Carrier
HEATING & COOLING

38EV,QV
Variable Speed Systems

Operation, Service and Troubleshooting

For Models 38EV024320, 38EV036320, 38QV024320, 38QV036320

CONTENTS

NOTE: Malfunction of certain electronic control components can cause lack of Automatic Emergency Heat initiation. See Service and Maintenance section for corrective servicing procedures.

INTRODUCTION

This publication is designed to provide the information necessary to understand and troubleshoot Carrier's 38EV and 38QV Variable Speed Split System Heat Pump and Air Conditioning Systems. The text covers variable speed 38EV condensing and 38QV heat pump outdoor units, coupled with 40QV Fan Coil or 28RD/RN Coil and 58SS Furnace with blower accessory package. All system combinations are controlled in a similar manner utilizing the same electronic components for both heat pump and cooling only systems. System Diagrams are shown in Figs. 2 and 3.

This guide covers single zone applications only. For multiple zone installation, see proper supplemental manual.

STEP 1—General System Description

Outdoor Units:

The 38EV condensing and 38QV heat pump units are derived from standard Carrier single-speed units. The control box is slightly larger to allow room for the induction inverter and system microprocessor control board.

Although the unit is 208/230 VAC single phase, the inverter supplies three-phase power at a wide range of frequencies to control the speed of the three-phase compressor. By varying compressor speed, the system is able to control its output within a range of about one-half to full rated capacity. The outdoor fan motor is of standard single-phase, single-speed design.

Indoor Units:

The 40QV Fan Coil provides variable indoor airflow control for the system. This feature gives the system the capability not only to vary its output capacity, but to control humidity levels throughout this capacity range.

The 58SSB Blower Accessory provides these same features when coupled with a 58SSB Furnace and 28RD/RN Furnace Coil.

Thermostat:

The 38EV/QV system must be installed with a VVT-II thermostat Model MST-04 or MST-16 with software revision 6.7 or higher, available through your Carrier distributor.

General Operation:

The ability of the system to control compressor and blower speeds as described above allows it to adjust its output capacity to match the varying load requirements of an installation.

This type of operation results in less on-off cycling (ref. Fig. 1), quieter operation and improved temperature control at moderate and low load conditions.

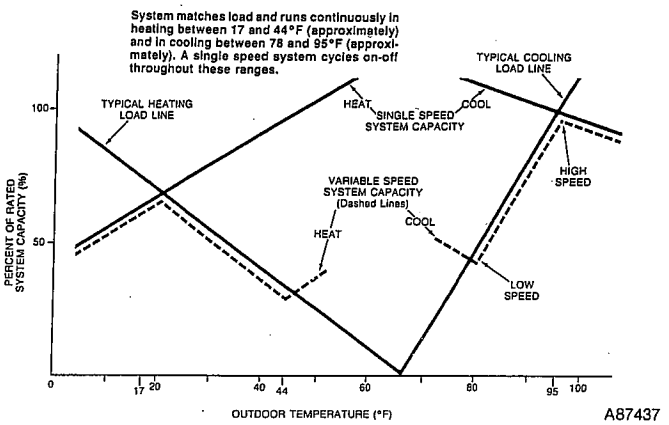

Fig. 1—Variable Speed System Matches Load

STEP 2—Component Functional Description

CONTENTS

Figs. 2 and 3 shows layout of components in the variable speed control system. This section will describe each component and discuss its function in attaining proper system operation.

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PC 101 Catalog No. 533-895 Printed In U.S.A. Form 38EV,QV-ASM Pg 1 12-87 Replaces: New

38EV Variable Speed Air Conditioning System

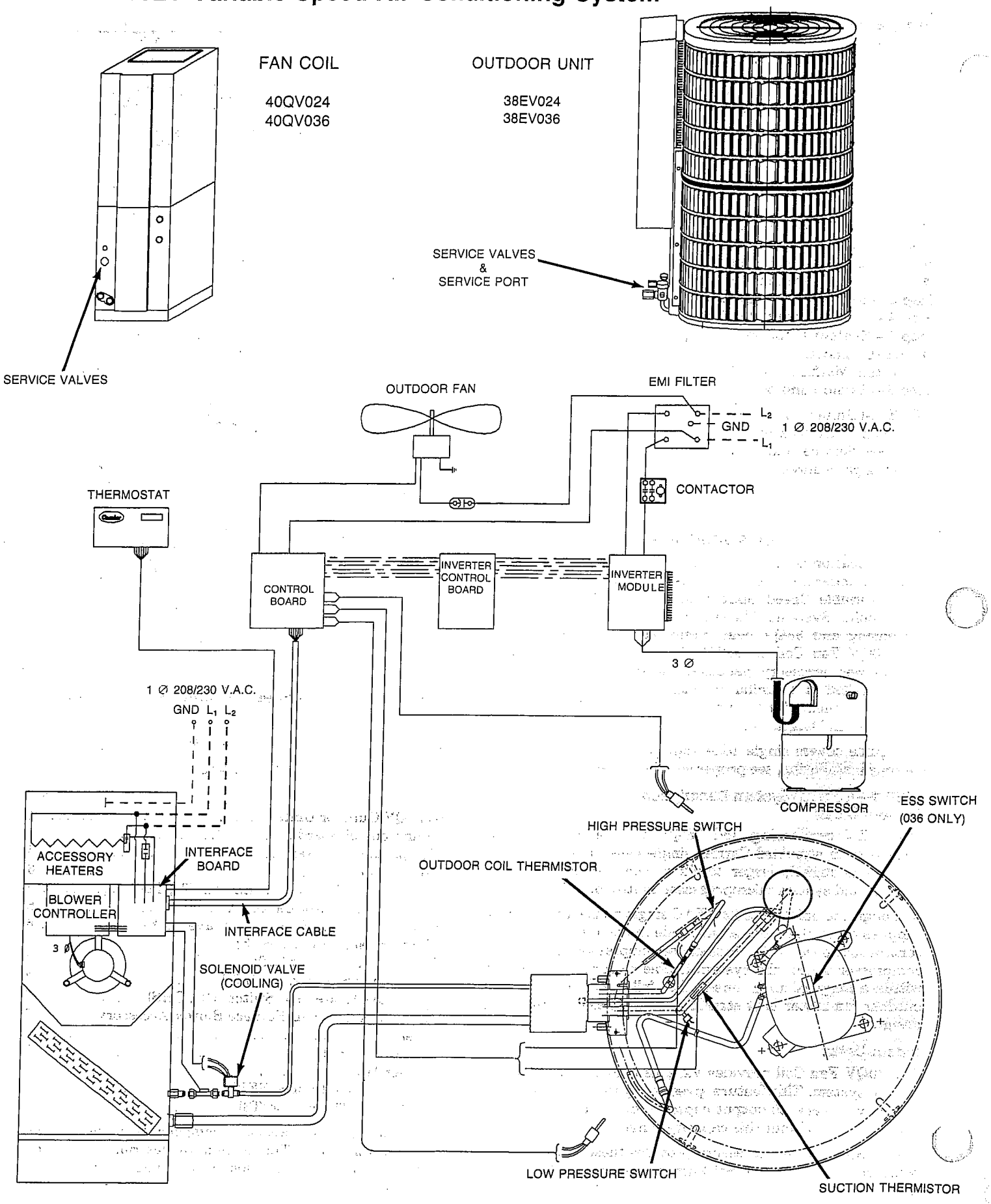

Fig. 2—Simplified System Schematic (shown with 40QV Fan Coil)

38QV Variable Speed Heat Pump System

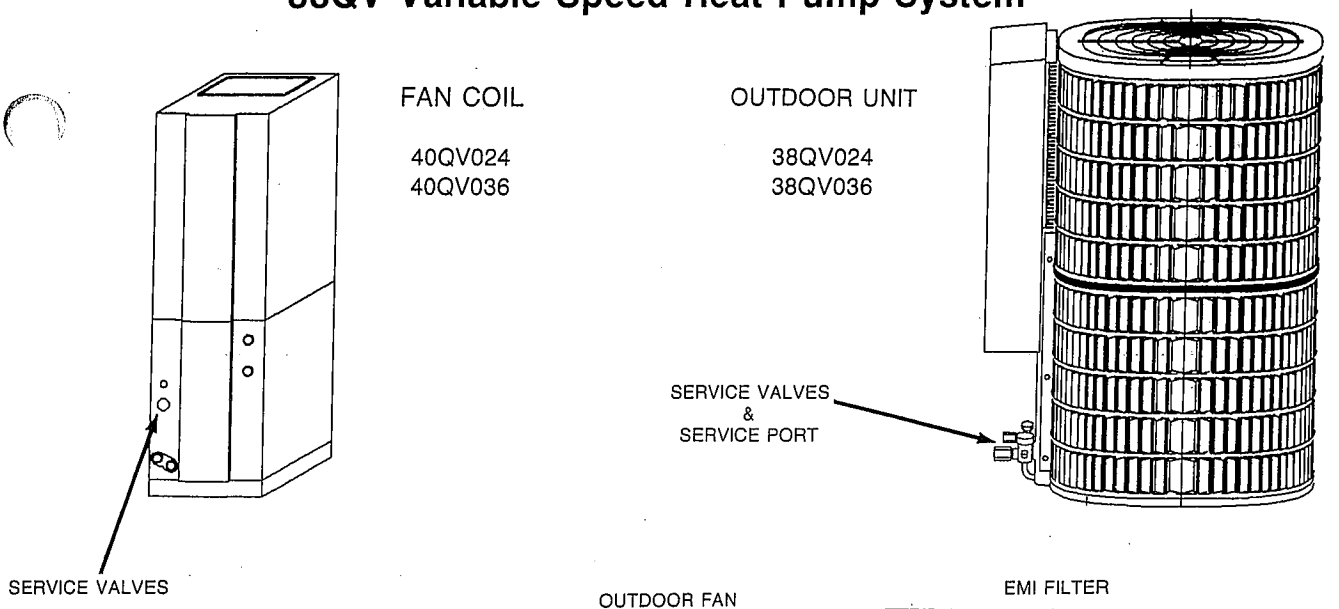

Fig. 3—Simplified System Schematic (shown with 40QV Fan Coil)

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38EV, 38QV Outdoor Unit

Main Control Board:

The main control board is located in the front of the 38EV/QV control box. It is fully visible and serviceable by simply removing the control box cover, as shown in Fig. 4. All wiring connections for components internal to the unit are at the top of the board as shown in Fig. 5. Low voltage connections are at the white 17 pin connector, high voltage (O.D. fan relay) at the two push on terminals in the upper left. All connections to the indoor unit are made through the 15 conductor Interface Cable connector located in lower left of the board.

The main control board receives information on system status from 5 devices (including VVT-II thermostat) and uses it to determine proper control for its 10 outputs. These I/O's are listed below:

Inputs:

1) Thermistor (T2), Suction Line.
2) Thermistor (T1), O.D. coil (between expansion device and coil).
3) Thermistor (T3), I.D. coil (between expansion device and coil).
4) Compressor Inverter (over-current alarm).
5) Thermostat (cool/heat, capacity demand, etc.)

Outputs:

1) Inverter (compressor) speed signal.
2) I.D. Blower Speed Signal (via interface board).
3) O.D. Solenoid Expansion Valve* (refrig. expansion control, heat mode).
4) I.D. Solenoid Expansion Valve (refrig. expansion control, cool model).
5) Main Contactor (inverter/compressor on-off control).
6) O.D. Fan (on-off control).
7) Reversing Valve* (on-off control).
8) Aux. Heat (electric or furnace heat on-off).
9) On-Board LED (on-off for diagnostics codes, etc.)
10) Thermostat (display of diagnostics codes, etc.)

*38QV Heat Pump Units Only

Compressor Inverter:

NOTE: The following text describes disassembly of the control box for purposes of explaining inverter component function only. Inverter components are not serviceable, and should not be removed from the control box.

Serviceable items include only the main control board, contactor and fan capacitor.

Failure of any other component requires replacement of the entire control box. See instructions included with replacement control box for this procedure.

The inverter is made up of 6 components, all mounted in the 38EV/QV control box.

With the main system control board and backpanel removed (3 screws) the inverter board is clearly visible (See Fig. 6).

Removal of the inverter board allows a view of the rest of the inverter components, which are pointed out in Fig. 7.

(Refer to Fig. 8) The inverter operates with 208-230VAC, single-phase input power provided to the *Diode Module* (or diode bridge). Here the AC power is converted to high voltage *DC* (325V approx.).

The large (black) *Smoothing Capacitor* in upper right of the control box is required to Smooth the DC voltage and is at this 325 VDC potential.

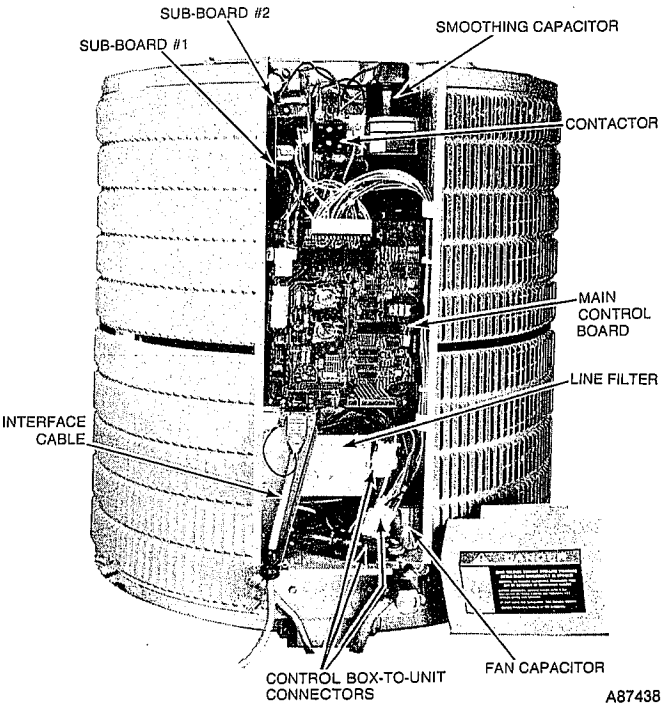

Fig. 4—Control Box, Cover Off

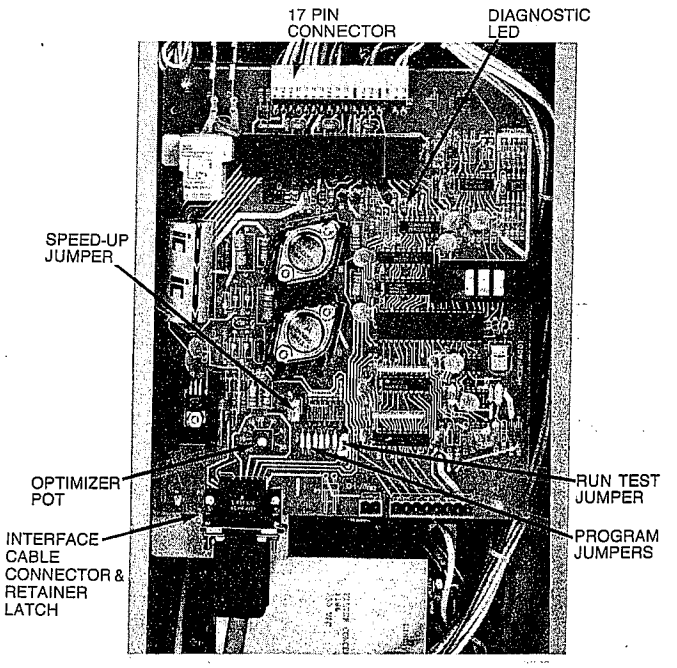

Fig. 5—Control Board

The DC power is then provided to the *Power Modules* (3) or Power Transistors via a buss mounted across all 3 modules. The power modules drive the 3-phase compressor when the *Inverter Board* receives a signal from the main control board requesting a certain compressor speed. The inverter board switches *each* power module on-off into a signal simulating a single-phase signal. (See Fig. 9A). Each power module is switched in the same pattern, but 120-deg. out-of-phase from the other two modules, so the total output is in 3-phase form. (See Fig. 9C).

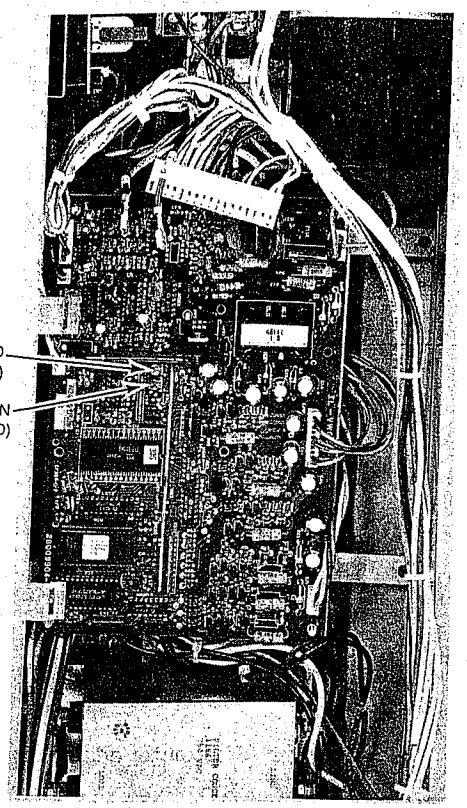

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Fig. 6—Control Board Removed

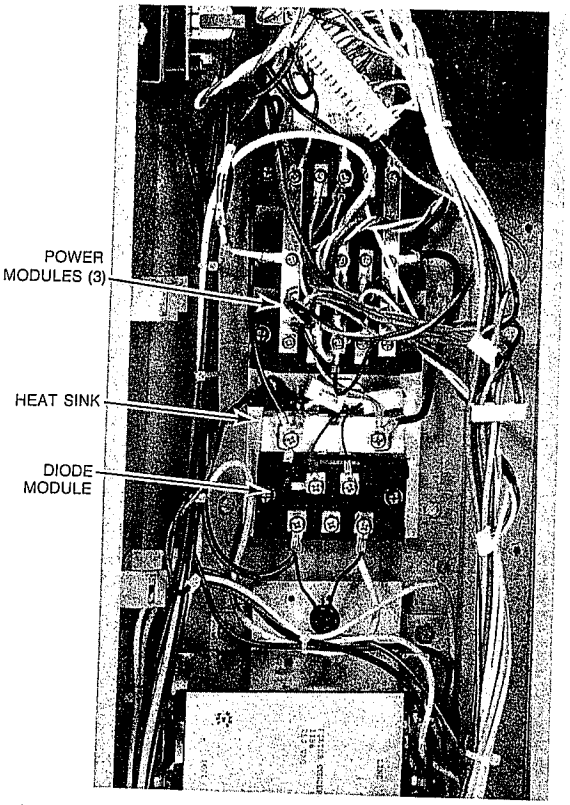

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Fig. 7—Inverter Board Removed

38EV/QV COMPRESSOR INVERTER OPERATION

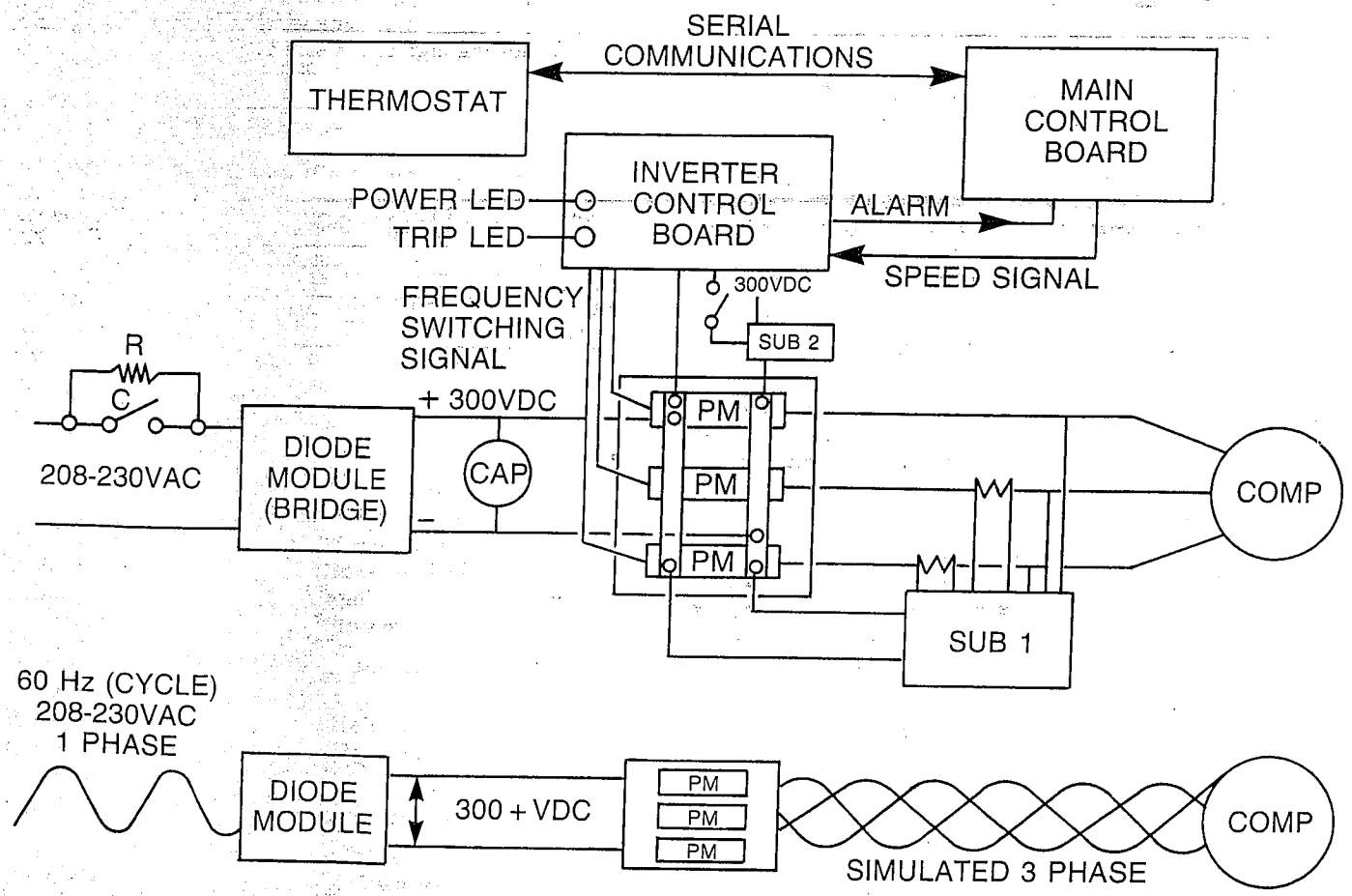

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Fig. 8—Inverter Function Diagram

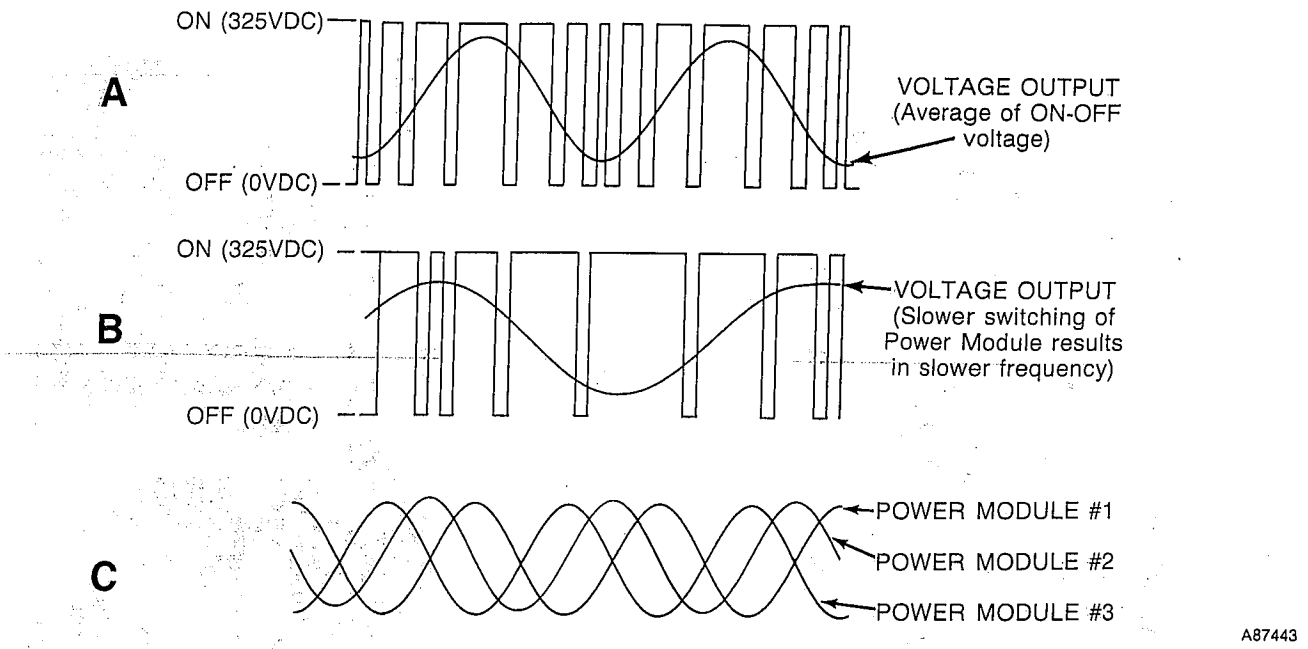


Fig. 9—Inverter Power Module Switching

A change in the speed signal from the main control board causes the inverter board to switch the power modules at a different rate, thus changing the 3-phase output frequency, and compressor speed. (Ref. Fig. 9B).

In summary, the inverter takes a 230V, single-phase, 60 Hz. frequency input and converts it to high voltage DC. It then converts it to *3-phase* AC power at frequencies of 30-90 Hz. to drive the 3-phase compressor at speeds of 1800 to 5400 RPM.

Although other inverter components (shown in Fig. 4) were not needed in the above functional description, they are still necessary to maintain inverter integrity and reliability. *Sub-board #1* is used to suppress electrical noise caused by power module switching to prevent interference with the inverter microprocessor. It also contains 2 current loops so the inverter can monitor its own current output. *Sub-board #2* is an under-voltage protector for the inverter board.

Compressors—are of a special design to operate reliably over the 1800-5400 RPM (30-90 Hz. frequency) speed range. They are driven by a standard design 3-phase motor.

—38EV024, 38QV024 Models—have a reciprocating compressor with internal PTC heater and internal overload feature. It has specially hardened valves for high speed operation, and special oil pump to retain proper lubrication at low speeds.

Its internal current and temperature sensitive overload resets automatically when internal compressor motor temperature drops to a safe level (overloads may require up to 30 minutes to reset). When an internal overload is suspected of being open, check by using an ohm-meter or continuity tester.

