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installation, startup, and operating instructions

UPFLOW GAS-FIRED INDUCED-COMBUSTION FURNACE

395C
Series A
Sizes 040
thru 130

**FILE
COPY**

Cancels: New

II 395C-40-1
2/15/89

NOTE: Before beginning the installation, READ THESE INSTRUCTIONS CAREFULLY AND COMPLETELY.

INTRODUCTION

The design of the upflow gas-fired furnace is A.G.A./CGA certified for natural and propane gas and for installation on combustible flooring, in alcoves, attics, basements, closets, or utility rooms. The design of this furnace line is *not* A.G.A./CGA certified for installation in mobile homes, recreation vehicles, or outdoors.

Before installing the furnace, refer to the current edition of the National Fuel Gas Code NFPA No. 54-1988/ANSI Z223.1-1988. Canadian installations must be installed in accordance with CAN/CGA.B149 Installation Codes and all authorities having jurisdiction. For further information, the National Fuel Gas Code is available from National Fire Protection Association Inc. Batterymarch Park, Quincy, MA 02269, American Gas Association, 1515 Wilson Boulevard, Arlington, VA 22209, or from Literature Distribution.

TABLE I—MINIMUM CLEARANCES (In Inches)
(From Combustible Materials)

Size	040 and 055	075 thru 130
Sides—Single-Wall Vent	1	0
Type-B Double-Wall Vent	0	0
Back	0	0
Top of Plenum	1	1
Vent Connector—Single-Wall	6	6
Type-B Double Wall	1	1
Front—Single-Wall	6	6
Type-B Double-Wall Vent	3	3
Service	30	30

NOTES:

1. Provide 30-inch front clearance for servicing. An open door in front of the furnace can meet this requirement.
2. A minimum clearance of 3-inches must be provided in front of the furnace for combustion air and proper operation.

Reference should also be made to the regulations of the serving gas supplier and the local building, heating, plumbing, or other codes in effect in the area in which the installation is made.

CAUTION: Application of this furnace should be indoors with special attention given to vent sizing and material, gas input rate, air temperature rise, and unit sizing. Improper installation or misapplication of the furnace can require excessive servicing or cause premature component failure.



This furnace is designed for a minimum continuous return air temperature of 60 degrees F DB or an intermittent operation down to 55 degrees F DB such as when used with a thermostat night setback. Return air temperature must not exceed a maximum of 85 degrees F DB.

WARNING: Improper installation, adjustment, alteration, service, maintenance, or use can cause carbon monoxide poisoning, explosion, fire, electrical shock, or other conditions which may cause personal injury or property damage. Consult a qualified installer, service agency, local gas supplier or your distributor or branch for information or assistance. The qualified installer or agency must use only factory authorized and listed kits or accessories when modifying this product. A failure to adhere to this warning can cause electrical shock, fire, personal injury, or death.

I. LOCATION

A. General

CAUTION: Do not install furnace in a corrosive or contaminated atmosphere. Make sure all combustion and circulating air requirements are adhered to, in addition to all local codes and ordinances.

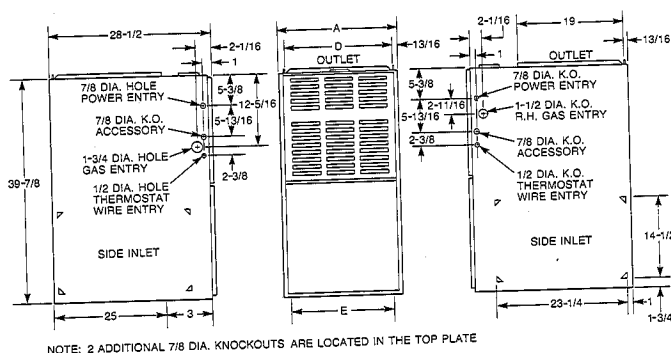
Do not use this furnace during construction when adhesives, sealers, and/or new carpets are being installed. If the furnace is required during construction, use clean outside air for combustion and ventilation. Compounds of chlorine and fluorine when burned with combustion air form acids which will cause corrosion of the heat exchangers and metal vent system. Some of these compounds are: paneling and dry wall adhesives, paints, thinners, masonry cleaning materials, and many other solvents commonly used in the construction process.

Locate the furnace close to the chimney/vent and as near the center of the air distribution system as possible. The furnace should be installed as level as possible.

