MANUAL 2100 - 024B

SPLIT SYSTEM HEAT PUMP COIL ONLY INDOOR SECTION

INSTALLATION INSTRUCTIONS

FOR USE WITH:
OIL
GAS
ELECTRIC
FURNACES

BARD MANUFACTURING CO. • BRYAN, OHIO 43506
Dependable quality home equipment... since 1914

GENERAL

The Bard add-on heat pump coil-only indoor sections were designed for use with certain Bard outdoor heat pump units. The selection of the matching outdoor unit should be primarily based on the cooling capacity required for the application, as is standard practice when sizing a heat pump system. Reference should be made to the specification sheets for performance values of the following approved matching combinations:

OUTDOOR UNIT	INDOOR COIL SECTION
18HPQ1	H18QS
24HPQ1	H24QS
30HPQ3	H3AQ
36HPQ3	H3AQ
42HPQ	H5AQ
48HPQ2	H5AQ
60HPQ3	H5AQ

NOTE: ONLY the above combinations are approved for use. DO NOT attempt to mix and match to build up a special system.

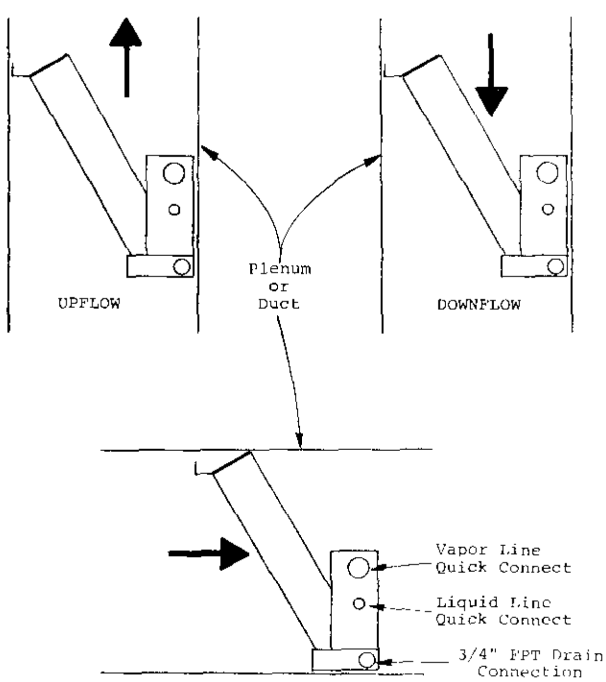
The heat pump add-on coils were initially designed to be used with Bard EFC Series electric furnace for counterflow applications. It can also be utilized as an add-on heat pump system to existing electric furnace installations to reduce operating costs.

Another increasingly popular concept is to use a heat pump system in conjunction with natural gas, manufactured gas, or fuel oil furnaces. The theme here is to take advantage of the heat pump efficiency during the large number of days when the outdoor temperature is in the mid 40° range or higher, and heating is required as dictated by the indoor wall thermostat. The fossil fuel furnaces are tremendously oversized for the 40° and higher outdoor temperature conditions, and utilization of the heat pump during this temperature range provides a very practical and economical heating system, while also offering the advantages of cooling operation during the summer months.

Each of the above applications demands special installation and control circuit wiring considerations, which are covered in detail for each specific application in the following paragraphs.

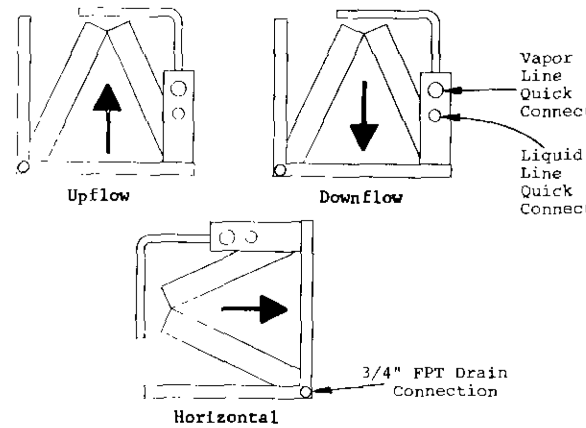
AIRFLOW DIRECTION — MODELS H18QS and H24QS

Models H18QS and H24QS are a slant-coil design, and can be used in all three installation positions with respect to airflow: upflow, downflow and horizontal. The following illustrations show the correct airflow directions across the coil.



AIRFLOW DIRECTION — MODELS H3AQ and H5AQ

Models H3AQ and H5AQ are A-coil designs designed for three mounting positions with respect to airflow: upflow, downflow, and horizontal. The coil is equipped with a dual condensate collector which permits one A-coil assembly to meet these three mounting positions, and no accessory parts are required. The three mounting positions and correct airflow directions across the coil are shown in the following illustrations:



AIRFLOW RATINGS IN CFM

Listed below are the rated airflow and also minimum-maximum airflows for each system combination:

System Combination	Rated Airflow	Airflow Range
18HPQ1 - H18QS	645	525 - 725
24HPQ1 - H24QS	780	625 - 850
30HPQ3 - H3AQ	1080	875 - 1200
36HPQ3 - H3AQ	1300	1050 - 1425
42HPQ - H5AQ	1625	1335 - 1750
48HPQ2 - H5AQ	1625	1335 - 1750
60HPQ3 - H5AQ	1900	1700 - 2100

CONDENSATE DRAIN

A single 3/4" FPT drain connection is supplied on all the add-on heat pump coil sections. The same drain connection is used regardless of installation position.

INSTALLATION ACCESSORIES

There are optional plenums and filter racks available for all the indoor coil sections. The optional filter racks as shown or some other means of air filtering are required on any application where the coil is installed upstream from the original filter location, which should be removed so excessive restriction is not placed on the system blower.

Indoor Coil Model	Plenum	Filter Rack
H18QS	HP3 ⚠1 ⚠2	FR3 ⚠2
H24QS	HP3 ⚠1 ⚠2	FR3 ⚠2
H3AQ	HP3	FR3
H5AQ	HP5	FR5

⚠1 Contains adapter plate for slant coils.

⚠2 HS152 plenum will also fit these coils. No filter rack is available. Desirable for use with H61-H81 Series gas furnace

NOTE: The HP3 plenum and FR3 filter rack were designed to mate with the EFC series electric furnace. There are 3/4" flanges on both the top and bottom of the plenum which permit the plenum to fit on top (return air inlet) of an inverted EFC furnace for downflow application, or support an EFC furnace for upflow application. The FR3 filter rack mates with either end of HP3 plenum, as required.

The HP5 plenum and FR5 filter rack are similar in design to the HP3 plenum and FR3 filter rack as described above, but are not designed to fit any particular furnace.

Both the HP3-FR3 combination or HP5-FR5 combination can be used for any application, as they have duct flanges on each end and existing duct work can be adapted.

ELECTRIC FURNACE APPLICATION—GENERAL

The only add-on heat pump coils generally considered for use with the Bard EFC Series electric furnaces are the H18QS (1-1/2 ton), H24QS (2 ton) and H3AQ (2-1/2 and 3 ton). This is because the standard indoor blower coil units available for these Btu size systems are not designed for downflow application. The EFC series furnace is designed for upflow, downflow and horizontal, and therefore a downflow installation can be achieved by using an EFC furnace in combination with either an H18QS, H24QS or H3AQ coil section.

The H5AQ is designed for use with 42HPQ (3-1/2 ton), 48HPQ2 (4 ton) and 60HPQ3 (5 ton) outdoor units. However, since the B48EHQ indoor blower coil (with or without installed electric heaters—used with 42HPQ and 48HPQ2) and B60EHQ indoor blower coil (with or without installed electric heaters—used with 60HPQ3) are both designed for upflow, downflow and horizontal use, there should be no reason to attempt to match the H5AQ coil assembly to an electric furnace. A possible exception to this would be an add-on to an existing furnace installation, If this is the case, there are a few important items for consideration:

1. Only the 42HPQ/H5AQ or 48HPQ2/H5AQ should be considered for use, and these only with EFC25 or EFC30. These are the only two furnace models with sufficient blower capacity to meet the airflow requirements for the heat pump system.
2. The 60HPQ3/H5AQ should not be used under any circumstances as sufficient airflow cannot be delivered by the EFC furnace.
3. The HP5 plenum does not mate exactly with the EFC furnace cabinet, and a sheet metal transition would be required.

