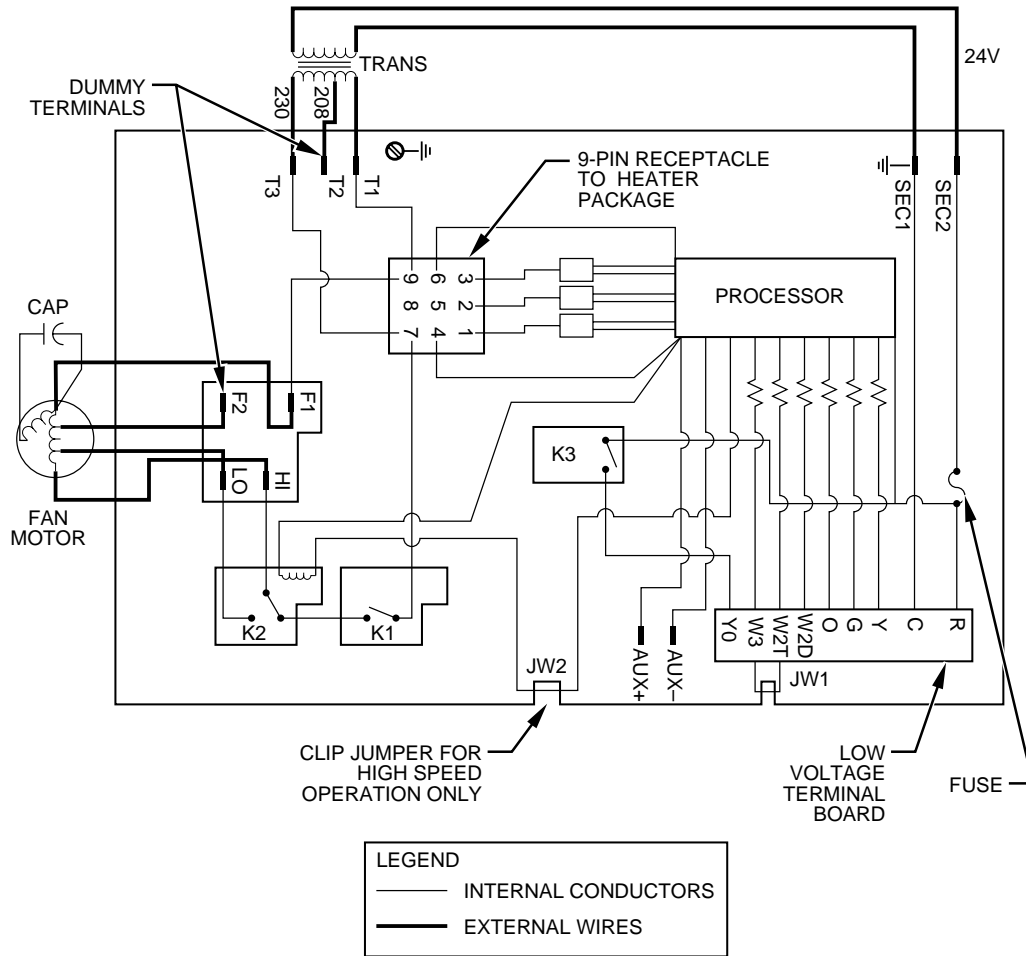
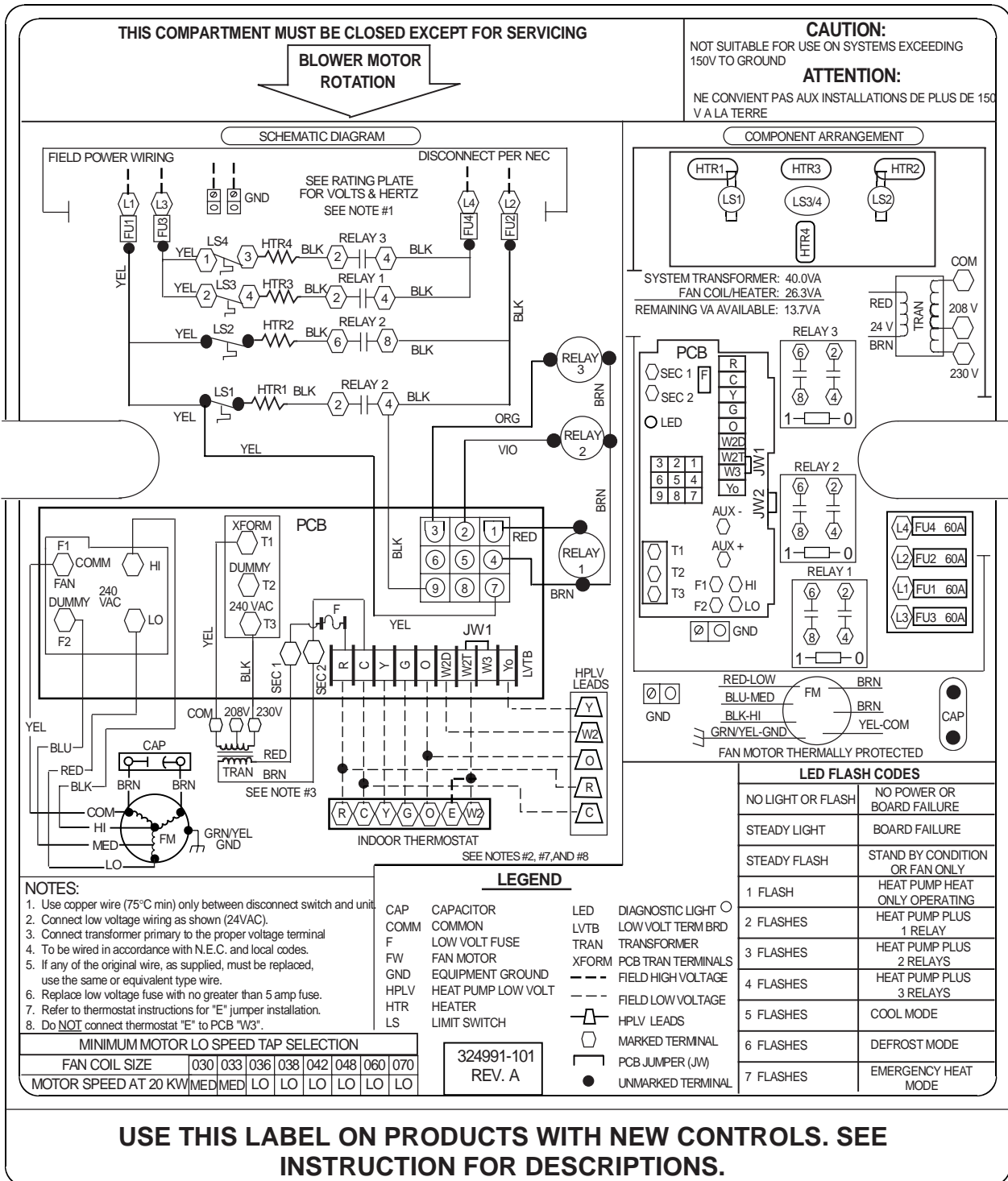


Fig. 11—PCB Schematic

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→ Fig. 12—Typical 20kw Wiring Label