The relief-air supply for the draft safeguard duct (drafhod) must be in the same atmospheric pressure zone as the combustion-air inlet supply to the furnace.

TABLE II—DIMENSIONS (In Inches)

Size	A	D	E	Vent Connection	Shipping Weight
024040	14-3/16	12-9/16	11-11/16	4	122
036040	14-3/16	12-9/16	11-11/16	4	124
024055	14-3/16	12-9/16	11-11/16	4	132
036055	14-3/16	12-9/16	11-11/16	4	134
036075	17-1/2	15-7/8	15	4	150
048075	21	19-3/8	18-1/2	4	154
036090	17-1/2	15-7/8	15	4	160
048090	21	19-3/8	18-1/2	4	166
060090	24-1/2	22-7/8	22	4	184
048110	21	19-3/8	18-1/2	5	178
060110	24-1/2	22-7/8	22	5	194
060130	24-1/2	22-7/8	22	5	204



NOTE: AIR DELIVERY ABOVE 1800 CFM REQUIRES THAT BOTH SIDES OF FURNACE BE USED, OR A COMBINATION OF ONE SIDE AND BOTTOM, OR BOTTOM ONLY FOR RETURN AIR.

Figure 1—Dimensional Drawing

When a furnace is installed so that the supply ducts carry air to areas outside the space containing the furnace, the return air must also be handled by a duct(s) sealed to the furnace casing and terminating outside the space containing the furnace.

Provide ample space for servicing and cleaning. Always comply with the minimum fire protection clearances shown on the unit rating plate. This furnace shall not be installed directly on carpeting, tile, or any combustible material other than wood flooring.

B. Location With Respect to Cooling Equipment

The cooling coil must be installed parallel with, or on the downstream side of, the furnace to avoid condensation in the heating element. When installed parallel with a furnace, dampers or other means used to control the flow of air must prevent chilled air from entering the unit. If the dampers are manually operated, they must be equipped with means to prevent operation of either unit unless the damper is in the full-heat or full-cool position.

C. Hazardous Locations

When the furnace is installed in a residential garage, it should be installed so that the burners and ignition source are located no less than 18-inches above the floor. Also, the furnace should be protected from physical damage by vehicles.

When a furnace is installed in public garages, airplane hangars, or other buildings having hazardous atmospheres, the unit should be installed in accordance with the recommended good practice requirements of the National Fire Protection Association, Inc.

II. AIR FOR COMBUSTION AND VENTILATION

Provisions for adequate combustion and ventilation air must be provided in accordance with Section 5.3, Air for Combustion and Ventilation, of the National Fuel Gas Code, ANSI Z223.1-1988, or applicable provisions of the local building codes.

Canadian installations must be installed in accordance with CAN/CGA.B149 Installation Codes, and all authorities having jurisdiction.

CAUTION: Air for combustion must not be contaminated by halogen compounds, which include fluoride, chloride, bromide and iodide.

These elements are found in aerosol sprays, detergents, bleaches, cleaning solvents, salts, air fresheners, and other household products.

All fuel burning equipment must be supplied with air for combustion of the fuel. Sufficient air **MUST** be provided to insure there will not be a negative pressure in the equipment room or space. In addition, a positive seal **MUST** be made between the furnace cabinet and the return-air duct pulling air from the burner area and draft safeguard opening.

CAUTION: THE OPERATION OF EXHAUST FANS, KITCHEN VENTILATION FANS, CLOTHES DRYERS, OR FIREPLACES COULD CREATE A NEGATIVE PRESSURE CONDITION AT THE FURNACE. MAKE UP AIR MUST BE PROVIDED FOR THE VENTILATION DEVICES IN ADDITION TO THAT REQUIRED BY THE FURNACE.

Combustion air requirements are determined by whether the furnace is in an UNCONFINED or CONFINED space.

A. Unconfined Space

An unconfined space must have at least 50 cubic feet for each 1000 Btuh of input for all the appliances (i.e. furnaces, clothes dryer, water heaters, etc.) in the space.

For Example:

Input Btuh	Minimum Sq Ft with 7-1/2 Ft Ceiling
50,000	333
100,000	667
150,000	1000

If the unconfined space is of unusually tight construction, air for combustion and ventilation **MUST** come from either the outdoors or spaces freely communicating with the outdoors. Combustion and ventilation openings must be sized the same as for a confined space. A minimum opening having a total of not less than 1 square inch per 5000 Btuh of total input rating for all equipment must be provided. Return air must not be taken from the room, unless an equal or greater amount of air is supplied to the room.