ELECTRIC FURNACE APPLICATION—INSTALLATION

The heat pump A-coil must be installed on the return air side of any electric furnace application. This is mandatory so that the heat output from the electric strip heaters, energized at the lower outdoor temperatures, does not drive into the heat pump coil and cause the refrigerant condensing pressure and temperature to raise to points well beyond the design limitations of a heat pump system, and cause the compressor to be de-energized by the manual reset high pressure switch.

Control Circuit Wiring - Control Circuit Diagrams

EF-1 to EF-4 are dedicated for use only with 18HPQ1/H18QS, 24HPQ1/H24QS, 30HPQ3/H3AQ or 36HPQ3/H3AQ.

Each different Kw size EFC electric furnace requires some variations in wiring, because of the different amount of sequencer controls on the EFC. Listed below are the appropriate control circuit wiring diagrams based upon EFC size, and also the number of field installed A-22 thermostats, Bard Part No. 8408-001, required for each application:

Model	Control Circuit Diagram	Quantity of A-22's
EFC15	EF-1	1
EFC20	EF-2	2
EFC25	EF-3	2
EFC30	EF-4	2

This circuitry allows for heat pump on 1st stage, with option on compressor cut-off at +10°F. Where warmer climatic conditions do not require a compressor cut-off, disregard the compressor cut-off wiring and DO NOT remove the factory wire between the changeover relay #4 and the compressor contactor coil. It also allows a maximum of 15Kw to be energized on the 2nd stage (W2) of the wall thermostat, any installed Kw over that amount being controlled by an A-22 acting as 3rd stage heat thermostat.

If this 3rd stage heat feature is not required or desired, do not remove the jumper between W1 and W2 on the EFC 24V terminal board and eliminate the A-22 and the wires shown connected to 24V terminals Y, F and W2 as shown on control circuit diagrams EF-2, EF-3 and EF-4. All of the installed Kw will then sequence on when the 2nd stage (W2) of the wall thermostat is energized.

Control Circuit Diagram EF-5 can be used for connecting a 42HPQ/H5AQ or 48HPQ2/H5AQ with an EFC25 or EFC30 only. See ELECTRIC FURNACE APPLICATION — GENERAL for details. A different control circuit is part of the inherent design of the 42HPQ-48HPQ2 series, and as a result a different wall thermostat and subbase is required than for the 1-1/2 - 3 ton systems. See section titled "Thermostats and Required Accessories" on page 4.

GAS OR OIL FURNACE APPLICATION

Application of heat pump coil only sections to fossil fuel furnaces require certain special considerations. The first is that return air applications are generally termed unacceptable because of: a) Local codes do not permit, b) may void heat exchanger warranty of furnace manufacturer, and c) past experience with return air applications generally very poor.

If we were concerned with heating cycle only, the reasons stated above would present no problems. However, during the cooling cycle the heat exchanger becomes chilled or cooled well below surrounding space temperatures due to the low air temperature coming off of the coil, and induces condensation to form on the heat exchanger.

As we consider placing the coil on the more traditional outlet (or leaving) air side of the furnace, we are faced with a new set of circumstances which must be considered.

Balance Point - The point at which the heat pump output capacity and the heat loss from the building being heated are equal is called the balance point, with the heat pump operating 100 per cent of the time. As the outdoor temperature goes down, the Btu capacity of the heat pump falls off while at the same time the heat loss from the structure increases. A means of placing the fossil fueled furnace in operation at outdoor temperatures below the balance point must be provided. In all instances, the gas or oil furnace must be of sufficient capacity to heat the building even under the most extreme outdoor temperature, without the aid of the heat pump.

There is no one given outdoor temperature at which the balance point will occur, it will be different for each application of heat pump to a building, and can even vary from day to day based upon cloud cover, relative humidity outdoors, and wind conditions. Of course, the design of the building (insulation, types of windows, doors, etc., and other items that affect the heat loss) also determine where the balance point will occur for a given size heat pump system.

Generally speaking, the balance point will be somewhere between 25°F - 40°F outdoor temperature. Unless there is some reason not to (see paragraph titled "Breakeven Point"), the heat pump should be allowed to operate down to the projected balance point. The balance point can be plotted on the respective heat pump performance curve if the heat loss for the structure is known for the outdoor design temperature for the area, which must be done to correctly select the gas or oil furnace to begin with. Operation of the heat pump down to the projected balance point is permissible, as long as nuisance compressor cycling problems are not encountered during defrost cycle.

Defrost Cycle - Heat pumps operating during outdoor temperatures below the low 40°F range and colder will gradually accumulate a frost build-up on the outdoor coil. A defrost cycle control system is built into all outdoor heat pump sections that will periodically and automatically clear the outdoor coil of this frost accumulation. This is accomplished by the heat pump system temporarily reverting back to the cooling cycle, using the hot refrigerant gas flowing through the outdoor coil to melt the frost. The outdoor fan motor also stops during this period to speed up the process. During this time of defrost cycle operation, there will be a cooling effect taking place at the indoor coil section, the same as would occur during the summer cooling system.

It is desirable to supply supplemental heat during the defrost cycle period, so as to avoid the discharging of cool air into the building. Laboratory and field testing has shown that firing of the gas or oil furnace during the defrost cycle is permissible and can in fact even shorten the time required for defrosting the outdoor coil because of the introduction of heat immediately ahead of the indoor coil assembly.

IMPORTANT: Since the size of the fossil fueled furnace is known only to the installer of the system, it is possible that there could be an excessively large Btu capacity furnace involved, especially in an add-on situation (it is not uncommon for some fossil fueled furnaces, especially oil-fired, to be vastly oversized). Should this instance be encountered, it is possible that because of the furnace Btu output involved, an excessively fast temperature rise air temperature entering the refrigerant coil mounted on the furnace may result in higher discharge pressures and temperatures than the compressor protective devices will tolerate and cause tripping of these protective devices.

It is the responsibility of the installer to understand this operation of the system in detail, and should this occur, set the temperature of the changeover thermostat to a higher temperature. This will lessen the amount of frost accumulation, shorten the length of the actual defrost cycles and thus the time of simultaneous operation of heat pump and furnace.

Breakeven Point - Another factor to be considered is one of economics. There is a "breakeven point" which could be calculated for all situations, based on actual values of gas or oil cost per unit, electric rates, published Btu and power consumption data of the heat pump system, and estimated efficiency of the furnace involved. To operate the heat pump at outdoor temperatures below this "break-even point" would result in a higher operating cost for that amount of Btu being supplied by the heat pump.

It is possible, where the electric rates are high and the alternate fuel, be it gas or oil, still at a low rate, to be more economical to operate the heat pump only at the outdoor temperatures above 45°F. It is at outdoor temperatures above 45°F where the heat pump becomes very efficient, there is no need for defrost cycles, and fossil fueled furnaces are least efficient because of being oversized for the heat loss requirement and resultant short-cycling.

General Operation - Heat Pump/Fossil Fuel Furnace - This type of system is a one-stage heating system, even though a two-stage heat wall thermostat is used. The thermostats specified for use are special stats for heat pumps with extra switches, signal lights, and special circuitry for heat pumps, and by design are two-stage heating stats. Since the extra features are also required for the special heat pump/fossil fuel systems, the same stats are used, but the 2nd stage circuit is not used. This is further explained in the next paragraph.

While it would be possible to electrically connect the furnace to the 2nd stage of the stat, the heat pump coil is located downstream from the furnace heat exchanger, and continuous simultaneous operation of the furnace and heat pump will result in excessive high discharge pressures and temperatures at the compressor and resultant overload tripping problems.

A changeover thermostat, properly set to control at or just above the balance point, will allow the most economical operation of the system. The changeover thermostat switches off the heat pump and on the fossil fueled furnace, based on the outdoor temperature. There is a 5°F differential in the changeover thermostat, so when the heat pump is de-energized and the furnace is activated, the outdoor temperature must rise 5°F above the set-point of the thermostat to stop the furnace and start the heat pump again.

The emergency heat switch allows for manual cut-off of the heat pump and operation of the furnace at any outdoor temperature.