The internal high Pressure Relief Valve opens at a pressure differential of approximately 450 + -50 psig between suction (low side) and discharge (high side) to allow pressure equalization.

See Table 1 for proper oil charge.

—38EV036, 38QV036 Models—have a scroll compressor. This type of compressor contains no valves, similar to a rotary type. The "movable" vane oscillates in a cam fashion to force refrigerant around from outer edge to the center discharge, while compressing it.

The scroll compressor contains no internal overload devices. Instead, an emergency stop switch (ESS) is mounted to the top of the compressor (see description below).

It also requires no high pressure relief valve. At excessive pressure the scroll vane is lifted from its sealing surface, allowing high to low side bypass.

Table 1—Refrigerant and Oil Charge

Unit Model	Charge R-22 (lb)	Oil Type	Oil Charge (oz) New/Recharge
38EV024	7.9	Calumet RD-15 or Sontex 2000	55/51
38QV024	8.5		
38EV036	8.1	Sunisco 4GS	41/39
38QV036	9.5		

Thermistors:

Three thermistors are utilized by the main control board to monitor refrigerant temperatures at locations shown in Figs. 2, 3 and 10. The same model thermistor is used at all three locations. Each is mounted in a $^{5}/_{16}$" O.D. tube secured to the refrigerant line for improved accuracy and protection of the device, and then heavily insulated (armaflex tube).

O.D. Fan Motor/Capacitor:

The totally enclosed fan motor is of standard 208-230 single-phase design for single-speed operation. Its related capacitor, located in lower right of the control box, is also of standard design.

Outdoor Solenoid Expansion Valve (SEV)—38QV Heat Pumps Only.

This device is identical to that used at the indoor unit, except for accurator piston size. Refer to Indoor Solenoid Expansion Valve Description.

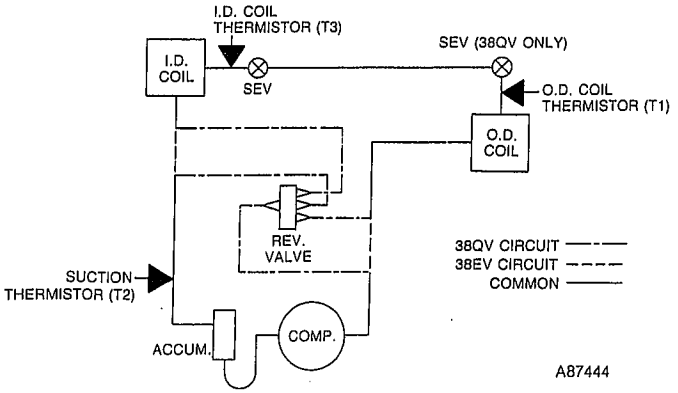


Fig. 10—Thermistor Locations

High Pressure Switch *(HPS)*—is provided for high pressure protection of the system. It is located on the liquid line in 38EV units, and the discharge line in 38QV units, (ref. Figs. 2 and 3). Its setting is 425 (+-10) psig.

Low Pressure Switch *(LPS)*—is included to provide loss-of-charge protection.

In 38QV heat pumps the LPS is located in the liquid line between the outdoor coil and outdoor SEV (ref. Fig. 3). Its setting is 5 + (+-3) psig and provides protection in the heating mode.

In 38EV cooling units, the LPS is located in the suction line between suction service valve and accumulator (ref. Fig. 2). Its setting is 27 (+-5) psig.

Emergency Stop Switch *(ESS)*—Is used only on 38EV036 and 38QV036 model units. It is mounted to the top of the scroll compressor to provide over-temperature protection, as the scroll has no internal overload. It is located in the safety electrical circuit in series with LPS and HPS switches. The ESS is set to open on temperature rise at 265 + -10 deg.F and reclose at 210 + -20 deg.F.

Crankcase Heater and Switch *(CH,CHS)*—is connected across the input side of the line filter and operates continuously except above the setting of the crankcase heater switch (70-deg.F) which is located on the liquid line.

The purpose of the heater is to keep the crankcase warm during the off cycle and thus prevent dilution of the oil with refrigerant. This assures good lubrication and prevents loss of oil from the crankcase during startup. To energize crankcase heater, turn the indoor thermostat to OFF position and energize electrical disconnect to the outdoor unit. If the electrical disconnect switch to the outside unit has been off for an extended period of time, the crankcase heater should be always energized for 24 hours before starting the compressor.

INDOOR UNIT COMPONENT DESCRIPTION

40QV Fan Coils—Are essentially standard Carrier indoor units with motor replaced by the variable speed motor and 208-230 VAC controller and interface board (ref. Figs. 11 and 12.)

58SSB Furnace Blower Accessory—Includes the same motor as the 40QV fan coil. Its controller and interface board are 115 VAC versions of the fan coil components, mounted as shown in Fig. 13.

Interface Board—serves three major functions in the system.

Whenever gas or electric heat is energized, the interface board takes over control of the blower from the outdoor unit. It then forces the blower to high heating speed, which is adjusted at the blower speed trimpot (ref. Fig. 14).

The board also contains the VVT-II thermostat power supply.

Last of all, it acts as a connection point for input power, and the control circuit between outdoor unit and indoor components (i.e., indoor SEV, thermistor, transformer, and blower motor).

Blower Controller—serves a function similar to the outdoor unit compressor inverter. It converts single-phase, 60 Hz. power into a variable frequency output to control blower motor speed. High and low motor speed settings are adjustable at a 10-pin connector on the controller.

Blower Motor—is of unique design, containing a permanent magnet rotor for superior efficiency.

⚠ CAUTION

An extremely hard or sharp blow to the casing or dropping the motor may affect motor operation due to magnet damage.

Indoor SEV Assembly—Is provided with the 38EV or 38QV outdoor unit. It must be mounted to indoor unit liquid connection during installation. The 38EV SEV assembly provides two expansion orifices in parallel; a main orifice, which is controlled by the solenoid, and a bypass orifice (See Fig. 15).

The bypass orifice is sized to meter refrigerant properly at low compressor speeds with valve de-energized. At high compressor speed, the solenoid is energized, allowing parallel flow through a second, main orifice, sized properly for the additional refrigerant flow needed. At intermediate compressor speeds, the solenoid is cycled on-off to control mid-range flow rates.

The 38QV heat pump valve functions in much the same manner, except the fixed bypass orifice is replaced by a standard accurator piston. This allows the capability for non-expanded flow in the reverse direction needed in heat pumps. This valve, with cutaway, is shown in Figs. 16 and 17. See Table 3 for piston sizes.

The SEV solenoids are energized by a 24 VDC coil, driven directly by the main control board.

Indoor Coil Thermistor (T3)—Mounted to the SEV assembly, it is identical to the outdoor unit thermistors.

STEP 3—Sequence Of Operation

Startup—Once the system is properly installed or serviced, there are two methods available to start the system and check operation.

The first method is the "Run Test" function, which is highly recommended for operational checkout after initial installation or servicing. The Run Test automatically operates the system in both the heat (including aux. heat) and cool modes, thus eliminating the need to adjust the thermostat a number of times to force system into the desired operating conditions. Auto test operation is detailed below.

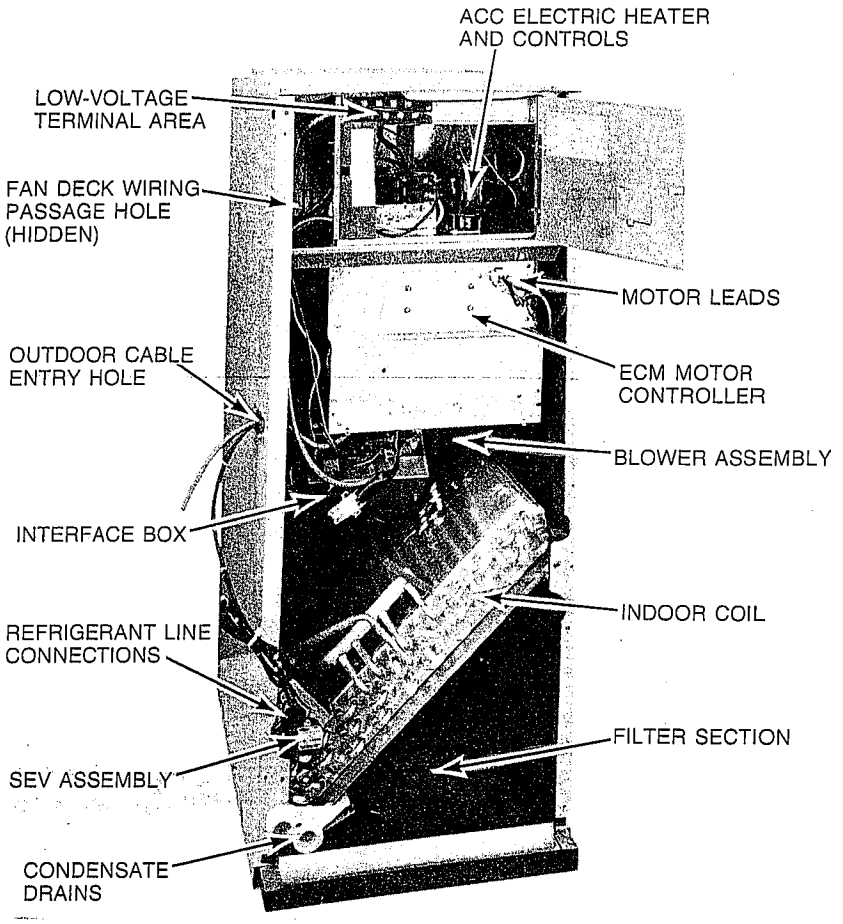


Fig. 11—40QV024 Fan Coil

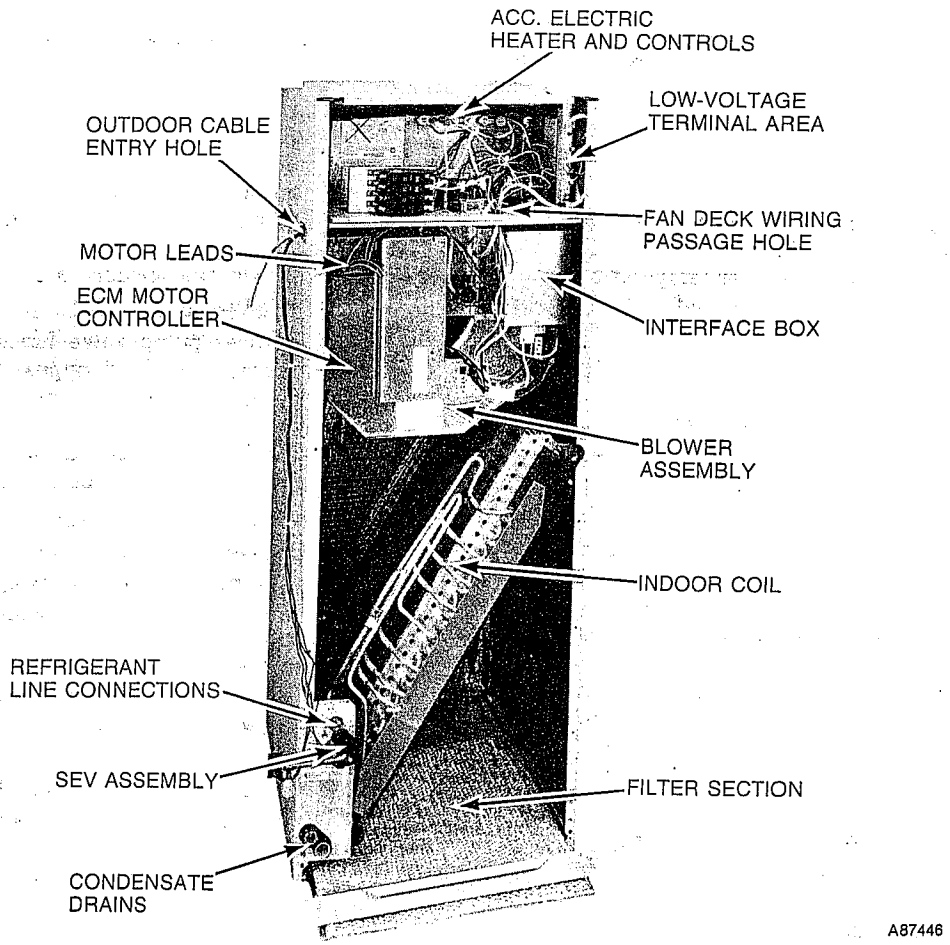


Fig. 12—40QV036 Fan Coil

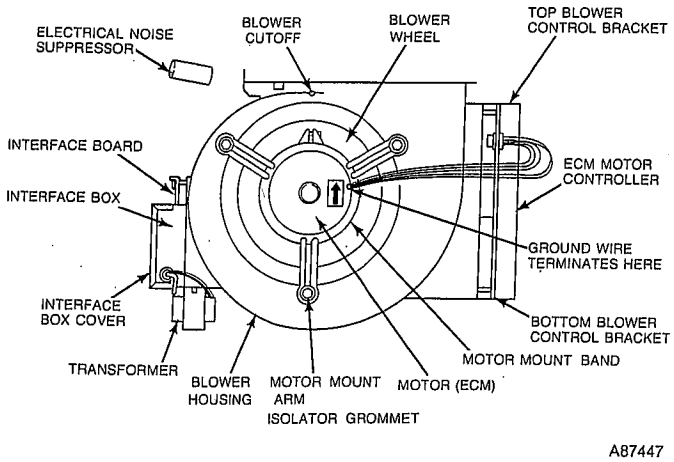


Fig. 13—58SSB Furnace Blower Assembly

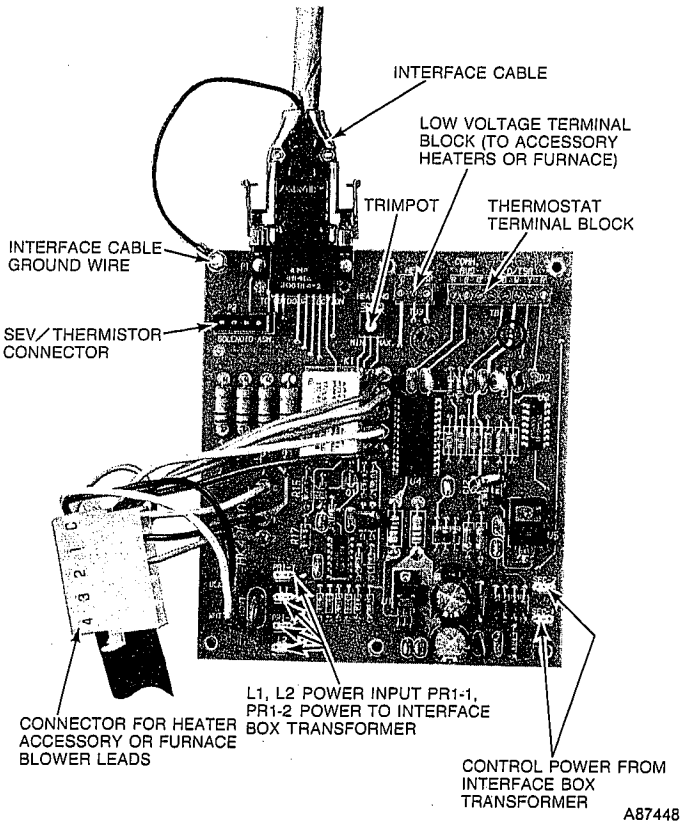


Fig. 14—Interface Board

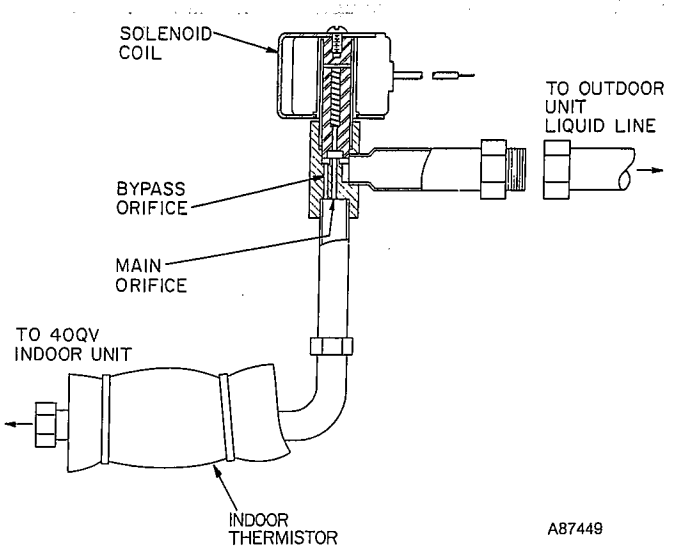


Fig. 15—38EV SEV Cutaway

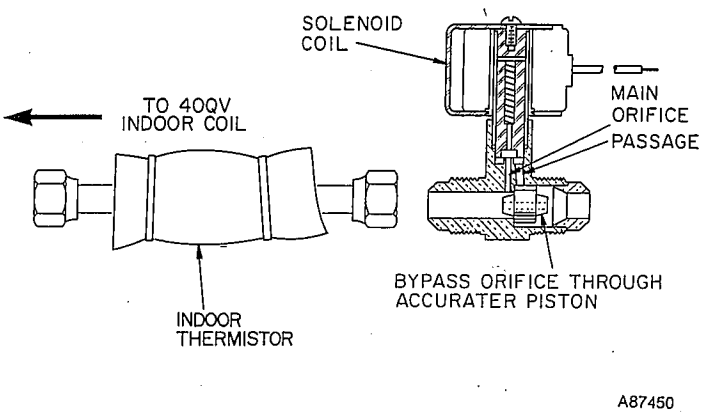


Fig. 16—38QV SEV Cutaway

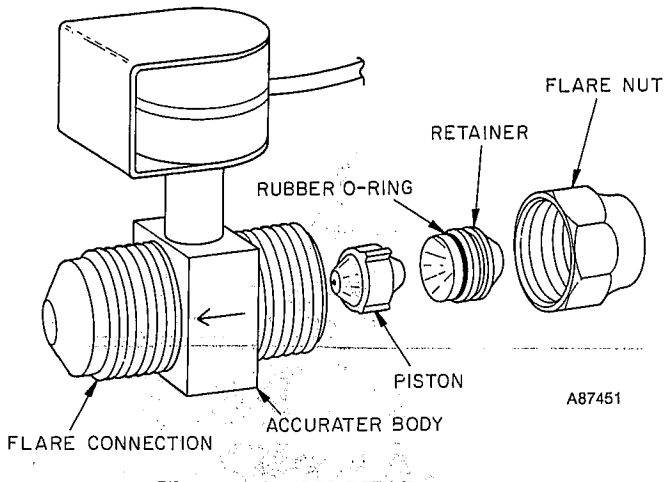


Fig. 17—38QV SEV Parts

The second method involves setting the thermostat setpoint for a high demand (4-deg.F or more from room temperature) in the heat or cool mode. To accomplish this, refer to thermostat setup instructions, Step 4. This will allow the system to start and operate normally.

A "Speed-Up" function is available to aid in operational checkout if the normal startup method is used. The "Speed-Up" function shortens the delays and timing sequences of the normal startup routine, and is described in this section.

The system Self-Diagnostic feature (Ref. Troubleshooting, Step 5) is incorporated in both the Run Test and normal startup operation.

Run Test—

Initiation—Remove the outdoor unit control box cover, then apply power to indoor and outdoor units.

⚠ WARNING

High Voltage power is supplied to control box components immediately upon closure of external main disconnect. The main contactor is bypassed for initial charge-up of inverter capacitor (ref. Fig. 8). Electrical shock or death may result.

The Red LED on Main Control Board will illuminate for approximately 30 seconds, and then extinguish.

To initiate "Run Test" function, remove yellow jumper (board is labeled "Run Test" as shown in Fig. 5). *Unit will start soon after jumper is reinstalled in its proper position on the board.*

Operating Sequence:

In the absence of any diagnosed problems, the system will operate in the Cool Mode for 7 minutes. It will then switch to Heat with auxiliary heat on (gas or electric) and immediately ramp the compressor down and off. Auxiliary heat remains energized for about 3 minutes. See Fig. 18 for a pictorial of Run Test sequence.

Influence of Diagnostics:

If a problem is diagnosed by the main control board, the Red LED will flash an error code. Refer to Section 5, "Troubleshooting" for interpretation of the flashing code.

The system may, however, react in different ways, depending upon the problem diagnosed. Certain errors will cause one of the following responses:

a) The unit may not start (Error Codes 3-5,8).

b) The unit may shut down prematurely (Error Codes 9, 10). Compressor and/or indoor fan speed may fluctuate before shutdown as the system attempts to verify or clear the problem (Error Codes 11, 14).

c) The unit may complete the Run Test properly, but flash an Error Code during operation. Some diagnostics, such as low charge indication (Error Code 15), are designed to warn the serviceman of potential problems but may not affect system operation.

Manual Checkout During Run Test:

Although the system is equipped with self-diagnostic capabilities, it should still be visually and audibly inspected for proper installation and operation during the Run Test.

A check list of system operational functions is included below. Refer to Fig. 18 for the sequence of these functions and check each item. To complete the list, the Run Test can be initiated more than once.

a) Verify that compressor and outdoor fan operate without excessive vibration of the outdoor unit in its mounted position.

b) Verify indoor blower operates in both the Cool and Heat Mode.

c) Verify indoor solenoid expansion valve operates properly by listening closely for valve clicking off-on at about 3-second intervals.

d) Reversing valve switches off (detected by "woosh" sound) when unit changes to Heat Mode. This sound also ensures valve was properly energized for cooling operation (38QV only).

e) Verify that indoor blower speed override for gas or electric heat operates properly (blower jumps from medium to high speed). This function is necessary to guarantee full blower speed operation when electric heat or furnace is on. (Blower control is different for gas vs. electric heat as shown in Fig. 18).

f) Verify that electric heaters or furnace burners operate.

Once the "Run Test" has completed and the unit, including auxiliary heat is off, the main control board LED will illuminate. When it extinguishes, system can be started normally by adjusting thermostat.

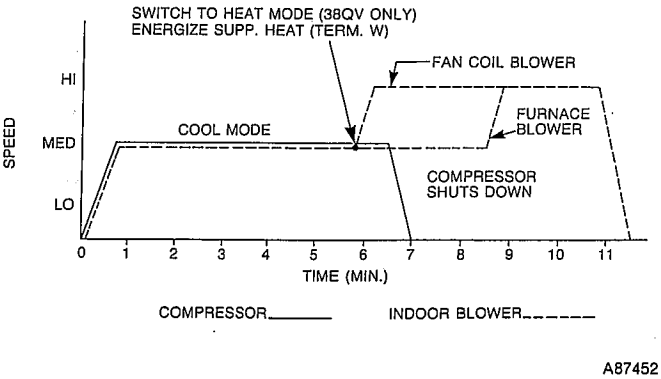


Fig. 18—Run Test Sequence

⚠ WARNING

Unit is capable of restarting on normal thermostat demand soon after Run Test is completed. Personal injury can result.

Normal System Startup Sequence

Apply power to indoor units via main disconnect switches.

If outdoor unit control box cover is removed, main control board LED will light and extinguish after 30 seconds.

Thermostat will display HP00 (for 38QV units) or AC00 (for 38EV units).

Set up thermostat in heat, cool or automatic mode for room temperature desired (Ref. Thermostat Operation, Troubleshooting Section 4).

Thermostat setpoint must be 2-deg.F or more away from room temperature for the system to initiate a startup. (Room temperature can be displayed on thermostat by pressing both heat setpoint adjustment buttons to right of display simultaneously).

Startup Sequence

NOTE: Startup delays and sequence times can be shortened for system checkout by initiating "Speed-Up" jumper, described below.

a) *Time Guard—*

Normal Ambient Startup—After applying power and/or adjusting thermostat setpoint, the system will undergo a 5-minute delay before starting. This will also occur any time the system cycles off normally, to prevent unnecessary on-off cycling.

Low Ambient, Initial Startup—When outdoor temperatures are near or below 20-deg.F, the system will undergo a 20-minute delay on *initial* power-up only. This allows the crankcase heater to at least partially warm up compressor before startup.

Startup—Compressor will start and ramp up to low speed, outdoor fan will come on. Indoor blower will start in a similar manner to compressor, 30 seconds later.

b) *Low Speed Lock-In*—After starting, the unit will lock in at low speed for a period of 8 minutes. This is done for the following reasons:

1. System self-diagnostics will monitor system conditions during this period to verify proper system operation.
2. Allows indoor blower time to circulate and slowly mix possibly cold ductwork air with room air, thus avoiding erratic speed fluctuations due to unstable thermostat readings.

c) *Transition to Normal Control*—If the thermostat is satisfied during the 8-minute period at low speed, the system will remain at low speed for 4 more minutes and then shut down. If not, it will speed up depending upon thermostat demand. The startup sequence is complete.

"Speed-Up" Function

The "Speed-Up" jumper is a yellow jumper, similar to the "Run Test" jumper. It's located on the outdoor unit main control board next to the label "Speed-Up" (ref. Fig. 5). The function is initiated by removing *and reinstalling the jumper during the sequence period you want to eliminate.*

For instance, if you want to eliminate the time guard period before startup, wait for the LED to extinguish after power-up. Then pull and reinstall the "Speed-Up" jumper. This will shorten the respective period (i.e. 5 minutes down to 2 minutes for the normal time guard, or 20 minutes down to 4 minutes for low ambient initial startup).

If the jumper is pulled and reinstalled during a sequence period listed in Table 2, it will shorten that period as indicated. The speed-up function will then cancel automatically when the next event listed in the table occurs. To shorten subsequent sequence periods, the jumper must be initiated again.

Table 2—Speed-Up Function

Initiate The Jumper During This Period	Period Will Shorten From Normal- to Speed-Up	Speed-Up Function Will Cancel When
—Prestart Time Guard	5 Min.—2 min. OR* 20 Min.—4 Min.	Compressor Starts
—Low Speed Lock In At Startup	8 Min.— 40-50 Seconds	Compressor Begins Ramping Above Low Speed, Or Shuts Down
—Between Defrost Periods (Below 32-Deg.F Ambient)	45 Min.—4-5 Min. (1st Defrost) 30 Min.-4 Hrs.— 3-24 Min. (Subsequent Defrosts)	Unit Initiates A Defrost
—During Defrost	4-10 Min.— 24 Sec-1 Min.	Defrost Termination

*Low Ambient Initial Startup

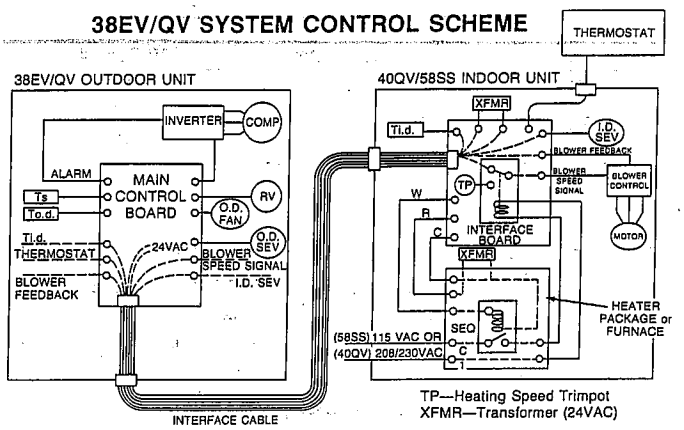
Cooling Operation

Compressor—

During normal operation, the compressor speed will vary, based on thermostat demand, from 2200 RPM at low speed to 5000 RPM at high speed.

