

Check Safety Controls

The flame sensor, gas valve, and pressure switch were all checked in the Start-up procedure section as part of normal operation.

1. Check Main Limit Switch

This control shuts off combustion system and energizes air-circulating blower motor, if furnace overheats. By using this method to check limit control, it can be established that limit is functioning properly and will operate if there is a restricted return-air supply or motor failure. If limit control does not function during this test, cause must be determined and corrected.

- a. Run furnace for at least 5 minutes.
 - b. Gradually block off return air with a piece of cardboard or sheet metal until the limit trips.
 - c. Unblock return air to permit normal circulation.
 - d. Burners will re-light when furnace cools down.
- #### 2. Check draft safeguard switch. The purpose of this control is to cause the safe shutdown of the furnace during certain blocked vent conditions.
- a. Verify vent pipe is cool to the touch.
 - b. Disconnect power to furnace and remove vent connector from furnace vent elbow.
 - c. Restore power to furnace and set room thermostat above room temperature.
 - d. After normal start-up, allow furnace to operate for 2 minutes, then block vent elbow in furnace 80 percent of vent area with a piece of flat sheet metal.
 - e. Furnace should cycle off within 2 minutes. If gas does not shut off within 2 minutes, determine reason draft safeguard switch did not function properly and correct condition.
 - f. Remove blockage from furnace vent elbow.
 - g. Switch will auto-reset when it cools.
 - h. Re-install vent connector.

NOTE: Should switch remain open longer than 3 minutes, furnace control board will lockout the furnace for 3 hours. To reset furnace control board, turn thermostat below room temperature or from HEAT to OFF and turn 115-v power OFF, then back ON.

3. Check Pressure Switch(es)

This control proves operation of the draft inducer blower.

- a. Turn off 115-v power to furnace.
- b. Disconnect inducer motor lead wires from wire harness.
- c. Turn on 115-v power to furnace.
- d. Set thermostat to "call for heat" and wait 1 minute. When pressure switch is functioning properly, hot surface igniter should NOT glow and control diagnostic light flashes a status code 32. If hot surface igniter glows when inducer motor is disconnected, shut down furnace immediately.
- e. Determine reason pressure switch did not function properly and correct condition.
- f. Turn off 115-v power to furnace.
- g. Reconnect inducer motor wires, replace outer door, and turn on 115-v power.
- h. Blower will run for 90 seconds before beginning the call for heat again.
- i. Furnace should ignite normally.

Checklist

1. Put away tools and instruments. Clean up debris.
2. Verify that switches SW1-1 and SW1-6 are OFF and other setup switches are set as desired. Verify that switches

SW1-7 and SW1-8 for the blower OFF DELAY are set as desired per Table 10.

3. Verify that blower and burner access doors are properly installed.
4. Cycle test furnace with room thermostat.
5. Check operation of accessories per manufacturer's instructions.
6. Review User's Guide with owner.
7. Attach literature packet to furnace.

SERVICE AND MAINTENANCE PROCEDURES

WARNING

FIRE, INJURY OR DEATH HAZARD

Failure to follow this warning could result in personal injury, death and/or property damage.

The ability to properly perform maintenance on this equipment requires certain knowledge, mechanical skills, tools, and equipment. If you do not possess these, do not attempt to perform any maintenance on this equipment other than those procedures recommended in the User's Manual.

CAUTION

ENVIRONMENTAL HAZARD

Failure to follow this caution may result in environmental pollution.

Remove and recycle all components or materials (i.e. oil, refrigerant, control board, etc.) before unit final disposal.

WARNING

ELECTRICAL SHOCK, FIRE OR EXPLOSION HAZARD

Failure to follow this warning could result in personal injury or death, or property damage.

Before installing, modifying, or servicing system, main electrical disconnect switch must be in the OFF position and install a lockout tag. There may be more than one disconnect switch. Lock out and tag switch with a suitable warning label. Verify proper operation after servicing.

CAUTION

ELECTRICAL OPERATION HAZARD

Failure to follow this caution may result in improper furnace operation or failure of furnace.

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation.

General

These instructions are written as if the furnace is installed in an upflow application. An upflow furnace application is where the blower is located below the combustion and controls section of

the furnace, and conditioned air is discharged upward. Since this furnace can be installed in any of the 4 positions shown in Fig. 4, you must revise your orientation to component location accordingly.

Electrical Controls and Wiring

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

There may be more than one electrical supply to the furnace. Check accessories and cooling unit for additional electrical supplies that must be shut off during furnace servicing. Lock out and tag switch with a suitable warning label.

The electrical ground and polarity for 115-v wiring must be properly maintained. Refer to Fig. 25 for field wiring information and to Fig. 53 for furnace wiring information.

NOTE: If the polarity is not correct, the STATUS LED on the control will flash rapidly and prevent the furnace from heating. The control system also requires an earth ground for proper operation of the control and flame-sensing electrode.

The 24-v circuit contains an automotive-type, 3-amp. fuse located on the control. (See Fig. 26.) Any shorts of the 24-v wiring during installation, service, or maintenance will cause this fuse to blow. If fuse replacement is required, use ONLY a 3-amp. fuse. The control LED will display status code 24 when fuse needs to be replaced.

Proper instrumentation is required to service electrical controls. The control in this furnace is equipped with a Status Code LED (Light-Emitting Diode) to aid in installation, servicing, and troubleshooting. Status codes can be viewed at the sight glass in blower access door. The amber furnace control LED is either ON continuously, rapid flashing, or a code composed of 2 digits. The first digit is the number of short flashes, the second digit is the number of long flashes.

For an explanation of status codes, refer to service label located on blower access door or Fig. 52, and the troubleshooting guide which can be obtained from your distributor.

See Fig. 58, a brief Troubleshooting Guide.

For 2-Stage Variable Speed ECM Controls the stored status codes will NOT be erased from the control memory, when 115- or 24-v power is interrupted. The control will store up to the last 7 Status Codes in order of occurrence.

1. To retrieve status codes, proceed with the following:

NOTE: NO thermostat signal may be present at control, and all blower-OFF delays must be completed.

- a. Leave 115-v power to furnace turned on.
- b. Remove outer access door.
- c. Look into blower access door sight glass for current LED status.
- d. Remove blower access door.

NOTE: The Status Codes cannot be retrieved by disconnecting the limit switch or draft safeguard switch. To retrieve Status Codes, follow the procedure below.

2. Turn Setup Switch, SW1-1 “ON.”
3. Manually close blower access door switch.
4. Control will flash up to 7 Status Codes.
5. The last Status Code, or 8th Code, will be Code 11.
6. Turn SW1-1 “OFF.”
7. A continuously-lit Amber LED will appear and indicates proper operation.
8. Release blower access door switch, install blower access door and replace outer door or refer to the SERVICE label on the front of the blower access door for more information.

Component Self-Test

Component Test can ONLY be initiated by performing the following:

1. Remove outer access door.
2. Remove blower access door.
3. Remove the wire from the “R” terminal of the control board.
4. Turn Setup Switch, SW-1-6 “ON.”
5. Manually close blower access door switch.

Blower access door switch opens 115-v power to control. No component operation can occur unless switch is closed. Caution must be taken when manually closing this switch for service purposes.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury, or death.

Blower access door switch opens 115-v power to furnace control. No component operation can occur unless switch is closed. Exercise caution to avoid electrical shock from exposed electrical components when manually closing this switch for service purposes.