B. Confined Space

A confined space **MUST** have two permanent openings, one within 12-inches of the ceiling, and the other within 12-inches of the floor. See Figure 2.

NOTE: In determining the free area of an opening, the blocking effect of the louvers, grilles and screens must be considered. If the free area of a louver or grille design is unknown, it may be assumed that wood louvers have a 20 percent free area and metal louvers or grilles have a 60 per-

cent free area. Screens, when used, must not be smaller than 1/4-inch mesh. Louvers and grilles must be constructed so they cannot be closed.

The size of the openings depend upon whether the air comes from inside or outside of the structure.

1. All air from inside the structure
Each opening **MUST** have at least 1 square inch of free area per 1000 Btuh of the total input for all equipment within the confined space, but not less than 100 square inches per opening.

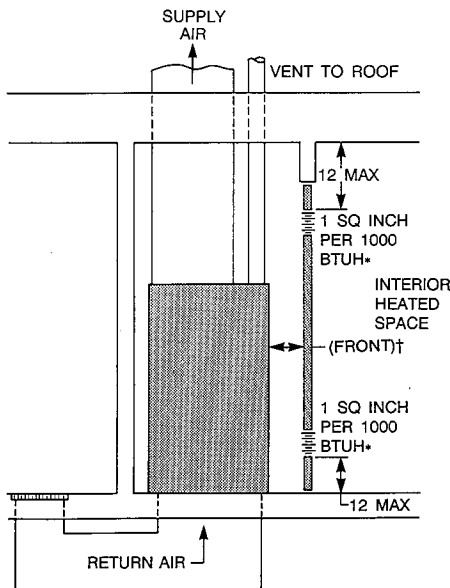
For Example:

Total Input Btuh	Free Area per Opening (square inches)
50,000	100
100,000	100
150,000	150

If the building is of unusually tight construction, a permanent opening directly communicating with the outdoors shall be provided. This opening shall have a minimum free area of 1 square inch per 5000 Btuh of total input rating for all equipment in the enclosure.

If the furnace is installed on a raised platform to provide a return air plenum, and return air is taken directly from the hallway or space adjacent to the furnace, all air for combustion must come from outdoors.

2. All air from outdoors
 - a. If combustion air is taken from outdoors through vertical ducts, the openings and ducts **MUST** have at least one square inch of free area per 4000 Btuh of the total input for all equipment within the confined space.



*Minimum opening size is 100 square inches.
†Minimum of 3 inches when type-B vent is used.

Figure 2

For Example:

Total Input Btuh	Free Area per Opening (square inches)	Round Pipe (inches dia)
50,000	12.5	4
100,000	25.0	6
150,000	37.5	7

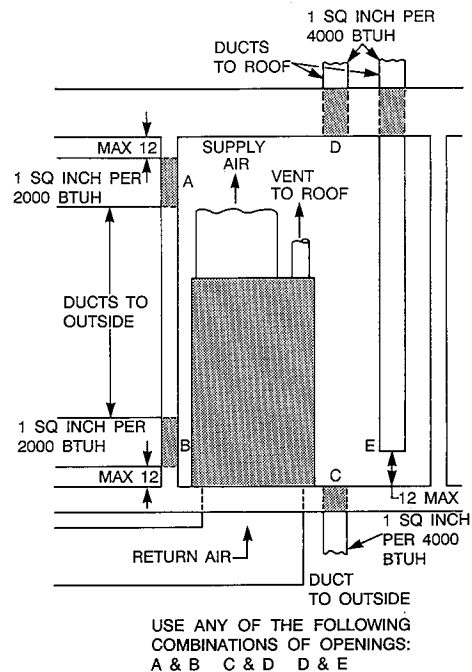
- b. If combustion air is taken from the outdoors through horizontal ducts, the openings and ducts **MUST** have at least one square inch of free area per 2000 Btuh of the total input for all equipment within the confined space.

For Example:

Total Input Btuh	Free Area per Opening (square inches)	Round Pipe (inches dia)
50,000	25	6
100,000	50	8
150,000	75	10

When ducts are used, they must be of the same cross sectional area as the free area of the openings to which they connect. The minimum dimension of rectangular ducts must not be less than 3-inches. See Figure 3.