NOTE ON INDOOR BLOWER OPERATION - Because of the design of the heat pump wall thermostats, and the fact that a cooling blower relay must be installed in parallel with the fan side of the combination fan/limit control on the gas or oil furnace, the furnace blower will start as soon as the wall stat calls for heat. This is required for the heat pump and will also occur during the time when the heat pump is off and the furnace is operating. This is contrary to normal blower operation on a gas or oil furnace and is sometimes misunderstood, but an inherent part of the system operation. While in the gas or oil furnace mode of operation, there will still be a run-on in blower operation until the bonnet temperature cools down to the blower off setting of the fan/limit switch.

Control Circuit Wiring - There are four (4) separate control circuit wiring diagrams for fossil fuel furnaces with heat pumps. One each for gas and oil furnaces with 18HPQ1/H18QS, 24HPQ1/H24QS, 30HPQ3/H3AQ and 36HPQ3/H3AQ, and one each for gas and oil furnaces with 42HPQ/H5AQ, 48HPQ2,H5AQ and 60HPQ3/H5AQ. The 1½ - 3 ton systems are necessarily different from the 3½ - 5 ton systems because of the internal wiring characteristics of the systems.

System	Gas Control Circuit Diagram	Oil Control Circuit Diagram
18HPQ1/H18QS	GFF-1	OFF-1
24HPQ1/H24QS	GFF-1	OFF-1
30HPQ3/H3AQ	GFF-1	OFF-1
36HPQ3/H3AQ	GFF-1	OFF-1
42HPQ/H5AQ	GFF-2	OFF-2
48HPQ2/H5AQ	GFF-2	OFF-2
60HPQ3/H5AQ	GFF-2	OFF-2

CFM FOR ADD-ON HEAT PUMPS

The furnace that you are going to add a heat pump to must be able to deliver enough air to satisfy the heat pump's requirements, usually 400 CFM/Ton.

When the heat pump is in the heating mode, the indoor coil becomes the condensing coil, this is why the amount of air is so critical. Not enough air results in too high of high side pressures and temperatures. The furnace CFM can be calculated by using the following formula:

$$CFM = \frac{\text{Output (Btu/h)}}{1.08 \times \text{Temp. Rise}}$$

When adding a heat pump to an existing GAS FURNACE, proceed as follows to determine the gas input to the furnace. Shut off all other gas appliances in the home, then set the indoor wall thermostat to call for heat. Go to the gas meter and clock the fastest moving dial, then refer to the chart below.

Seconds for one Rev	SIZE OF TEST DIAL ¼ cu ft	½ cu ft.	1 cu.ft	2 cu.ft	5 cu ft.
10	90	180	360	720	1800
11	82	164	327	655	1636
12	75	150	300	600	1500
13	69	138	277	555	1385
14	64	129	257	514	1286
15	60	120	240	480	1200
16	56	113	225	450	1125
17	53	106	212	424	1059
18	50	100	200	400	1000
19	47	95	189	379	947
20	45	90	180	360	900
21	43	86	171	343	857
22	41	82	164	327	818
23	39	78	157	313	783
24	37	75	150	300	750
25	36	72	144	288	720
26	34	69	138	277	692
27	33	67	133	267	667
28	32	64	129	257	643
29	31	62	124	248	621
30	30	60	120	240	600
31	-	--	116	232	581
32	28	56	113	225	563
33	–		109	218	545
34	26	53	106	212	529
35		-	103	206	514

Seconds for one Rev.	SIZE OF TEST DIAL ¼ cu ft.	½ cu ft.	1 cu.ft	2 cu.ft	5 cu.ft
36	25	50	100	200	500
37	-	-	97	195	486
38	23	47	95	189	474
39			92	185	462
40	22	45	90	180	450
41				176	439
42	21	43	86	172	429
43		--	–	167	419
44		41	82	164	409
45	20	40	80	160	400
46		–	78	157	391
47	19	38	76	153	383
48	–	-	75	150	375
49				147	367
50	18	36	72	144	360
51		–	--	141	355
52		-	69	138	346
53	17	34		136	340
54		-	67	133	333
55			-	131	327
56	16	32	64	129	321
57				126	316
58		31	62	124	310
59			-	122	305
60	15	30	60	120	300

Example: Most gas utilities use 1000 Btu per cubic foot of gas. If you were to clock the 1 cubic foot dial and found it took 36 seconds for one revolution, then in one hour the furnace would use 100,000 Btu, but we all know that no furnace is 100% efficient, so suppose we assume this furnace to be 70% efficient, then we should have approximately 70,000 Btu per hour output. Using that figure our formula would look like this:

$$CFM = \frac{\text{Output}}{1.08 \times \text{T.R.}} \quad \text{or CFM} \quad \frac{70,000}{1.08 \times ?}$$

We must still obtain a temperature rise through the furnace. This is done by measuring the return air temperature and the supply air temperature. Let's again assume we were able to measure a 60°F temperature rise through the furnace. Now we can complete our formula.

$$CFM = \frac{70,000}{1.08 \times 60} \quad \text{or} \quad CFM = \frac{70,000}{65}$$

Th n, our CFM for this furnace would be 1076 CFM.

If th: furnace is equipped with a direct drive motor, make sure you have it wired to the high speed tap. If it is a belt rive motor, then read the mc r's nameplate amps. Then, hook on an amp probe and see if it is possible to speed the blower up by adjusting the variable pulley.

If you are at the limits of the motor, then check with the furnace manufacturer to see if a larger horsepower motor car be installed and also if the blower will give you the needed CFM with a larger motor.

When you have determined that your furnace can handle the required CFM for your heat pump, the indoor coil must be installed and your CFM calculation must be rechecked with the coil in place.

When adding to an OIL FURNACE, you must determine what size nozzle the unit has in the burner and then install a p essure gauge in the oil delivery pumps discharge port and set the pressure at 100 psig. An example might be that we find the burner equipped with a one gallon per hour nozzle, operating at 100 psi. This nozzle will deliver one G.P.H. and a gallon of #2 fuel oil has approximately 140,000 Btu of heat.

The 140,000 Btu is our input and again let us assume that this furnace is operating at 70% efficiency. Then our Btu output is 98,000 Btu, and if we use the rule of thumb that an oil furnace should operate with an 85°F temperature rise, then our formula would look like this:

$$CFM = \frac{98,000 \text{ Btu/h}}{1.08 \times 85^{\circ}F} \quad \text{or} \quad \frac{98,000 \text{ Btu/h}}{92} = 1065 \text{ CFM}$$

When adding on to an electric furnace we must also take one more thing into consideration and that is the heat pump coil must be installed on the return side of the electric furnace. To find out what CFM the electric furnace can deliver, we must measure the voltage and amperage of each heating element or Volts x Amp = Watts. The total Watts x 3.4 Btu - Btu Output. An example might look like this with a 15Kw electric furnace.

240 Volts x 21 Amps	= 5040 Watts
5040 Watts x 3 Elements	= 15120 Watts
15120 Watts x 3.4 Btu/Watt	= 51408 Btu

One word of caution, never go by nameplate rating. Always measure volts and amps.

One more item that is different with an electric furnace and that is, never obtain a supply air temperature reading in sight of the electric element (because of the radiant effect). Now our formula looks like this again:

$$CFM = \frac{51408 \text{ Btu/h}}{1.08 \times 44^{\circ}F} \quad \text{or} \quad \frac{51408 \text{ Btu/h}}{48} = 1071 \text{ CFM}$$