6. Component Test sequence will function as follows:
 - a. Inducer motor starts on high-speed and continues to run until Step (d.) of component test sequence.
 - b. Hot surface igniter is energized for 15 sec, then deenergized.
 - c. Blower operates for 10 sec, then turns off.
 - d. Inducer motor goes to low-speed for 10 seconds, then turns off.
 - e. After component test is completed, one or more status codes (11, 25, or 41) will flash. See component test section of service label for explanation of status codes.

NOTE: To repeat component test, turn setup switch SW1-6 OFF then back ON.

- f. Turn setup switch SW1-6 OFF.

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7. RELEASE BLOWER ACCESS DOOR SWITCH, reattach wire to "R" terminal on furnace control board, replace blower access door, and replace outer access door.

CARE AND MAINTENANCE

⚠ WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow this warning could result in personal injury, death and/or property damage.

Never store anything on, near, or in contact with the 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. Exposure to these materials could lead to corrosion of the heat exchangers.

For continuing high performance and to minimize possible furnace failure, periodic maintenance must be performed on this furnace. Consult your local dealer about proper frequency of maintenance and the availability of a maintenance contract.

⚠ WARNING

ELECTRICAL SHOCK AND FIRE HAZARD

Failure to follow this warning could result in personal injury, death, and/or property damage.

Turn off the gas and electrical supplies to the furnace and install lockout tag before performing any maintenance or service. Follow the operating instructions on the label attached to the furnace.

⚠ WARNING

CARBON MONOXIDE POISONING AND FIRE HAZARD

Failure to follow this warning could result in personal injury, death and/or property damage.

Never operate furnace without a filter or with filter access door removed.

⚠ CAUTION

CUT HAZARD

Failure to follow this caution may result in personal injury. Sheet metal parts may have sharp edges or burrs. Use care and wear appropriate protective clothing, safety glasses and gloves when handling parts, and servicing furnaces.

The minimum maintenance on this furnace 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.
4. Inspect burner compartment before each heating season for rust, corrosion, soot or excessive dust. If necessary, have furnace and burner serviced by a qualified service agency.
5. Inspect the vent pipe/vent system before each heating season for rust, corrosion, water leakage, sagging pipes or broken fittings. Have vent pipes/vent system serviced by a qualified service agency.
6. Inspect any accessories attached to the furnace such as a humidifier or electronic air cleaner. Perform any service or maintenance to the accessories as recommended in the accessory instructions.

Cleaning and/or Replacing Air Filter

The air filter arrangement will vary depending on the application.

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

⚠ CAUTION

CUT HAZARD

Failure to follow this caution may result in personal injury.

Sheet metal parts may have sharp edges or burrs. Use care and wear appropriate protective clothing, safety glasses and gloves when handling parts, and servicing furnaces.

Media cabinet filter procedures:

1. Turn off electrical supply to furnace before removing filter access door.
2. Remove filter cabinet door.
3. Slide filter out of cabinet.
4. If equipped with permanent, washable 3/4-in. (19 mm) 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. See Table 15 for size information.
5. If equipped with factory-specified disposable media filter, replace only with media filter having the same part number and size. For expandable replacement media, refer to the instructions included with the replacement media.
6. Slide filter into cabinet.
7. Replace filter cabinet door.
8. Turn on electrical supply to furnace.

Blower Motor and Wheel

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Blower access door switch opens 115-v power to control. No component operation can occur unless switch is closed. Caution must be taken when manually closing this switch for service purposes.

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

The following steps should be performed by a qualified service agency.

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

Table 16 – Filter Size Information - In. (mm)

FURNACE CASING WIDTH	FILTER SIZE		FILTER TYPE
	SIDE RETURN	BOTTOM RETURN	
14–1/2 (368)	16 X 25 X 3/4 (406 X 635 X 19)	14 X 25 X 3/4 (356 X 635 X 19)	Washable*
17–1/2 (445)	16 X 25 X 3/4 (406 X 635 X 19)	16 X 25 X 3/4 (406 X 635 X 19)	Washable*
21 (533)	16 X 25 X 3/4 (406 X 635 X 19)	20 X 25 X 3/4 (508 X 635 X 19)	Washable*
24 (610)	16 X 25 X 3/4 (406 X 635 X 19)	24 X 25 X 3/4 (610 X 635 X 19)	Washable*

* Recommended

The inducer and blower motors are pre-lubricated and require no additional lubrication. These motors can be identified by the absence of oil ports on each end of the motor.

Clean blower motor and wheel as follows:

1. Turn off electrical supply to furnace.
2. Remove outer door.
3. For downflow or horizontal furnaces having vent pipes within the furnace that pass in front of the blower access door:
 - a. Disconnect vent connector from furnace vent elbow.
 - b. Disconnect and remove short piece of vent pipe from within furnace.
4. Remove 2 screws from blower access door and remove blower access door.
5. All factory wires can be left connected, but field thermostat connections may need to be disconnected depending on their length and routing.
6. Remove 2 screws holding blower assembly to blower deck and slide blower assembly out of furnace.
7. Clean blower wheel and motor using a vacuum with soft brush attachment. Blower wheel blades may be cleaned with a small paint or flux brush. Do not remove or disturb balance weights (clips) on blower wheel blades.
8. Vacuum any loose dust from blower housing, wheel and motor.
9. If a greasy residue is present on blower wheel, remove wheel from the blower housing and wash it with an appropriate degreaser. To remove wheel:

NOTE: Before disassembly, mark blower mounting arms, motor, and blower housing so motor and each arm is positioned at the same location during reassembly.

- a. Disconnect ground wire attached to blower housing.
 - b. Remove screws securing cutoff plate and remove cutoff plate from housing.
 - c. Loosen set screw holding blower wheel on motor shaft (160+/-20 in.-lb. when assembling).
 - d. Remove bolts holding motor to blower housing and slide motor out of wheel (40+/-10 in.-lb. when reassembling).
 - e. Remove blower wheel from housing.
 - f. Clean wheel and housing.
10. Reassemble motor and blower by reversing steps 9a, through 9e. Be sure to reattach ground wire to the blower housing.
 11. Verify that blower wheel is centered in blower housing and set screw contacts the flat portion of the motor shaft. Loosen set screw on blower wheel and reposition if necessary.
 12. Spin the blower wheel by hand to verify that the wheel does not rub on the housing.
 13. Reinstall blower assembly in furnace.
 14. Reinstall 2 screws securing blower assembly to blower deck.

15. Reconnect blower leads to furnace control. Refer to furnace wiring diagram, and connect thermostat leads if previously disconnected.

16. To check blower for proper rotation:
- a. Turn on electrical supply.

WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury, or death.

Blower access door switch opens 115-v power to furnace control. No component operation can occur unless switch is closed. Exercise caution to avoid electrical shock from exposed electrical components when manually closing this switch for service purposes.

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- b. Manually close blower access door switch.

NOTE: If R-W/W1 thermostat terminals are jumpered at the time blower access door switch is closed, blower will run for 90 sec before beginning a heating cycle.

- c. Perform component self-test as shown at the bottom of the SERVICE label, located on the front of blower access door.
- d. Verify blower is rotating in the correct direction
17. If furnace is operating properly, RELEASE BLOWER ACCESS DOOR SWITCH. Remove any jumpers or reconnect any disconnected thermostat leads. Replace blower access door.
18. Downflow or horizontal furnaces with vent pipe through furnace only:
 - a. Install and connect short piece of vent pipe inside furnace to existing vent.
 - b. Connect vent connector to vent elbow.
19. Reinstall outer door.
20. Turn on gas supply and cycle furnace through one complete heating and cooling cycle. Verify the furnace temperature rise as shown in Adjustments Section. Adjust temperature rise as shown in Adjustments Section. If outdoor temperature is below 70°F, turn off circuit breaker to outdoor unit before running furnace in the cooling cycle. Turn outdoor circuit breaker on after completing cooling cycle.