Indoor Blower—

Blower speed (or airflow) will "track" or follow compressor speed; i.e., when the compressor is at low speed, so is the blower. If the compressor ramps to high speed, the blower ramps to high speed simultaneously. This speed signal is sent from the outdoor unit main control board, through the indoor unit interface board to the blower controller. (See Fig. 19).



A87453

Fig. 19—System Control Scheme

Outdoor Fan—

The outdoor fan cycles on-off with the compressor.

Solenoid Expansion Valves (SEV)—

In the cooling mode only, the SEV at the indoor unit is operated. SEV operation "tracks" or follows compressor speed directly. At low compressor speed operation, the solenoid remains off and all refrigerant flow is directed through a bypass orifice in the valve body (38EV systems). In 38QV systems, the bypass orifice is located in the accurator piston (Ref. Component Description, Section 3). At high compres-

sor speed, the solenoid is energized on continuously, allowing the extra refrigerant flow required through a second orifice in parallel to the bypass orifice. At intermediate compressor speeds, the SEV is cycled on-off at different rates, depending upon compressor speed. This rate is based on a 5-second on-off period, with the on-time increasing (with compressor speed) from zero (at low speed) to the full five seconds on (i.e., continuous on) at high speed. For instance, at lower speeds, the SEV is on 1 second, off 4 seconds; at medium speed, on 2.5 seconds, off 2.5 seconds, and so on.

Proper valve operation can be checked by listening closely for the "clicking" at the indoor SEV during intermediate speed operation.

The system will cycle on-off at low speeds at moderate (75-deg.F) outdoor temperatures. It will operate continuously at increasingly higher speeds as outdoor temperatures increase.

Heating Operation—38QV Systems Heat Pump

Heat pump operation is executed in the same manner as in the cooling mode. Indoor blower speed and SEV control "track" or follow compressor speed directly. However, in the heat mode, only the outdoor unit SEV is operated. It is cycled in the same pattern as cool mode control, except cycling on-time is shortened at colder ambients. (i.e. At low ambients, the SEV may also be cycling on-off rather than remaining full on when the unit is at high speed).

The system will cycle on-off at low speeds during normal operation at moderate (50-deg.F) outdoor temperatures. It will operate continuously at increasingly higher speeds as outdoor temperatures drop.

When outdoor temperatures drop to a point where supplementary heat is required, or the optimizer function is enabled, electric or gas heat is initiated. Electric heat and furnace operation are described in the following sections.

Table 3—38QV Piston Sizes

UNIT	LOCATION	PISTON #
38QV024	Outdoor Indoor	42 49
38QV036	Outdoor Indoor	52 63

Electric Heat Control—(38EV and 38QV Systems)

Electric heat is initiated and controlled by energizing "W" in the same manner as in standard systems. However, since the variable speed blower needs a speed input signal to operate, blower control is considerably different.

Blower Control—In a standard heat package, energizing "W" energizes the heater sequencer(s). When this is done, the fan relay is bypassed by 230V power to drive the blower directly. Therefore, if the fan relay is faulty, the blower still operates for safe electric heat operation.

40QV Fan Coil Units operate in a similar manner (Ref. Wiring Diagrams). However, instead of operating the blower directly, this 230VAC power is applied to the interface board at terminals C and 1 (see Figs. 14 and 19). When these terminals are energized by the electric heat sequencer, the interface board relay breaks the speed signal connection from the outdoor unit and allows the interface board to drive the board at a speed set by the adjustable pot on the board.

When the electric heat ("W") is cycled off, normal sequencer operation retains blower control from the interface board until the heaters cool down. When terminals C and 1 are de-energized by heater package, blower control reverts back to the outdoor main control board.

Supplemental (2nd Stage) Heat—(38QV Heat Pump/40QV Fan Coil Systems Only)

Supplemental heat is required when the outdoor temperature drops too low for the heat pump to handle the load alone. At this point, the system begins cycling electric heat, in addition to continuing full speed heat pump operation. This is done by energizing heater package terminal "W." The heaters and blowers are controlled as described above.

A change in blower speed when the interface board takes over control may not be noticeable, since the outdoor unit is already operating it at high speed.

It may be noticeable if the blower heating speed trimpot is adjusted below its maximum setting.

Heating Operation—(38EV Cooling Systems) **and Emergency Heat**—(38QV Heat Pump Systems)

Electric or gas heat is operated directly on thermostat demand on 38EV systems or whenever the 38QV outdoor unit operation is locked out due to a diagnostic problem. The blower is controlled by the interface board as described above. However, since the blower is not being operated by the outdoor unit during electric heat off cycles, the blower will cycle full-on-off similar to standard systems.

NOTE: Malfunction of certain electronic control components can cause lack of Automatic Emergency Heat initiation. See Service & Maintenance section for corrective servicing procedures.

The 58SSB furnace will operate as described in the literature provided with it. The only difference is control of the variable speed blower. The standard 58SSB furnace bypasses its fan relay to lock-in blower operation when the burner is on, just like an electric heat package.

The variable speed blower package switches blower control to its interface board when "W" is energized, in the same manner as described above for "Electric Heat Control." (The furnace interface board design is identical to that for the 40QV fan coil, except it is a 115VAC version).

The blower will remain off for 2-3 minutes while the burner ignites and warms the heat exchanger. The blower will then start, and ramp to low speed for a short period before going to full speed. When "W" is de-energized, the blower will stay on for a short period to use the remaining heat from the exchanger.

Supplemental (2nd Stage) and Optimizer Control—(38QV Heat Pump/58SSB Furnace Systems)

Unlike fan coil operation, the furnace will not operate simultaneously with the heat pump. Therefore, whenever the outdoor temperature drops to where the heat pump can no longer match the load, or the optimizer setpoint is reached, the heat pump will shut down when furnace startup is requested ("W" is energized). At this point, the heat pump will also shut down the indoor blower (except if the thermostat is in the fan-on position). The normal furnace delay of 2-3 minutes will then pass before the blower is cycled back on, to allow the heat exchanger to heat up. Once the thermostat is satisfied by the furnace, it will cycle off. Operation will alternate between furnace and heat pump, until either the heat pump can handle the entire load, or the optimizer setpoint is reached. If the optimizer setpoint is reached, the heat pump will be locked out (a minimum of two hours) and the furnace will cycle directly on thermostat demand.

Adaptive Defrost—

38QV Heat Pump Systems utilize an adaptive defrost control which clears the coil of frost only when necessary. Based on coil conditions and outdoor temperature, the time between defrosts is adjusted between 30 minutes and four hours, as described below.

Between Defrost Period Calculation—

Defrost monitoring is begun when the O.D. coil thermistor temperature drops below 32 degrees F. The first defrost will occur 45 minutes later.

When the unit is ready to defrost, the pre-defrost O.D. coil thermistor temperature (frosted coil) is memorized, and the unit then switches to defrost. A short time after defrost is completed, a post-defrost thermistor temperature (clear coil) is memorized.

The after-defrost (clear coil) temperature is used to estimate outdoor temperature and the optimum pre-to-post defrost coil temperature change (i.e. frosted coil vs. clear coil temperature).

The time period to the next defrost is then determined by:

a) If defrost time was less than 5 minutes, add 30 minutes to previous period.

b) If defrost time was maximum (10 minutes), and O.D. coil temperature at termination was:

—more than 45 degrees F, divide previous period in half.

—less than 45 degrees F, next period will be 30 minutes.

c) If defrost time was greater than five and less than 10 minutes, the new time is calculated by:

$$\text{previous period} \times \frac{\text{optimum temperature change}}{\text{actual post-defr. temp. minus pre-defrost temp.}}\ *$$

*The new period calculated by this method cannot be less than half, or more than double the previous period.

Other Limitations:

Maximum period between defrosts is 4 hours.
Minimum period between defrosts is 30 minutes, except:

The initial defrost after coming out of optimizer mode will occur 15 minutes after startup.

Defrost Sequence—

When a defrost is initiated, compressor speed is dropped to medium speed. This is done to minimize shock to the compressor. The reversing valve and heat (terminal "W") relays are energized, the outdoor fan relay de-energized, and compressor then ramped to full speed for a rapid defrost. Defrost is terminated on any of the following occurrences:

a) O.D. coil thermistor rises to 80 degrees F (when outdoor temperature is above 10 degrees F).

b) O.D. coil thermistor rises to 60 degrees F (when outdoor temperature is below 10 degrees F).

c) 10-Minute maximum defrost period.

The system then ramps down to medium speed, returns to heat mode, and returns to the pre-defrost speed.

Heat/Cool/Auto Control—

This thermostat function controls as in standard systems. Heat or cool operation may be requested separately. The "Auto" position allows the system to switch between these two modes automatically as required to satisfy thermostat setpoint demand.

Fan-On/Auto—

With the fan-auto mode selected, the indoor blower will cycle on-off with the outdoor unit and/or the electric/gas indoor unit.

The fan-on mode will keep the indoor blower operating at all times. The blower will operate at low speed during system-off intervals.

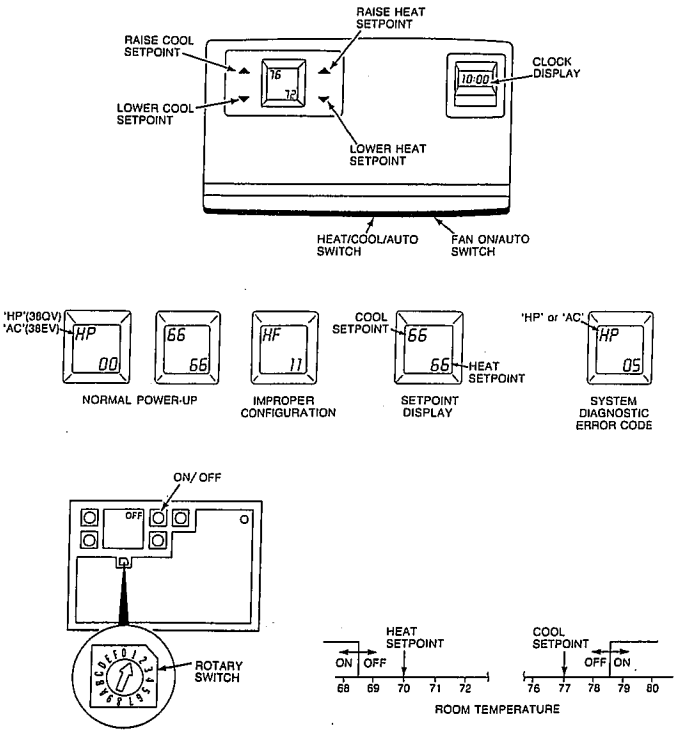


Fig. 20—VVT-II MST Thermostat A87454

STEP 4 VVT-II Thermostat Startup/Troubleshooting

The MST-04 or MST-16 thermostat consists of a printed circuit board, a connector board, and a wall mounted case.

A thermostat software revision of 6.7 or higher is required.

All wiring connections to the thermostat are made to the connector board.

Mount the thermostat as described in 38EV or 38QV outdoor unit installation instructions, or follow the Installation Instructions included with each control. Thermostat must be wired as shown in Figs. 36 and 37.

Fig. 20 shows front view of the VVT-II MST thermostat.

Start-Up Procedure:

Close indoor main disconnect.

Normal Display—The thermostat will display HP00 (for 38QV systems), AC00 (for 38EV systems), or 4 zeros, then switch to the normal heating/cooling setpoint as shown.

Blinking Display—If the thermostat display blinks on and off or is erratic, it is an indication that a wiring connection is not correct, or that the thermostat is not receiving adequate power. Check the wiring connections and the supply voltage (22VAC minimum) at terminals SEC-1 and SEC-2 on the interface board. Make certain the thermostat ribbon cable has been inserted into the connector board correctly.

Display Four Zeros—If the display shows four zeros upon power-up, and then displays "HF-11," it indicates that the thermostat is currently configured for a multiple-zone system. It must be reset for single-zone control.

Setting Thermostat For Single-Zone Control—

To correct the configuration, set the rotary switch to position #1 (ref. Fig. 20). A number and "ON" or "OFF" will

appear on the display. Press either of the right ("Heat") setpoint buttons to change the display to "OFF." This is the indication that the thermostat is now correctly set for single-zone control. Now adjust the displayed number to "2" by pressing the cool setpoint buttons; the lower one to decrease the number, upper one to increase. Return the rotary switch to position #0 and press any setpoint button to display the normal setpoints.

Adjust Heating/Cooling Setpoints—The setpoints for both heating and cooling can be easily adjusted by pressing the setpoint buttons as shown.

Installer Adjustable Features/Time Clock Option—Each thermostat is equipped with a built-in instruction manual which explains the various installer adjustable features and how to set the time clock.

Follow each page of the manual to configure the thermostat based on the application. Always set the "Local Set-back Control" to ON.

For single-zone control applications, the following features will have no effect on the thermostat operation and can be disregarded at the time of installation:

#6—Duct Temperature Sensor Calibration
#7—Max Damper Position/Min Ventilation Position
#C—System Demand
#D—Communication Test
#E—Supplemental Heat

Error Codes—are displayed as HF, SF, HP or AC followed by a two digit number (ref. Fig. 20.) An HF or SF code indicates a thermostat malfunction (see Thermostat Troubleshooting, below). A HP or AC code indicates a system diagnostic malfunction (see System Troubleshooting, Section 5).

Set-Back Feature—If the homeowner desires to use the set-back feature, remove the "set-back override jumper" from the connector board at the back of the thermostat.

Operation—When an "OFF" time occurs, the thermostat displays the word "SETBACK" and the highest cooling and lowest heating setpoints. When an "ON" time occurs the thermostat returns to the last setpoints that were displayed before set-back.

Overriding Set-Back—During set-back the heating or cooling set-back setpoint can be manually overridden by adjusting the setpoint through the use of the setpoint buttons. The setpoint selected becomes the new comfort setpoint that the thermostat uses when the next "ON" time occurs.

When the set-back setpoint is overridden the comfort setpoint chosen remains displayed until the next "OFF" time occurs, unless the user manually adjusts the setpoint back to the set-back setpoint.

Programming Set-Back—Follow the built-in thermostat instruction manual (behind front cover) to program the ON/OFF times for set-back operation (and for programming the electronic time clock).

Set-Back Programming Tips—If it is desirable for a particular period to be in set-back continuously do not enter any ON/OFF times for that period.

If it is desirable for a particular period to be in the comfort mode continuously enter an ON time that is the same as an OFF time.

Heating/Cooling Cycles—The thermostat should be set to energize a heating cycle and a cooling cycle. Check to make certain the 38EV or 38QV system operates properly.

"HEAT," "COOL," or "FAN" may be shown in the lower left corner of the thermostat display depending on the status of the system. The 38EV or 38QV system controls to 1.5-deg.F from setpoint in both heat and cool modes. It will start-up at 1.5 deg.F from setpoint (minimum run time is 12 minutes), and cycle off based on rate of room temperature change (ref. Fig. 20).

VVI-II Thermostat Troubleshooting

Hardware Failures—HF-11 or HF-12. The thermostat is not properly configured for single-zone control application. Make certain that "OFF" is displayed when the rotary switch is set to position #1.

HF-14, HF-15, or HF-16. There is a failure in the electronic circuitry on the thermostat. Replace the thermostat circuit board.

HF-13. The thermostat room temperature sensor is reading out of its normal range . . . 30 to 180 F. (Ref. thermostat instructions).

Check the room temperature sensor to make sure that it is physically intact.

Attempt to calibrate the room temperature sensor by following the built-in instruction manual. If calibration is not possible, replace the thermostat circuit board.

Storage Failures—The thermostat continuously checks its memory to make certain that stored information is valid. If information is ever determined to be invalid an error code of "SF" followed by a number is displayed.

When an "SF" error is displayed, the thermostat will also use a safe, substitute value appropriate to the particular code. (See instructions included with thermostat.)

To Clear An "SF" Error—Follow the built-in thermostat manual to find the correct rotary switch position and reset the desired setting. Then return the rotary switch back to position #0.

Time Clock—The time clock should be accurate to within 10 minutes per year. During a power failure, the time will be maintained for a minimum of 8 hours, after which it may be necessary to reset the clock. (Ref. thermostat instructions).

If the clock is not keeping accurate time, make certain the power has not been off for over 8 hours. If it has not, then replace the thermostat.

Set-Back—If the thermostat never goes into set-back make certain:

The set-back override jumper has been removed from the connector board.

The thermostat hasn't been programmed to be continuously in the comfort mode.

The thermostat is set for the proper time of day.

If the thermostat never comes out of set-back make certain:

A set-back On/Off program has been entered.

The thermostat is set for the proper time of day.

STEP 5 System Troubleshooting

TABLE OF CONTENTS

BEFORE TROUBLESHOOTING THE SYSTEM

This troubleshooting guide covers all components of the 38EV/QV variable speed system, including outdoor and indoor units.

See previous section for thermostat troubleshooting. (Thermostat Error Codes HF and SF).

⚠ WARNING

High voltage (300VDC) circuit remains energized after main disconnect is opened. Normal capacitive discharge time is ten (10) minutes, but this period may be extended indefinitely by component failure. Before servicing, always check with D.C. voltmeter between contactor terminal #23 (violet wire) and ground. Always reinstall safety shield in top of control box after servicing. Electrical shock can cause personal injury or death.

Before replacing components to correct a system malfunction, always inspect circuit for damaged or corroded wiring. Connectors should be inspected for improper mating. They should then be unplugged and examined for corrosion, damage or incomplete terminal insertion. This procedure is especially required when a system malfunction is intermittent (does not occur consistently).

Clean and/or repair wiring as required. A special accessory terminal kit (Carrier Service Part No. 38QV660001) including terminal extraction tools is available through your local distributor.

Use high quality multimeter for troubleshooting electronic devices in this system.

Self-Diagnostic Error Codes—

Error codes are indicated at an LED located on the outdoor unit main control board (Ref. Fig. 5), and on the indoor thermostat display (Ref. Fig. 20).

Control board LED error codes are shown as a series of ½ second on, ½ second off flashes, followed by a 10-second pause before repeating.

Thermostat display error codes are shown as a two-digit number, preceded by "HP" on 38QV heat pump systems or "AC" on 38EV cooling-only systems.

As an example, when an error Code #5 is diagnosed, "HP05" or "AC05" will be displayed at the thermostat when 5 flashes are indicated at the control board LED.

Automatic System Restarts on Diagnostic Shutdown—

All diagnostic shutdowns described in this text will cause as many as five restarts before final shutdown and compressor lockout. The system will remain off for at least five minutes (time guard function) before attempting each restart.

Note that the control board LED will display the error code *after each shutdown*. The thermostat display will indicate an error code *only after final compressor lockout.*

⚠ CAUTION

Whenever troubleshooting system with power on and control board LED flashing error code, check thermostat display. If error code is not indicated at thermostat, automatic restart is pending. Servicing of equipment at time of automatic restart may cause personal injury.

How to "Clear" Error Codes—

Indoor unit power (i.e., control power) must be broken and reset in order to cancel system lockout on a diagnostic.

The Self-Diagnostics feature is designed to monitor inputs (thermistors and inverter alarm) and take over control of the system if these inputs go out of normal range.

Table 4 lists each of the Self-Diagnostic error codes, the conditions that cause the code, and how the system reacts to each condition.

Troubleshooting System with Power On—

Always break power to both indoor and outdoor units when servicing, except as indicated in the following procedures.

Table 4—Self Diagnostic Error Codes

ERROR CODE	DESCRIPTION	CAUSE	SYSTEM REACTION
3	O.D. Coil Thermistor Failure	Thermistor reads greater than 160°F or less than −40°F	Immediate Shutdown or no startup*
4	Suction Thermistor Failure	Same as above	Same as above*
5	I.D. Coil Thermistor Failure	Same as above	Same as above*
8	Locked Compressor Rotor	Inverter alarm—on within 2 minutes after contactor energization	Same as above*
9	Overcurrent Trip	Inverter alarm—on after 2 minutes of run time (See Note 1)	Compressor slows down to cancel alarm. If alarm stays on system shuts down.
10	Contactor Control Failure	No change in thermistor readings (See Note 2)	Immediate Shutdown or no startup*
11	Reversing Valve Failure	O.D., I.D. Coil Thermistor readings change in wrong directions (See Note 2).	Compressor speeds up to shift valve. If thermistor readings don't switch direction, system shuts down.*
14	Indoor Coil Freeze	Suction Thermistor reads less than 32°F in Cool Mode.	Blower speeds up to raise suction temperature above 35°F. If so, blower continues operation at higher speed. If not, system shuts down.*
15	Low Refrigerant Charge	Suction thermistor reads much higher than I.D. coil (cool), or O.D. coil (heat) thermistor.	No effect on system operation. Error code on control board LED only.

NOTES:

* System attempts 5 restarts (each followed by 5 minute timeguard) before lockout and error code display on thermostat.

1. Inverter alarm comes on at 100% of rated inverter output current. Control board ramps compressor speed down until alarm goes off at 85% of rated current. If control board drops compressor speed to minimum and alarm remains on, it knows inverter has tripped, and shuts system down. (Inverter trip requires reset of inverter power through contactor to shut off alarm).
2. Control board compares thermistor readings after 5 minutes of run time to readings taken at startup (contactor energization).

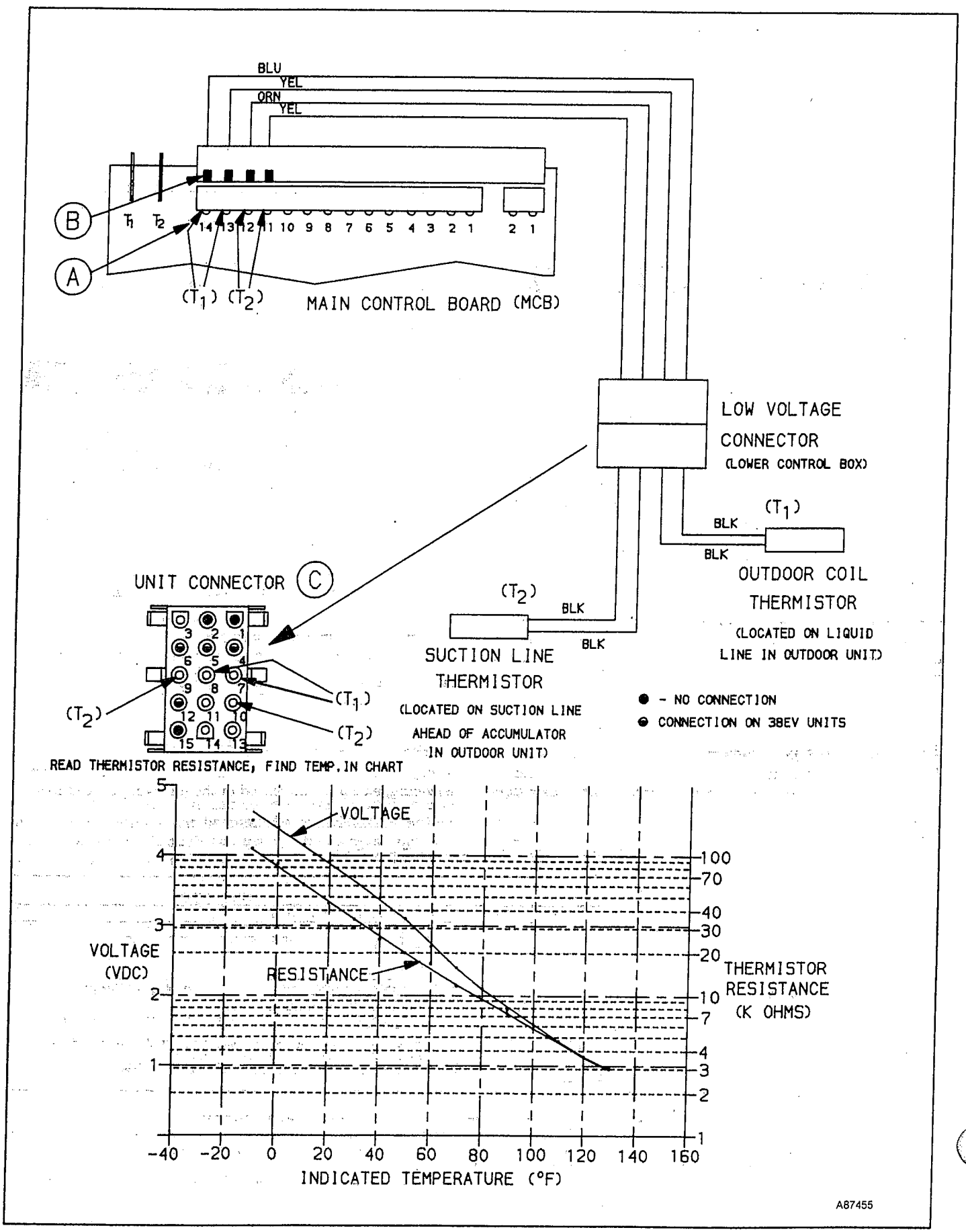
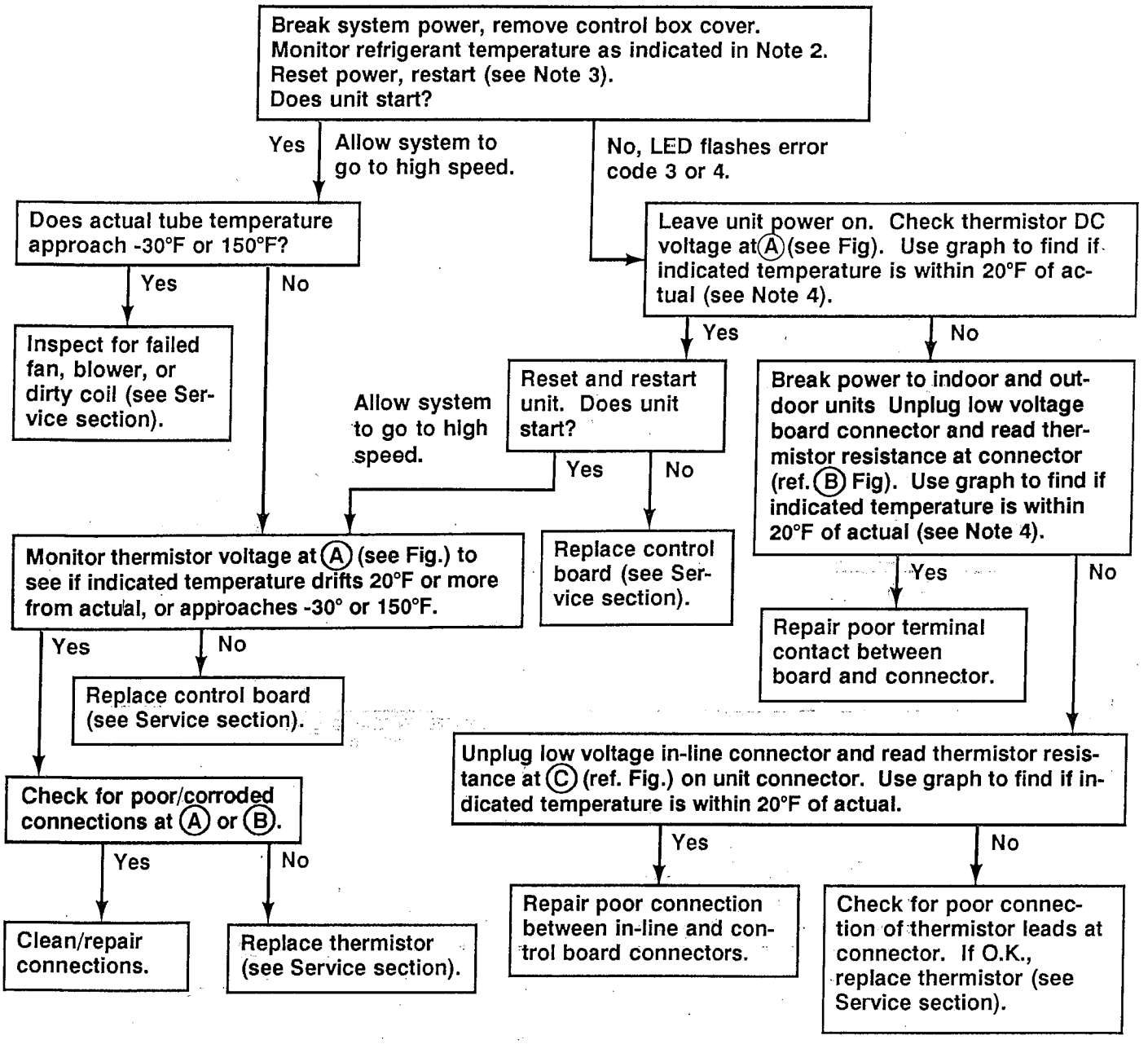


Fig. 21—Error Codes 3 and 4

ERROR CODE #3 - OUTDOOR THERMISTOR FAILURE
ERROR CODE #4 - SUCTION THERMISTOR FAILURE
REASON: CONTROL BOARD READS THERMISTOR TEMPERATURE ABOVE 160°F OR BELOW -40°F.
POSSIBLE CAUSES: 1) Thermistor failed or out of calibration (see Note 1).
2) Loose or corroded connection.
3) Faulty control board.