THERMOSTATS AND REQUIRED ACCESSORIES

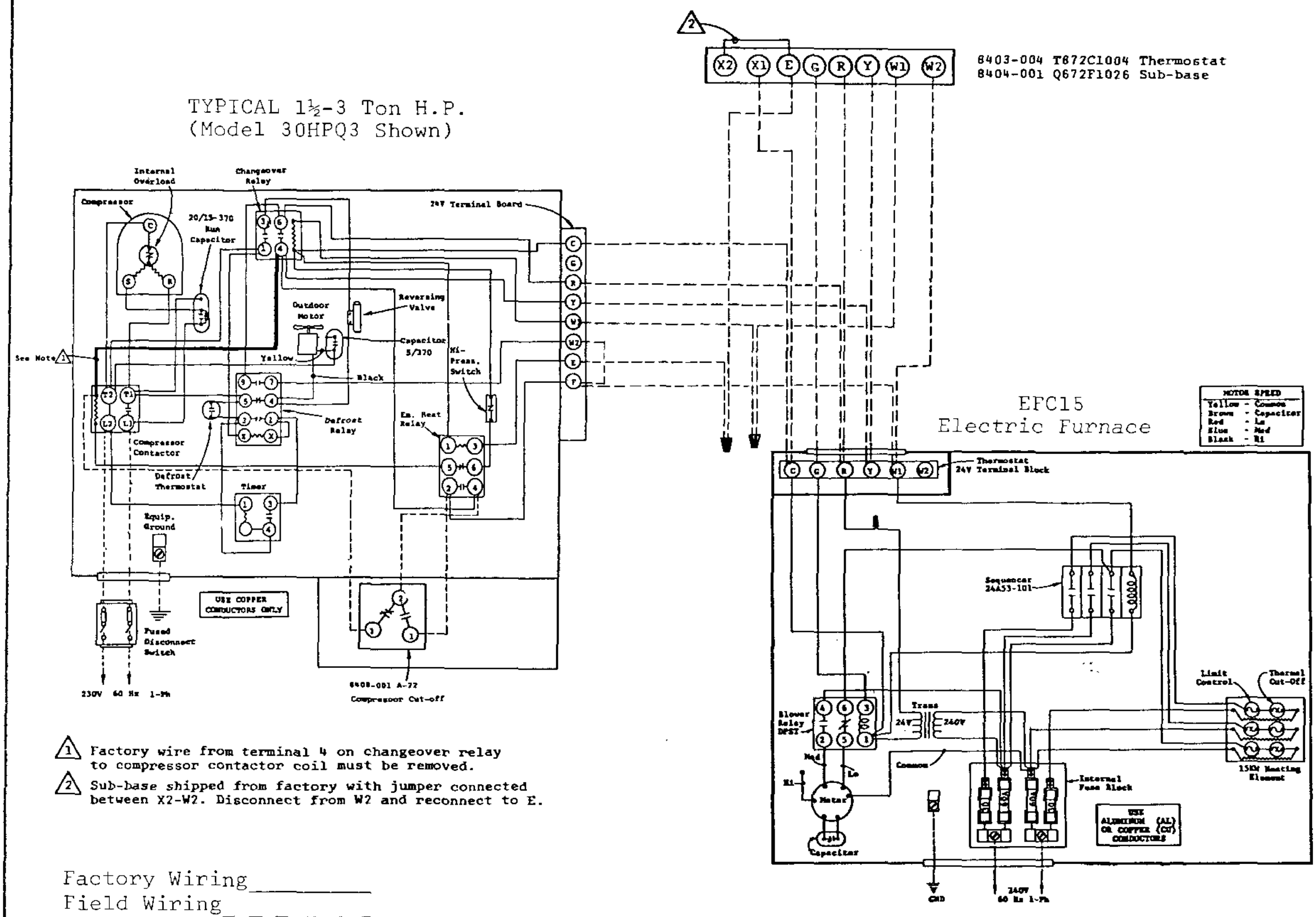
	GAS FURNACE HOOK-UP COMPONENTS		OIL FURNACE HOOK-UP COMPONENTS	
SYSTEMS	Bard Part No.	Description	Bard Part No.	Description
18HPQ1/H18QS 24HPQ1/H24QS 30HPQ3/H3AQ 36HPQ3/H3AQ	8403-004	T872C1004 Thermostat	8403-004	T872C1004 Thermostat
	8404-001	Q672F1026 Subbase	8404-001	Q672F1026 Subbase
	8408-001	A-22 Outdoor Thermostat	8408-001	A-22 Outdoor Thermostat
	8201-007 (1)	R8239C1009 Fan Center or 175-210304-10 Fan Center	8201-007	R8239C1009 Fan Center or 175-210304-10 Fan Center
			8201-015	184-50114-406 Relay
42HPQ/H5AQ 48HPQ2/H5AQ 60HPQ3/H5AQ	8403-012 (2)	T872R1164 Thermostat	8403-012 (2)	T872R1164 Thermostat
	8404-007	Q672L1185 Subbase	8404-007	Q672L1185 Subbase
	8408-001	A-22 Outdoor Thermostat	8408-001	A-22 Outdoor Thermostat
	8201-007	R8239C1009 Fan Center or 175-201304-10 Fan Center	8201-007	R8239C1009 Fan Center or 175-201304-10 Fan Center
	8201-015	184-50114-406 Relay	8201-015	184-50114-406 Relay

ELECTRIC FURNACE HOOK-UP COMPONENTS

H.P. System	Furnace Model	Bard Part No.	Description
18HPQ1/H18QS 24HPQ1/H24QS 30HPQ3/H3AQ 36HPQ3/H3AQ	EFC15	8403-004	T872C1004 Thermostat
		8404-001	Q672F1026 Subbase
		8408-001	A-22 Outdoor Thermostat
	EFC20 EFC25 EFC30	8403-004	T872C1004 Thermostat
		8404-001	Q672F1026 Subbase
		(2) 8408-001	A-22 Outdoor Thermostat
42HPQ/H5AQ 48HPQ2/H5AQ	EFC25 EFC30	8403-012 (2)	T872R1164 Thermostat
		8404-007	Q672L1185 Subbase
		8408-001	A-22 Thermostat
		8201-015	184-50114-406 Relay

(1) Not required for gas furnaces factory built with heating/cooling blower relay. Not required for Bard models *H81SD3, H81SD3E, H106SD3, H106SD3E, H121SD4, H121SD4E, C106SD3, C106SD3E.*

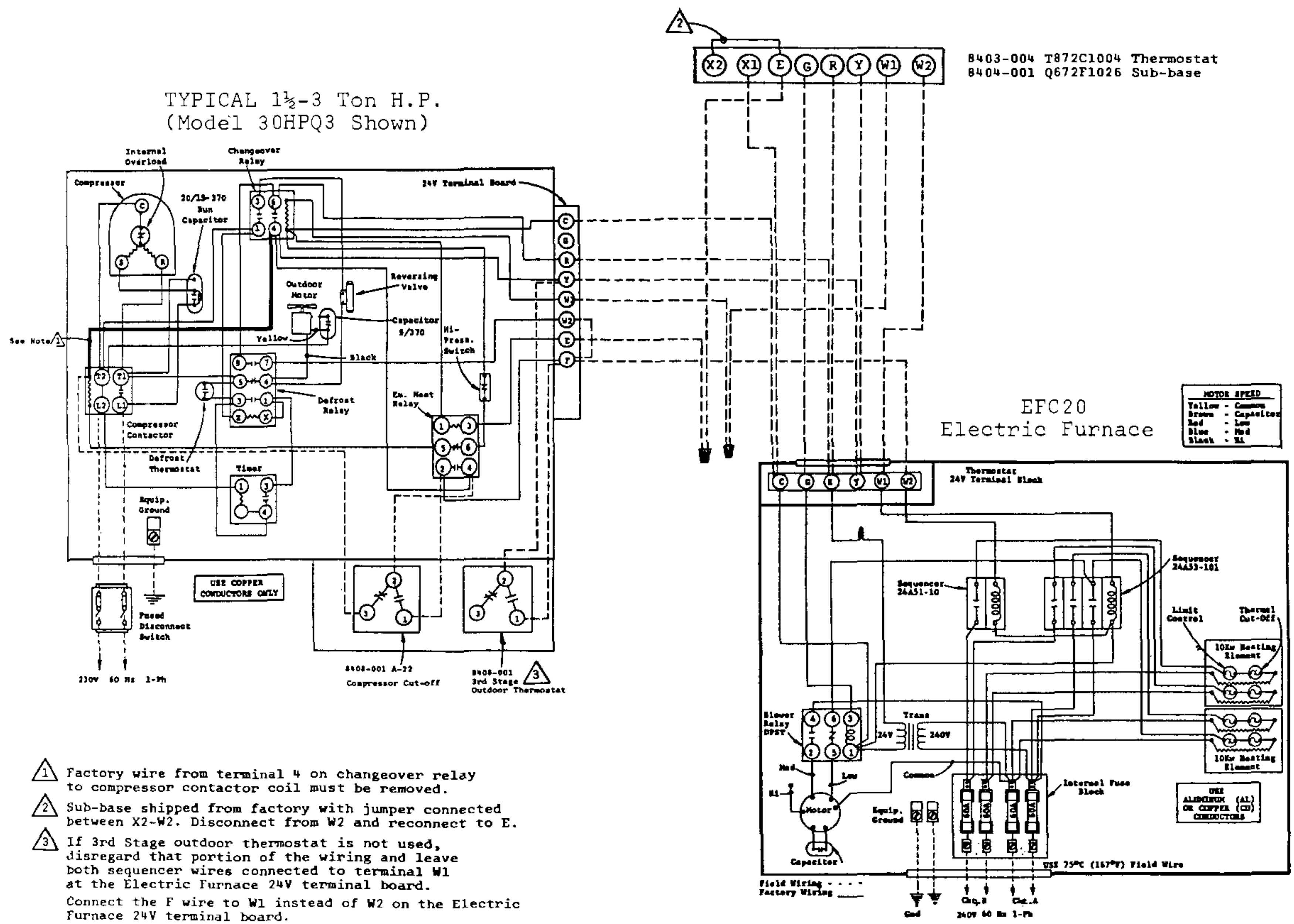
(2) This stat and subbase combination are manual changeover from heat to cool, and incorporate a non-cycling reversing valve circuit. Alternate parts are 8403-015 T872N1063 thermostat and 8404-008 Q672F1299 subbase which allows automatic changeover from heat to cool and has cycling reversing valve operation. IMPORTANT: Whichever type of operation is desired, the stat and subbase must be matched as shown above.