WARNING: Do not install the furnace on its back; safety control operation will be adversely affected. Never connect return air ducts to the back of the furnace. A failure to adhere to this warning can cause a fire, physical injury, or death.



USE ANY OF THE FOLLOWING COMBINATIONS OF OPENINGS:
A & B C & D D & E

Figure 3

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A89013

III. FILTER ARRANGEMENT

The factory-supplied filter(s) is shipped in the blower compartment. After the return-air duct has been connected to the furnace, install the filter(s) inside the furnace blower compartment. See Figure 4 for side return application and Figure 5 for bottom return application.

A bottom closure panel is factory-installed in the bottom of the furnace. When bottom return inlet is desired, remove and discard the enclosure panel.

TABLE III—FILTER INFORMATION

Furnace Casing Width	Filter Size*		Filter Type
	Side Return	Bottom Return	
14-3/16	(1) 16 x 25 x 1†	(1) 14 x 25 x 1	Cleanable
17-1/2	(1) 16 x 25 x 1†	(1) 16 x 25 x 1	Cleanable
21	(1) 16 x 25 x 1	(1) 20 x 25 x 1†	Cleanable
24-1/2	(2) 16 x 25 x 1†	(2) 12 x 25 x 1	Cleanable

*Filters can be field-modified by cutting and folding the frame as indicated on the filter. Alternate sizes can be ordered from your Distributor or Dealer.

†Factory provided with the furnace.

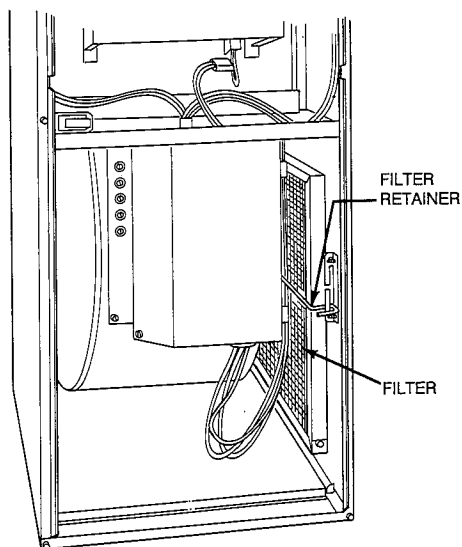


Figure 4—Side Filter Arrangement

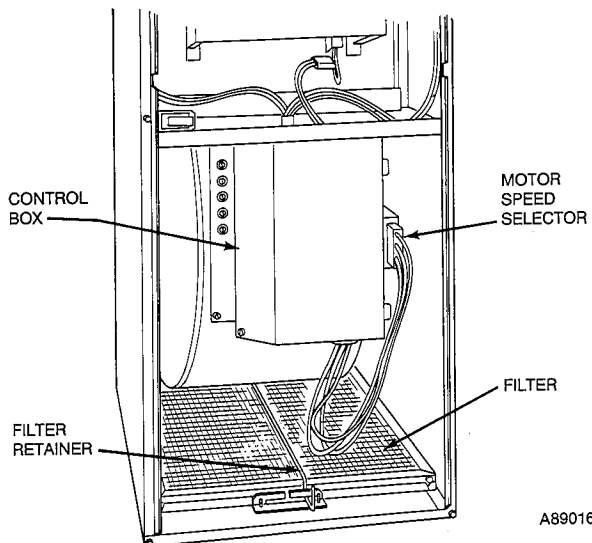


Figure 5—Bottom Filter Arrangement

WARNING: Never operate unit without a filter or with filter access door removed. A failure to adhere to this warning can cause a fire, physical injury, or death.

IV. LEVELING LEGS (If Required)

When the furnace is used with side inlet(s), and leveling legs are required, refer to Figure 6, and install field-supplied corrosion-resistant 5/16-inch machine bolts and nuts.

NOTE: The maximum length of the bolt should not exceed 1-1/2 inches.

1. Lay furnace on its back, locate and drill 5/16-inch diameter hole in each bottom corner of furnace as shown in Figure 6.
2. Install nut on bolt and install bolt and nut in hole. (Install flat washer if desired.)
3. Install another nut on other side of furnace base. (Install flat washer if desired.)
4. Adjust outside nut to provide desired height, and tighten inside nut to secure arrangement.

