



Service and Maintenance Procedures

UPFLOW/HORIZONTAL VARIABLE-SPEED, 2-STAGE INDUCED-COMBUSTION FURNACE

**333BAV
333JAV
Series C&D**

Cancels: SP04-57

SP04-64
10-00

NOTE: Read the entire instruction manual before starting the installation.

TABLE OF CONTENTS

SAFETY CONSIDERATIONS	1
INTRODUCTION	2
ELECTROSTATIC DISCHARGE (ESD) PRECAUTIONS PROCEDURE	2
CARE AND MAINTENANCE	2
Cleaning and/or Replacing Air Filter.....	2
Blower Motor and Wheel.....	3
Cleaning Heat Exchanger.....	4
Electrical Controls and Wiring.....	5
Wiring Diagrams.....	6
Troubleshooting.....	6

SAFETY CONSIDERATIONS

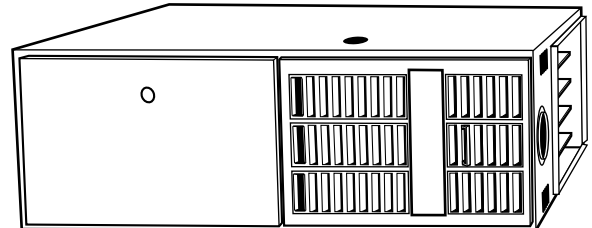
Installing and servicing heating equipment can be hazardous due to gas and electrical components. Only trained and qualified personnel should install, repair, or service heating equipment.

Untrained personnel can perform basic maintenance functions such as cleaning and replacing air filters. All other operations must be performed by trained service personnel. When working on heating equipment, observe precautions in the literature, tags, and labels attached to or shipped with the unit and other safety precautions that may apply.

In the United States, follow all safety codes including the National Fuel Gas Code (NFGC) NFPA No. 54-1996/ANSI Z223.1-1999. In Canada, refer to the current edition of the National Standard of Canada CAN/CGA-B149.1- and .2-M99 Natural Gas and Propane Gas Installation Codes (NSCNGPIC). Wear safety glasses and work gloves. Have fire extinguisher available during start-up and adjustment procedures and service calls.

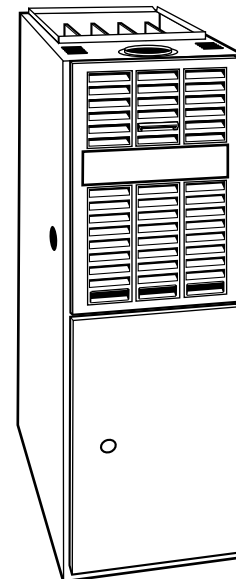
Recognize safety information. This is the safety-alert symbol . When you see this symbol on the furnace and in instructions or manuals, be alert to the potential for personal injury.

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



A95137

Fig. 1—Model 333BAV or 333JAV Horizontal



A94085

Fig. 2—Model 333BAV or 333JAV Upflow



REGISTERED QUALITY SYSTEM

⚠	WARNING: The ability to properly perform maintenance on this equipment requires certain expertise, mechanical skills, tools, and equipment. If you do not possess these items, do not attempt to perform any maintenance on this equipment other than those procedures recommended in the User's Manual. A FAILURE TO FOLLOW THIS WARNING COULD RESULT IN POSSIBLE DAMAGE TO THIS EQUIPMENT, SERIOUS PERSONAL INJURY, OR DEATH.
---	--

INTRODUCTION

These instructions are written for the Upflow/Horizontal, Variable-Speed, 2-Stage, Induced-Combustion Furnace.

ELECTROSTATIC DISCHARGE (ESD) PRECAUTIONS PROCEDURE

⚠	CAUTION: Electrostatic discharge can affect electronic components. Take precautions during furnace installation and servicing to protect the furnace electronic control and motor. Precautions will prevent electrostatic discharges from personnel and hand tools which are held during the procedure. These precautions will help to avoid exposing the control to electrostatic discharge by putting the furnace, the control, the motor, and the person at the same electrostatic potential.
---	---

1. Disconnect all power to the furnace. DO NOT TOUCH THE CONTROLS OR ANY WIRE CONNECTED TO THE CONTROLS PRIOR TO DISCHARGING YOUR BODY'S ELECTROSTATIC CHARGE TO GROUND.
2. Firmly touch a clean, unpainted, metal surface of the furnace chassis which is close to the control. Tools held in a person's hand during grounding will be satisfactorily discharged.
3. After touching the chassis you may proceed to service the controls, motor, or connecting wires as long as you do nothing that recharges your body with static electricity (for example; DO NOT move or shuffle your feet, DO NOT touch ungrounded objects, etc.).
4. If you touch ungrounded objects (recharge your body with static electricity), firmly touch furnace again before touching control or wires.
5. Use this procedure for installed and uninstalled (ungrounded) furnaces.
6. Before removing a new control or motor from its container, discharge your body's electrostatic charge to ground to protect the control or motor from damage. If the control or motor is to be installed in a furnace, follow items 1. through 5. before bringing the control, motor, or yourself into contact with the furnace. Put all used AND new controls into containers before touching ungrounded objects.
7. An ESD service kit (available from commercial sources) may also be used to prevent ESD damage.