Cleaning Heat Exchanger

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

NOTE: If the heat exchangers get a heavy accumulation of soot and carbon, they should be replaced rather than trying to clean them thoroughly. A build-up of soot and carbon indicates that a problem exists which needs to be corrected, such as improper adjustment of manifold pressure, insufficient or poor quality combustion air, incorrect size or damaged manifold orifice(s), improper gas, or a restricted heat exchanger. Action must be taken to correct the problem.

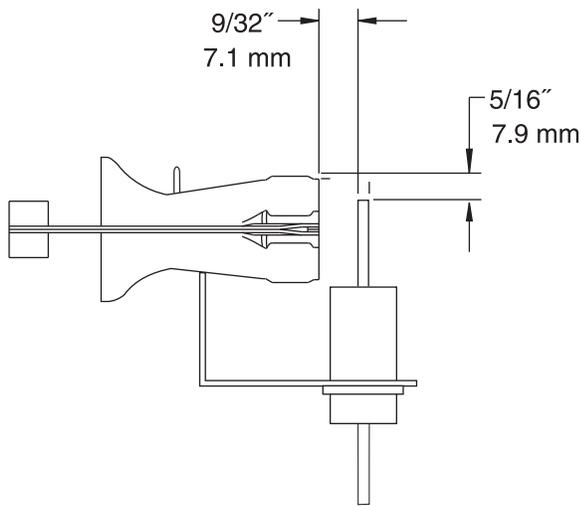


Fig. 54 - Igniter Position - Side View

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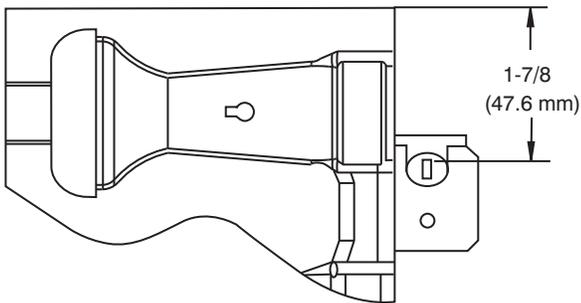


Fig. 55 - Igniter Position - Top View

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If it becomes necessary to clean the heat exchangers because of dust or corrosion, proceed as follows:

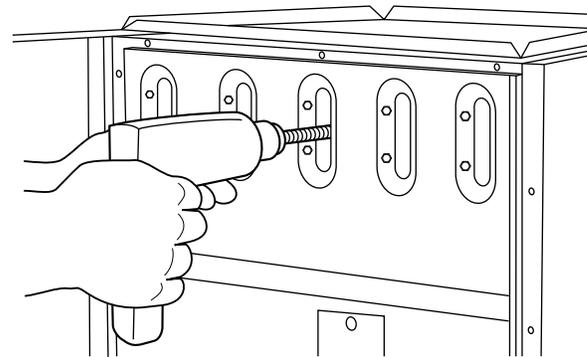
1. Turn OFF gas and electrical power to furnace.
2. Remove outer access door.
3. Disconnect vent connector from furnace vent elbow.
4. For downflow or horizontal furnace having an internal vent pipe, remove internal vent pipe within the casing.
5. Disconnect wires to the following components. Mark wires to aid in reconnection (be careful when disconnecting wires from switches because damage may occur):
 - a. Draft safeguard switch.
 - b. Inducer motor.
 - c. Pressure switches.
 - d. Limit overtemperature switch.
 - e. Gas valve.
 - f. Hot surface igniter.
 - g. Flame-sensing electrode.
 - h. Flame rollout switches.
6. Remove screws that fasten the collector box assembly to the cell panel. Be careful not to damage the collector box. Inducer assembly and elbow need not be removed from collector box.
7. Disconnect gas line from gas manifold.
8. Remove the four screws that attach the burner assembly to the cell panel. The gas valve and individual burners need not be removed from support assembly. Remove NOx baffles, if installed.

NOTE: Be very careful when removing burner assembly to avoid breaking igniter. See Fig. 54-55 for correct igniter location.

9. Using field-provided 25-caliber rifle cleaning brush, 36-in. (914 mm) long, 1/4-in. (6 mm) diameter steel spring cable, a variable speed, follows:
 - a. Remove metal screw fitting from wire brush to allow insertion into cable.
 - b. Insert the twisted wire end of brush into end of spring cable, and crimp tight with crimping tool or crimp by striking with ball-peen hammer. **TIGHTNESS IS VERY IMPORTANT.**

NOTE: The materials needed in item 9 can usually be purchased at local hardware stores.

- (1.) Attach variable-speed, reversible drill to the end of spring cable (end opposite brush).
- (2.) Insert brush end of cable into the outlet opening of cell and slowly rotate with drill. **DO NOT** force cable. Gradually insert cable into upper pass of cell. (See Fig. 57.)
- (3.) 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.
- (4.) Insert brush end of cable in burner inlet opening of cell, and proceed to clean 2 lower passes of cell in same manner as upper pass.
- (5.) Repeat foregoing procedures until each cell in furnace has been cleaned.
- (6.) Using vacuum cleaner, remove residue from each cell.
- (7.) Using vacuum cleaner with soft brush attachment, clean burner assembly.
- (8.) Clean flame sensor with fine steel wool.
- (9.) Install NOx baffles (if removed).



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Fig. 56 - Cleaning Heat Exchanger Cell

- (10.) Reinstall burner assembly. Center burners in cell openings.

10. Remove old sealant from cell panel and collector box flange.
11. Spray releasing agent on the heat exchanger cell panel where collector box assembly contacts cell panel.

NOTE: A releasing agent such as cooking spray or equivalent (must not contain corn or canola oil, aromatic or halogenated hydrocarbons or inadequate seal may occur) and RTV sealant (G.E. 162, 6702, or Dow-Corning 738) are needed before starting installation. **DO NOT** substitute any other type of RTV sealant. G.E. 162 (P771-9003) is available through RCD in 3-oz tubes.

12. Apply new sealant to flange of collector box and attach to cell panel using existing screws, making sure all screws are secure.

13. Reconnect wires to the following components (Use connection diagram on wiring label, if wires were not marked for reconnection locations.):
 - a. Draft safeguard switch.
 - b. Inducer motor.
 - c. Pressure switches.
 - d. Limit overtemperature switch.
 - e. Gas valve.
 - f. Hot surface igniter.
 - g. Flame-sensing electrode.
 - h. Flame rollout switches.
14. Reinstall internal vent pipe, if applicable.
15. Reinstall vent connector on furnace vent elbow. Securely fasten vent connector to vent elbow with 2 field-supplied, corrosion-resistant, sheet metal screws located 180° apart.
16. Replace blower access door only if it was removed.
17. Set thermostat above room temperature and check furnace for proper operation.
18. Verify blower airflow and speed changes between heating and cooling.

⚠ WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow this warning could result in personal injury, death, and/or property damage.

Never purge a gas line into a combustion chamber. Never test for gas leaks with an open flame. Use a commercially available soap solution made specifically for the detection of leaks to check all connections. A fire or explosion may result causing property damage, personal injury or loss of life.