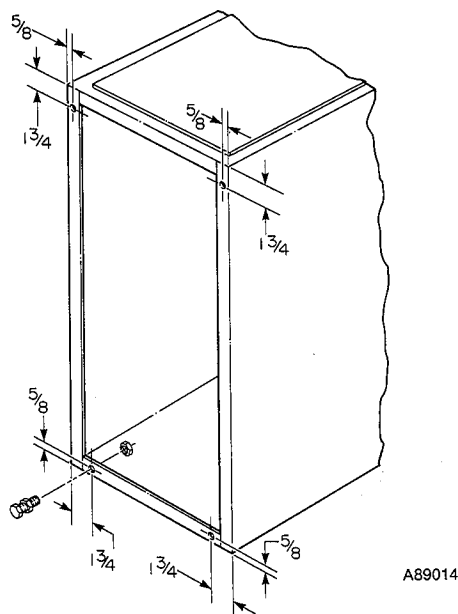


Figure 6—Leveling Leg Installation

V. GAS PIPING

Gas piping must be installed in accordance with national and local codes. Refer to the current edition of the National Fuel Gas Code.

Canada installations must be installed in accordance with CAN/CGA.B149 Installation Codes, and all authorities having jurisdiction.

CAUTION: If a flexible connector is required or allowed by the authority having jurisdiction, black iron pipe shall be installed at the gas valve and extend a minimum of 2 inches outside the furnace casing.

Piping should be pressure-tested in accordance with local and national plumbing and gas codes before the furnace has been attached. If the pressure exceeds 0.5 psig (14-inch wc), the gas supply pipe must be disconnected from the furnace and capped before the pressure test. If the test pressure is equal to or less than 0.5 psig (14-inch wc), close the manual shut-off valve located on the gas valve before the test. It is recommended that the ground joint union be loosened before pressure testing.

shut-off valve located on the gas valve before the test. It is recommended that the ground joint union be loosened before pressure testing.

After all connections have been made, purge the lines and check for leakage.

WARNING: Never purge a line into a combustion chamber. Never use matches, candles, flame, or other sources of ignition for the purpose of checking leakage. Use a soap-and-water solution to check for leakage. A failure to adhere to this warning can cause a fire, explosion, physical injury, or death.

An accessible manual shut-off valve shall be installed upstream of the furnace gas controls and within 6 feet of the furnace. A 1/8-inch NPT plugged tapping, accessible for test gauge connection, must be installed immediately upstream of the gas supply connection to the furnace and downstream of the manual shut-off valve.

WARNING: Use the proper length of pipes to avoid stress on the gas control manifold. A failure to adhere to this warning can cause a gas leak resulting in a fire, explosion, physical injury, or death.

CAUTION: Use a backup wrench when connecting the gas pipe to the furnace to avoid damaging gas controls.

VI. ELECTRICAL CONNECTIONS

A. 115-Voltage Wiring

Refer to the unit rating plate for equipment electrical requirements. The control system requires an earth ground for proper operation.

CAUTION: Do not connect aluminum wire between disconnect switch and furnace.

Make all electrical connections in accordance with the National Electrical Code ANSI/NFPA 70-1987 and any local codes or ordinances that might apply. For Canadian installations, all electrical connections must be made in accordance with CSA C22.1 Canadian Electrical Code, or authorities having jurisdiction.

WARNING: The cabinet **must** have an uninterrupted or unbroken ground according to National Electrical Code, ANSI/NFPA 70-1987 and Canadian Electrical Code, CSA C22.1 or local codes to minimize personal injury if an electrical fault should occur. This may consist of electrical wire or conduit approved for electrical ground when installed in accordance with existing electrical codes. Do not use gas piping as an electrical ground.