CARE AND MAINTENANCE

For continuing high performance and to minimize possible equipment failure, it is essential that periodic maintenance be performed on this equipment. Consult your local dealer as to the proper frequency of maintenance and availability of a maintenance contract.

⚠	WARNING: Never store anything on, near, or in contact with furnace, such as: 1. Spray or aerosol cans, rags, brooms, dust mops, vacuum cleaners, or other cleaning tools. 2. Soap powders, bleaches, waxes or other cleaning compounds, plastic or plastic containers, gasoline, kerosene, cigarette lighter fluid, dry cleaning fluids, or other volatile fluids. 3. Paint thinners and other painting compounds, paper bags or other paper products. A failure to follow this warning could result in corrosion of the heat exchanger, fire, personal injury, or death.
---	--

⚠	WARNING: Turn off the gas and electrical supplies to the unit before performing any maintenance or service on it. Follow operating instructions on the label attached to the furnace. A failure to follow this warning could result in personal injury.
---	--

⚠	CAUTION: As with any mechanical equipment, personal injury can result from sharp metal edges, etc.; therefore, be careful when removing parts.
---	---

The minimum maintenance that should be performed on this equipment is as follows:

1. Check and clean air filter each month or more frequently if required. Replace if torn.
2. Check blower motor and wheel for cleanliness each heating and cooling season. Clean as necessary.
3. Check electrical connections for tightness and controls for proper operation each heating season. Service as necessary.

⚠	CAUTION: If motor is removed from blower assembly, the motor MUST be reinstalled so arrow on end of the motor is pointing in the direction of airflow through the furnace. The belly band MUST be the specified distance from the motor end shield surface at the shaft end. (See Fig. 3.)
---	---

I. CLEANING AND/OR REPLACING AIR FILTER

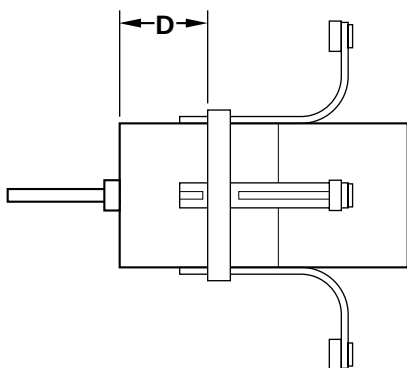
The air filter arrangement may vary depending on the application.

NOTE: If the filter has an airflow direction arrow, the arrow must point toward the blower.

⚠	WARNING: Never operate unit without a filter or with filter access door removed. A failure to follow this warning could result in fire, personal injury, or death.
---	---

To clean or replace filters, proceed as follows:

1. Filters installed in media cabinet adjacent to furnace (see Fig. 4):
 - a. Turn off electrical supply to furnace
 - b. Remove filter cabinet door.
 - c. Slide filter out of cabinet.
 - d. If equipped with permanent, washable filter, clean filter by spraying cold tap water through filter in opposite direction of airflow. Rinse filter and let dry. Oiling or coating of the filter is not recommended.

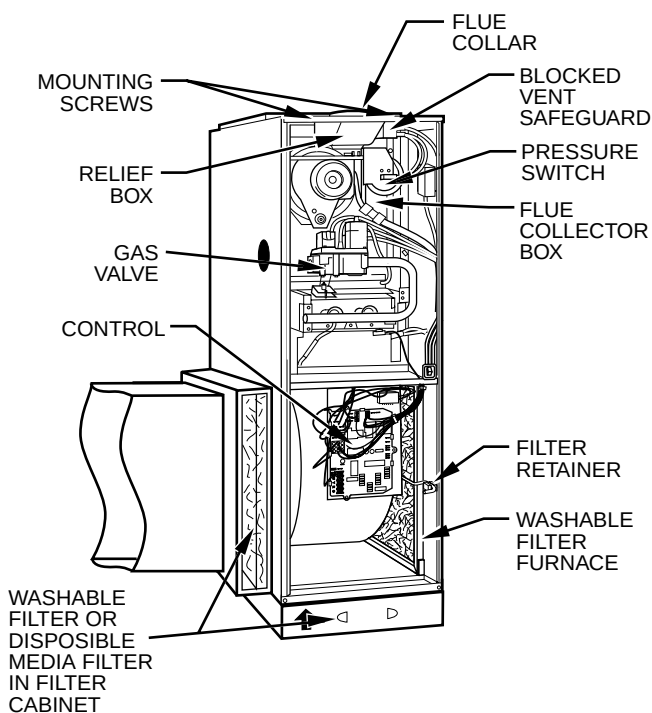


A95268

DIMENSIONS (IN.)

FURNACE SIZE	D
036060	1
048080	1-1/2
060100	3
060120	3

Fig. 3—Motor Belly Band Location



A00293

Fig. 4—Upflow/Horizontal Component Identification

- e. If equipped with factory-specified disposable media filter, replace only with media filter having the same part number and size.
 - f. Slide filter into cabinet.
 - g. Replace filter cabinet door.
 - h. Turn on electrical supply to furnace.
2. Filter(s) installed in side(s) and/or bottom of blower compartment (See Fig. 4):
 - a. Turn off electrical supply before removing blower and control access doors.
 - b. Release filter retainer from clip at front of furnace casing. (See Fig. 4.) For side return, clips may be used on either or both sides of the furnace.
 - c. Slide filter out.