19. Check for gas leaks.

Sequence of Operation

NOTE: Furnace control must be grounded for proper operation or else control will lock out. Control is grounded through green/yellow wire routed to gas valve and burner box screw. Using the schematic diagram in Fig. 53, follow the sequence of operation through the different modes. Read and follow the wiring diagram very carefully.

NOTE: If a power interruption occurs during a call for heat (W/W1 or W/W1-and-W2), the control will start a 90-second blower-only ON period two seconds after power is restored, if the thermostat is still calling for gas heating. The amber LED light will flash code 12 during the 90-second period, after which the LED will be ON continuous, as long as no faults are detected. After the 90-second period, the furnace will respond to the thermostat normally.

The blower door must be installed for power to be conducted through the blower door interlock switch ILK to the furnace control CPU, transformer TRAN, inducer motor IDM, blower motor BLWM, hot-surface igniter HSI, and gas valve GV.

1. Two-Stage Heating (Adaptive Mode) with Single-Stage Thermostat
See Fig. 27 - 34 for thermostat connections

NOTE: The low-heat only switch SW1-2 selects either the low-heat only operation mode when ON, (see item 2. below) or the adaptive heating mode when OFF in response to a call for

heat. (See Table 10.) When the W2 thermostat terminal is energized it will always cause high-heat operation when the R-to-W circuit is closed, regardless of the setting of the low-heat only switch. This furnace can operate as a two-stage furnace with a single-stage thermostat because the furnace control CPU includes a programmed adaptive sequence of controlled operation, which selects low-heat or high-heat operation. This selection is based upon the stored history of the length of previous gas-heating periods of the single-stage thermostat.

The furnace will start up in either low- or high-heat. If the furnace starts up in low-heat, the control CPU determines the low-heat on-time (from 0 to 16 minutes) which is permitted before switching to high-heat.

If the power is interrupted, the stored history is erased and the control CPU will select low-heat for up to 16 minutes and then switch to high-heat, as long as the thermostat continues to call for heat. Subsequent selection is based on stored history of the thermostat cycle times.

The wall thermostat “calls for heat”, closing the R-to-W circuit. The furnace control performs a self-check, verifies the low-heat and high-heat pressure switch contacts LPS and HPS are open, and starts the inducer motor IDM in high-speed.

a. Inducer Prepurge Period

- (1.) If the furnace control CPU selects low-heat operation the inducer motor IDM comes up to speed, the low-heat pressure switch LPS closes, and the furnace control CPU begins a 15-second prepurge period. If the low-heat pressure switch LPS fails to remain closed the inducer motor IDM will remain running at high-speed. After the low-heat pressure switch re-closes the furnace control CPU will begin a 15-second prepurge period, and continue to run the inducer motor IDM at high-speed.
- (2.) If the furnace control CPU selects high-heat operation, the inducer motor IDM remains running at high-speed, and the high-heat pressure switch relay HPSR is de-energized to close the NC contact. When sufficient pressure is available the high-heat pressure switch HPS closes, and the high-heat gas valve solenoid GV-HI is energized. The furnace control CPU begins a 15-second prepurge period after the low-heat pressure switch LPS closes. If the high-heat pressure switch HPS fails to close and the low-heat pressure switch LPS closes, the furnace will operate at low-heat gas flow rate until the high-heat pressure switch closes for a maximum of 2 minutes after ignition.

b. **Igniter Warm-Up** -At the end of the prepurge period, the Hot-Surface Igniter HSI is energized for a 17-second igniter warm-up period.

c. **Trial-For-Ignition Sequence** -When the igniter warm-up period is completed the main gas valve relay contact GVR closes to energize the gas valve solenoid GV-M. The gas valve solenoid GV-M permits gas flow to the burners where it is ignited by the HSI. Five seconds after the GVR closes, a 2-second flame proving period begins. The HSI igniter will remain energized until the flame is sensed or until the 2-second flame proving period begins. If the furnace control CPU selects high-heat operation, the high-heat gas valve solenoid GV-HI is also energized.

COOLING TONNAGE VS. AIRFLOW (CFM)

AIR CONDITIONING TONS (12,000 BTU/HR)	AIRFLOW (CFM)	070 MODEL	090 MODEL	110, 135, & 155 MODELS
1-1/2	525	X ₂	X	—
2	700	X	X ₂	X
2-1/2	875	X	X	X ₂
3	1050	X ₁	X	X
3-1/2	1225	X	X ₁	X
4	1400	—	X	X
5	1750	—	—	X ₁
6	2100	—	—	X

X-INDICATES AN ALLOWABLE SELECTION.

BASED ON 350 CFM/TON (SETUP SWITCH SW1-5 OFF, SW4-3 OFF)

MODEL SIZE	SETUP SWITCH SW2 OR SW3 POSITIONS								
070	DEF.	525 ₂	700	875	1050 ₁	1225	1225	1225	
090	DEF.	525 ₂	700	875	1050	1225	1400 ₁	1400	
110, 135, 155	DEF.	700	875 ₂	1050	1225	1400	1750 ₁	2100	

BASED ON 400 CFM/TON (SETUP SWITCH SW1-5 ON, SW4-3 OFF)

MODEL SIZE	SETUP SWITCH SW2 OR SW3 POSITIONS								
070	DEF.	600 ₂	800	1000	1200 ₁	1400	1400	1400	
090	DEF.	600 ₂	800	1000	1200	1400	1600 ₁	1600	
110, 135, 155	DEF.	800	1000 ₂	1200	1400	1600	2000 ₁	2200	

BASED ON 325 CFM/TON (SETUP SWITCH SW1-5 OFF, SW4-3 ON)

MODEL SIZE	SETUP SWITCH SW2 OR SW3 POSITIONS								
070	DEF.	488 ₂	651	814	976 ₁	1139	1139	1139	
090	DEF.	488 ₂	651	814	976	1139	1302 ₁	1302	
110, 135, 155	DEF.	651	814 ₂	976	1139	1302	1627 ₁	1950	

BASED ON 370 CFM/TON (SETUP SWITCH SW1-5 ON, SW4-3 ON)

MODEL SIZE	SETUP SWITCH SW2 OR SW3 POSITIONS								
070	DEF.	558 ₂	744	930	1116 ₁	1302	1302	1302	
090	DEF.	558 ₂	744	930	1116	1302	1488 ₁	1488	
110, 135, 155	DEF.	744	930 ₂	1116	1302	1488	1860 ₁	2200	

1. DEFAULT A/C AIRFLOW WHEN A/C SWITCHES ARE IN OFF POSITION
2. DEFAULT CONT. FAN AIRFLOW WHEN CF SWITCHES ARE IN OFF POSITION
3. SWITCH POSITIONS ARE ALSO SHOWN ON FURNACE WIRING DIAGRAM

Fig. 57 - Cooling (A/C) or Continuous-Fan (CF) Airflow Selection Chart

A13055

d. **Flame-Proving** - When the burner flame is proved at the flame-proving sensor electrode FSE, the inducer motor IDM switches to low-speed unless the furnace is operating in high-heat, and the furnace control CPU begins the blower-ON delay period and continues to hold the gas valve GV-M open. If the burner flame is not proved within two seconds, the control CPU will

close the gas valve GV-M, and the control CPU will repeat the ignition sequence for up to three more Trials-For-Ignition before going to Ignition-Lockout. Lockout will be reset automatically after three hours, or by momentarily interrupting 115 vac power to the furnace, or by interrupting 24 vac power at SEC1 or SEC2 to the furnace control CPU (not at W/W1, G, R,

etc.). If flame is proved when flame should not be present, the furnace control CPU will lock out of Gas-Heating mode and operate the inducer motor IDM on high speed until flame is no longer proved.