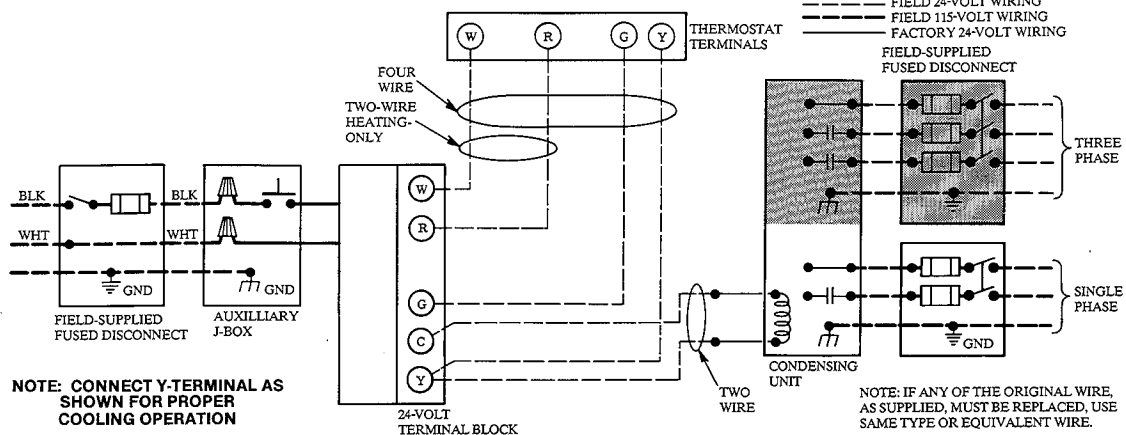


Figure 8—Heating and Cooling Application Wiring Diagram

TABLE IV—ELECTRICAL DATA

Furnace Size	Volts-Hertz-Phase	Operating Voltage Range		Max. Unit Amps	Min. Wire Size	Max. Wire Length Feet†	Max. Fuse† or HACR-Type Ckt Bkr Amps
		Max.*	Min.*				
024040	115—60—1	127	104	6.7	14	53	15
036040	115—60—1	127	104	8.3	14	43	15
024055	115—60—1	127	104	7.1	14	50	15
036055	115—60—1	127	104	8.7	14	41	15
036075	115—60—1	127	104	9.0	14	40	15
048075	115—60—1	127	104	10.4	14	35	15
036090	115—60—1	127	104	7.9	14	45	15
048090	115—60—1	127	104	9.6	14	37	15
060090	115—60—1	127	104	14.4	12	40	20
048100	115—60—1	127	104	10.0	14	36	15
060100	115—60—1	127	104	13.3	12	43	20
060130	115—60—1	127	104	14.0	12	41	20

*Permissible limits of the voltage range at which the unit will operate satisfactorily.

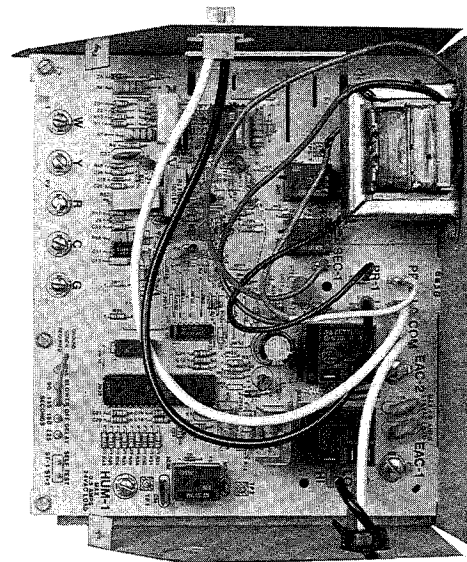
†Time-delay fuse is recommended.

‡Length shown is as measured one way along wire path between unit and service panel for maximum 2% voltage drop.

NOTE: Proper polarity must be maintained for 115-VAC wiring. If polarity is incorrect, the microprocessor will shut off gas flow shortly after the completion of ignition trial period.

B. 24-Voltage Wiring

Make field 24-volt connections at the 24-volt terminal strip. See Figure 7. Connect terminal Y as shown in Figure 8 for proper cooling operation.



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Figure 7—Control Center

C. Accessory

1. Electronic air cleaner
Two screw terminals (EAC-1 and EAC-2) are provided for electronic air cleaner connection. The terminals are energized with 115 VAC, 1 amp maximum during blower motor operation.
2. Humidifier
Screw terminals (HUM-1 and C) are provided for 24-VAC humidifier connection. The terminals are energized with 24 VAC, 0.5 amp maximum during heating blower motor operation.

VII. VENTING

These instructions are to be used only for 395C Furnace vent systems. These furnaces are equipped with induced-combustion blowers, and are classified as Category I type furnaces in accordance with ANSI/A.G.A. Z21.47 central furnace standards. Category I furnaces use nonpositive, noncondensing vent systems, and may be connected to lined masonry chimneys sized and installed per the National Fuel Gas Code.