Reference Figure 21



Notes:
1) If thermistor is out of calibration, it may read accurately when system is off, but may drift from actual temperatures during operation.
2) COOL MODE: Monitor temperature at unit service valves.
HEAT MODE: Monitor temperature inside unit at thermistor location.
3) Adjust thermostat 4°F or more above or below room temperature, depending on mode, to force system to high speed.
4) If unit has been off a short time, allow refrig. temperatures to stabilize.

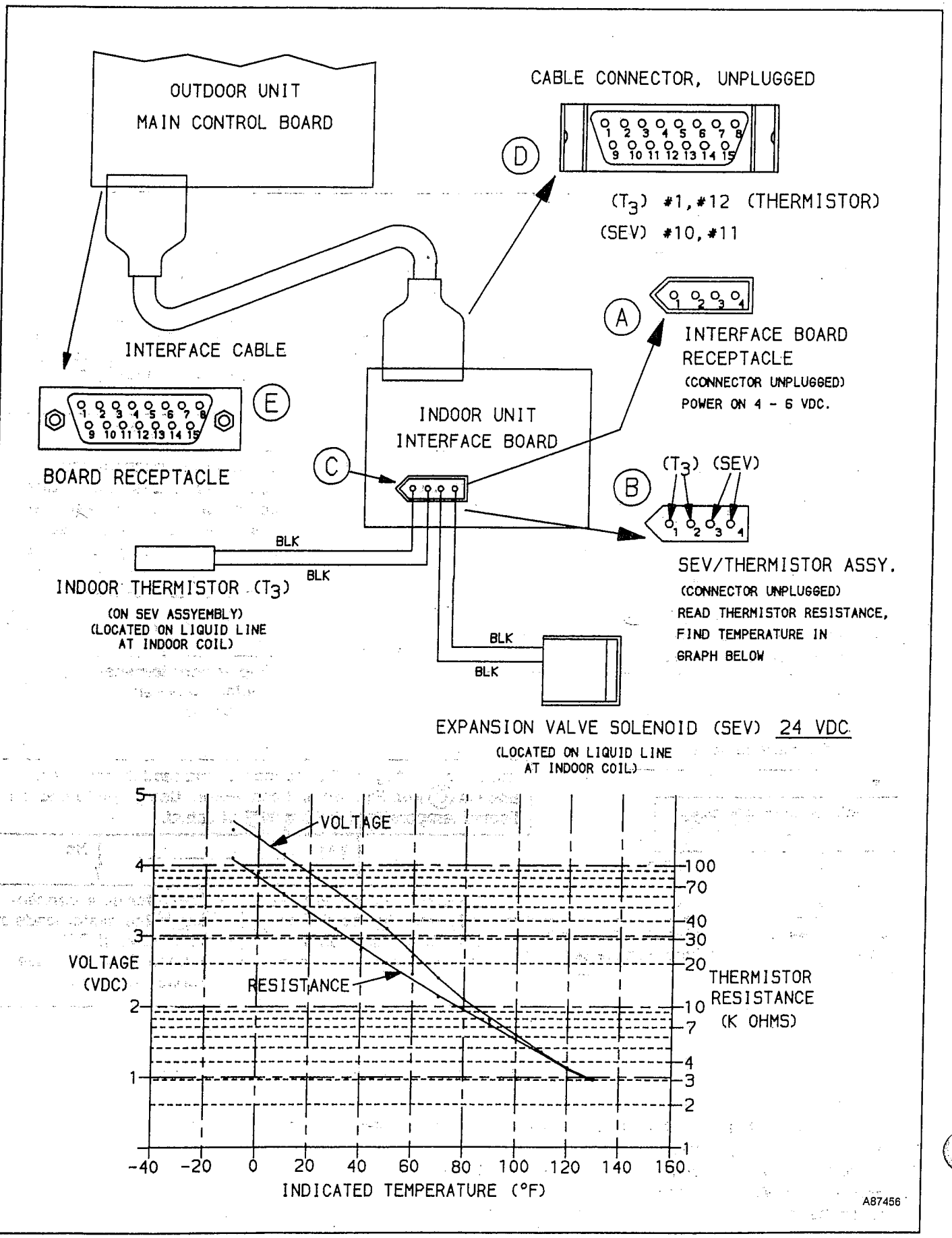
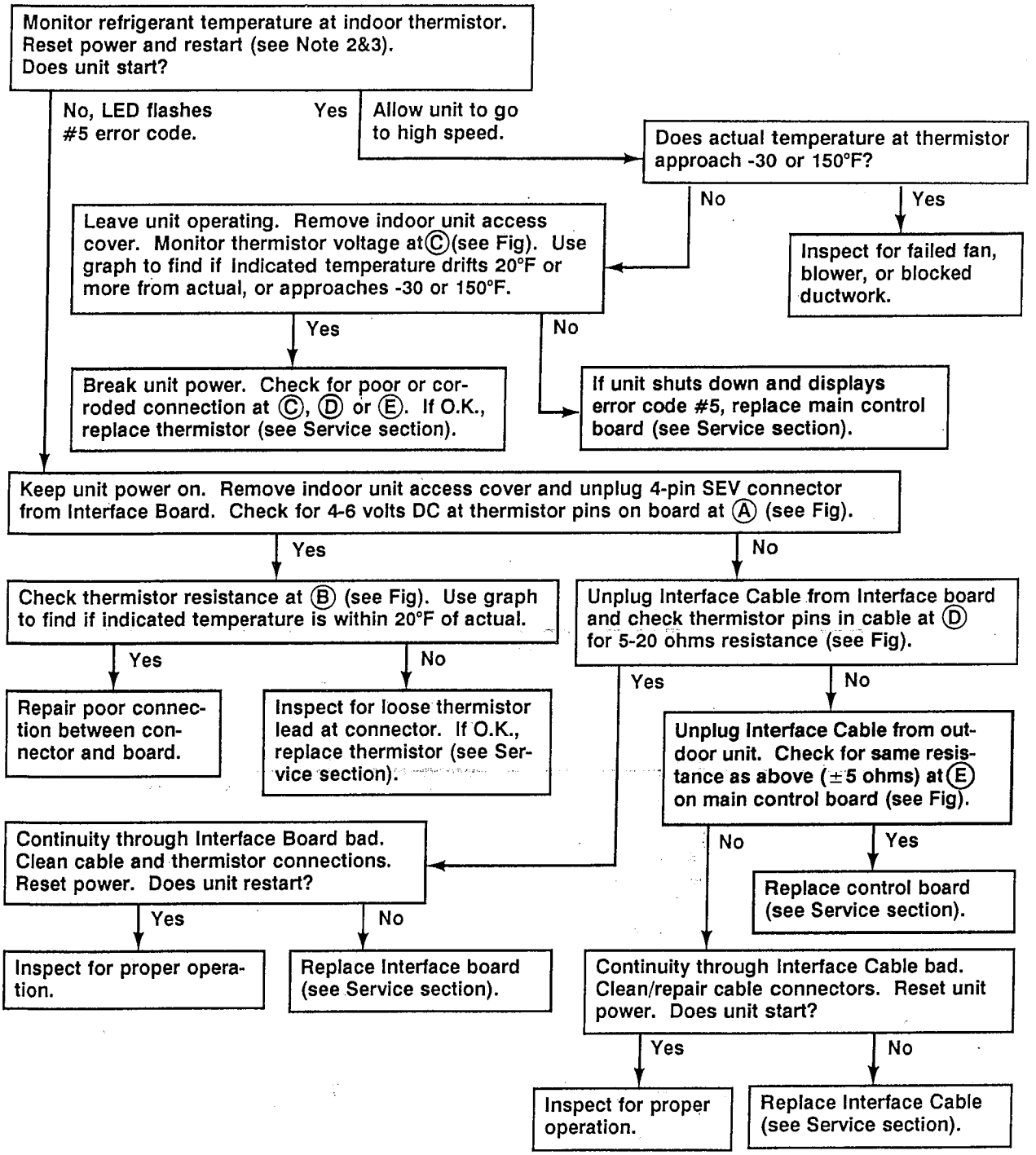


Fig. 22—Error Code 5

ERROR CODE #5 - INDOOR THERMISTOR FAILURE
REASON: CONTROL BOARD READS TEMPERATURE ABOVE 150°F OR BELOW -30°F.
POSSIBLE CAUSES: 1) Thermistor failed or out of calibration (see Note 1).
2) Loose or corroded connection.
3) Faulty control board, Interface board or cable.

Reference Figure 22



Notes:

1) If thermistor is out of calibration, it may read accurately with system off, but may drift from actual temperatures during operation.
2) For furnace applications - Remove furnace access panel and tape kill switch so that panel can later be removed for blower inspection without breaking power.
   Reinstall access panel.
3) Adjust thermostat 4°F or more above or below room temperature, depending on mode, to force system to full speed.

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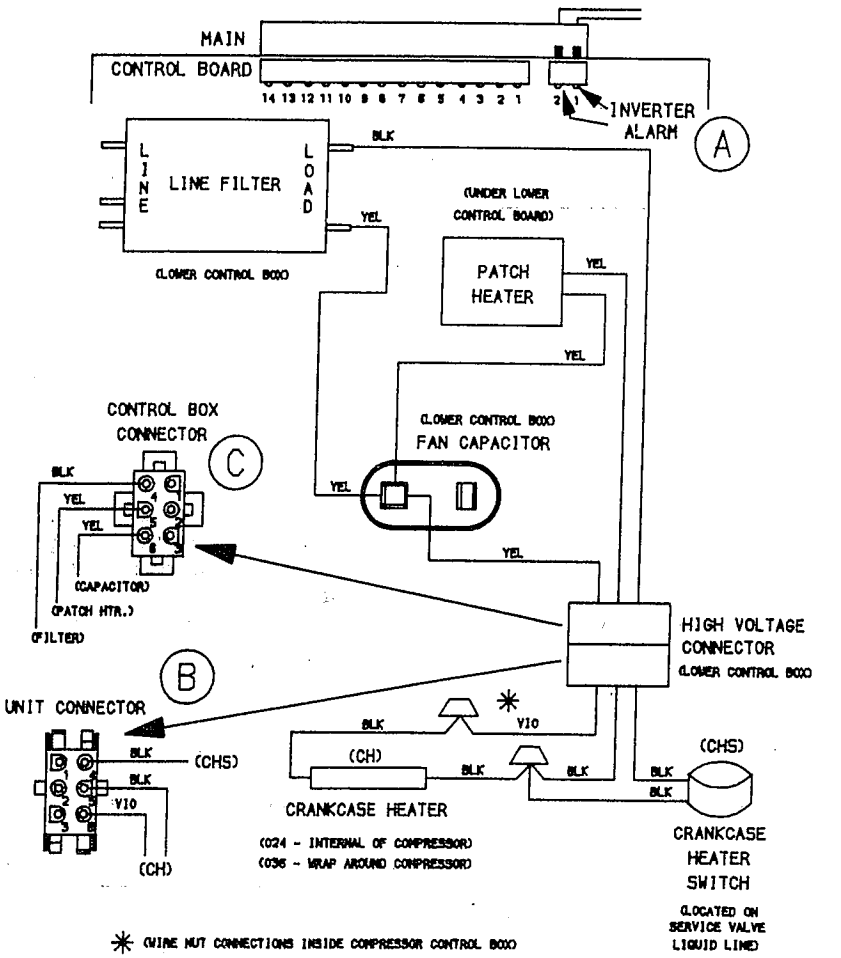
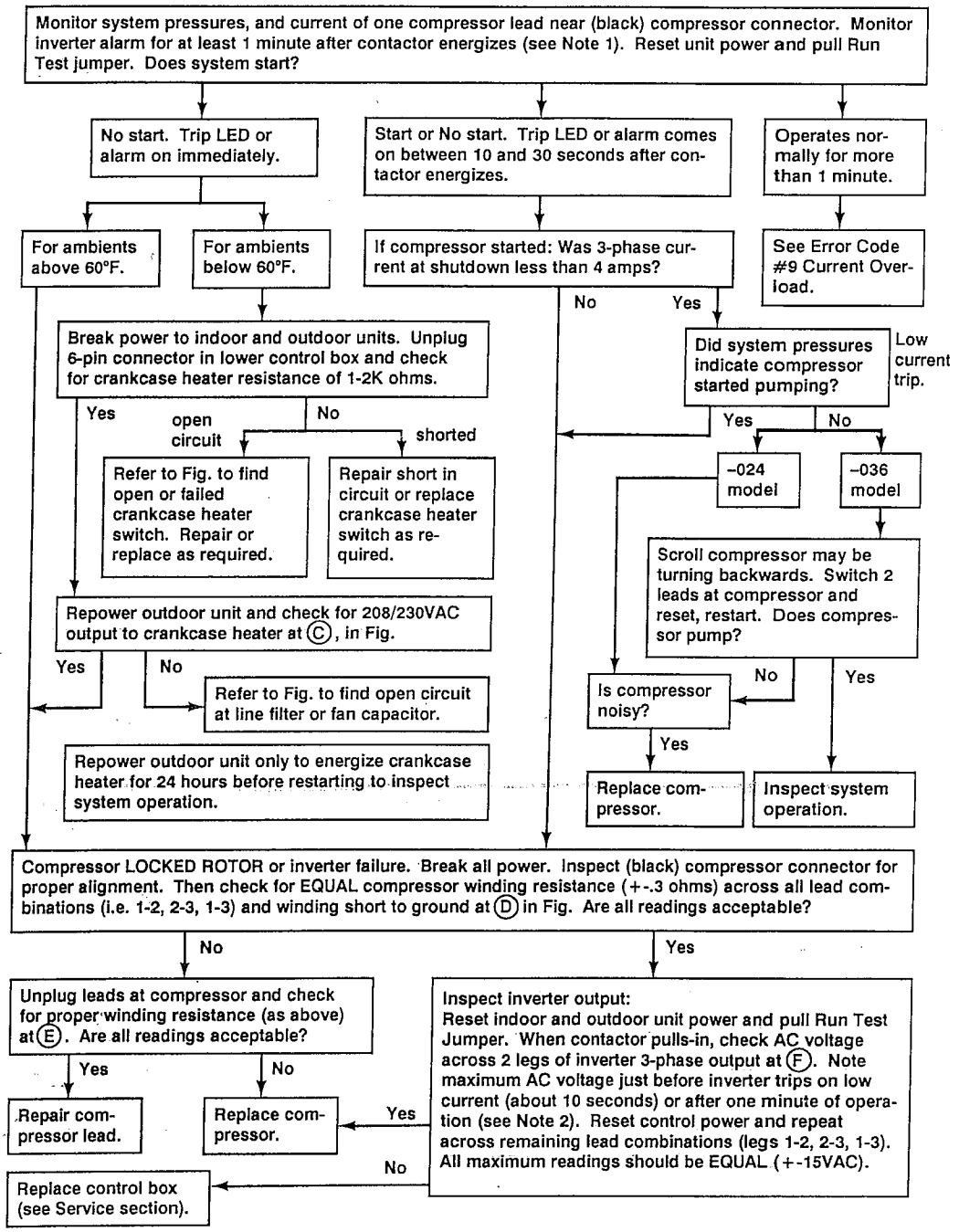


Fig. 23—Error Code 8

ERROR CODE #8 – LOCKED COMPRESSOR ROTOR Reference Figure 23

REASON: OVERCURRENT OR UNDERCURRENT SITUATION OCCURS DURING FIRST 2 MINUTES OF COMPRESSOR OPERATION.

POSSIBLE CAUSES: 1. Loose high voltage lead
2. –036 Models: scroll compressor running backwards
3. Failed compressor
4. Failed inverter



Notes:

1) Inverter alarm may be monitored using DC voltmeter at Ⓐ, in Figure. Alarm-on is 1VDC. Alarm may energize before inverter trips.
   Inverter trip LED (yellow) may be viewed by removing safety sheild from upper control box. View downward into box, beyond contactor and under main control board at inverter board. See Figure 7 for LED location.
   Power (red) LED should light whenever contactor closes.
   Power and Trip LED's will go off when contactor de-energizes.
2) When contactor energizes, inverter output voltage will increase gradually for about 30 seconds before leveling off. Inverter may trip on low current at about 10 seconds.

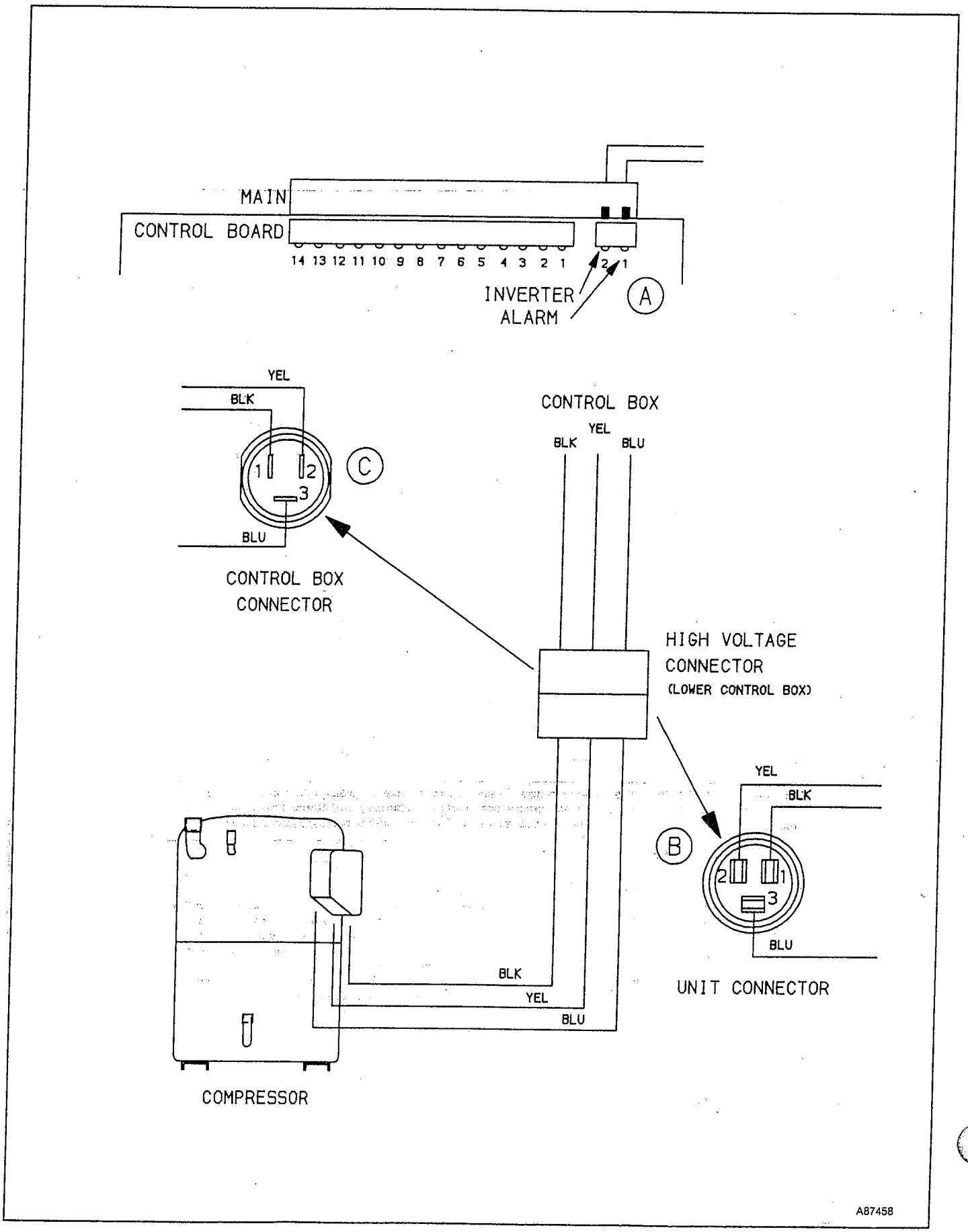
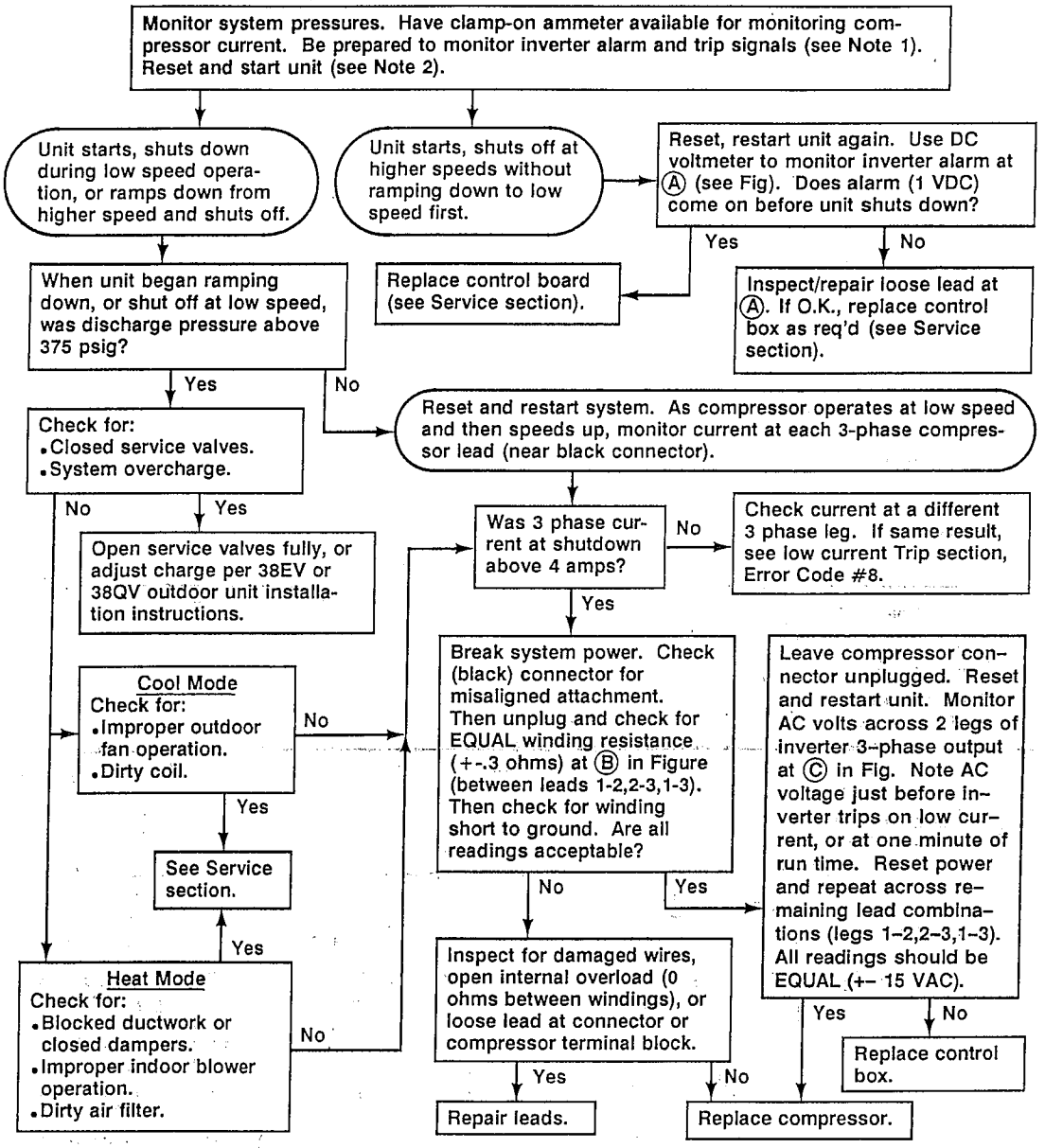


Fig. 24—Error Code 9

ERROR CODE #9 - OVERCURRENT TRIP
REASON: OVERCURRENT SITUATION AFTER FIRST 2 MINUTES OF RUN TIME.
POSSIBLE CAUSES: 1) Defective compressor or inverter.
2) Failed control board.
3) loose or corroded high voltage or inverter alarm connection.
4) Excessive loading due to:
Cool Mode - improper fan operation, dirty outdoor coil, overcharge.
Heat Mode - improper blower operation, dirty air filter, blocked duct, overcharge.