- e. **Blower-On delay** - If the burner flame is proven the blower-ON delays for low-heat and high-heat are as follows:

Low-heat - 45 seconds after the gas valve GV-M is opened the blower motor BLWM is turned ON at low-heat airflow.

High-heat - 25 seconds after the gas valve GV-M is opened the BLWM is turned ON at high-heat airflow. Simultaneously, the humidifier terminal HUM and electronic air cleaner terminal EAC-1 are energized and remain energized throughout the heating cycle.

- f. **Switching from Low- to High-Heat** - If the furnace control CPU switches from low-heat to high-heat, the furnace control CPU will switch the inducer motor IDM speed from low to high. The high-heat pressure switch relay HPSR is de-energized to close the NC contact. When sufficient pressure is available the high-heat pressure switch HPS closes, and the high-heat gas valve solenoid GV-HI is energized. The blower motor BLWM will transition to high-heat airflow five seconds after the furnace control CPU switches from low-heat to high-heat.
- g. **Switching from High- to Low-Heat** -The furnace control CPU will not switch from high-heat to low-heat while the thermostat R-to-W circuit is closed when using a single-stage thermostat.
- h. **Blower-Off Delay** -When the thermostat is satisfied, the R to W circuit is opened, de-energizing the gas valve GV-M, stopping gas flow to the burners, and de-energizing the humidifier terminal HUM. The inducer motor IDM will remain energized for a 5-second post-purge period. The blower motor BLWM and air cleaner terminal EAC-1 will remain energized at low-heat airflow or transition to low-heat airflow for 90, 120, 150, or 180 seconds (depending on selection at blower-OFF delay switches). The furnace control CPU is factory-set for a 120-second blower-OFF delay.

2. Two-Stage Thermostat and Two-Stage Heating

See Fig. 27-34 for thermostat connections.

NOTE: In this mode the low-heat only switch SW1-2 must be ON to select the low-heat only operation mode in response to closing the thermostat R-to-W1 circuit. Closing the thermostat R-to- W1-and-W2 circuits always causes high-heat operation, regardless of the setting of the low-heat only switch.

The wall thermostat “calls for heat”, closing the R-to-W1 circuit for low-heat or closing the R-to-W1-and-W2 circuits for high-heat. The furnace control performs a self-check, verifies the low-heat and high-heat pressure switch contacts LPS and HPS are open, and starts the inducer motor IDM in high-speed.

The start up and shut down functions and delays described in item 1. above apply to the 2-stage heating mode as well, except for switching from low- to high-Heat and vice versa.

- a. **Switching from Low- to High-Heat** - If the thermostat R-to-W1 circuit is closed and the R-to-W2 circuit closes, the furnace control CPU will switch the inducer motor IDM speed from low to high. The high-heat pressure switch relay HPSR is de-energized to close the NC contact. When sufficient pressure is available the high-heat pressure switch HPS closes, and the high-heat gas valve solenoid GV-HI is energized. The blower motor BLWM will transition to

high-heat airflow five seconds after the R-to-W2 circuit closes.

- b. **Switching from High- to Low-Heat** -If the thermostat R-to- W2 circuit opens, and the R-to-W1 circuit remains closed, the furnace control CPU will switch the inducer motor IDM speed from high to low. The high-heat pressure switch relay HPSR is energized to open the NC contact and de-energize the high-heat gas valve solenoid GV-HI. When the inducer motor IDM reduces pressure sufficiently, the high-heat pressure switch HPS will open. The gas valve solenoid GV-M will remain energized as long as the low-heat pressure switch LPS remains closed. The blower motor BLWM will transition to low-heat airflow five seconds after the R-to-W2 circuit opens.

3. Cooling mode

The thermostat “calls for cooling”.

- a. **Single-Speed Cooling-**

See Fig. 27 for thermostat connections

The thermostat closes the R-to-G-and-Y circuits. The R-to- Y circuit starts the outdoor unit, and the R-to-G-and-Y/Y2 circuits start the furnace blower motor BLWM on cooling airflow. Cooling airflow is based on the A/C selection shown in Fig. 57. The electronic air cleaner terminal EAC-1 is energized with 115 vac when the blower motor BLWM is operating.

When the thermostat is satisfied, the R-to-G-and-Y circuits are opened. The outdoor unit will stop, and the furnace blower motor BLWM will continue operating at cooling airflow for an additional 90 seconds. Jumper Y/Y2 to DHUM to reduce the cooling off-delay to 5 seconds. (See Fig. 26.)

- b. **Single-Stage Thermostat and Two-Speed Cooling (Adaptive Mode) -**

See Fig. 34 for thermostat connections.

This furnace can operate a two-speed cooling unit with a single-stage thermostat because the furnace control CPU includes a programmed adaptive sequence of controlled operation, which selects low-cooling or high-cooling operation. This selection is based upon the stored history of the length of previous cooling period of the single-stage thermostat.

NOTE: The air conditioning relay disable jumper ACRDJ must be connected to enable the adaptive cooling mode in response to a call for cooling. (See Fig. 26.) When ACRDJ is in place the furnace control CPU can turn on the air conditioning relay ACR to energize the Y/Y2 terminal and switch the outdoor unit to high-cooling.

The furnace control CPU can start up the cooling unit in either low- or high-cooling. If starting up in low-cooling, the furnace control CPU determines the low-cooling on-time (from 0 to 20 minutes) which is permitted before switching to high-cooling. If the power is interrupted, the stored history is erased and the furnace control CPU will select low-cooling for up to 20 minutes and then energize the air conditioning relay ACR to energize the Y/Y2 terminal and switch the outdoor unit to high-cooling, as long as the thermostat continues to call for cooling. Subsequent selection is based on stored history of the thermostat cycle times.

The wall thermostat “calls for cooling”, closing the R-to-G-and-Y circuits. The R-to-Y1 circuit starts the outdoor unit on low-cooling speed, and the R-to-G-and-Y1 circuits starts the furnace blower motor BLWM at low-cooling airflow which is the true on-board CF selection as shown in Fig. 57.

If the furnace control CPU switches from low-cooling to high-cooling, the furnace control CPU will energize the air conditioning relay ACR. When the air conditioning relay ACR is energized the R-to-Y1-and-Y2 circuits switch the outdoor unit

to high-cooling speed, and the R-to-G-and-Y1-and-Y/Y2 circuits transition the furnace blower motor BLWM to high-cooling airflow. High-cooling airflow is based on the A/C selection shown in Fig. 57.

NOTE: When transitioning from low-cooling to high-cooling the outdoor unit compressor will shut down for 1 minute while the furnace blower motor BLWM transitions to run at high-cooling airflow.

The electronic air cleaner terminal EAC-1 is energized with 115 vac whenever the blower motor BLWM is operating.

When the thermostat is satisfied, the R-to-G-and-Y circuit are opened. The outdoor unit stops, and the furnace blower BLWM and electronic air cleaner terminal EAC-1 will remain energized for an additional 90 seconds. Jumper Y1 to DHUM to reduce the cooling off-delay to 5 seconds. (See Fig. 26.)

- c. **Two-Stage Thermostat and Two-Speed Cooling**
See Fig. 33 for thermostat connections

NOTE: The air conditioning relay disable jumper ACRDJ must be disconnected to allow thermostat control of the outdoor unit staging. (See Fig. 26.)