- d. Clean filters by spraying tap water through filter from opposite direction of airflow.
- e. Rinse and let dry. Oiling or coating of filter is NOT recommended or required.
- f. Place filter in furnace.
- g. Fasten filter retainer in front slot.
- h. Replace blower and control access doors and turn on electrical supply to furnace.

II. BLOWER MOTOR AND WHEEL

For long life, economy, and high efficiency, clean accumulated dirt and grease from blower wheel and motor annually.

The following items should be performed by a qualified service technician:

The motors have prelubricated sealed bearings and require no lubrication.

Remember to disconnect the electrical supply before removing access doors.

Clean as follows:

1. Remove blower access door.
2. Disconnect blower electrical leads from motor. Squeeze latches to remove connectors from motor. Disconnect green ground wire from screw. Note location of wires for reassembly.
3. Remove control.
4. Remove screws holding blower assembly to blower deck and slide blower assembly out of furnace.
5. Mark blower wheel, motor, and motor support in relation to blower housing before disassembly to ensure proper reassembly.
6. Loosen setscrew(s) holding blower wheel on motor shaft.
7. Remove bolts holding motor and motor mount to blower housing and slide motor and mount out of housing. Motor mount belly band need not be removed unless motor is to be replaced.



CAUTION: The blower wheel should not be dropped or bent as balance will be affected.

8. Remove blower wheel from housing.
 - a. Mark cutoff plate location to ensure proper reassembly.
 - b. Remove screws holding cutoff plate and remove cutoff plate from housing.
 - c. Lift blower wheel from housing through opening.
9. Clean blower wheel and motor using a vacuum with soft brush attachment. Do not remove or disturb balance weights (clips) on blower wheel blades.
10. Reinstall blower wheel by reversing items 8a through 8c. Be sure wheel is positioned for proper rotation.
11. Reassemble motor and blower by reversing items 6 and 7.



CAUTION: Be sure the motor is properly positioned in the blower housing. The motor arrow must point in the direction of airflow through the furnace after the blower assembly has been reinstalled in the furnace.

12. Reinstall blower assembly in furnace.
13. Reinstall control. Be sure motor ground wire is connected as before.

14. Reinstall vent connector on furnace flue collar. After fully assembling vent connector to furnace flue collar, securely fasten vent connector to flue collar with 2 field-supplied, corrosion-resistant, sheet metal screws located 180 degrees apart and midway up the collar.
15. Connect blower electrical leads to motor. Please note that connections are polarized for assembly. DO NOT FORCE.
16. If power choke is attached to blower housing, ensure it is connected in series with black power lead to motor.
17. Replace blower and control access doors and turn on electrical power to furnace.
18. Check for proper blower operation in heating and cooling.

III. CLEANING HEAT EXCHANGER

The following steps should be performed by a qualified service technician:

NOTE: Deposits of soot and carbon indicate the existence of a problem which needs to be corrected. Take action to correct the problem.

If it becomes necessary to clean the heat exchanger because of carbon deposits, soot, etc., proceed as follows:

1. Turn gas and electrical power to furnace to OFF.
2. Remove control and blower access doors.
3. Disconnect wires to the following components. Mark wires to aid in reconnection of:
 - a. Draft safeguard switch.
 - b. Inducer motor.
 - c. Pressure switch(es).
 - d. Limit overtemperature switch(es).
 - e. Gas valve.
 - f. Hot surface ignitor.
 - g. Flame-sensing electrode.
 - h. Wiring connectors leading to control.
4. Remove 2 screws that secure relief box. (See Fig. 4.)
5. Remove complete inducer assembly from flue collector box, exposing flue openings.
6. Remove 8 screws that secure flue collector box to center panel. Be careful not to damage sealant.
7. Using field-provided small wire brush, steel spring cable, reversible electric drill, and vacuum cleaner, clean cells as follows:
 - a. Assemble wire brush and steel spring cable.
 - (1.) Use 48 in. of 1/4-in. diameter high-grade steel spring cable (commonly known as drain clean-out or Roto-Rooter[®] cable).
 - (2.) Use 1/4-in. diameter wire brush (commonly known as 25-caliber rifle cleaning brush).

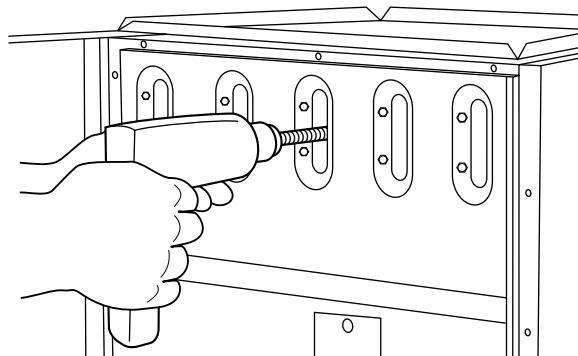
NOTE: The materials needed in items (1.) and (2.) can usually be purchased at local hardware stores.