Reference Figure 24



Notes:

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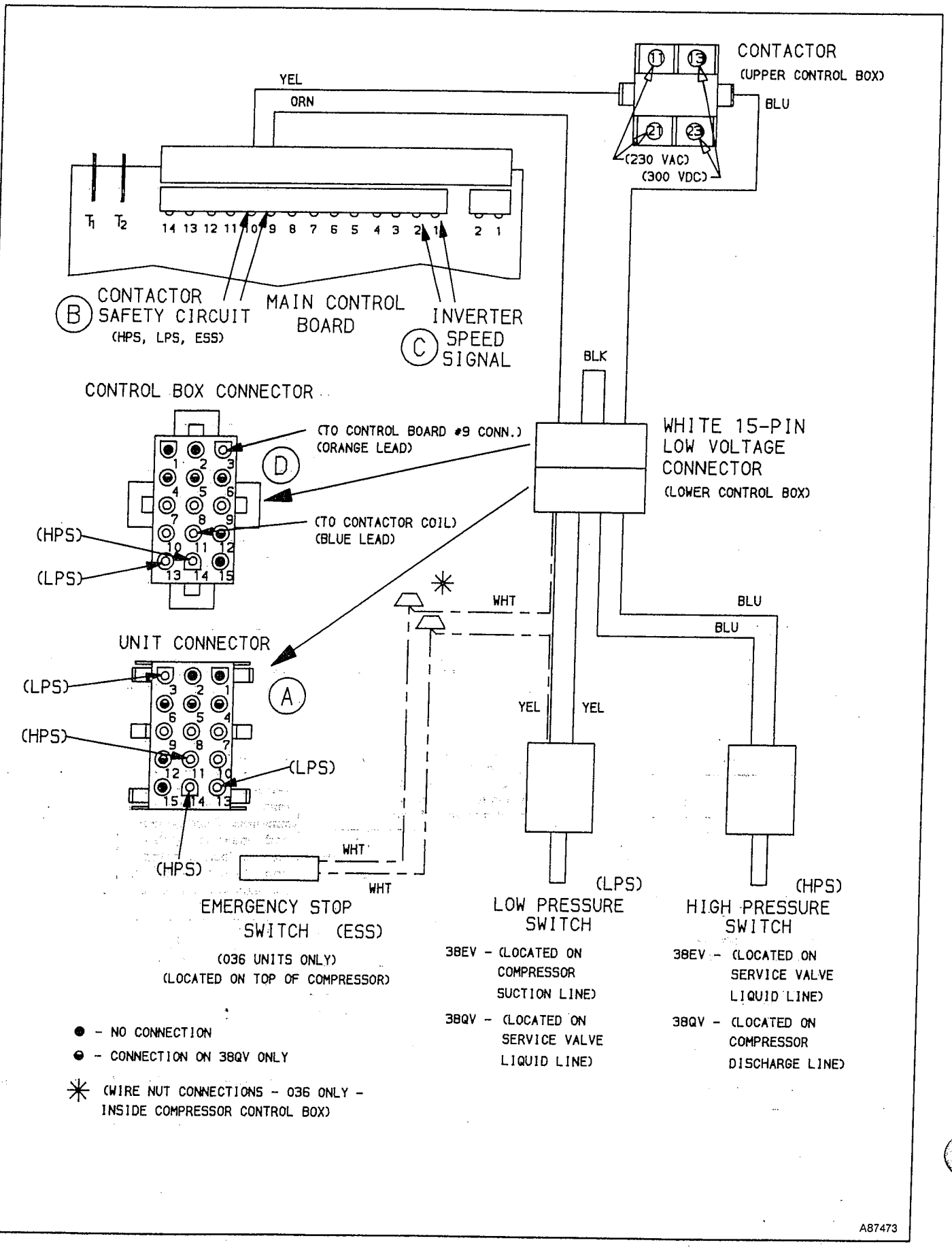
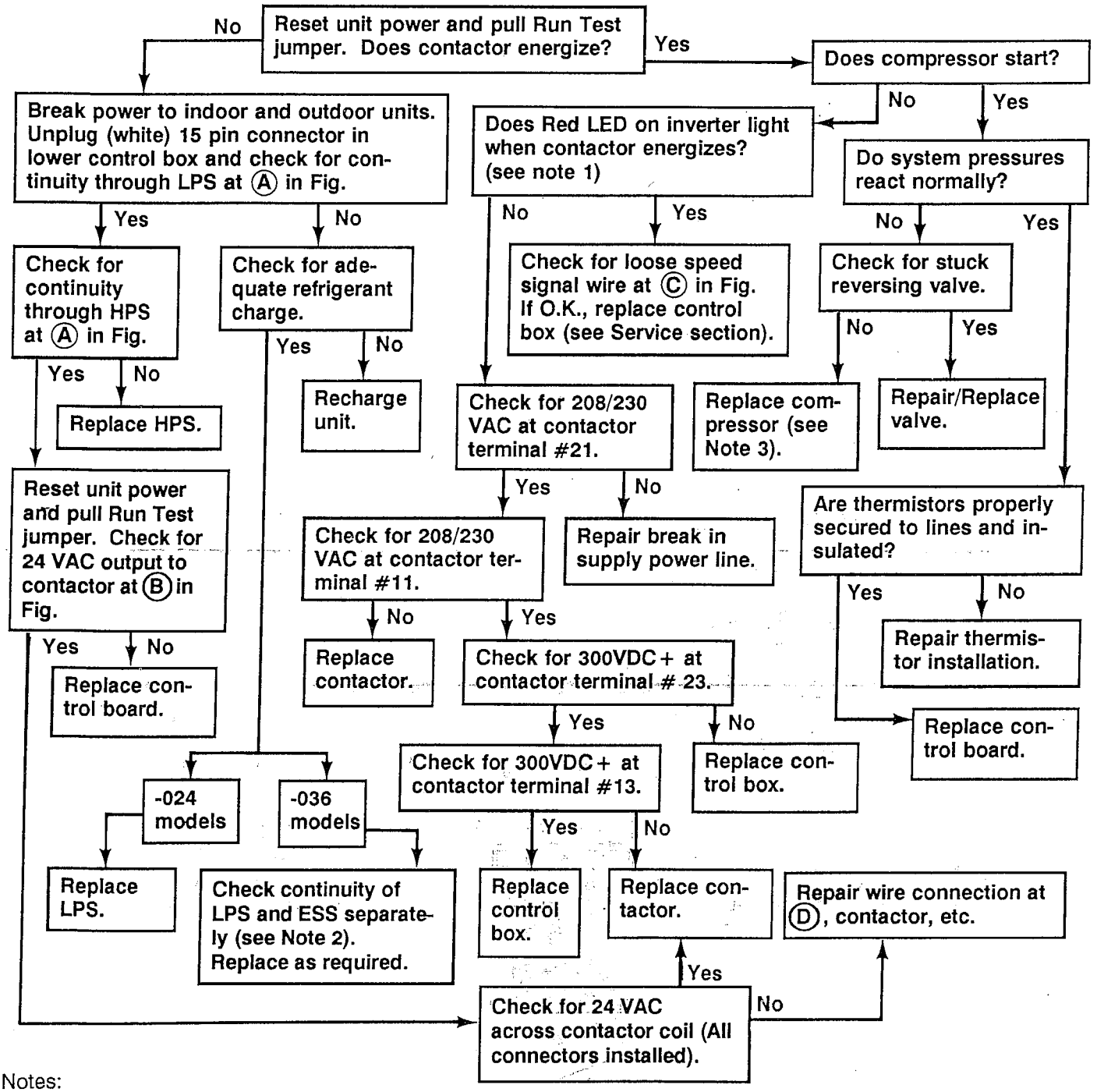


Fig. 25—Error Code 10

ERROR CODE #10 - CONTACTOR CONTROL FAILURE
REASON: THERMISTOR TEMPERATURES DID NOT CHANGE AFTER 5 MINUTES OF RUN TIME,
(i.e. REFRIGERANT NOT CIRCULATING IN SYSTEM) see Note 4.
POSSIBLE CAUSES: 1) Failed contactor, or control board output.
2) High, low pressure, or ESS (-036 only) switch.
3) Very low charge.
4) Stuck reversing valve.

Reference Figure 25



Notes:

1) Inverter POWER (red) LED can be viewed from above the control box. CAREFULLY remove white safety shield. Look downward into box beyond contactor and behind main control board at inverter board. See Figure 7 for LED location. Red LED should be on whenever contactor is energized, and outdoor unit power is on.
2) ESS - to - LPS splice is located in compressor terminal box.
3) -036 Models Only
If compressor has been serviced or replaced, check for proper 3-phase wiring connections. If leads are miswired, compressor will not pump in reverse direction.
4) Error code may not appear until up to 5 minutes after start up (outdoor fan energizes).

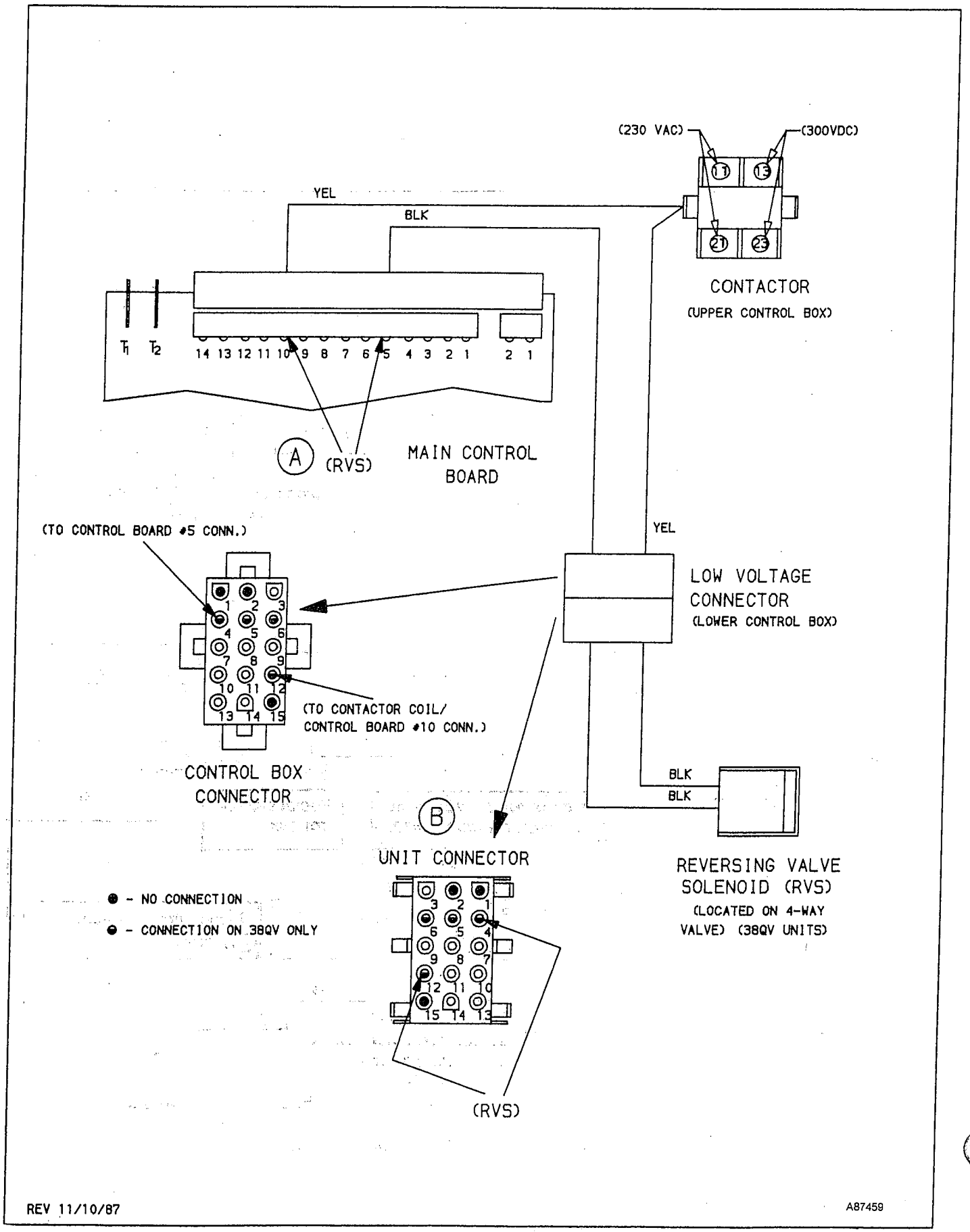
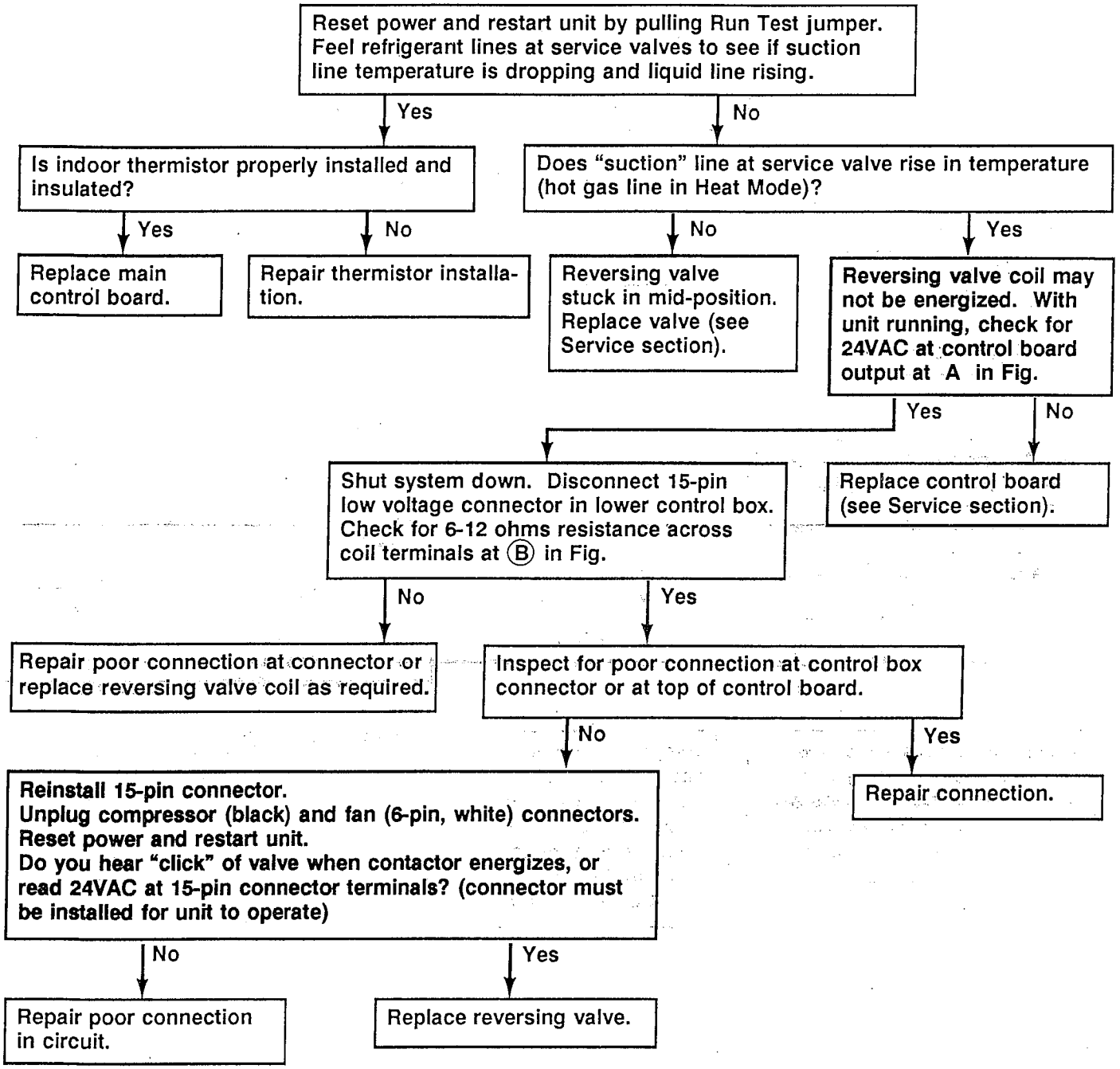


Fig. 26—Error Code 11

ERROR CODE #11 - REVERSING VALVE FAILURE (38QV HEAT PUMPS ONLY)

REASON: INDOOR THERMISTOR DOES NOT DROP IN TEMPERATURE AFTER SYSTEM STARTUP (COOL MODE ONLY) see Note 1.

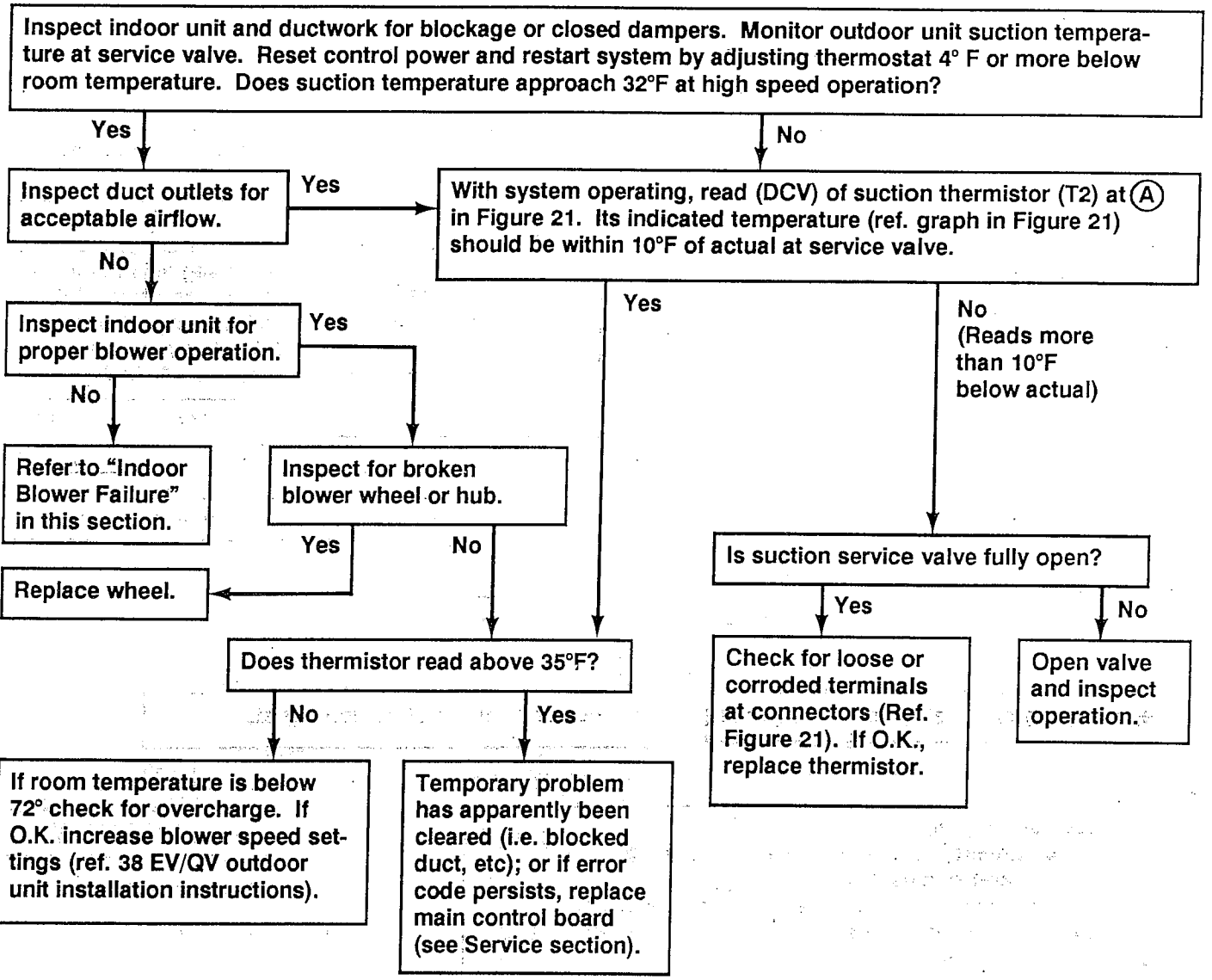
POSSIBLE CAUSES:
1) Reversing valve stuck.
2) Reversing valve coil not energizing.
3) Indoor thermistor not installed properly.



Notes:

1) Error code may not appear until up to 5 minutes after startup.

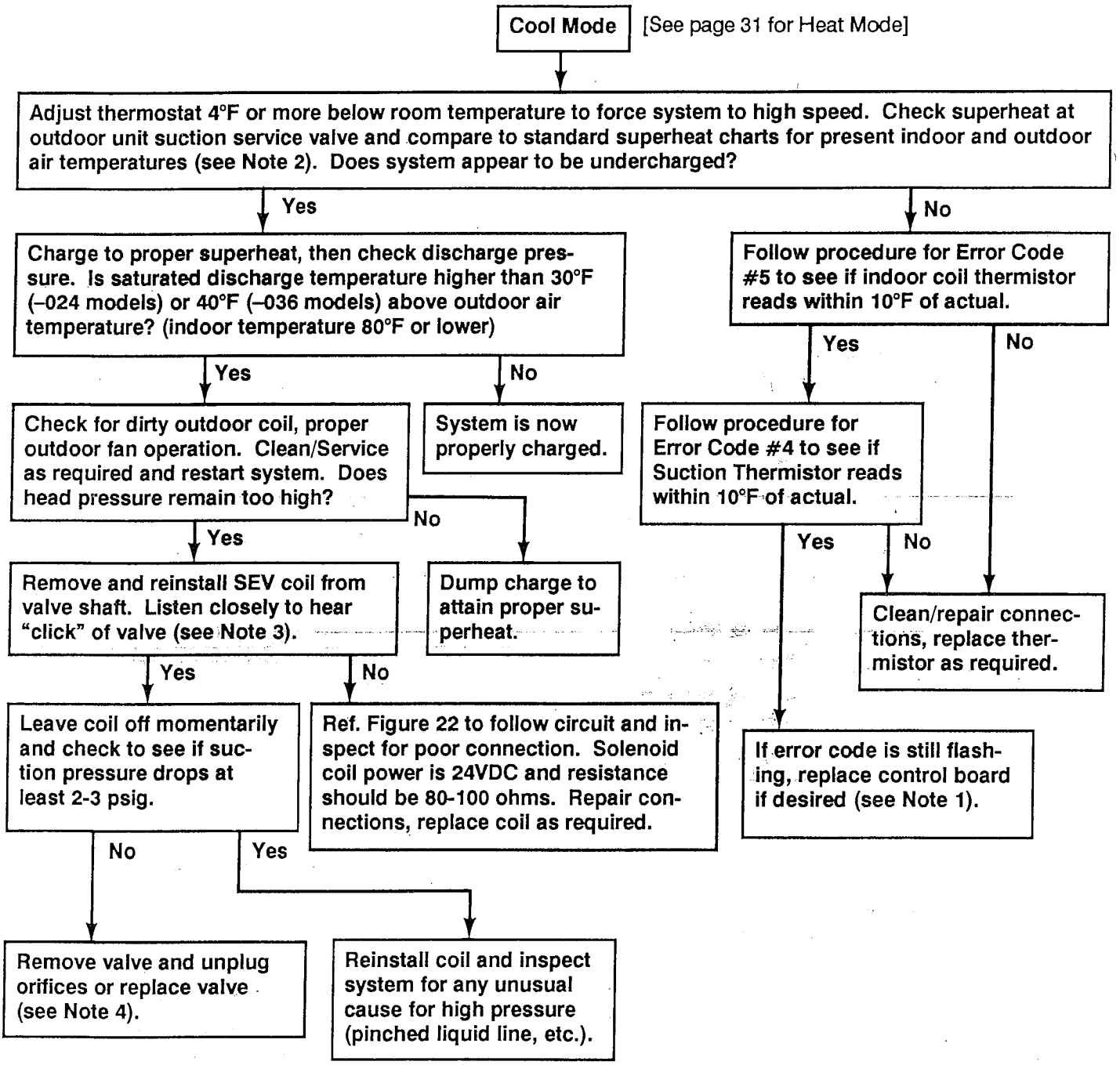
ERROR CODE # 14 - INDOOR COIL FREEZE
REASON: SUCTION THERMISTOR READS BELOW 32° F.
POSSIBLE CAUSES: 1) Blocked return or supply duct.
2) Dirty air filter.
3) Suction thermistor out of calibration (see Note 1).



Notes:
1) If thermistor is out of calibration it may read accurately with system off, but may drift from actual during operation.

A87472

ERROR CODE #15 - LOW REFRIGERANT CHARGE (see Note 1).
REASON: LARGE REFRIGERANT TEMPERATURE RISE THROUGH INDOOR COIL (COOL MODE),OR OUTDOOR COIL (HEAT MODE).
POSSIBLE CAUSES: 1) Low refrigerant charge.
2) Plugged or failed solenoid expansion valve (SEV).



Notes:
1) Error code will not affect system operation, and will only be displayed at control board LED.
2) Superheat Tables provided in outdoor unit installation instructions.
3) In outdoor ambients below 75–80°F in Cool, above 45°F in Heat, system will not go to full speed, and SEV should be cycling on-off.
4) Refer to Figures 15 and 16 to see location of valve orifices. Valve main orifice may be cleaned by blowing air, etc. into outlet of valve . If this is unsuccessful, replace valve.