The thermostat closes the R-to-G-and-Y1 circuits for low-cooling or closes the R-to-G-and-Y1-and-Y2 circuits for high-cooling. The R-to-Y1 circuit starts the outdoor unit on low-cooling speed, and the R-to-G-and-Y1 circuit starts the furnace blower motor BLWM at low-cooling airflow which is the true on-board CF (continuous fan) selection as shown in Fig. 55. The R-to-Y1-and-Y2 circuits start the outdoor unit on high-cooling speed, and the R-to-G-and-Y/Y2 circuits start the furnace blower motor BLWM at high-cooling airflow. High-cooling airflow is based on the A/C (air conditioning) selection shown in Fig. 57.

The electronic air cleaner terminal EAC-1 is energized with 115 vac whenever the blower motor BLWM is operating.

When the thermostat is satisfied, the R-to-G-and-Y1 or R-to-G-and-Y1-and-Y2 circuits are opened. The outdoor unit stops, and the furnace blower BLWM and electronic air cleaner terminal EAC-1 will remain energized for an additional 90 seconds. Jumper Y1 to DHUM to reduce the cooling off-delay to 5 seconds. (See Fig. 26.)

4. Thermidistat Mode

See Fig. 27-29 for thermostat connections.

The dehumidification output, DHUM on the Thermidistat should be connected to the furnace control thermostat terminal DHUM. When there is a dehumidify demand, the DHUM input is activated, which means 24 vac signal is removed from the DHUM input terminal. In other words, the DHUM input logic is reversed. The DHUM input is turned ON when no dehumidify demand exists. Once 24 vac is detected by the furnace control on the DHUM input, the furnace control operates in Thermidistat mode. If the DHUM input is low for more than 48 hours, the furnace control reverts back to non-Thermidistat mode.

The cooling operation described in item 3. above also applies to operation with a Thermidistat. The exceptions are listed below:

- a. **Low cooling**-When the R-to-G-and-Y1 circuit is closed and there is a demand for dehumidification, the furnace blower motor BLWM will drop the blower airflow to 86 percent of low-cooling airflow which is the true on-board CF (continuous fan) selection as shown in Fig. 55.
- b. **High cooling**-When the R-to-G-and Y/Y2 circuit is closed and there is a demand for dehumidification, the furnace blower motor BLWM will drop the blower airflow to 86 percent of high-cooling airflow. High-cooling airflow is based on the A/C (air conditioning) selection shown in Fig. 55.

- c. **Cooling off-delay**-When the “call for cooling” is satisfied and there is a demand for dehumidification, the cooling blower-off delay is decreased from 90 seconds to 5 seconds.

5. Super-Dehumidify Mode

Super-Dehumidify mode can only be entered if the furnace control is in the Thermidistat mode and there is a demand for dehumidification. The cooling operation described in item 3. above also applies to operation with a Thermidistat. The exceptions are listed below:

- a. When the R-to-Y1 circuit is closed, R-to-G circuit is open, and there is a demand for dehumidification, the furnace blower motor BLWM will drop the blower airflow to 65 percent of low-cooling airflow for a maximum of 10 minutes each cooling cycle or until the R-to-G circuit closes or the demand for dehumidification is satisfied. Low-cooling airflow is the true on-board CF (continuous fan) selection as shown in Fig. 57.
- b. When the R-to-Y/Y2 circuit is closed, R-to-G circuit is open, and there is a demand for dehumidification, the furnace blower motor BLWM will drop the blower airflow to 65 percent of high-cooling airflow for a maximum of 10 minutes each cooling cycle or until the R-to-G circuit closes or the demand for dehumidification is satisfied. High-cooling airflow is based on the A/C (air conditioning) selection shown in Fig. 57.
- c. When the “call for cooling” is satisfied and there is a demand for dehumidification, the cooling blower-off delay is decreased from 90 seconds to 5 seconds.

6. Continuous Blower Mode

When the R-to-G circuit is closed by the thermostat, the blower motor BLWM will operate at continuous blower airflow. Continuous blower airflow selection is initially based on the CF (continuous fan) selection shown in Fig. 57. Factory default is shown in Fig. 57. Terminal EAC-1 is energized as long as the blower motor BLWM is energized.

During a call for heat, the furnace control CPU will transition the blower motor BLWM to continuous blower airflow, low-heat airflow, or the mid-range airflow, whichever is lowest. The blower motor BLWM will remain ON until the main burners ignite then shut OFF and remain OFF for the blower-ON delay (45 seconds in low-heat, and 25 seconds in high-heat), allowing the furnace heat exchangers to heat up more quickly, then restarts at the end of the blower-ON delay period at low-heat or high-heat airflow, respectively.

The blower motor BLWM will revert to continuous-blower airflow after the heating cycle is completed. In high-heat, the furnace control CPU will drop the blower motor BLWM to low-heat airflow during the selected blower-OFF delay period before transitioning to continuous-blower airflow.

When the thermostat “calls for low-cooling”, the blower motor BLWM will switch to operate at low-cooling airflow. When the thermostat is satisfied, the blower motor BLWM will operate an additional 90 seconds at low-cooling airflow before transitioning back to continuous-blower airflow.

When the thermostat “calls for high-cooling”, the blower motor BLWM will operate at high cooling airflow. When the thermostat is satisfied, the blower motor BLWM will operate an additional 90 seconds at high-cooling airflow before transitioning back to continuous-blower airflow. When the R-to-G circuit is opened, the blower motor BLWM will continue operating for an additional 5 seconds, if no other function requires blower motor

BLWM operation.

Continuous Blower Speed Selection from Thermostat

To select different continuous-blower airflow from the room thermostat, momentarily turn off the FAN switch or push button on the room thermostat for 1-3 seconds after the blower motor BLWM is operating. The furnace control CPU will shift the continuous-blower airflow from the factory setting to the next highest CF selection airflow as shown in Fig. 57. Momentarily turning off the FAN switch again at the thermostat will shift the continuous-blower airflow up one more increment. If you repeat this procedure enough you will eventually shift the continuous-blower airflow to the lowest CF selection as shown in Fig. 57. The selection can be changed as many times as desired and is stored in the memory to be automatically used following a power interruption.

NOTE: If the blower-off delay is set to the maximum, the adjustable continuous-fan feature is locked (i.e., fan speed cannot be changed from its current setting).

7. Heat pump

See Fig. 29 - 32 for thermostat connections.

When installed with a heat pump, the furnace control automatically changes the timing sequence to avoid long blower off times during demand defrost cycles. Whenever W/W1 is energized along with Y1 or Y/Y2, the furnace control CPU will transition to or bring on the blower motor BLWM at cooling airflow, low-heat airflow, or the mid-range airflow, whichever is lowest. The blower motor BLWM will remain on until the main burners ignite then shut OFF and remain OFF for 25 seconds before coming back on at heating airflow. When the W/W1 input signal disappears, the furnace control begins a normal inducer post-purge period while changing the blower airflow. If Y/Y2 input is still energized the furnace control CPU will transition the blower motor BLWM airflow to cooling airflow. If Y/Y2 input signal disappears and the Y1 input is still energized the furnace control CPU will transition the blower motor BLWM to low-cooling airflow. If both the Y1 and Y/Y2 signals disappear at the same time, the blower motor BLWM will remain on at low-heat airflow for the selected blower-OFF delay period. At the end of the blower- OFF delay, the blower motor BLWM will shut OFF unless G is still energized, in which case the blower motor BLWM will operate at continuous blower airflow.

8. Component test

The furnace features a component test system to help diagnose a system problem in the case of a component failure. To initiate the component test procedure, ensure that there are no thermostat inputs to the control and all time delays have expired. Turn on setup switch SW1-6. (See Fig. 26.)