- (3.) Insert twisted wire end of brush into end of spring cable, and crimp tight with crimping tool or strike with ball-peen hammer. TIGHTNESS IS VERY IMPORTANT.
- (4.) Remove metal screw fitting from wire brush to allow insertion into cable.
- b. Clean each heat exchanger cell.
 - (1.) Attach variable-speed, reversible drill to end of spring cable (end opposite brush).

- (2.) Remove cell outlet plates.

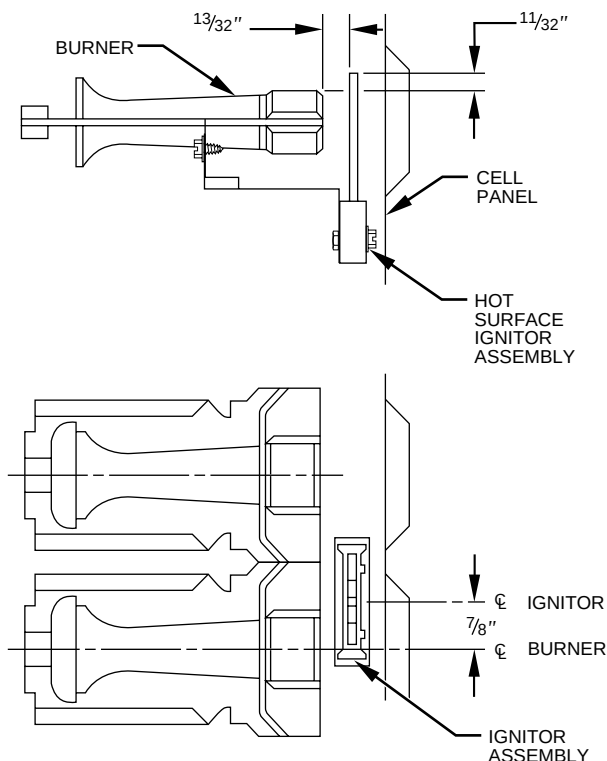
IMPORTANT: Replace screws in center panel to secure heat exchanger cells before cleaning.

- (3.) Insert brush end of cable into upper opening of cell and slowly rotate with drill. DO NOT force cable. Gradually insert at least 36 in. of cable into 2 upper passes of cell. (See Fig. 5.)
- (4.) Work cable in and out of cell 3 or 4 times to obtain sufficient cleaning. DO NOT pull cable with great force. Reverse drill and gradually work cable out.
- (5.) Remove burner assembly and cell inlet plates.



A91252

Fig. 5—Cleaning Heat Exchanger Cell

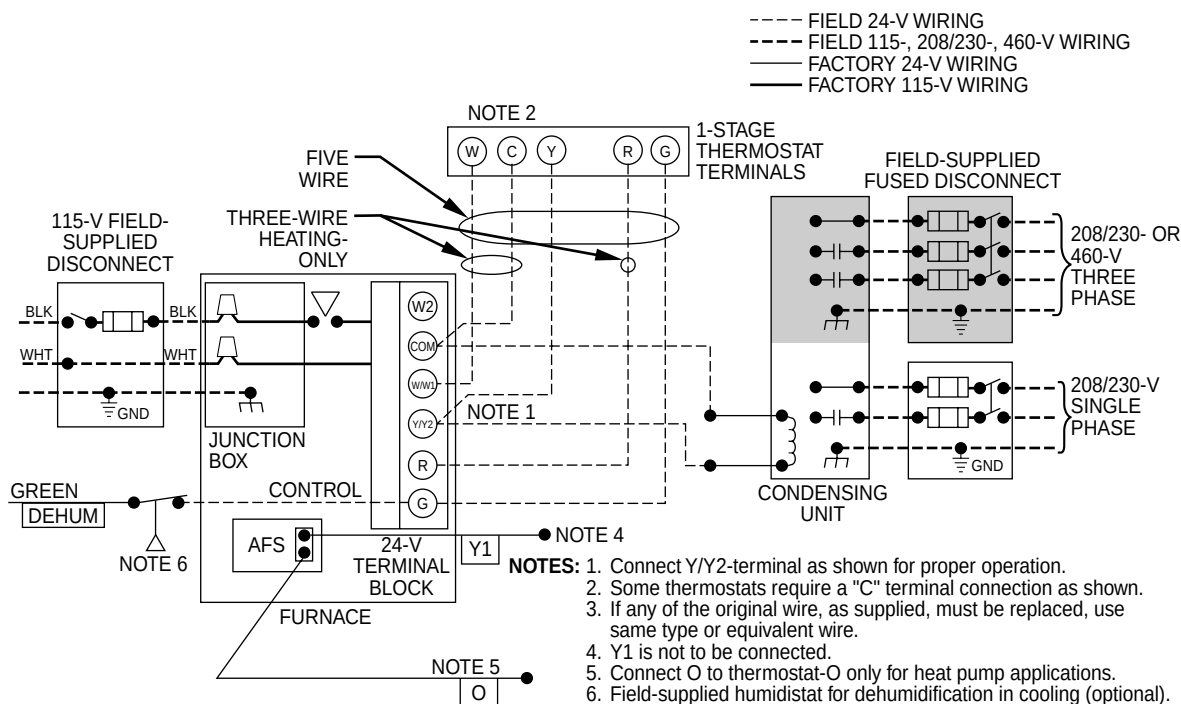


A93347

Fig. 6—Position of Ignitor to Burner

NOTE: Be very careful when removing the burner assembly to avoid breaking the ignitor. See Fig. 6 for the correct ignitor location.