1. Factory wire from terminal 4 on changeover relay to compressor contactor coil must be removed.
2. Sub-base shipped from factory with jumper connected between X2-W2. Disconnect from W2 and reconnect to E.

Factory Wiring ———————
Field Wiring — — — — —

Control Circuit Diagram EF-1



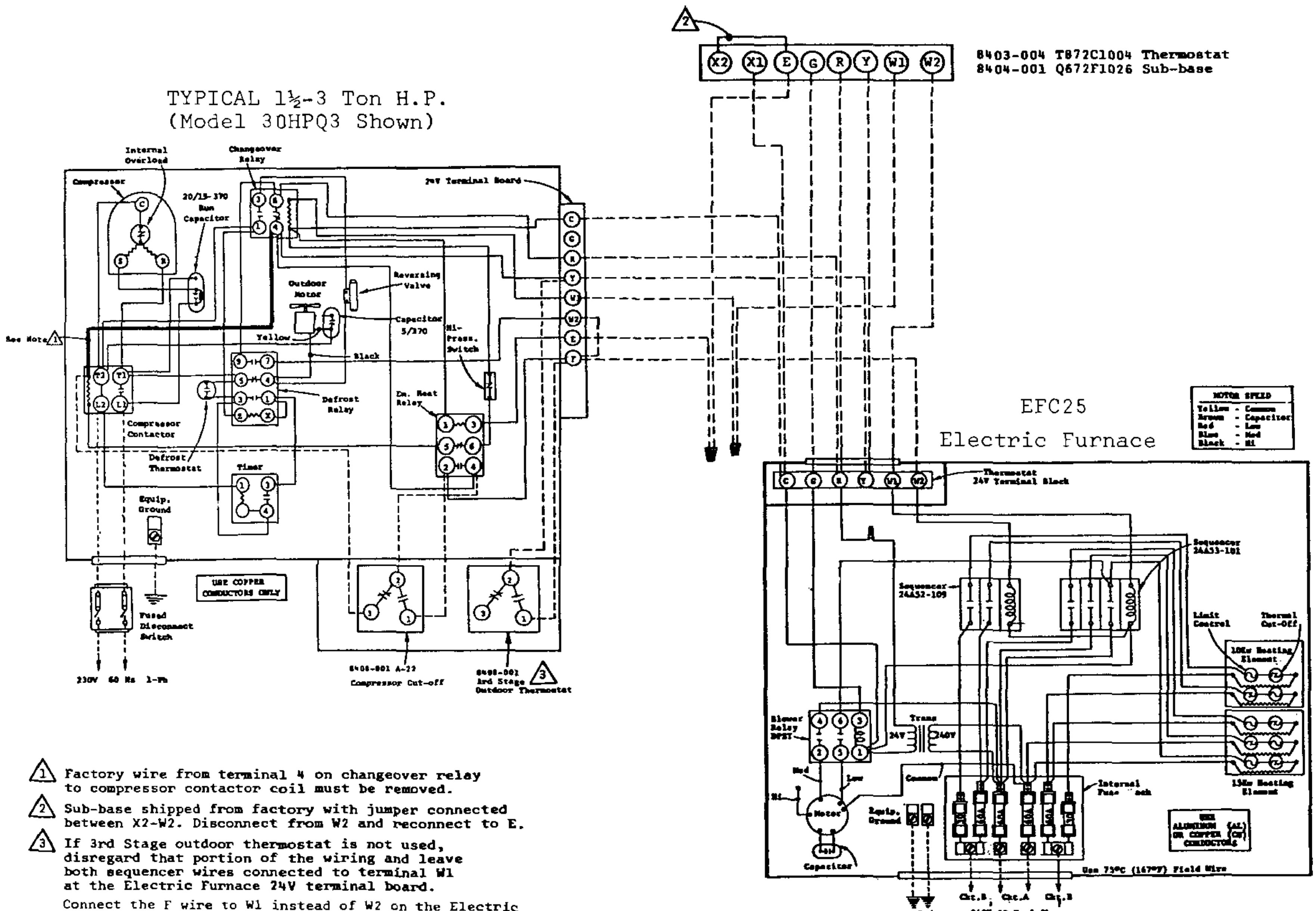
(1) Factory wire from terminal 4 on changeover relay to compressor contactor coil must be removed.

(2) Sub-base shipped from factory with jumper connected between X2-W2. Disconnect from W2 and reconnect to E.

(3) If 3rd Stage outdoor thermostat is not used, disregard that portion of the wiring and leave both sequencer wires connected to terminal W1 at the Electric Furnace 24V terminal board.
Connect the F wire to W1 instead of W2 on the Electric Furnace 24V terminal board.