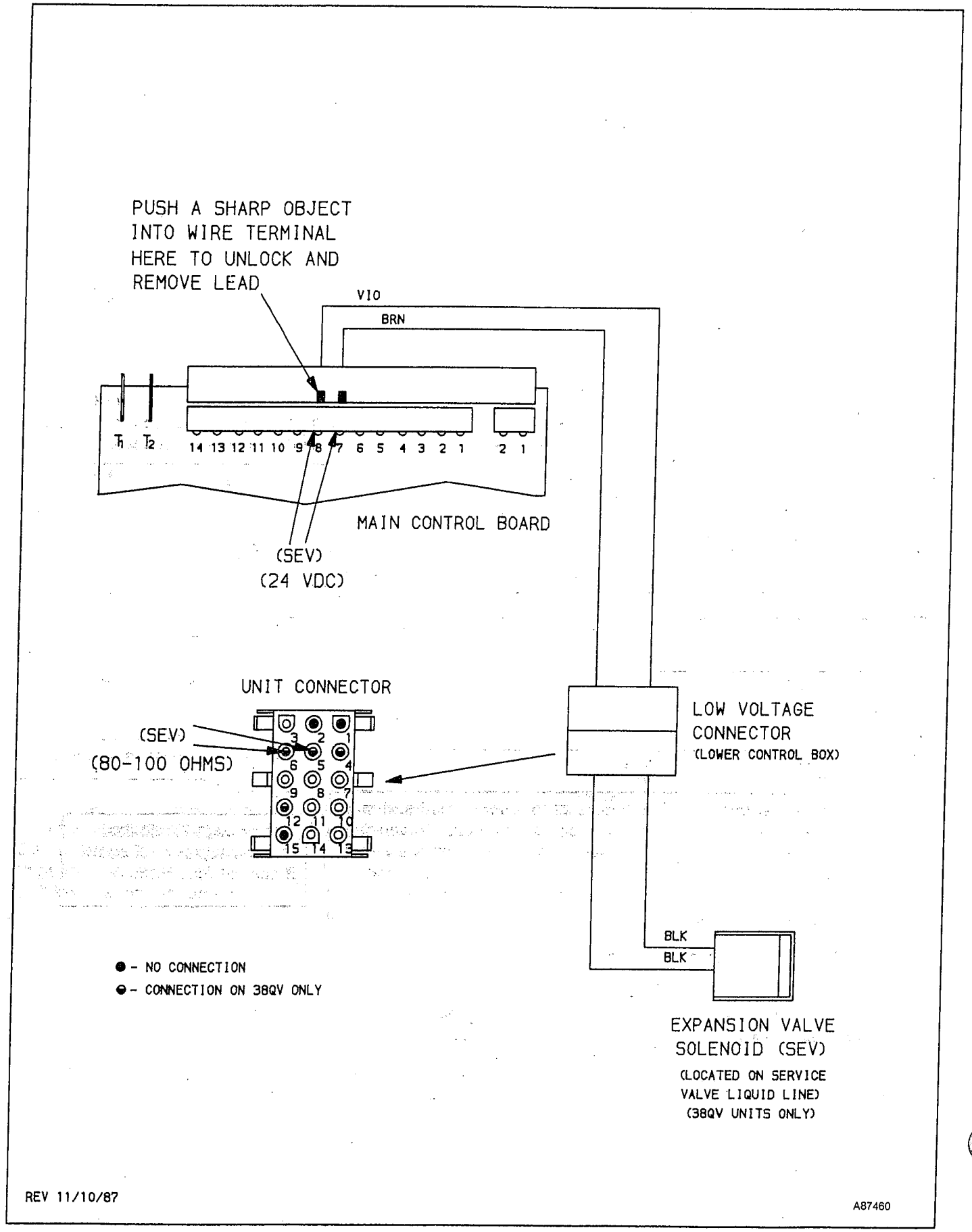
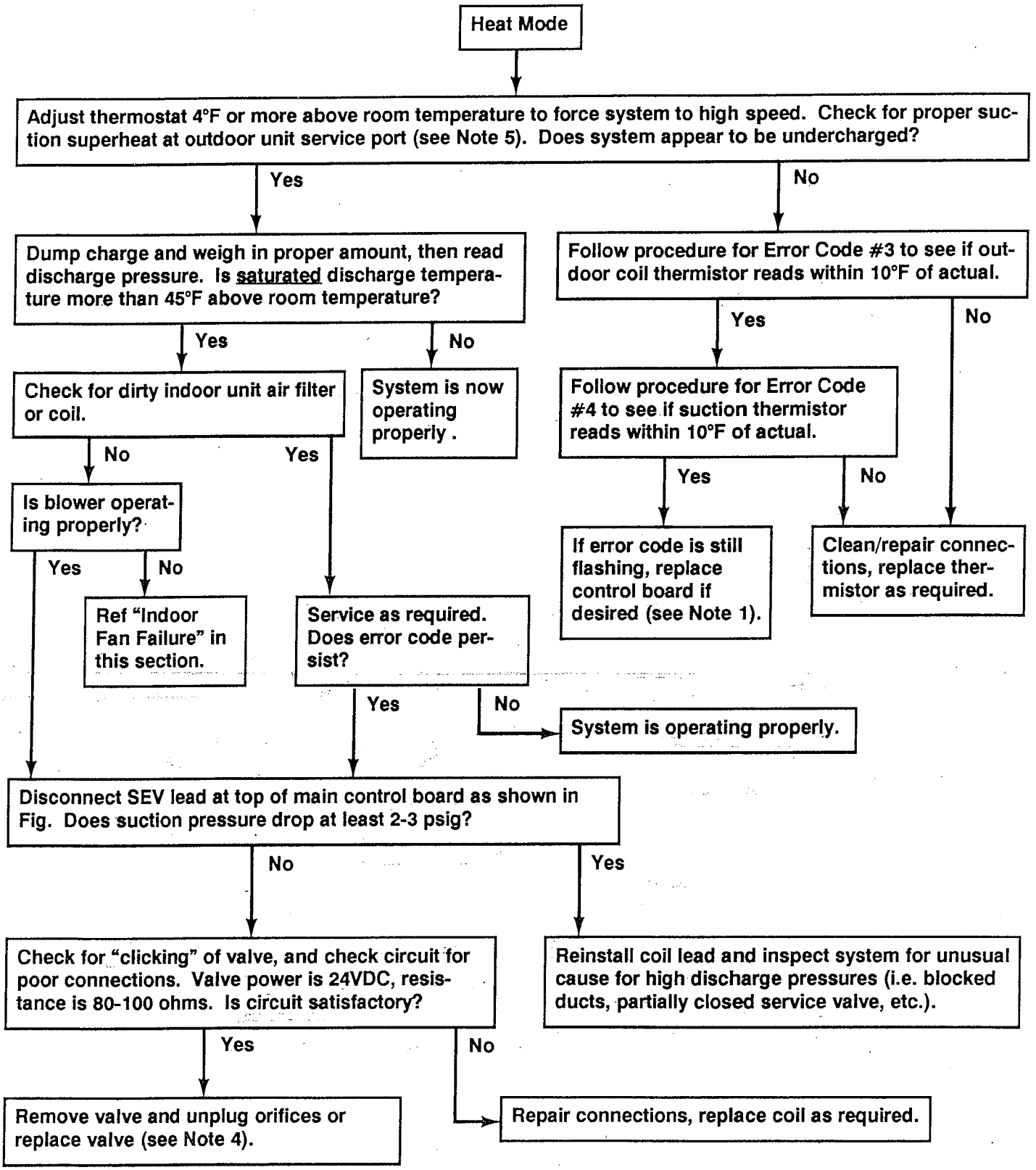


Fig. 27—Outdoor Unit Solenoid Expansion Valve (SEV)

(ERROR CODE #15 CONTINUED) 38QV UNITS ONLY
Reference Figure 27



Note:
5) Superheat should be less than 5°F, but may be up to 10°F in above 40°F outdoor temperatures.

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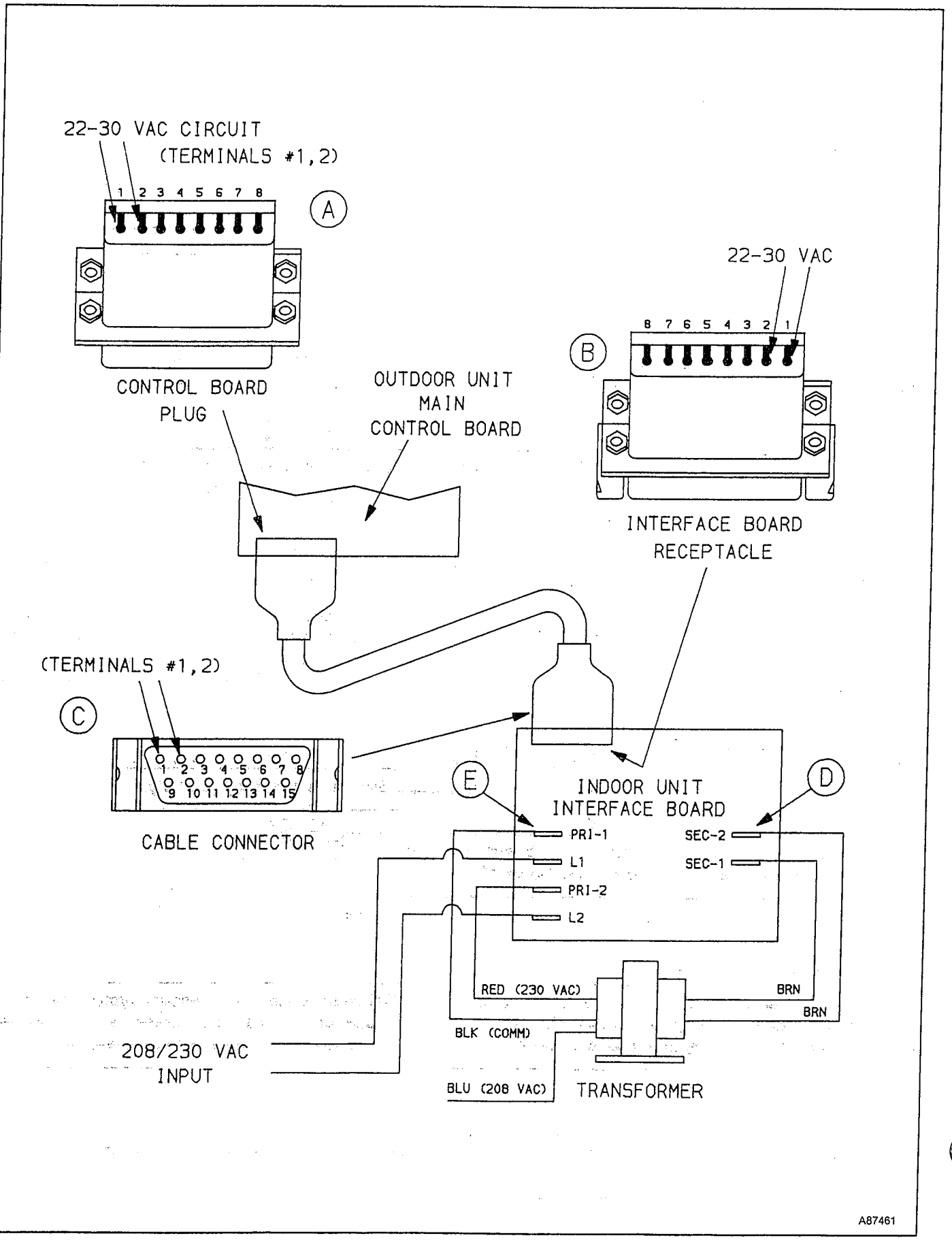
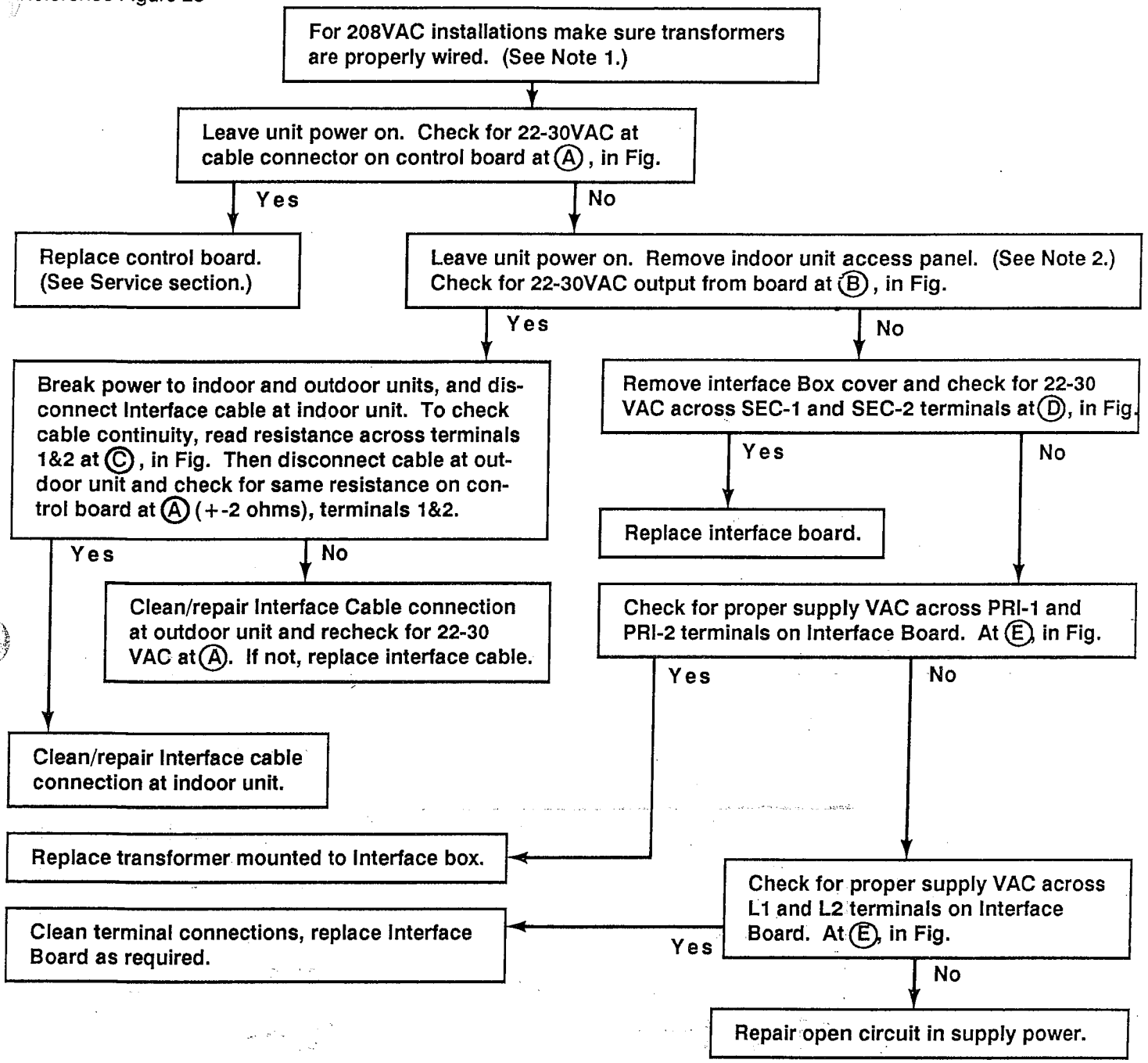


Fig. 28 – Control Board LED Does Not Light

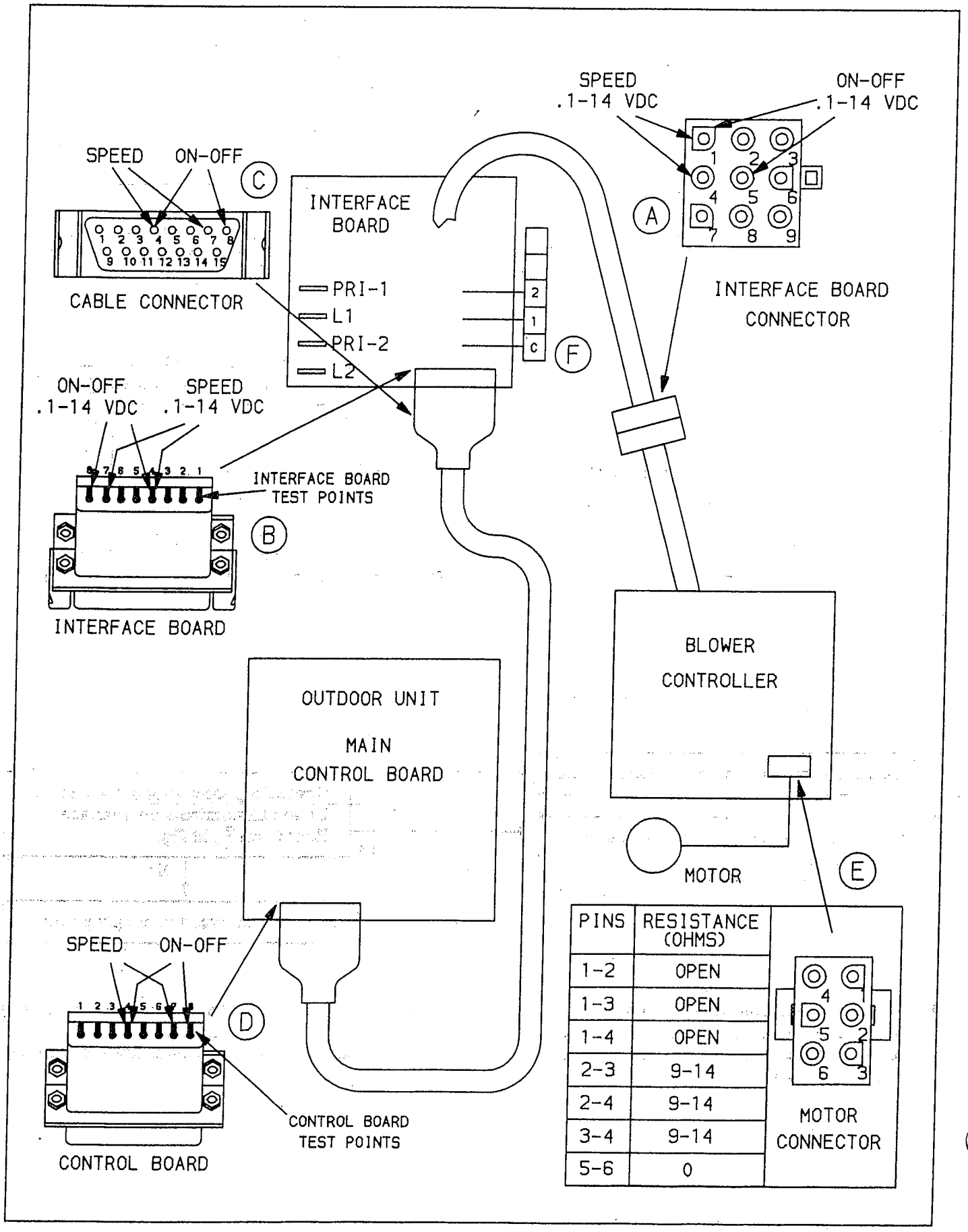
CONTROL BOARD LED DOES NOT LIGHT ON UNIT POWER-UP.
Reference Figure 28



Notes:

1) For 208VAC applications - Check (2) transformers at indoor unit to make sure red (230VAC) transformer lead connections are replaced by blue (208VAC) transformer leads.
2) For furnace applications - Remove furnace access panel and temporarily tape kill switch so control power can be supplied to outdoor unit.

A87467



PINS	RESISTANCE (OHMS)
1-2	OPEN
1-3	OPEN
1-4	OPEN
2-3	9-14
2-4	9-14
3-4	9-14
5-6	0

Fig. 29—Indoor Blower Failure

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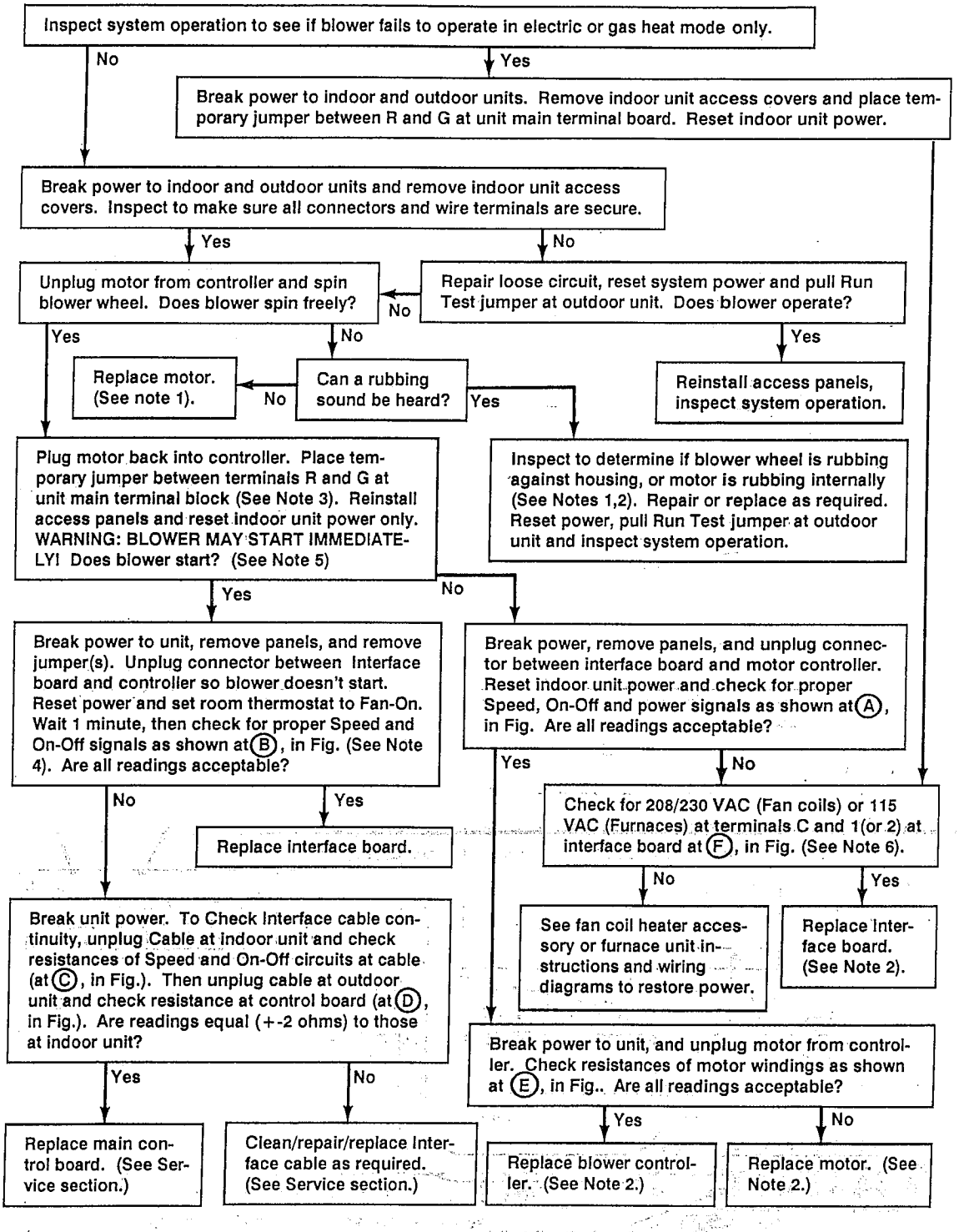
INDOOR BLOWER FAILURE
Reference Figure 29



Notes:

1) On some models, removal of blower housing is required to determine if wheel is rubbing.
2) Refer to indoor unit installation instructions for service and replacement procedures.
3) For fan coils without electric heat, place (2) jumpers at Interface board from L1 to C, and L2 to 1(or 2).
4) If Neither Speed or On-Off signals are present, wait longer and recheck, as it could take 2-3 minutes for blower to start in some cases.
5) If blower starts, break power, remove jumper and place between R and W2(or W). Reset power and check to see that electric or gas heat operate. If not, refer to "Electric/Gas Heat Failure."
6) Voltage at C and 1(or2) may also be read by removing interface box cover and reading at solder joint connections on board.