- (6.) **IMPORTANT:** Replace screws in center panel to secure heat exchanger cells before cleaning.
- (7.) Insert brush end of cable in lower opening of cell, and proceed to clean 2 lower passes of cell in same manner as 2 upper passes.



A99231

**Fig. 7—Heating and Cooling Application Wiring Diagram
for Single-Stage Thermostats and/or Single-Speed Condensing Units**

- (8.) Repeat foregoing procedures until each cell in furnace has been cleaned.
- (9.) Using vacuum cleaner, remove residue from each cell.
- (10.) Using vacuum cleaner with soft brush attachment, clean burner assembly.
- (11.) Clean flame sensor with fine steel wool.

- (12.) Reinstall cell outlet plates and screws **FIRST**; then, reinstall cell inlet plates and burner assembly. Care must be exercised to center the burners in the cell openings.

8. After cleaning flue openings, clean flue collector. Check sealant on flue collector to ensure that it has not been damaged. If new sealant is needed, contact your dealer or distributor.

9. Replace flue collector assembly, making sure all 8 screws are secure.

10. Reinstall inducer assembly.

11. Reinstall relief box.

12. Reconnect wires to the following components:

- a. Draft safeguard switch.
- b. Inducer motor.
- c. Pressure switches.
- d. Limit overtemperature switch(es).
- e. Gas valve.
- f. Hot surface ignitor.
- g. Flame-sensing electrode.
- h. Wiring connectors leading to control.

13. Reinstall vent connector to furnace flue collar. After fully assembling vent connector to furnace flue collar, securely fasten vent connector to flue collar with 2 field-supplied, corrosion-resistant, sheet metal screws located 180 degrees apart and midway up the collar.

14. Replace blower door only.

15. Turn power and gas to ON.

16. Set thermostat and check furnace for proper operation.

17. Verify blower airflow and that airflow rate changes between heating and cooling.

18. Check for gas leaks.

WARNING: Never use a match or other open flame to check for gas leaks. Use a soap-and-water solution. A failure to follow this warning could result in fire, personal injury, or death.

19. Replace control door.

IV. ELECTRICAL CONTROLS AND WIRING

CAUTION: There may be more than 1 electrical supply to unit.

The electrical ground and polarity for 115-v wiring must be maintained properly. Refer to Fig. 7 and 8 for field wiring information and to Fig.9 for furnace wiring information. If the polarity is NOT correct, the furnace control will display rapid flashing on the status LED and prevent heat operation. The control system also requires an earth ground for proper operation of the microprocessor and variable-speed motor.

NOTE: Be aware that measurement of current (amperes) and power (watts) for the ICM2+ variable-speed motor will be accurate only when the meter provides true root-mean-square (RMS) measurements.

With power disconnected from unit, check all electrical connections for tightness. Tighten all screws on electrical connections. If any smoky or burned connections are noticed, disassemble the connection, clean all parts and stripped wire, and reassemble properly and securely. Electrical controls are difficult to check without proper instrumentation; therefore, reconnect electrical power to unit and observe unit through 1 complete operating cycle.