Factory Wiring________ Field Wiring_ _ _ _ _ _

Control Circuit Diagram EF-2

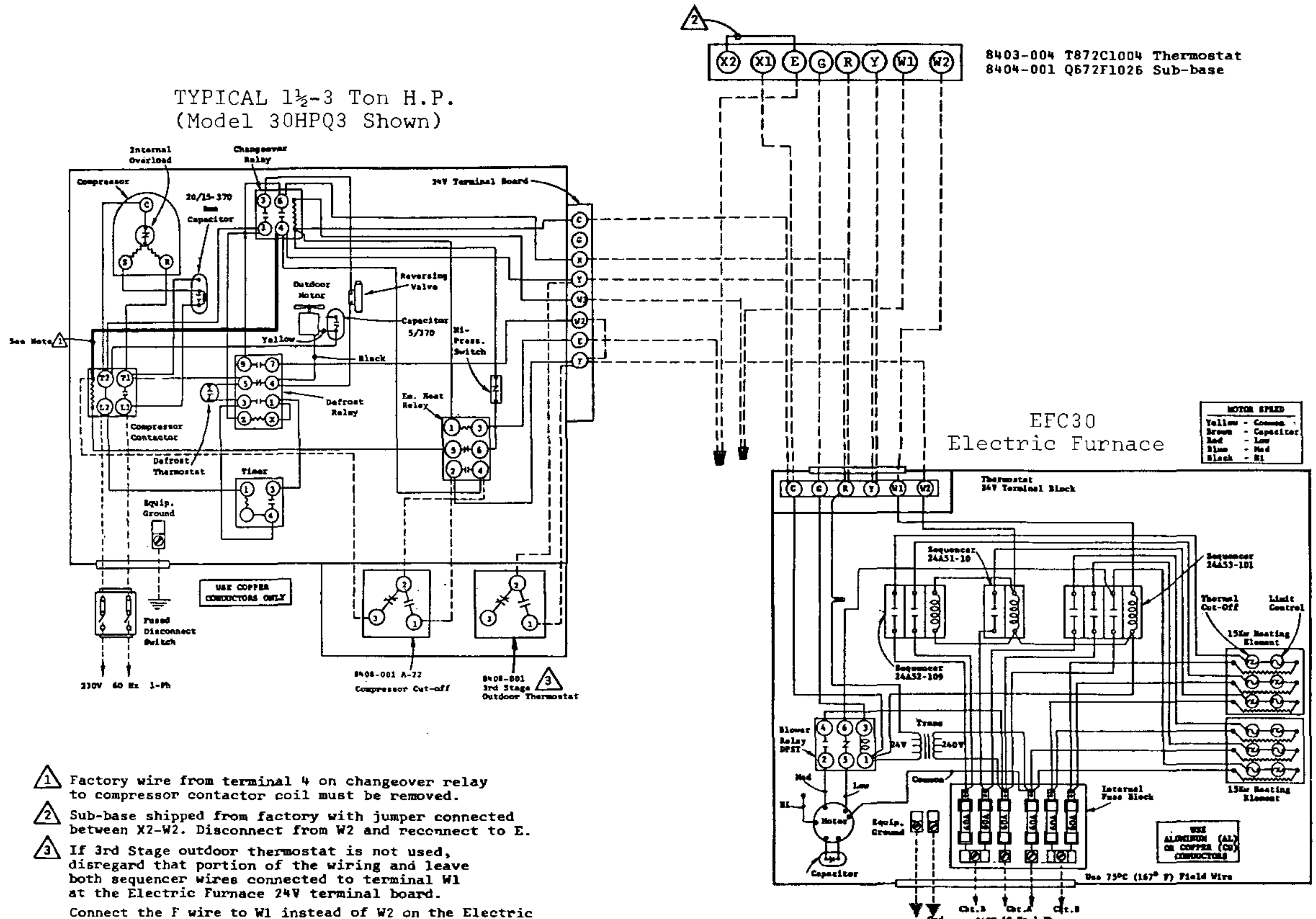


1. Factory wire from terminal 4 on changeover relay to compressor contactor coil must be removed.
2. Sub-base shipped from factory with jumper connected between X2-W2. Disconnect from W2 and reconnect to E.
3. If 3rd Stage outdoor thermostat is not used, disregard that portion of the wiring and leave both sequencer wires connected to terminal W1 at the Electric Furnace 24V terminal board.

Connect the F wire to W1 instead of W2 on the Electric *Furnace 24V terminal board.*

Factory Wiring________ Field Wiring_ _ _ _ _ _

Control Circuit Diagram EF-3



△1 Factory wire from terminal 4 on changeover relay to compressor contactor coil must be removed.

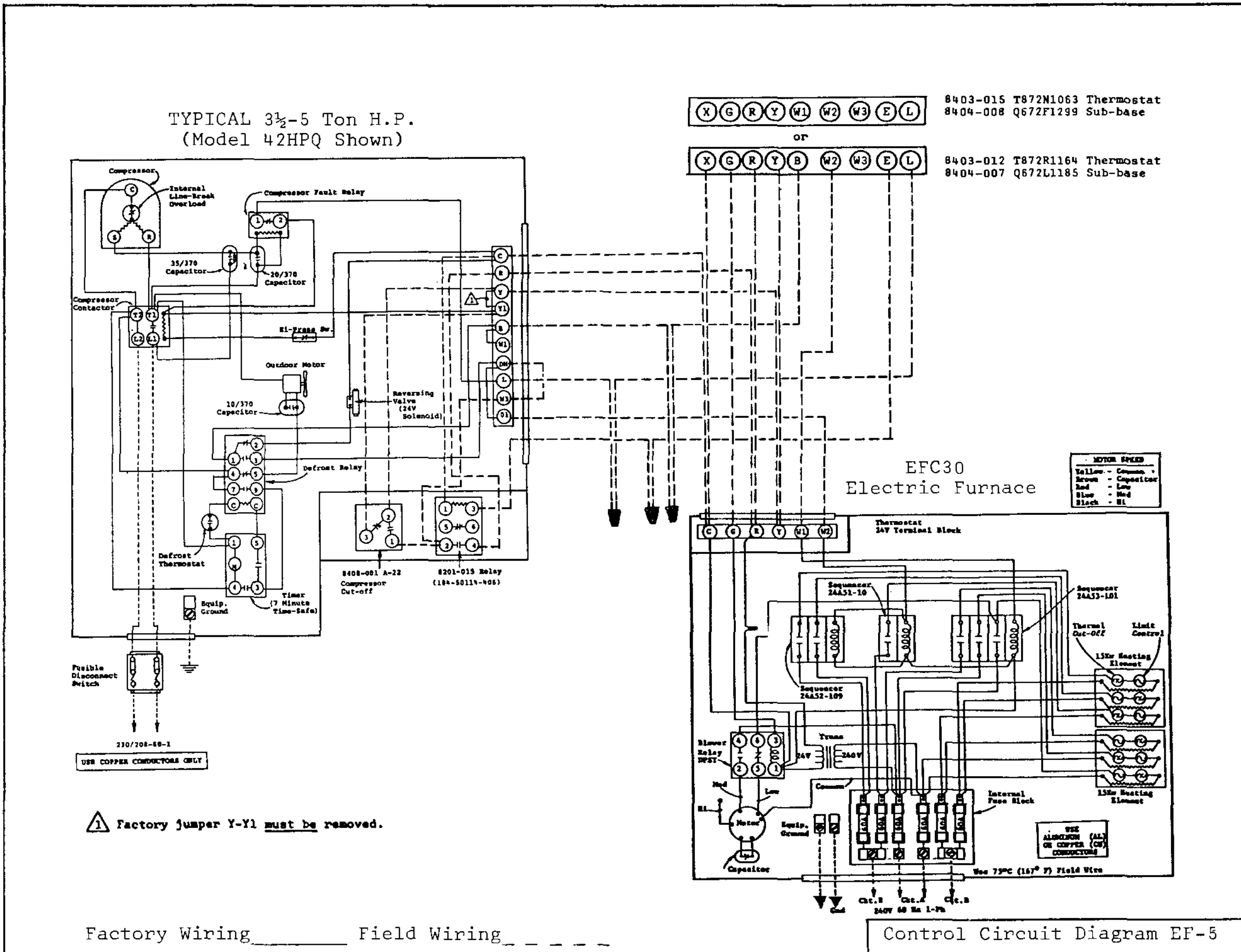
△2 Sub-base shipped from factory with jumper connected between X2-W2. Disconnect from W2 and reconnect to E.

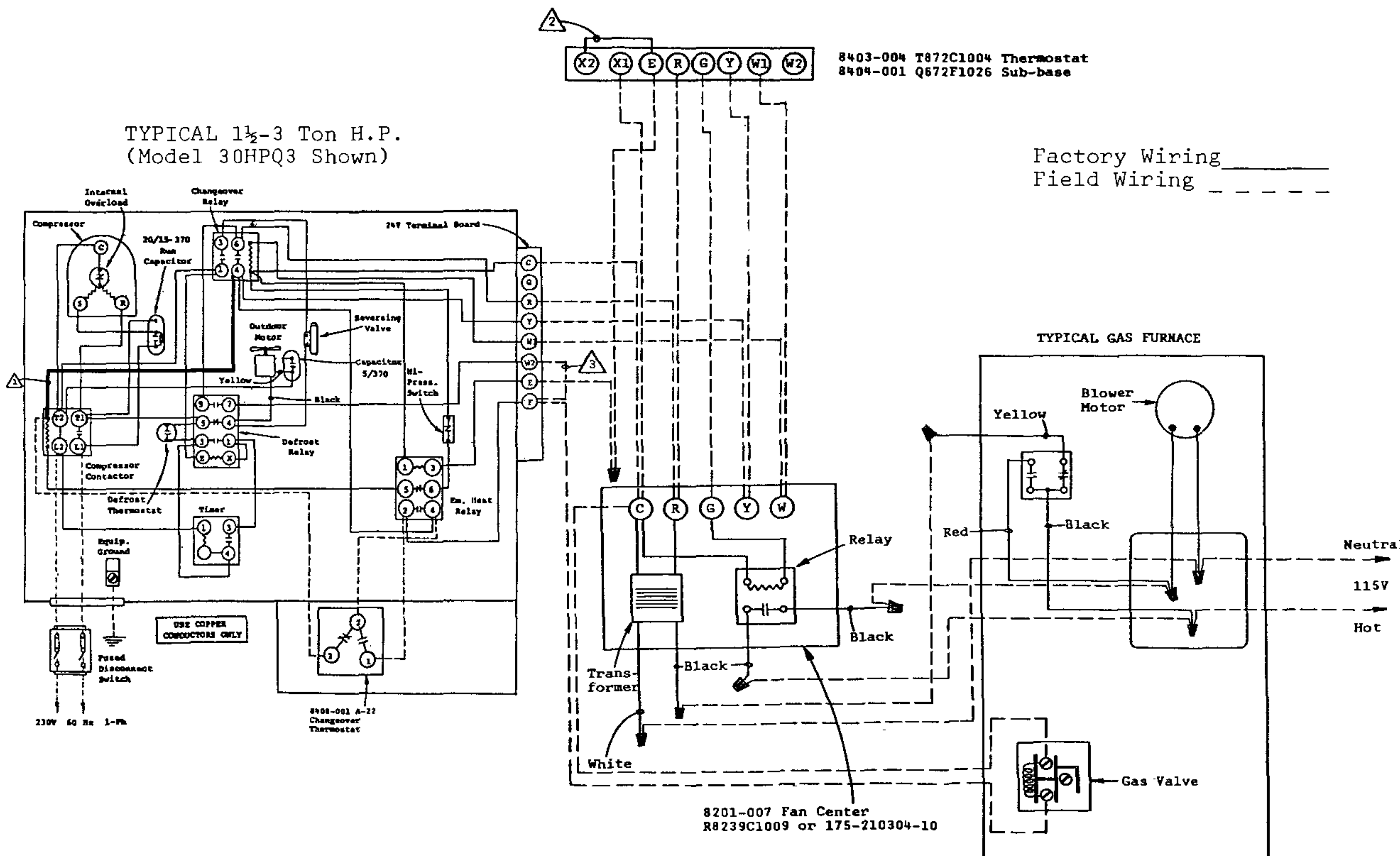
△3 If 3rd Stage outdoor thermostat is not used, disregard that portion of the wiring and leave both sequencer wires connected to terminal W1 at the Electric Furnace 24V terminal board.