NOTE: The component test feature will not operate if the control is receiving any thermostat signals or until all time delays have expired.

The component test sequence is as follows:

- a. The furnace control CPU turns the inducer motor ON at high-heat speed and keeps it ON through step c.
- b. After waiting 10 seconds the furnace control CPU turns the hot surface igniter ON for 15 seconds, then OFF.
- c. The furnace control CPU then turns the blower motor BLWM on at mid-range airflow for 15 seconds, then OFF.
- d. After shutting the blower motor OFF the furnace control CPU switches the inducer to low-heat speed for 10 seconds, then OFF.

NOTE: The EAC terminals are energized when the blower is operating.

After the component test is completed, 1 or more status codes (11, 25, or 41) will flash. See component test section or Service Label (Fig. 52) for explanation of status codes.

NOTE: To repeat component test, turn setup switch SW1-6 to OFF and then back ON.

Wiring Diagram

Refer to wiring diagram Fig. 53.

Troubleshooting

Refer to the service label. (See Fig. 52—Service Label.)

The Troubleshooting Guide (See Fig. 58.) can be a useful tool in isolating furnace operation problems. Beginning with the word “Start,” answer each question and follow the appropriate arrow to the next item.

The Guide will help to identify the problem or failed component. After replacing any component, verify correct operation sequence.

A more detailed Troubleshooting Guide is available from your distributor.

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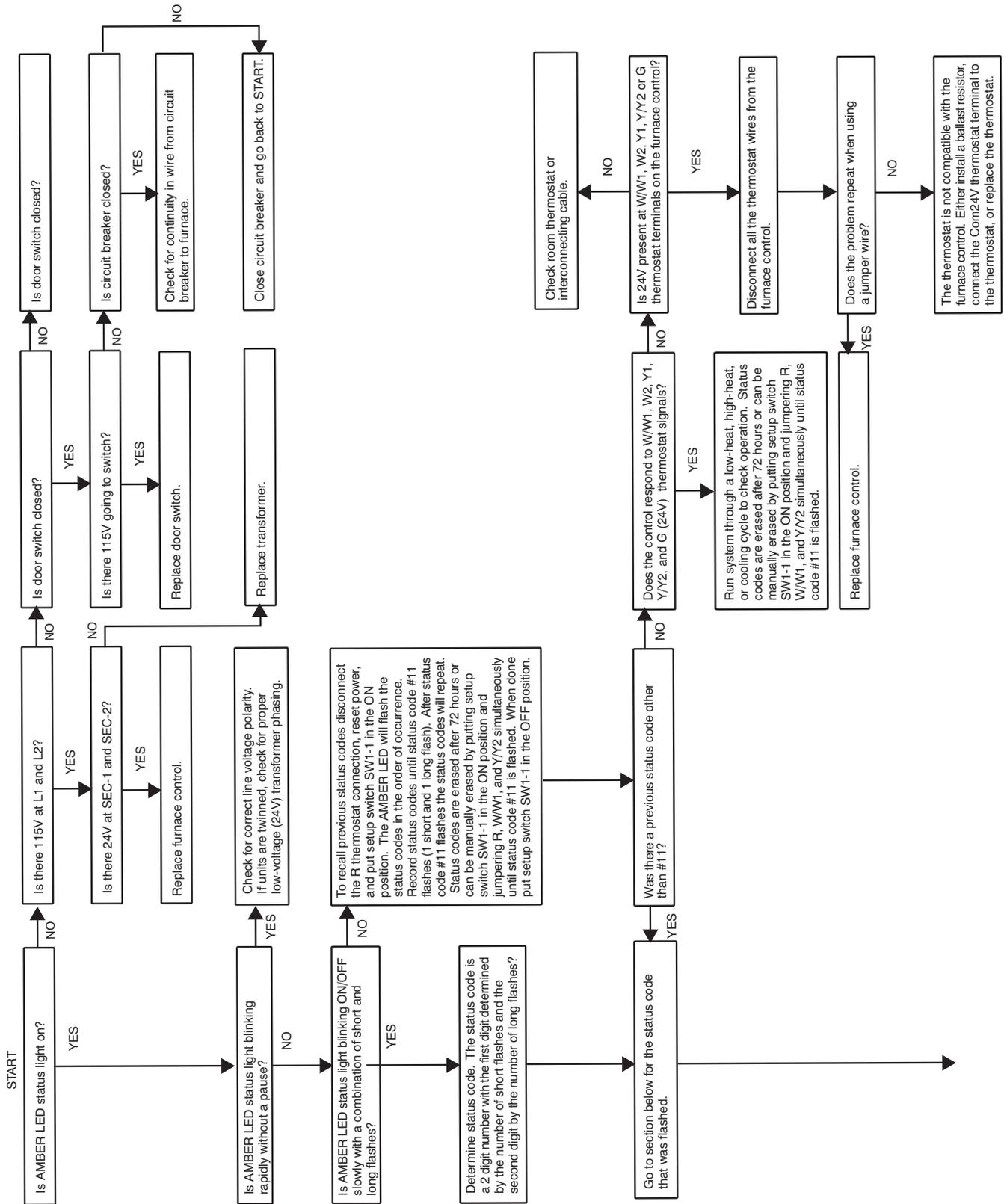
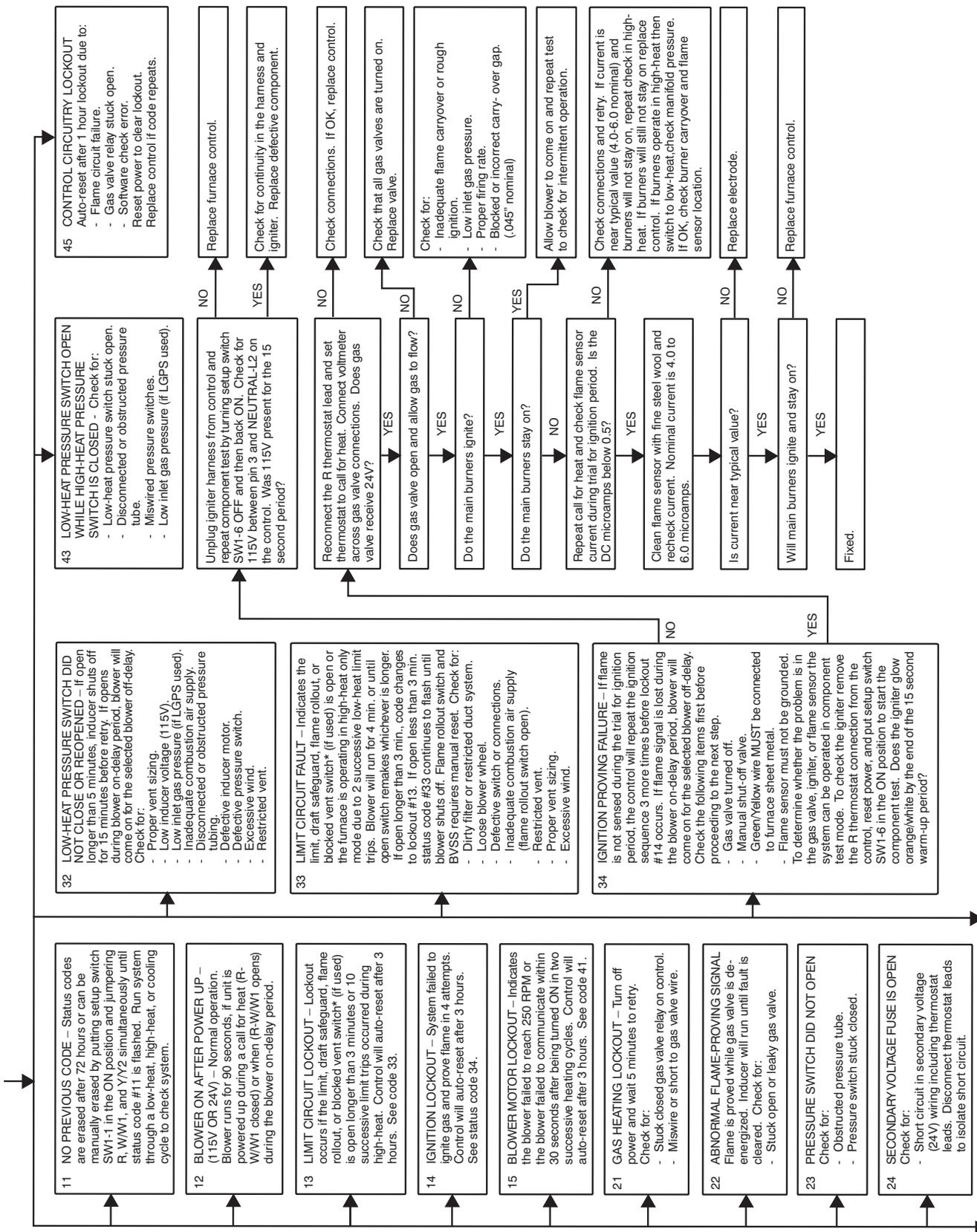
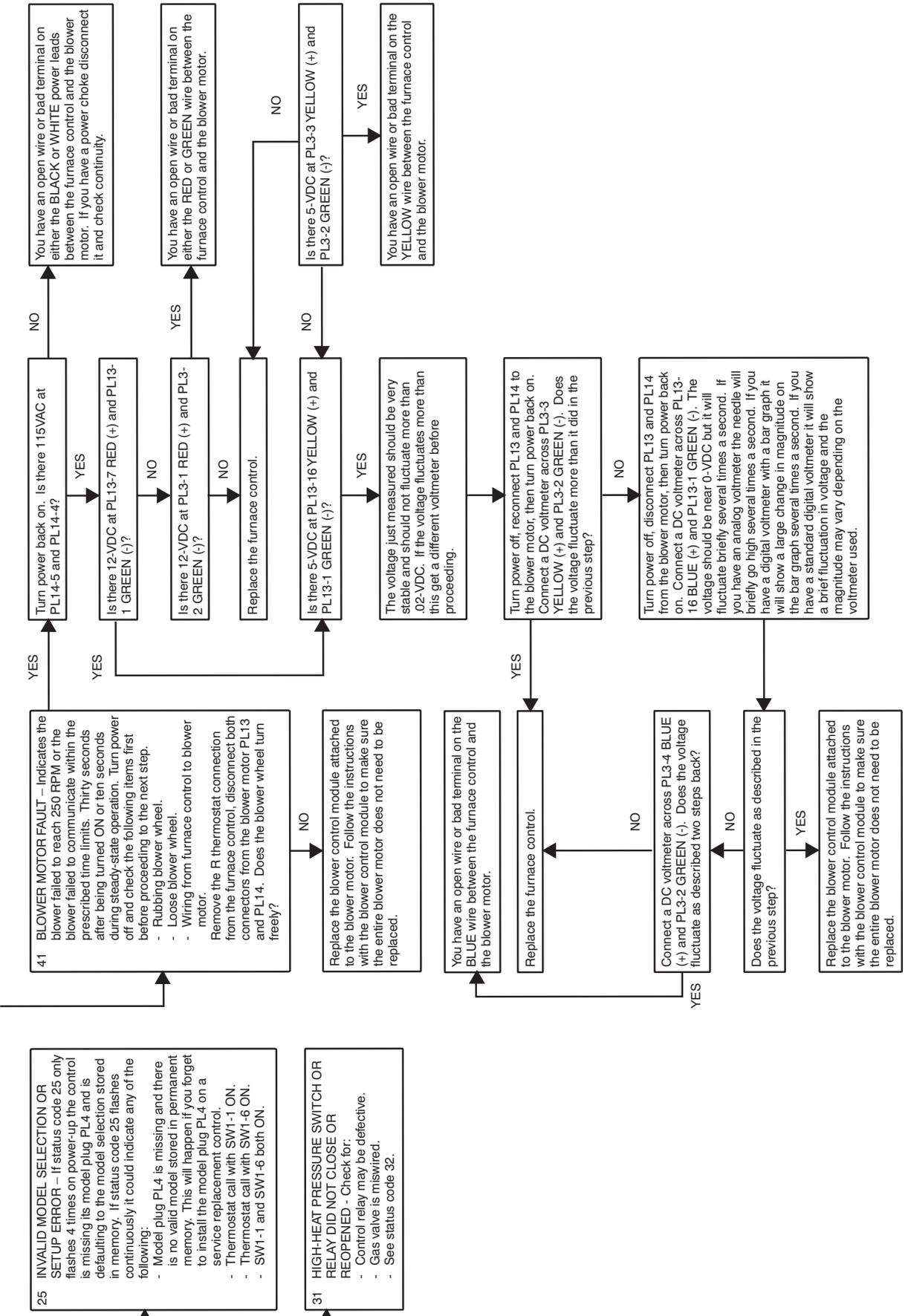