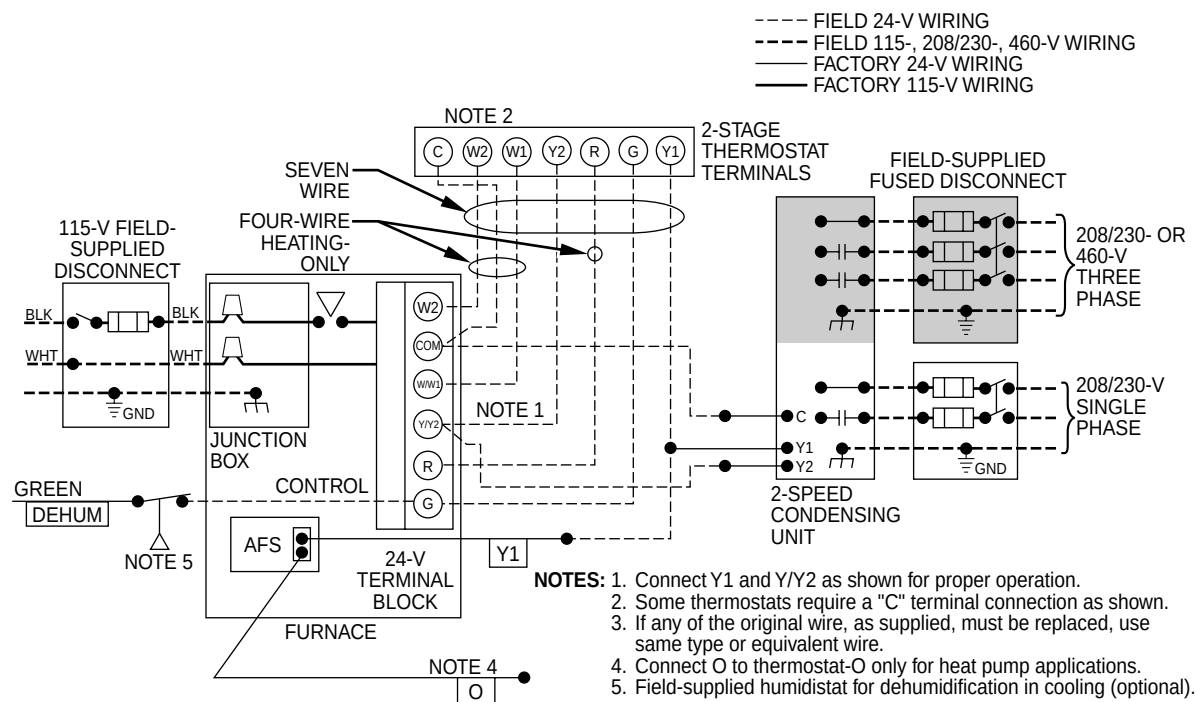


Fig. 8—Heating and Cooling Application Wiring Diagram for 2-Stage Thermostats and/or 2-Speed Condensing Units

WIRING DIAGRAMS

TROUBLESHOOTING

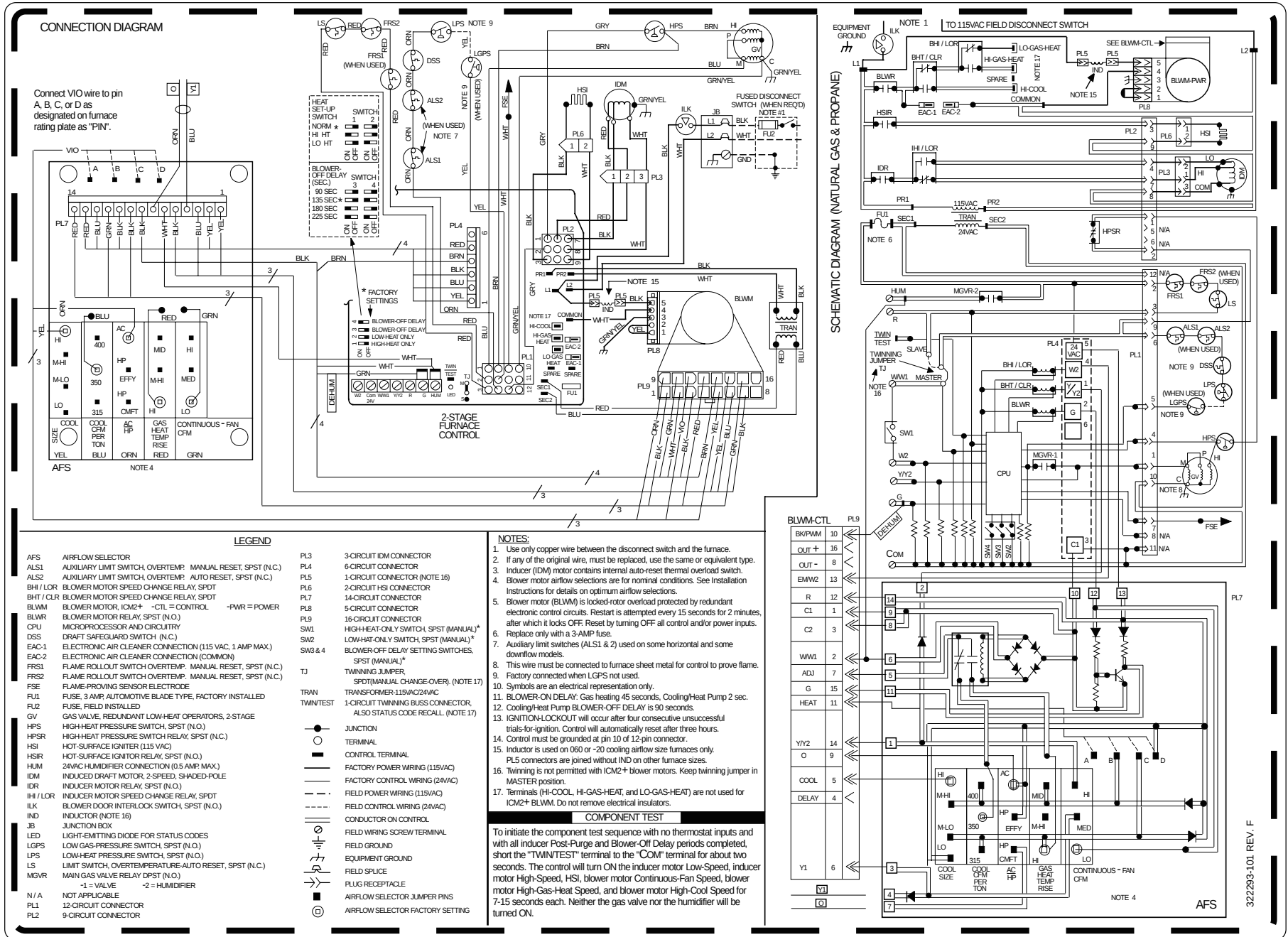


Fig. 9-Furnace Wiring Diagram

A00357

SERVICE

If status code recall is needed, do not remove power or blower door. Briefly remove and then reconnect one main limit wire to display stored status code.