Connect the F wire to W1 instead of W2 on the Electric Furnace 24V terminal board.

Factory Wiring________ Field Wiring_ _ _ _ _ _ _

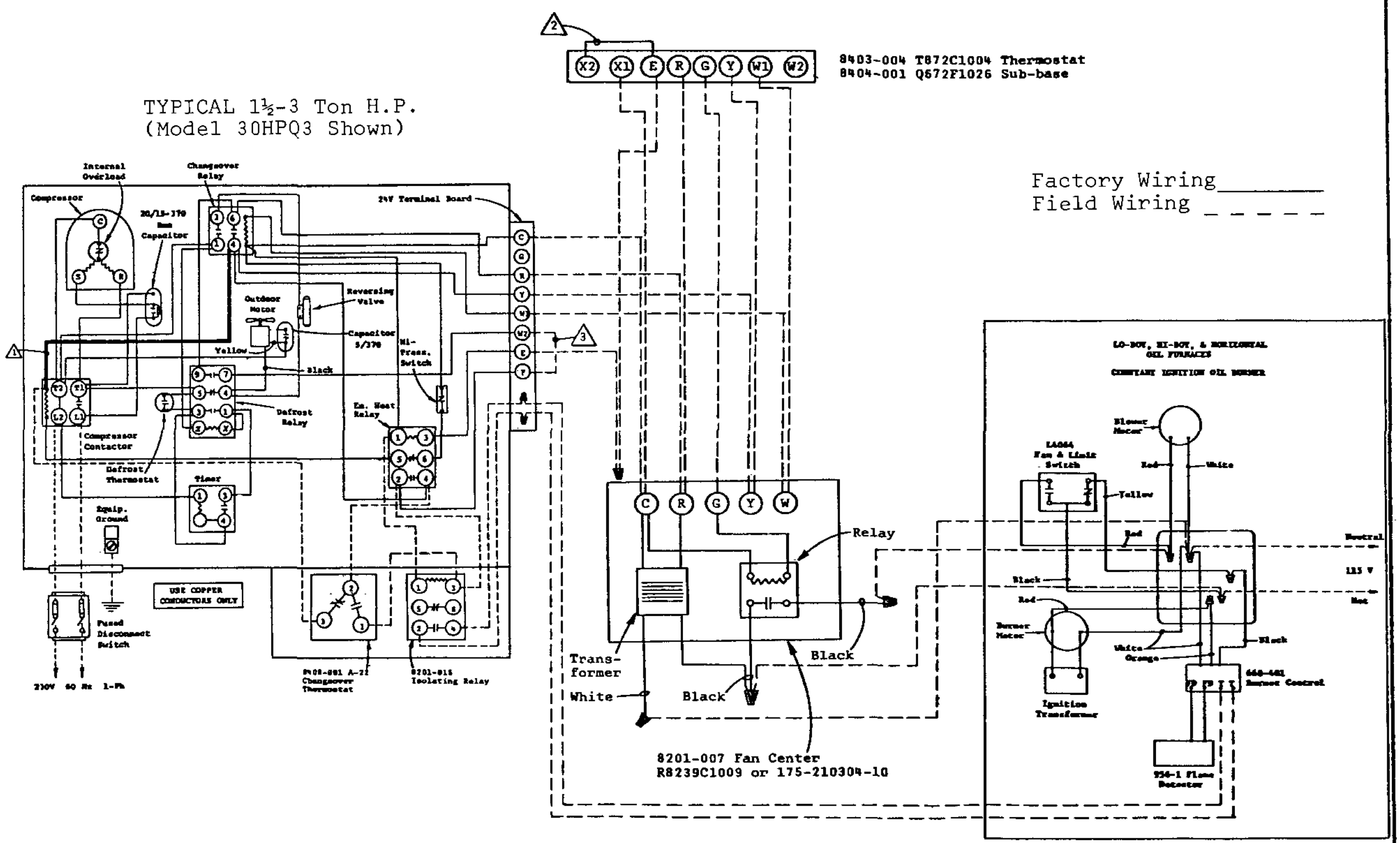
Control Circuit Diagram EF-4


TYPICAL 3½-5 Ton H.P.
(Model 42HPQ Shown)
8403-015 T872N1063 Thermostat
8404-008 Q672F1299 Sub-base
or
8403-012 T872R1164 Thermostat
8404-007 Q672L1185 Sub-base
Compressor
Internal Line-Break Overload
Compressor Fault Relay
35/370 Capacitor
20/370 Capacitor
Compressor Contactor
Outdoor Motor
10/370 Capacitor
Reversing Valve (24V Solenoid)
Defrost Relay
Defrost Thermostat
Timer (7 Minute Time-Safe)
Equip. Ground
8408-001 A-22 Compressor Cut-off
8201-015 Relay (184-50119-406)
Fusible Disconnect Switch
230/208-60-1
USE COPPER CONDUCTORS ONLY
Factory jumper Y-Y1 must be removed.
EFC30
Electric Furnace
MOTOR SPEED
Yellow - Common
Brown - Capacitor
Red - Low
Blue - Med
Black - Hi
Thermostat 24V Terminal Block
Sequencer 2AA51-10
Sequencer 2AA53-L01
Sequencer 2AA52-109
Thermal Cut-Off
Limit Control
15Kw Heating Element
Blower Relay DPST
Trans
24V
240V
Common
Motor
Capacitor
Equip. Ground
Internal Fuse Block
USE ALUMINUM (AL) OR COPPER (CU) CONDUCTORS
Use 75°C (167° F) Field Wire
240V 60 Hz 1-Ph
Gnd
Factory Wiring
Field Wiring
Control Circuit Diagram EF-5



1. Factory wire from terminal 4 on changeover relay to compressor contactor coil must be removed.
2. Sub-base shipped from factory with jumper connected between X2-W2. Disconnect from W2 and reconnect to E.
3. Remove jumper between W2-F to prevent furnace from firing during defrost cycle, if this mode of operation is not desired.