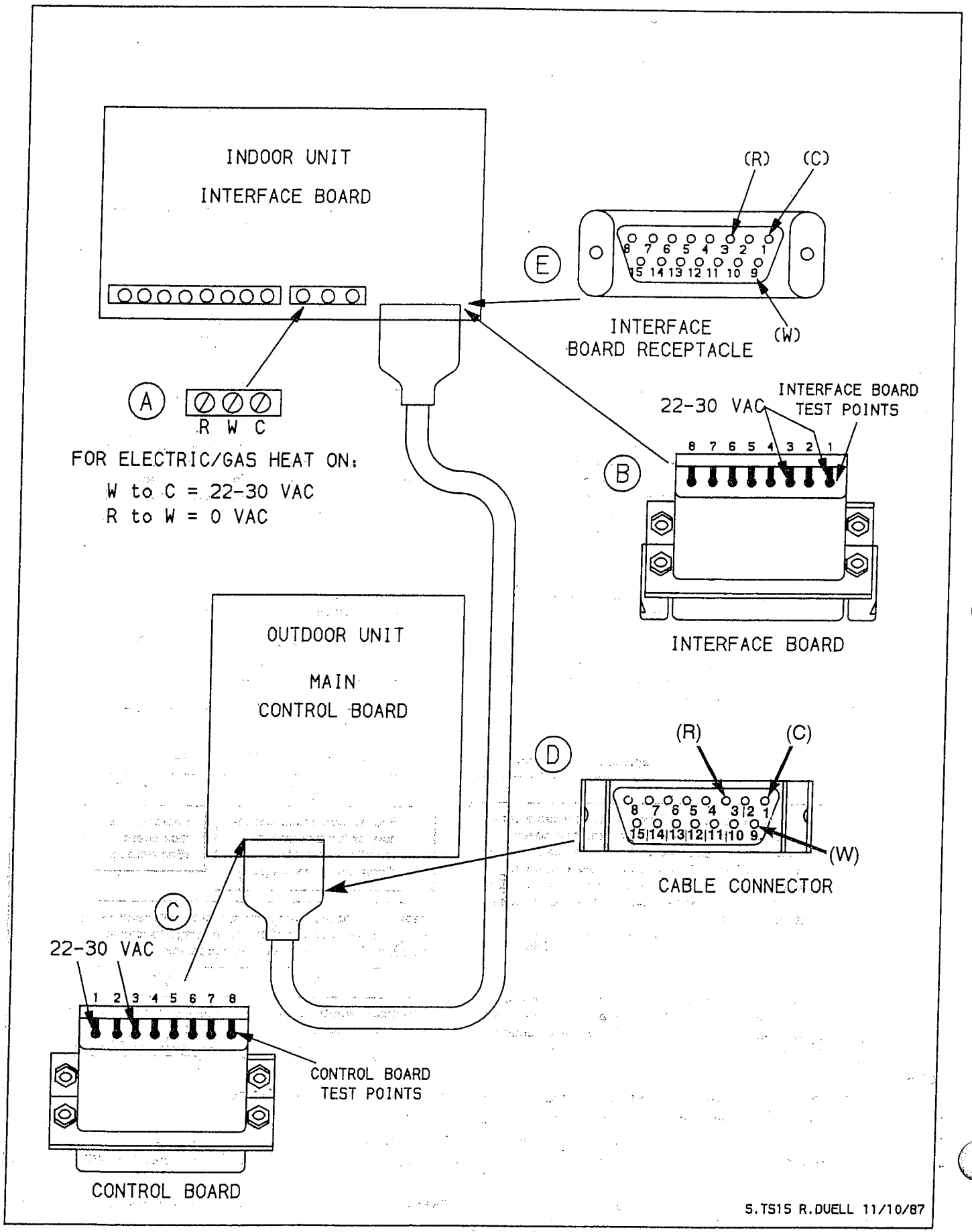
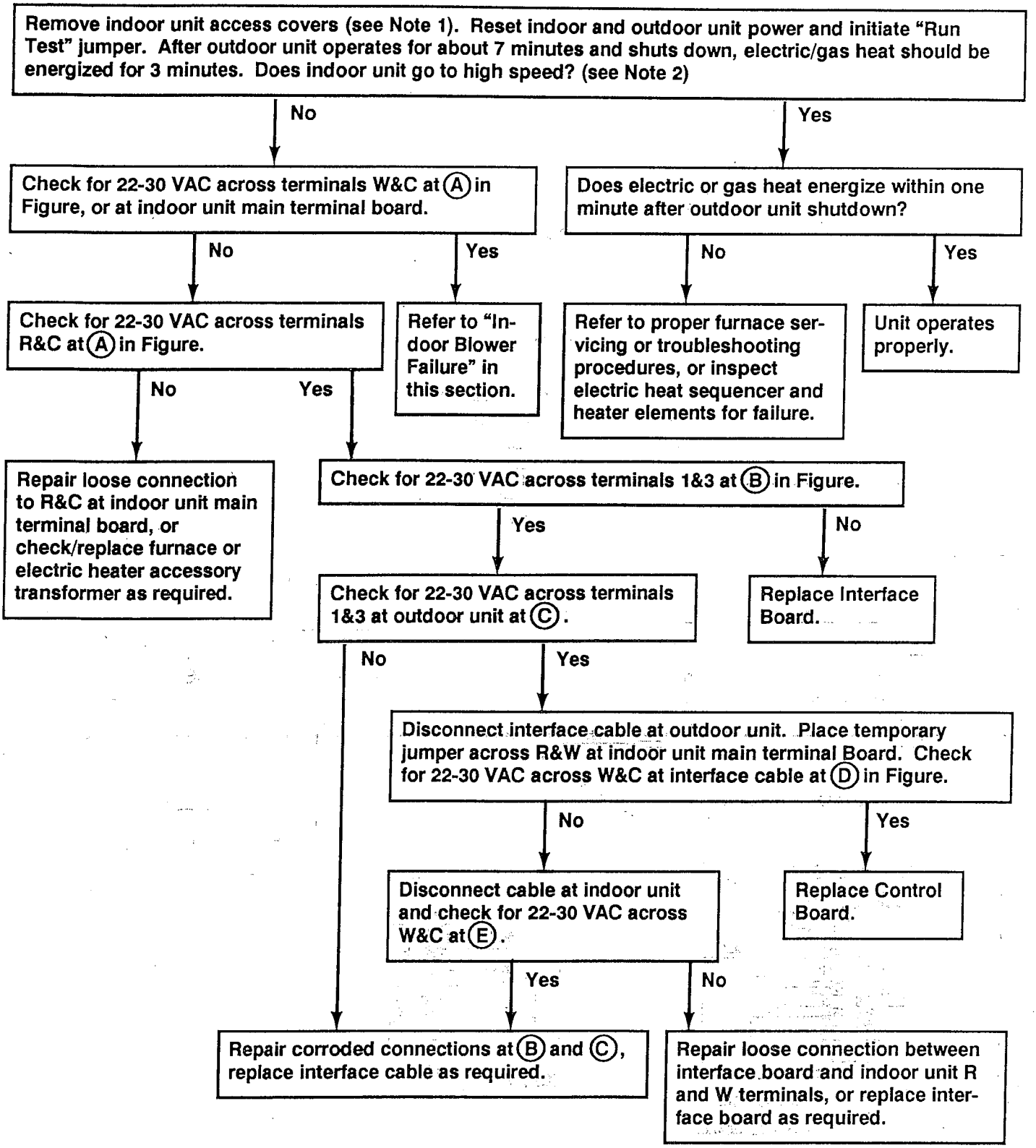


Fig. 30—Electric/Gas Heat Failure

ELECTRIC / GAS HEAT FAILURE
Reference Figure 30



Notes:

1) For furnace applications — Tape the kill switch under access cover so unit can be started and inspected during operation.
2) For furnace applications — Blower will go to high speed 2–3 minutes after burner ignites.

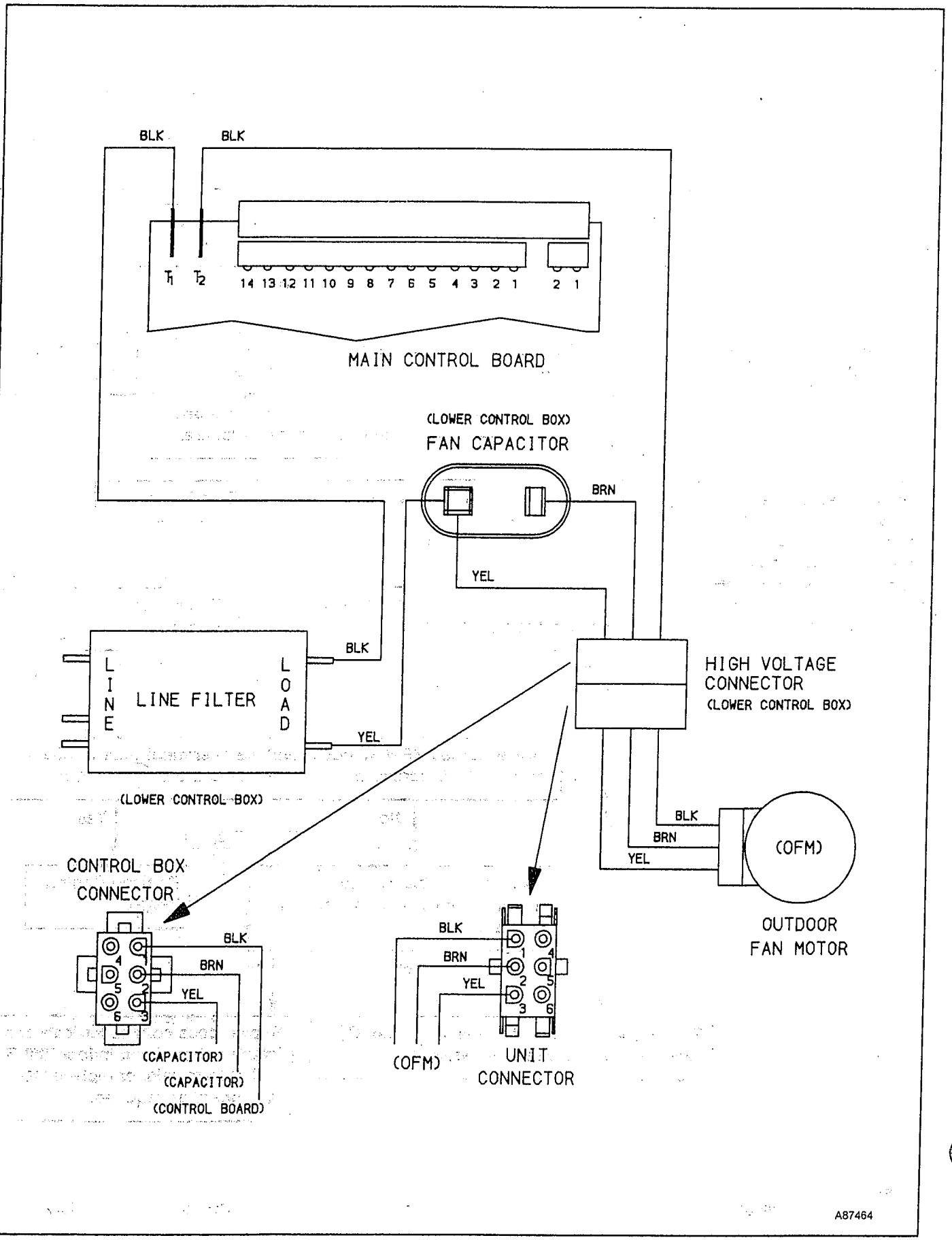


Fig. 31 - Outdoor Fan Circuit

MISCELLANEOUS MALFUNCTIONS

1) LED stays on after power up.
   Reason: Malfunction of communications between thermostat and outdoor unit main control board.
   Check For:
   A. Improper wiring of thermostat.
   B. Loose/corroded connection at:
      - thermostat
      - indoor unit interface board
      - Interface cable at indoor or outdoor unit
   C. Defective control board or thermostat (see Thermostat Section).
2) Compressor does not operate.
   - See Error Code #10.
3) Outdoor fan does not operate.
   - Fan motor is standard single phase component. Check for failed motor, capacitor, or control board using Figure 31.
4) Compressor and outdoor fan do not operate.
   - Initiate "Run Test" jumper. If either component operates, follow checkout procedure for the failed component in this section. If neither operates replace control board. If both operate, and control board LED goes off, unit is not receiving capacity demand from thermostat. Make sure proper Heat or Cool switch is in "Auto" at thermostat, and setpoint is at least 2°F away from setpoint. Pull "Speed-Up" jumper to bypass 5 minute timeguard. If unit does not start within 5 minutes, Follow same procedure for #1 above, "LED stays on after power up."
5) Compressor cycles on-off, outdoor fan stays on.
   - Compressor is cycling on safety device. See Error code #10 and Figure #25 to investigate excessively high or low pressures. Check for proper charge, failed fan, blower or failed/plugged solenoid expansion valve.
6) Thermostat display malfunction.
   - See thermostat troubleshooting section and instructions included with thermostat.
7) Reversing valve does not operate.
   - See Error Code #11.
8) Indoor coil freezing.
   - See Error Code # 14.
9) System running abnormally low suction pressures.
   - See Error Code #15.

STEP 6—Service And Maintenance

TABLE OF CONTENTS

38EV, 38QV Outdoor Unit Service and Maintenance

NOTE: Malfunction of certain electronic control components can cause lack of Automatic Emergency Heat initiation. See below for corrective servicing procedures.

Component replacement and maintenance procedures are covered in this text. Refer to 38EV or 38QV Installation Instruction for the following procedures:

—System Startup Checkout
—System Charging
—Optimizer, Electric Heat Lockout Setup
—Blower Speed Checkout, Adjustment

Manual Emergency Heat Activation—

38EV and 38QV systems are designed to automatically provide emergency gas or electric heat in the event of compressor lockout on a system malfunction.

However, certain system control malfunctions may cause lack of emergency heat initiation.

In the event that replacement parts are not readily available in the heating season, malfunction of the main control board or interface cable can be manually bypassed as described below to restore gas or electric heat operation.

Note, however, that a malfunction of the interface board causing inability to control blower speed, or failure of blower motor or controller cannot be bypassed and must be repaired.

Install a standard thermostat in the heated space for temporary control until the system can be repaired. Connect thermostat leads to the indoor unit terminal board across R and W, as connected in conventional systems. The interface board will control gas or electric heat to setpoint of the temporary thermostat.

COMPONENT REPLACEMENT

Before replacing any component in the entire system, turn off main power to system. There may be more than one disconnect switch. Turn off accessory heater power, if applicable.

⚠ WARNING

High voltage circuit remains energized after main disconnect is opened. Normal capacitive discharge time is ten (10) minutes, but this period may be extended indefinitely by component failure. Before servicing, always check with D.C. Voltmeter between contactor terminal #23 (violet wire) and ground. Do not service until reading is 10VDC or less. Electrical shock can cause personal injury or death. Always re-install safety shield in top of control box after servicing.

⚠ CAUTION

Aluminum tubing is used in unit coils. Do not overheat or place excessive strain on tubing or damage may result.

NOTE: To remove reversing valve, accumulator or compressor, control box and coil must be removed first. Coil removes quickly and easily. The minimal time required for coil removal facilitates service and component removal. See instructions below.

SERVICE VALVE REMOVAL—Coil must be removed to remove screws holding service valves.

COIL REMOVAL

1. Shut off power to indoor and outdoor units.
2. Remove refrigerant from unit, using refrigerant removal methods described in Carrier Standard Service Techniques Manual, Chapter 1, Refrigerants. Be sure system is 0 psig before proceeding.
3. Follow steps 4 through 12 below.

CONTROL BOX REMOVAL

Make sure power is off to indoor and outdoor units.

4. Remove control box cover (3 screws).
5. Disconnect (3) in-line electrical connectors in lower control box.
6. Disconnect power leads and interface cable if control box cannot be removed and set aside with them attached.
7. Remove (8) screws securing control box to louvered casing and (2) securing support legs to base pan.

⚠ WARNING

High voltage circuit remains energized after main disconnect is opened. Normal capacitive discharge time is ten (10) minutes, but this period may be extended indefinitely by component failure. Before servicing, always check with D.C. Voltmeter between contactor terminal #23 (violet wire) and ground. Do not service until reading is 10VDC or less. Always re-install safety shield in top of control box after servicing.

8. Supporting control box with one hand, remove safety shield and (2) top screws securing box to fan orifice ring. Remove control box by sliding horizontally away from unit.

NOTE: Before reinstalling box, gray plastic through-the-coil vent tube must be removed from control box. Do this by squeezing top and bottom of vent where it protrudes from rear of box. Then slide vent out through front of box, taking care not to damage wires.

Once the box is fully reinstalled, slide vent into slot in rear of box and through existing opening in coil. Make sure front lip of vent is against rear panel of box.

OUTDOOR FAN/MOTOR REMOVAL—

Make sure power is off to indoor and outdoor units.

9. Remove fan/motor/orifice assembly by removing remaining 4 screws around orifice assembly. (If control box is not being removed, remove safety shield, and (2) screws in upper control box). See Warning, above.

Unplug motor wires from base of motor prior to lifting out assembly.

Remove Coil—

⚠ WARNING

Cutting tubing is recommended to avoid possibility of fire, and personal injury.

10. Use midget tubing cutter to cut liquid and vapor lines at either side of coil. Cut in convenient location for easy reassembly with copper slip couplings.
11. Remove 4 screws around base pan securing louvered casing and wire coil wrap. Set louvered casing aside.
12. Lift coil vertically off base pan and place carefully to one side.

NOTE: While coil is removed from unit for intended service, use this opportunity to remove and replace strainer.

COMPRESSOR REPLACEMENT

⚠ CAUTION

Check whether unit is fastened to platform with tiedown bolts.

1. Remove control box, fan and coil as described under "Coil Removal" above.
2. Disconnect electrical leads from compressor. *Compressor is 3-phase—Note lead locations for proper wiring of replacement compressor.*

	Marking	*Wire Color*
-024 Models:	T1	Black
	T2	Yellow
	T3	Blue
-036 Models:	U	Black
	V	Yellow
	W	Blue

3. Cut compressor suction and discharge tubes at convenient location.
4. Loosen and remove crankcase heater (-036 models only).
5. Remove compressor mounting bolts.
6. Lift compressor out.
7. Carefully unbraze suction and discharge line piping stubs from compressor. Note position of stubs to assist when reinstalling.
8. Install new compressor. Install crankcase heater around compressor (-036 models only). Install compressor mounting bolts.
9. Braze suction and discharge lines to compressor (where unbrazed in Step 7) and piping stubs (at point where cut in Step 3 above). Rewire compressor.
10. Replace coil, braze liquid and vapor line. Test for leaks.
11. Replace fan/motor/orifice assembly.
12. Replace control box and reconnect wiring. (See note above, under "Control Box Removal.")
13. Evacuate and recharge system.

INSTALL FILTER DRIER—Install field-supplied heat pump filter drier in system liquid line when refrigerant system is opened for service as described under "Compressor Replacement," above. Position drier in liquid line at convenient location.

REVERSING VALVE REPLACEMENT (38QV Only)

1. Remove coil as described in "Coil Removal," above.
2. Cut 4 legs of valve using midget tubing cutter.
3. Wrap replacement valve with wet cloth to prevent overheating.
4. Replace new valve using tubing slip couplings.

MAIN CONTROL BOARD REPLACEMENT

a) Unplug Interface Cable from bottom L.H. side of board by sliding small metal retainer right.

b) Unplug white 17 pin connector and two fan motor push-on leads (Black) from top of board. Use caution to prevent board damage when removing connections.

c) Using fingers or small tipped pliers, depress plastic tabs on board standoffs (4) on corners of board and (1) near center (below black heat sink on board). Lift board out of position.

d) Align new board on plastic standoffs, and push board down over standoffs until small locking tabs secure board in place.

e) Reinstall 2 (black) fan wires and white connector at top of board. Be sure white connector is aligned correctly. Reinstall interface cable, sliding metal locking retainer to the left.

f) Cut only those program jumpers on new board (ref. Fig. 5) which were cut on old board.

⚠ CAUTION

Failure to cut the proper programming jumpers will result in improper operation. Jumpers not cut on the old board must remain uncut. Inadequate operation and equipment damage may result.

Jumper functions are listed in Table 3 for reference purposes.

g) Set Optimizer Pot (ref. Fig. 5) on 38QV Heat Pump units if jumper J4 or J5 is cut. Adjust to same setting as old board, or refer to procedure for optimizer or electric heat lockout setup in 38QV unit Installation Instructions.

Table 5—Programming Jumpers

Jumper No.	38QV Heat Pump Systems	38EV Cooling Systems
J1	UNCUT	CUT
J2, J3	UNCUT	UNCUT
J4	CUT FOR 58SSB FURNACE APPLICATIONS	
J5	CUT FOR ELECTRIC HEAT LOCKOUT AT HIGH OUTDOOR TEMPERATURES*	UNCUT
J6, J7	UNCUT	UNCUT

*38QV Systems only

THERMISTOR REPLACEMENT

a) Break power to indoor and outdoor units.

b) For outdoor unit thermistor replacement, remove top grille.

c) Cut plastic ties holding foam tube over thermistor. Thermistor is mounted inside 5/16" copper tube soldered to refrigerant lines and is retained by one (1) plastic tie. Remove this tie and remove thermistor.

d) Cut thermistor leads about 12″ back from end. Cut replacement thermistor leads to about 16″ long, strip back all leads, and splice leads together with a crimp-type connector. Use silicone sealer in connector to make it waterproof.

e) Re-insert thermistor into 5/16″ tube, retain with (1) plastic tie around wires and refrigerant tube. Be sure thermistor is not sticking out end of tube. Fill both ends of small tube with petroleum jelly and similar.

f) Wrap thermistor tube with same 3″ piece of armaflex insulation, or similar. Slit of foam insulation must be on opposite side of refrigerant tube from thermistor well. Tie in place with (2) plastic ties as before.

CONTACTOR REPLACEMENT

Break power to indoor and outdoor units, and remove control box cover.

a) Disconnect all wires to contactor noting attach point to component. Refer to unit wiring diagram. Loosen upper left mounting screw and remove lower right screw. Remove contactor and replace.

b) Rewire contactor following unit wiring diagram.

⚠ CAUTION

Make sure contactor wiring is correct before starting unit. Left side of contactor (terminals #11 and #21) of contactor is for 230 VAC input power. Right side (terminals #13 and #23) is 300 VDC supply to inverter board (violet wires).

EMERGENCY STOP SWITCH (ESS) REPLACEMENT

(38EV036 and 38QV036 Only)

a) Break power to indoor and outdoor units.

b) ESS switch is in series with low pressure switch and is connected with wire nuts within the compressor junction box. Remove unit top grille and compressor sound shield. Switch is located on top of compressor under a special metal clip with white wires going to junction box.

b) Push switch (rectangular aluminum body) toward wire end and it will slip out from under clip.

c) *DO NOT* remove wires from compressor junction box. Cut white wires about 6″ out of box.

d) Slide new switch under clip until it hits stop at end of clip.

e) Re-wire switch to old white wires out of compressor junction box with wire nuts. Note wires are #20 gage so use appropriate nuts. Fill connector cavity with silicone sealer.

f) Replace sound shield and top grille.

EXPANSION VALVE COIL REPLACEMENT

a) Break power to indoor and outdoor units. For outdoor SEV replacement, remove top grille.

b) Remove nut holding solenoid on body of valve. Cut wires about 12″ away from coil.

c) Replace with new solenoid. Cut leads of new coil to about 16″ long. Splice with crimp-type connectors. Reinstall nut and harness wires as before. Use silicone sealer in connector cavity.

d) Replace top grille (for outdoor SEV replacement).

ELECTRONIC EXPANSION VALVE REPLACEMENT

38QV OUTDOOR UNIT—

See Figs. 2 and 3 for Locations of Outdoor Unit SEV.

a) Break power to indoor and outdoor units.

b) Remove top grille.

c) Remove system charge using proper procedures.

d) Remove solenoid coil. Using two (2) wrenches, loosen the flare nuts holding valve to tube. USE CARE to not twist tubing. Remove valve. Remove piston as you would in a standard unit when piston is in service valve.

e) Insert same piston or new piston and new retainer in new valve. Set valve in liquid line and hand-tighten flare nuts. Tighten nuts to 10-15 lb. ft. Note: Use care to not overtighten valve connections, which could deform valve and bind pistons. This valve must be mounted with coil in a vertical position as on original installation. Piston must be at valve end toward service valve, with arrow on valve body toward coil. Reinstall solenoid coil, and top grille.

f) Recharge system.

Indoor Location—

The indoor SEV valve is located on the liquid line at the indoor coil.

38QV Heat Pump Systems—follow procedure for outdoor unit SEV replacement, above. When installed, new valve should have arrow on body toward indoor unit, accurator piston end facing toward outdoor unit.

38EV Cooling Systems—

a) Break power to indoor and outdoor units.

b) Remove system charge using proper procedures.

c) Remove thermistor insulation by cutting tie wraps. Cut tie wrap securing thermistor leads to line, and slide thermistor out of well.

d) Remove solenoid coil. Using two (2) wrenches loosen flare nuts holding valve assembly in place. Use care not to twist indoor unit fitting. Remove valve assembly.

e) Carefully unbraze valve from assembly tubes and braze in new valve.

f) Set valve in line and hand-tighten flare nuts. Tighten nuts to 25-30 lb-ft.

g) Reinstall thermistor, insulation, and solenoid coil.

h) Recharge system.

INTERFACE CABLE—

a) Break power to outdoor and indoor units.

b) Disconnect interface cable from outdoor unit control board by sliding locking latch to right. Disconnect ground wire. Loosen black plastic nut on cable strain relief and remove cable from slot in box. The new cable will have a new strain relief attached.

c) Disconnect interface cable from indoor interface control box by squeezing the metal tabs on the cable end. Unfasten cable black ground wire with ring terminal from sheet metal screw. Route cable out through hole provided in cabinet.

d) Remove ALL ties securing cable to refrigerant lines and remove cable from installation.

e) Connect new interface cable to outdoor unit control board. This cable is polarized so it will only go on one way. Slide metal retainer left to retain cable. Reattach black ground wire to sheet metal screw. Loosen black plastic strain relief nut on cable, set in slot on box and tighten nut. Use care to not put excess strain on control board.

f) Working from outdoor to indoor unit, secure cable to refrigerant lines every 2-3 ft. using tie wraps, or similar.

g) Connect cable to indoor interface control board. Route cable through holes provided in unit as before. This cable end is also polarized so it will only go on one way.

Squeeze clips on cable and insert in receptacle on box. Reattach black ground wire to sheet metal screw.

LOW AND HIGH PRESSURE SWITCH, REVERSING VALVE SOLENOID

These components are the same as on any Carrier unit, and can be replaced using normal procedures with the following exception:

The wiring back to the control box is through a 15 pin plug connection, so the wires must be cut within 12 to 15 inches of component and replaced with new part using wire splice with crimp-type connection. Use silicone sealer in connector cavity.

CRANKCASE HEATER SWITCH, CRANKCASE HEATER, FAN MOTOR

Crankcase Heater Switch: One lead goes to junction box on compressor, attached with wire splice. Replace as required.

a) The second wire is connected to the control box through a six pin plug connection. Note location of CHS on liquid tube. Remove switch with pliers squeezing clip as on a standard unit. Cut wire about 12 to 15 inches away.

b) Install new switch. Cut leads to 15 inches and splice to unit leads. Use splice with crimp-type connection. Fill splice cavity with silicone sealer to make splices waterproof.

Crankcase Heater: These components are the same as on a standard unit. Replace as required. Cut leads back 12″ from component and splice in new heater leads. Seal splice connections with silicone.

Electrical Terminals (Within Unit Plugs)

To repair terminals within the three (3) unit plugs in the outdoor section and plug on interface box in indoor section a terminal kit is available from Service Parts. #38QV660001.

This kit contains 12 each of every plug and receptable terminal used within system. Also included is a removal tool for terminals inside receptacles.

Possible Television, Radio and Home Computer Screen Interference

NOTE: This equipment generates and uses radio frequency energy. If not installed properly, it may cause interference with TV and/or radio reception. This system has been designed to provide reasonable protection against such interference in a residential installation. If this system does cause such interference to TV and/or radio reception, which can be checked by turning the system on and off, check the following:

Check Interface Cable—

a) This cable has a black ground lead that is attached to the sheet metal on both the outdoor unit and indoor unit. Check that the lead is properly installed and not insulated by a painted surface.

b) If installation uses two (2) interface cables connected together, the middle connection has two black ground wires that must be connected together with the provided bolt, nut, and lockwasher. If not, use a #10 x 3/8″ bolt and locknut.

c) Check that black ground lead is connected to black plastic plug case. Plastic case can be opened to check that wire is connected to cable shielding. If not, replace cable or fix loose wire with soldering gun. Use care not to burn wires.

d) Check that cable is installed properly. This cable must be installed alongside refrigerant tubing and tied to it as much as possible.

Check Unit Ground Connection—

a) Outdoor Unit: Inside control box cover is an aluminum lug attached to box. Field ground connection must be connected.

b) Indoor Unit: (Fan-Coil or furnace) check for similar connection inside control box.

Check Indoor Unit Thermostat Wires—

a) System thermostat leads run from interface control box board (TB-4) on fan coil or furnace kit (see unit wiring label) to Parker thermostat. Leads must be shielded.

b) Thermostat leads leaving interface box must run through an EMI shield (ferrite-"iron" core—5/8″ O.D. x 3/8″ I.D. x 2 1/4″ long.

c) If core is not installed, order from Service Parts #HK99FA001.

Check Location of Television, Radio or Monitor to System—

a) If cable shielding and EMI shield are not in place, this system is designed to not interfere if appliances are 30 ft and one wall away from system (indoor or outdoor units).

b) Move TV receiving antenna to eliminate interference.

c) Check that TV, radio or monitor are not on the same electrical circuit as the system.

d) Ensure that cable grounding and EMI shield are installed.

Check Other Computer or Signal Generating Devices In House—

a) Appliances like modern dishwashers, dryers, sewing machines, power tools, room air conditioners can emit the same signals.

b) Check that these appliances are not on the same electrical circuit as the system.

MAINTENANCE

⚠ WARNING

Before performing recommended maintenance, be sure unit main power switch is turned off. Failure to do so may result in electric shock, injury or death from rotating fan blade.