LED CODE

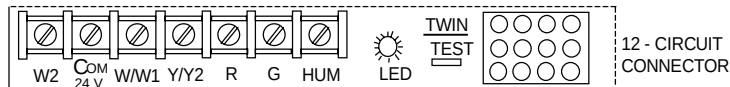
STATUS

- CONTINUOUS OFF - Check for 115VAC at L1 and L2, and 24VAC at SEC1 and SEC2
 CONTINUOUS ON - Control has 24VAC power.
 RAPID FLASHING - Line voltage (115VAC) polarity reversed. If twinned, refer to twinning kit instructions.

Each of the following status codes is a two-digit number with the first digit determined by the number of short flashes and the second digit by the number of long flashes.

- 11 NO PREVIOUS CODE Stored status codes are erased when power (115VAC or 24VAC) to control is interrupted or 48 hours after each fault is cleared.
- 12 BLOWER ON AFTER POWER UP (115VAC or 24VAC)- Blower runs for 90 seconds, if unit is powered up during a call for heat (R-W closed).
- 13 LIMIT OR FLAME ROLL-OUT SWITCH LOCKOUT Control will auto reset after three hours. Reset switch or replace fuse link. Refer to #33.
- 14 IGNITION LOCKOUT -Control will auto-reset after three hours. Refer to #34.
- 21 GAS HEATING LOCKOUT -Control will NOT auto-reset.
 Check for: - Mis-wired gas valve - Defective control (valve relay)
- 22 ABNORMAL FLAME-PROVING SIGNAL- Flame is proved while gas valve is de-energized. Inducer will run until fault is cleared. Check for:
 - Leaky gas valve - Stuck-open gas valve
- 23 PRESSURE SWITCH DID NOT OPEN Check for:
 - Obstructed pressure tubing - Pressure switch stuck closed.
- 24 SECONDARY VOLTAGE FUSE IS OPEN Check for: - Short-circuit in secondary voltage (24VAC) wiring
- 31 HIGH-HEAT PRESSURE SWITCH OR RELAY DID NOT CLOSE OR REOPENED
 Check for: -Control relay may be defective - Refer to #32
- 32 LOW-HEAT PRESSURE, DRAFT SAFEGUARD (when used) , AUX-LIMIT (when used*) SWITCH DID NOT CLOSE OR REOPENED (DOWNFLOW ONLY*) If open longer than five minutes, inducer shuts off for 15 minutes before retry. If it opens after trial for ignition period, blower will come on for 90 second recycle delay. Check for:
 *- Defective blower motor or capacitor - Restricted vent
 - Proper vent sizing - Low inducer voltage (115VAC)
 - Disconnected or obstructed pressure tubing - Excessive wind
 - Defective inducer motor - Defective pressure switch
 - Inadequate combustion air supply
- 33 LIMIT OR FLAME ROLL-OUT SWITCH IS OPEN Open longer than three minutes, code changes to #13. Flame roll-out switch requires manual reset. Check for:
 - Dirty filter or restricted duct system. - Loose blower wheel.
 - Defective blower motor or capacitor. - Defective switch or connections.
 - Inadequate combustion air supply (Flame roll-out switch or fuse link open).
 - Open flame roll-out switch, or fuse link. Manual reset or replace.
- 34 IGNITION PROVING FAILURE Control will try three more times before lockout #14 occurs. If flame signal is lost after trial for ignition period, blower will come on for 90 second recycle delay. Check for:
 - Gas valve defective or gas valve turned off.
 - Oxide buildup on flame sensor (clean with fine steel wool).
 - Proper flame sense current (.5 microamps D.C. min., 4.0 - 6.0 nom. in HIGH HEAT).
 - Green wire MUST be connected to furnace sheet metal.
 - Flame sensor must be ungrounded. - Manual valve shut-off.
 - Defective hot surface ignitor - Control ground continuity.
 - Inadequate flame carryover or rough ignition. - Low inlet gas pressure.
- 43 LOW-HEAT PRESSURE, DRAFT SAFEGUARD (when used) , OR AUX-LIMIT (when used*) SWITCH OPEN WHILE HIGH-HEAT PRESSURE SWITCH IS CLOSED Check for:
 - Pressure switch stuck open
 - Disconnected or obstructed pressure tubing - Refer to #32 and #33
- 45 REPLACE CONTROL

COMPONENT TEST



To initiate the component self-test sequence, shut off the room thermostat or disconnect the "R" thermostat lead. Briefly short the TWIN/TEST terminal to the Com24V terminal. Status LED will turn off. NON-CONDENSING FURNACE: The control will turn ON the inducer motor low speed, then high speed and remain on high speed for the entire test. The other components will be ON for 7 to 15 seconds: Hot surface ignitor, Low heat blower speed, High heat blower speed, High cooling blower speed. CONDENSING FURNACE: The inducer motor will start in high speed and remain on high speed until the end of the test, then shift to low speed for 7 to 15 seconds. All other components will be tested in the same sequence as the NON-CONDENSING.