Control Circuit Diagram GFF-1

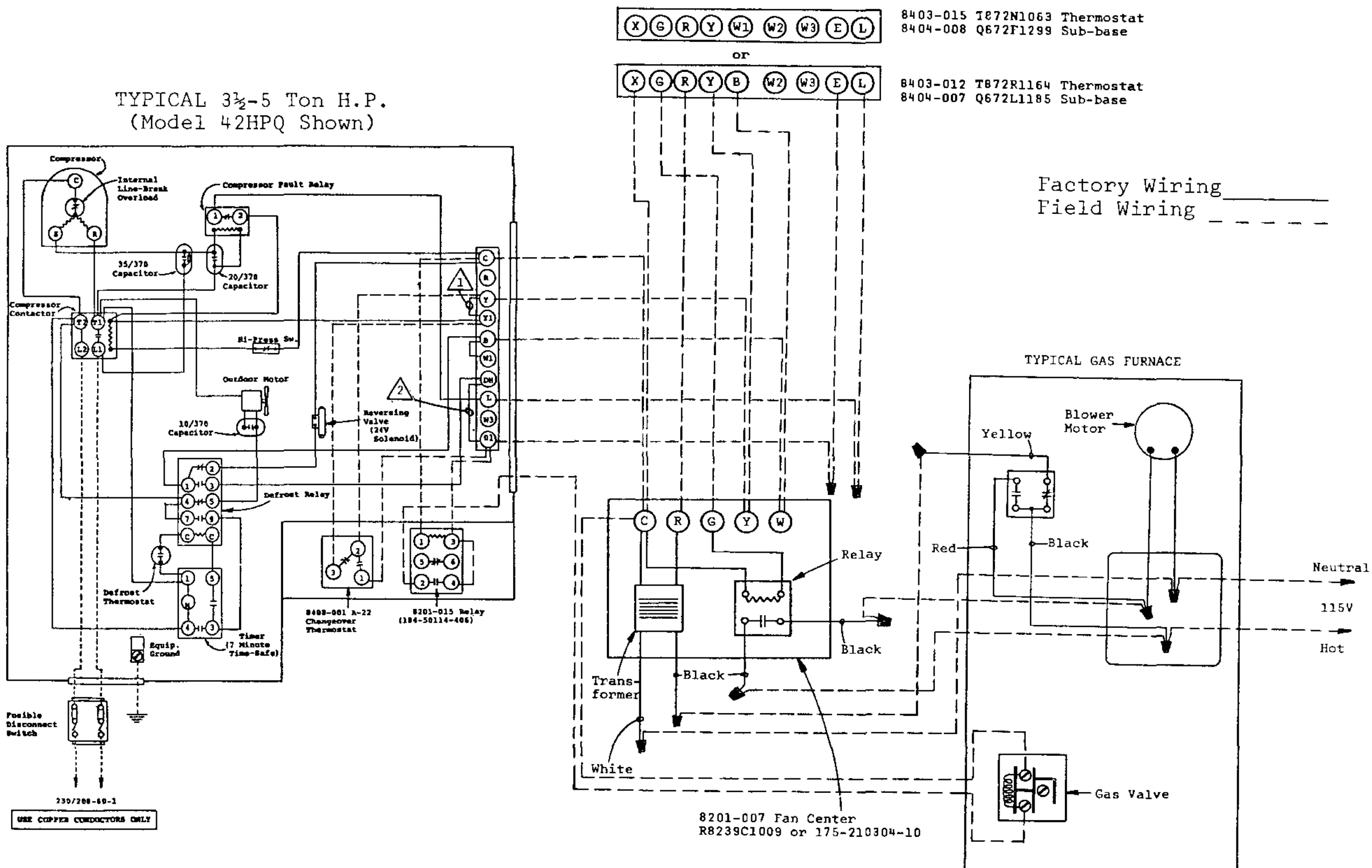


⚠1 Factory wire from terminal 4 on changeover relay to compressor contactor coil must be removed.

⚠2 Sub-base shipped from factory with jumper connected between X2-W2. Disconnect from W2 and reconnect to E.

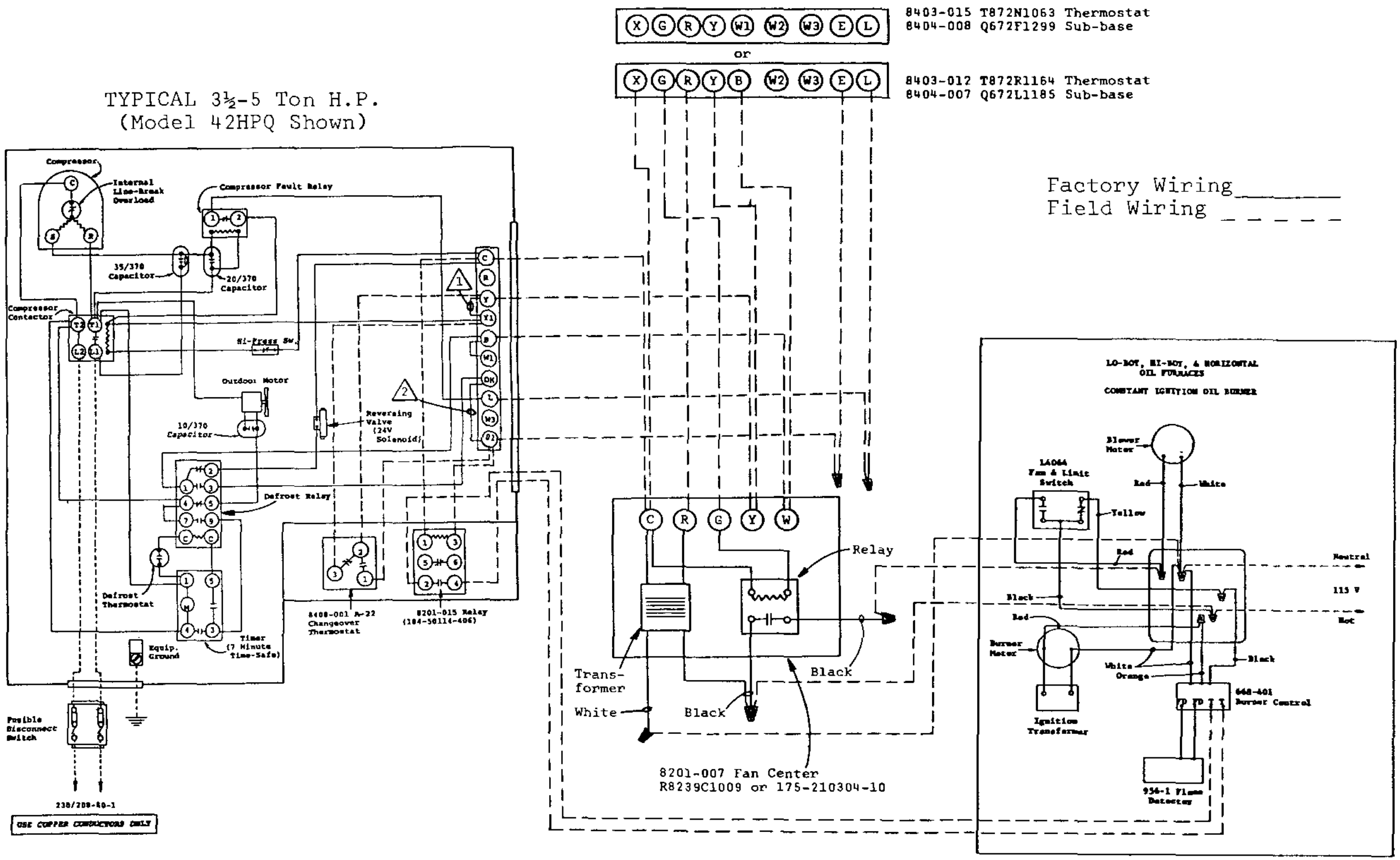
⚠3 Remove jumper between W2-F to prevent furnace from firing during defrost cycle, if this mode of operation is not desired.

Control Circuit Diagram OFF-1R



1. Factory jumper Y-Y1 must be removed.
2. Remove factory jumper between DH-01 to prevent furnace from firing during defrost cycle, if this mode of operation is not desired.

Control Circuit Diagram GFF-2



1 Factory jumper Y-Y1 must be removed.

2 Remove factory jumper between DH-O1 to prevent furnace from firing during defrost cycle, if this mode of operation is not desired.

Control Circuit Diagram OFF-2

IMPORTANT

PURCHASER'S RESPONSIBILITIES

Below are the responsibilities of the purchaser and these items cannot be considered as defects in workmanship or material.

1. Air filter cleaning or replacement.

2. Failure to operate due to improper air distribution over indoor and outdoor equipment sections.

3. Failure to start due to voltage conditions, blown fuses or other damage due to inadequacy or interruption of electrical service.

4. Damage caused directly or indirectly by improper installation.

5. Damage due to lack of proper and periodic maintenance.

6. Damage resulting from transportation, moving or storage of unit.

7. Unit must be readily accessible for servicing and/or repair at all times.

8. Any adjustment or service to the unit should be made by qualified service personnel.

9. Misapplication of product.

MODEL NO.____________ SERIAL NO.____________ DATE INSTALLED_________

INSTALLER: Please fill in above blanks and leave this manual with equipment owner/operator.