Lubrication

FAN MOTOR BEARINGS—Oiling holes are provided at each end of condenser fan motor. Remove fan motor and lubricate motor with 32 drops (16 drops per hole) of SAE-10 nondetergent oil at intervals described below.

a) Annually when environment is very dirty, ambient temperature is higher than 105 F (40 C), and average unit operating time exceeds 15 hours a day.

b) Every 3 years when environment is reasonably clean, ambient temperature is less than 105 F (40 C) and unit operating time averages 8 to 15 hours a day.

c) Every 5 years when environment is clean, ambient temperature is less than 105 F (40 C) and unit operating time averages less than 8 hours a day.

COMPRESSOR contains factory oil charge. If oil requires replenishment, see Table 1 for oil recharge and Carrier Standard Service Techniques Manual, Chapter 1, Refrigerants, page 1-21, for instructions. Use proper oil as listed in Table 1.

Coil and Heat Sink Cleaning to be done at the beginning of each cooling season or more often if required. (Heat sink is located between control box and unit.)

⚠ CAUTION

Fin damage can result in higher operating costs or compressor damage. Do not use flame, high-pressure water, steam, volatile or corrosive cleaners on fins or tubing. Follow these instructions carefully. Contact your dealer if you encounter problems.

1. Shut off power to unit.
2. Clean coil and heat sink using vacuum cleaner and coil crevice tool (see Fig. 32). Work crevice tool *vertically* making sure tool only touches dirt on coil fins. To prevent fin damage, do not "scrub" fins with tool or move tool horizontally.
3. If oil deposits are present, spray coil and heat sink with ordinary household detergent. Wait 10 minutes then proceed to step 4.
4. Using garden hose, spray coil vertically downward with a constant stream of water at moderate pressure (see Fig. 33). Keep nozzle at a 15 to 20 degree angle, about 3-in. (76 mm) from coil face and 18-in. (457 mm) from tube. Spray so debris is washed out of coil and heat sink.
5. Restore power to unit.

40QV Fan Coil, 58SSB Blower Accessory Service and Maintenance—

Refer to related installation instructions for component replacement, service and maintenance procedures.

For blower speed inspection and adjustment procedures see related instructions and 38EV or 38QV outdoor unit installation instructions.

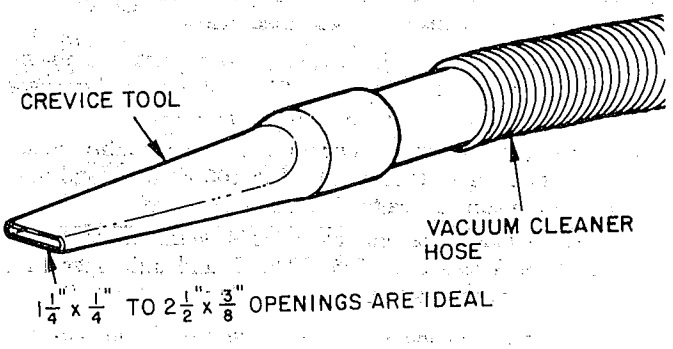


Fig. 32—Crevice Tool

A87037

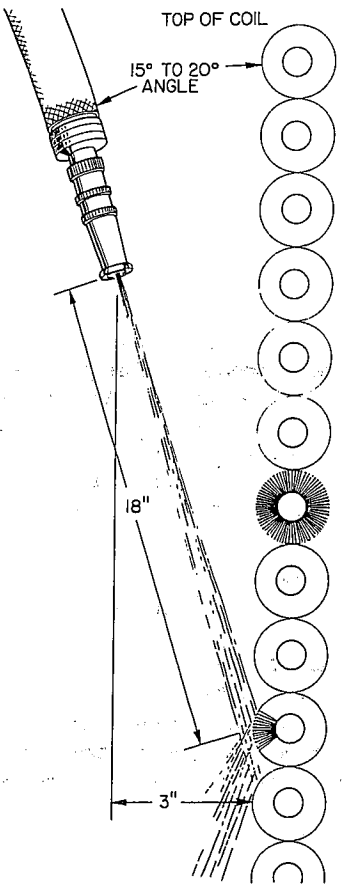
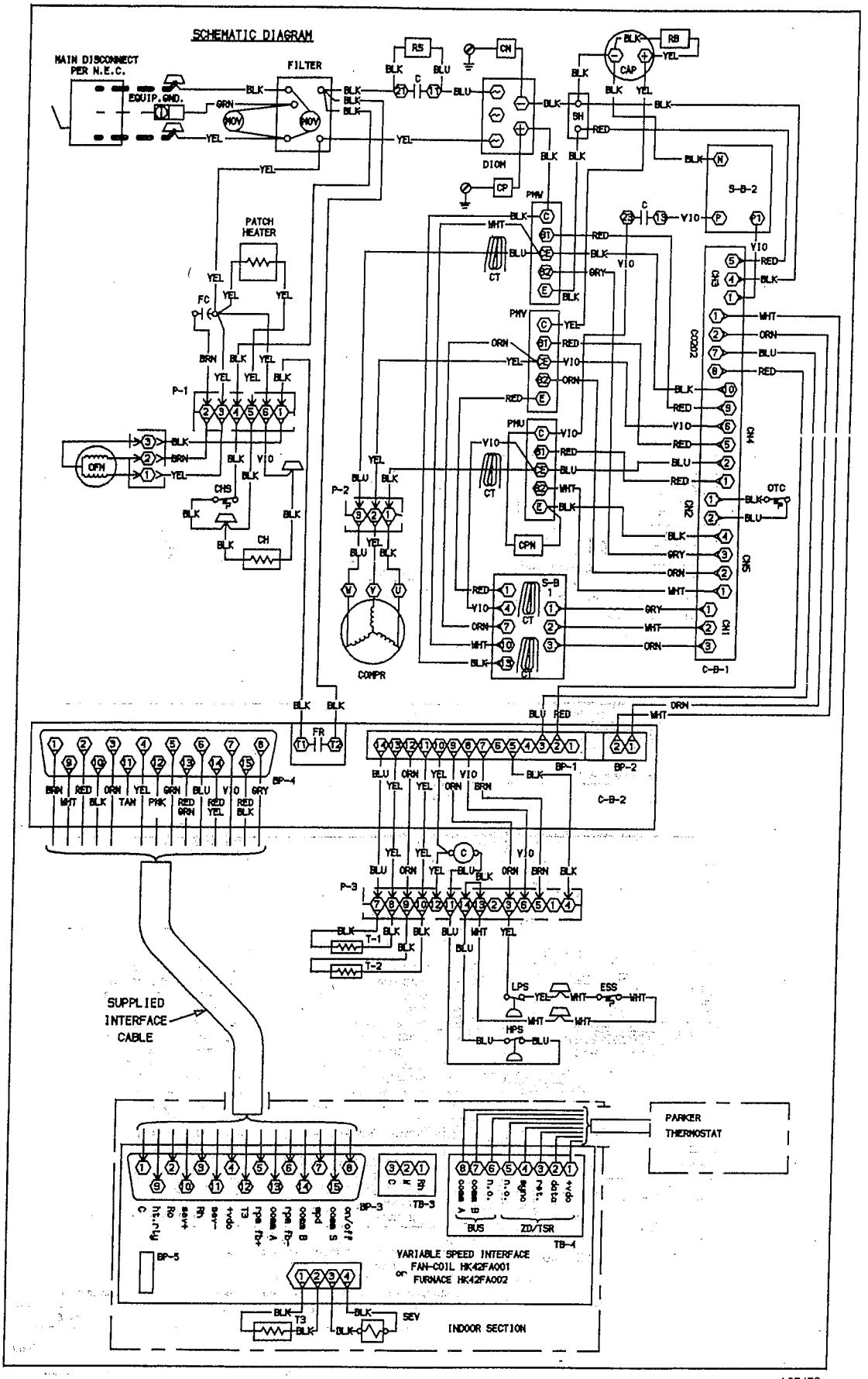


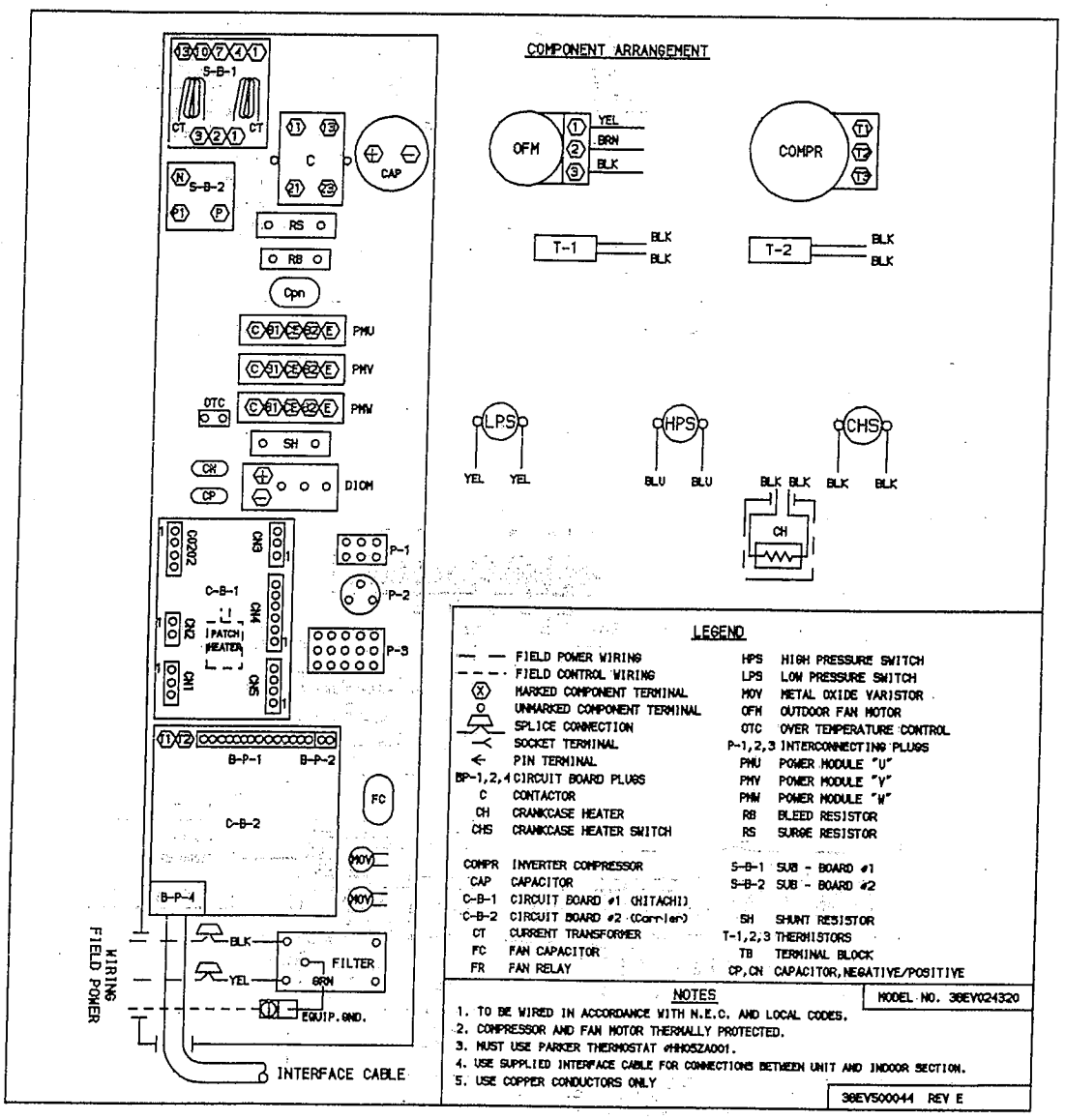
Fig. 33—Positioning Hose to Spray Coil

A87050



NOTE: Emergency Stop Switch (ESS) used on 036 size only.

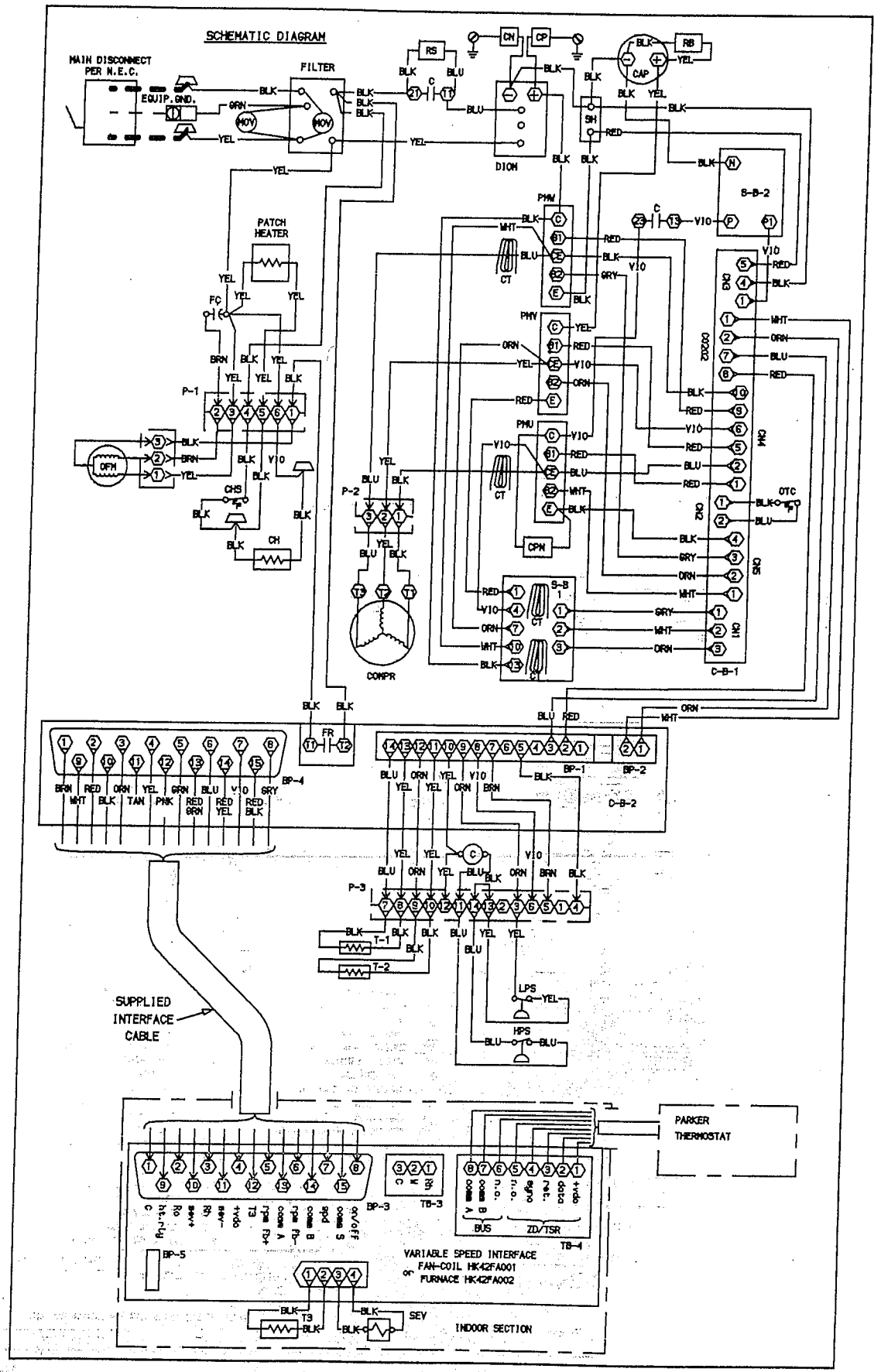
Fig. 34—38EV Schematic Diagram



A87480

NOTE: Emergency Stop Switch (ESS) used on 036 size only.

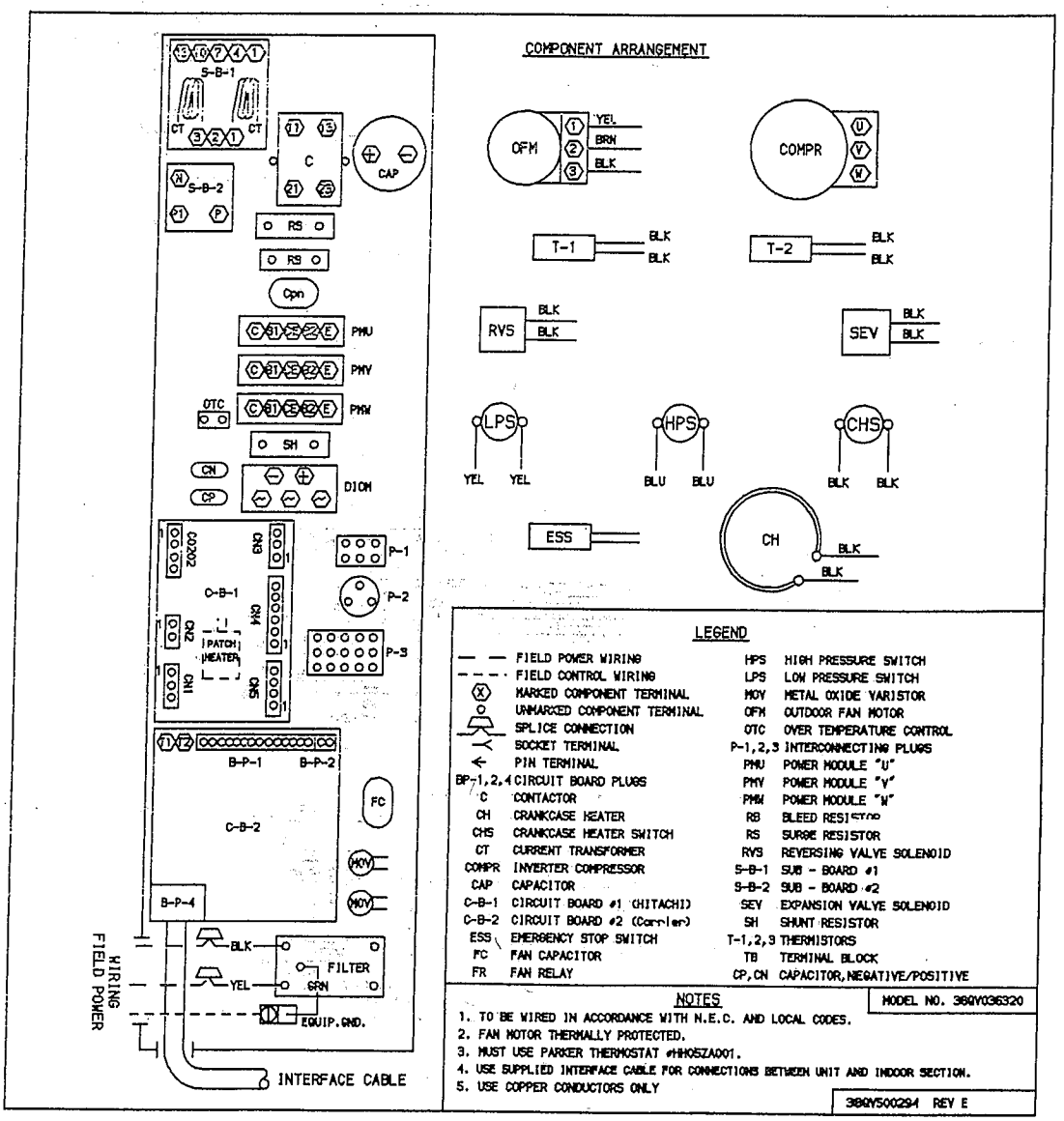
Fig. 35 – 38EV Component Arrangement



A87482

NOTE: Emergency Stop Switch (ESS) used on 036 size only.

Fig. 36—38QV Schematic Diagram



A87481

NOTE: Emergency Stop Switch (ESS) used on 036 size only.

Fig. 37—38QV Component Arrangement

VVT SINGLE-ZONE WIRING DIAGRAM
WITH 40QV VARIABLE SPEED FAN-COIL

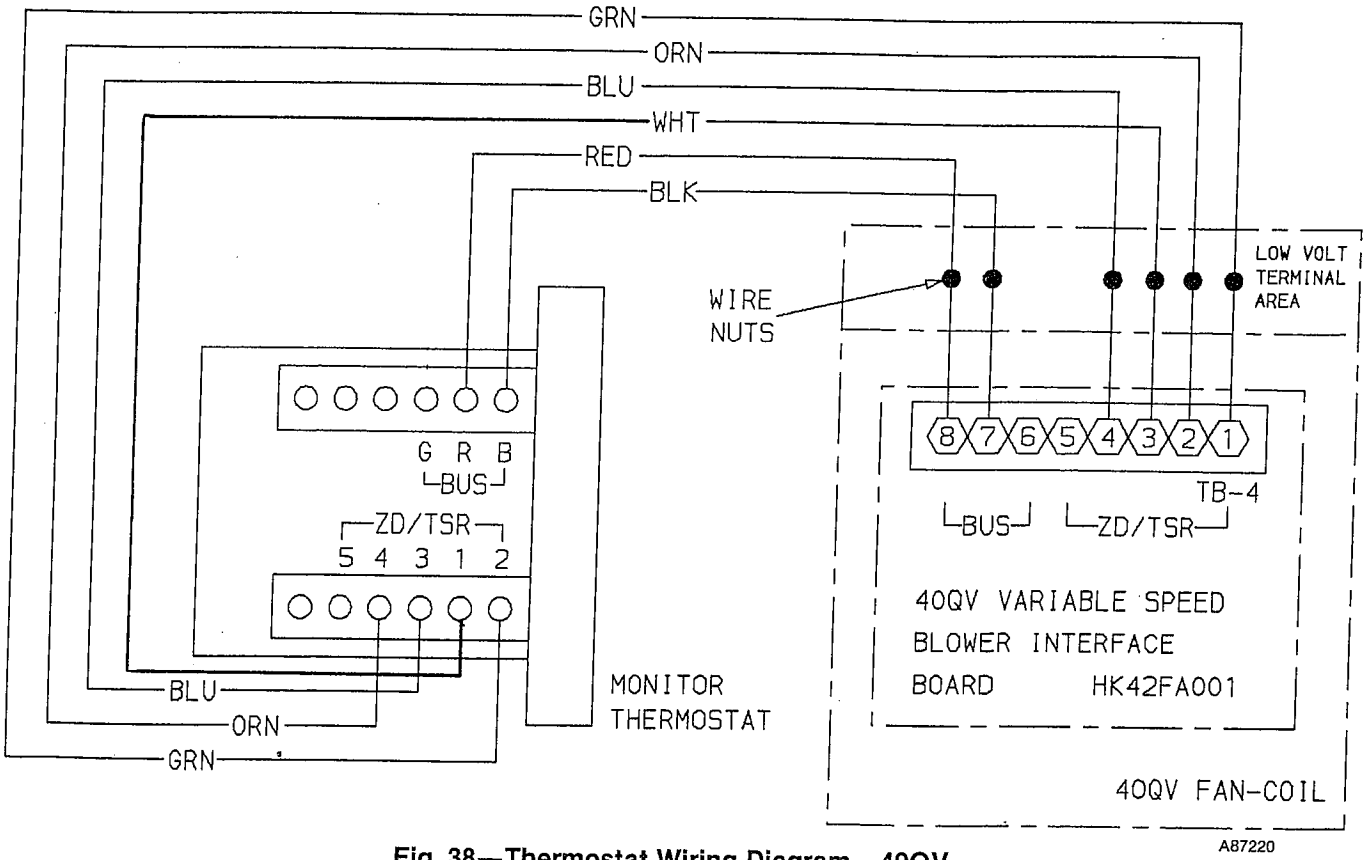


Fig. 38—Thermostat Wiring Diagram—40QV

VVT SINGLE ZONE WIRING DIAGRAM
FOR ACCESSORY FURNACE VARIABLE SPEED KIT.

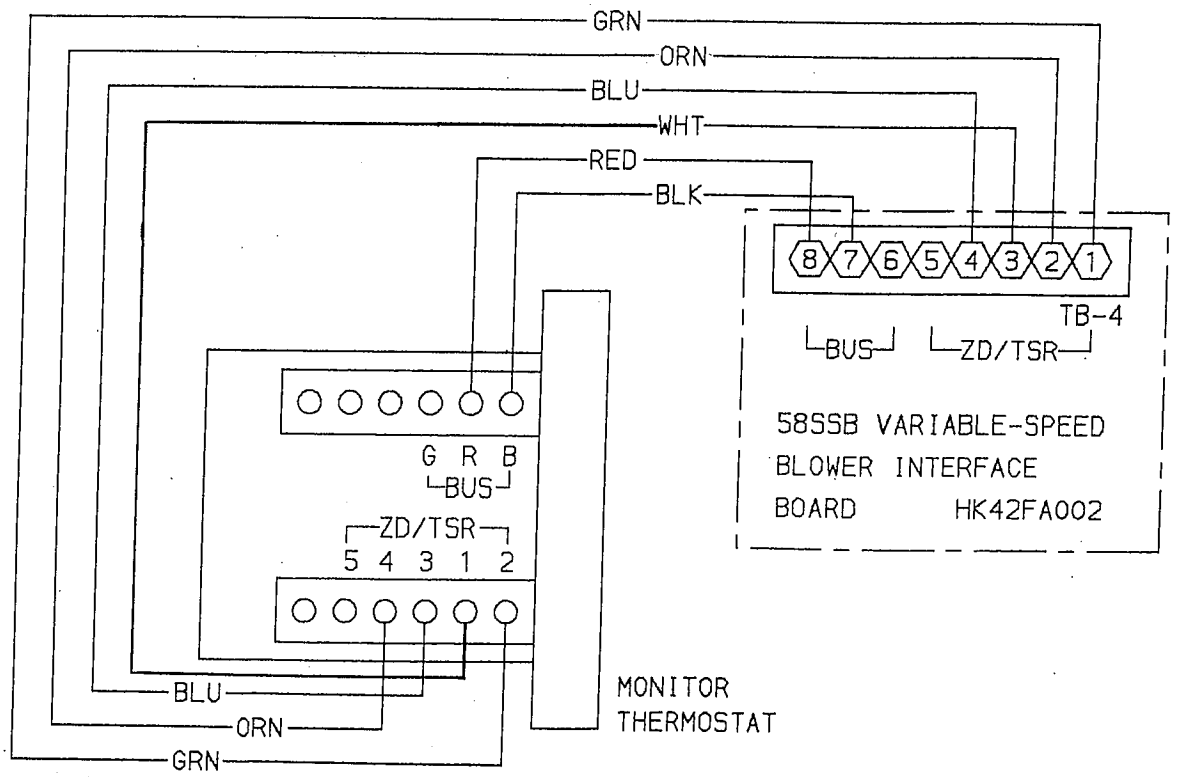


Fig. 39—Thermostat Wiring Diagram—58SSB