320893-101 REV. E

Fig. 10—Service Label

NOTES:

1. Refer to information label on blower compartment door for procedure for use of LED status codes and problem solving suggestions.
2. LED indicator is viewed through window in blower compartment door.
3. If 115-vac power is de-energized or interrupted during a call for heat, the indoor blower will run for 90 sec before a gas heating cycle begins – **Code 12**.
4. After replacing any component, verify correct operating sequence.

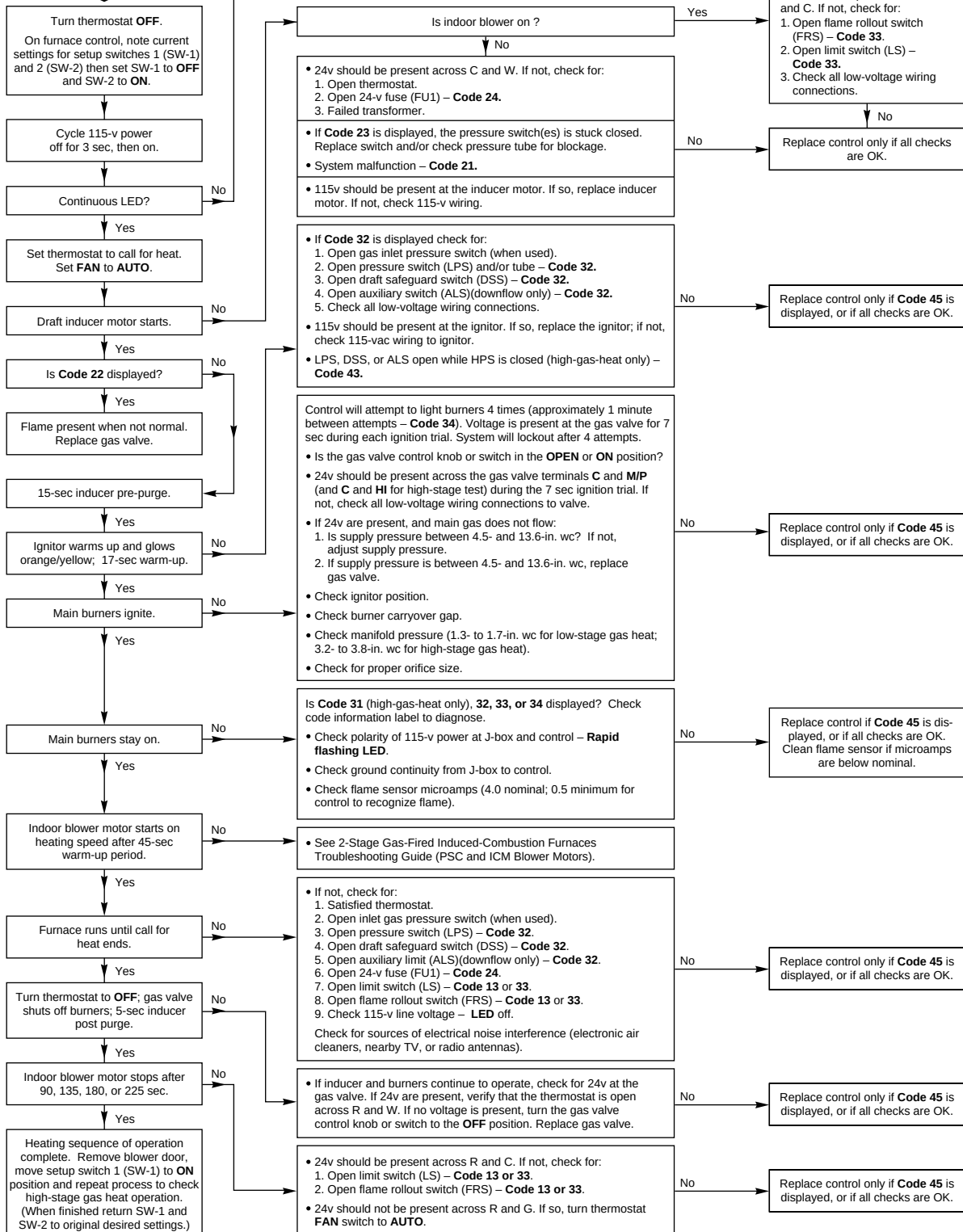
TROUBLESHOOTING GUIDE

⚠ WARNING

ELECTRICAL SHOCK HAZARD

ONLY QUALIFIED AND TRAINED SERVICE PERSONNEL SHOULD PERFORM THIS PROCEDURE

START



SERVICE TRAINING

Packaged Service Training programs are an excellent way to increase your knowledge of the equipment discussed in this manual, including:

- Unit Familiarization
- Maintenance
- Installation Overview
- Operating Sequence

A large selection of product, theory, and skills programs is available, using popular video-based formats and materials. All include video and/or slides, plus companion book.

Classroom Service Training plus "hands-on" the products in our labs can mean increased confidence that really pays dividends in faster troubleshooting, fewer callbacks. Course descriptions and schedules are in our catalog.

CALL FOR FREE CATALOG 1-800-962-9212

☐ Packaged Service Training

☐ Classroom Service Training

A94328