Fig. 58 - Troubleshooting Guide



* Blocked vent switch used in Chimney Adapter Kit



PARTS REPLACEMENT INFORMATION GUIDE

CASING GROUP

Outer door
Blower door
Top filler plate
Bottom filler plate
Bottom enclosure

ELECTRICAL GROUP

Control bracket
Junction box
Limit switch(es)
Circuit board
Door switch
Transformer
Wiring harness 115v
Wiring harness 24v

BLOWER GROUP

Blower housing
Blower cutoff
Blower motor
Blower wheel
Capacitor (where used)
Capacitor strap (where used)
Grommet
Power choke (where used)

GAS CONTROL GROUP

Manifold
Burner assembly
Orifice
Flame sensor
Hot surface igniter
Gas valve
Manual reset limit switches
Burner support assembly

HEAT EXCHANGER GROUP

Heat exchanger cell
Cell panel
Lox NOx baffle (California models only)

INDUCER GROUP

Housing assembly
Pressure switch
Inducer motor
Inducer wheel
Vent elbow assembly
Draft safeguard switch

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TO OBTAIN INFORMATION ON PARTS: Consult your installing dealer or classified section of your local telephone directory under "Heating Equipment" or "Air Conditioning Contractors and Systems" headings for dealer listing by brand name or contact:

BRYANT HEATING & COOLING SYSTEMS

Consumer Relations Department
P.O. Box 4952
Syracuse, New York 13221-4952
1-800-428-4326

Have available the model number, series number, and serial number located on the unit rating plate to ensure correct replacement part.

Example of Model Number

MODEL	VOLTAGE	IGNITION TYPE	COOLING SIZE (AIRFLOW)	HEATING SIZE	VARIATION	SERIES	VARIATION
315A	A	V	066	155	A	F	JA

WARNING: Improper installation, adjustment, alteration, service, or maintenance can cause personal injury, property damage, or death. Consult a qualified installer, service agency, or your local gas supplier for information or assistance. The qualified installer or service agency must use only factory-authorized replacement parts, kits, or accessories when modifying this product.