However, the venting of this furnace into a lined masonry chimney could result in the formation of flue gas condensate due to cold surfaces and oversizing. If condensate is present in the masonry chimney, a drain must be provided to prevent condensate flow into the vent connector and furnace. Field experience on induced-combustion furnaces has shown that venting through a properly sized Type-B vent significantly reduces the occurrence of vent condensation. Any condensate formed is acidic and could cause corrosion of the vent materials. Therefore, manufacturer recommends that these furnaces be connected to vent systems constructed of Type-B vent material.

A. General Instructions

1. This furnace must be installed in accordance with these instructions, the National Fuel Gas Code NFPA No. 54-1988/ANSI Z223.1-1988, and all applicable local codes, and all authorities having jurisdiction.
2. This furnace must not be connected to a chimney flue servicing a separate appliance designed to burn solid fuel.
3. Never connect this furnace to a chimney serving a fireplace, unless the fireplace opening is sealed off.
4. This furnace is recommended for connection to a vent system constructed of Type-B double-wall vent pipe (UL or ULC listed). Connection to Type-B vent system using a minimum length single-wall vent pipe as a vent connector or a listed single-wall to Type-B vent adapter is required (see Section B.1). A minimum 1-inch clearance is required between the Type-B vent pipe and combustible material.
5. Insulation may be added to the Type-B and single-wall pipe and vent connector if allowed by local codes. Added insulation should be made of fiberglass, and be at least 1-inch thick with a foil backing. Attach insulation to vent pipe with permanent foil tape. (Both the tape and insulation must be suitable for temperatures up to 350°F.)
6. Insulation should be used for any vent or vent connector which will be exposed to ambient temperatures of 30 degrees Fahrenheit or less. Do not add insulation to vent pipe exposed to outdoor weather conditions (i.e. above roof lines).
7. Do not use a vent size smaller or larger than the size shown in Tables V thru XIII.
8. If this furnace is connected to a lined, masonry chimney, the chimney must be sized and installed according

to the provisions of the National Fuel Gas Code, or Canadian CAN/CGA.B149 requirements. Vent connectors from the furnace to the chimney must be made with insulated (minimum 1-inch thick foil backed fiberglass) single-wall vent pipe or Type-B vent pipe.

9. Installation of the vent pipe should be as directly as possible, with a minimum number of turns or elbows.
10. Maintain a minimum of 1/4-inch upward slope per linear foot on all horizontal vent pipe runs.
11. Rigidly support the vent pipe every 5 feet or less with hangers or straps to ensure that there will be no movement after installation.
12. No portion of the vent system shall extend into, or pass through, any circulation air duct or plenum.
13. The Type-B vent system shall terminate above the roof surface per the National Fuel Gas Code or CAN/CGA.B149 requirements, and shall include a UL or ULC listed vent cap or roof assembly, unless prohibited by local codes.
14. This furnace may be common vented with another furnace or other listed gas-fired appliances. Total input rates of all appliances will determine the vent size. See Sections C and D.
15. If a common vent system becomes blocked, the furnace will be shut off by the draft safeguard switch located on the inducer assembly.

WARNING: Do not bypass the draft safeguard switch, as an unsafe condition exists which must be corrected. A failure to adhere to this warning could result in a buildup of carbon monoxide and lead to personal injury or death.

16. All vent pipe passing through floors, ceilings, and walls must be installed with the proper clearances from combustible material, and be fire-stopped according to the National Fuel Gas Code requirements and Canadian Standards CAN/CGA.B149.
17. In replacement installation, where an existing vent system may be used, the vent system must be inspected for condition, size, type of vent material, and height to meet these instructions. Never use an existing vent system which is larger than shown in Tables V thru XIII. The vent system will be oversized, and condensation could occur.
18. When removing an existing furnace from a common vent system, the vent system is likely to be oversized for the remaining appliances. Refer to Section E for additional information.
19. Vent connectors or vents servicing Category I appliances shall not be connected into any portion of mechanical draft systems operating under positive pressure.

B. Venting Tables For Dedicated Vent System (one 395C Furnace)

The following tables are used to size the vent system for the 395C Furnaces when using a dedicated vent system made of Type-B vent. The tables indicate the maximum horizontal length of vent pipe allowed for a vent system of a set height and number of elbows. Each table also includes information for insulated and uninsulated vent systems. See Tables V thru X and Figure 10.

1. A single-wall vent connector may be used to attach the Type-B vent to the furnace flue outlet, but the single-wall pipe must be insulated as indicated in Section A.5. A listed single-wall to Type-B vent adapter may also be used.

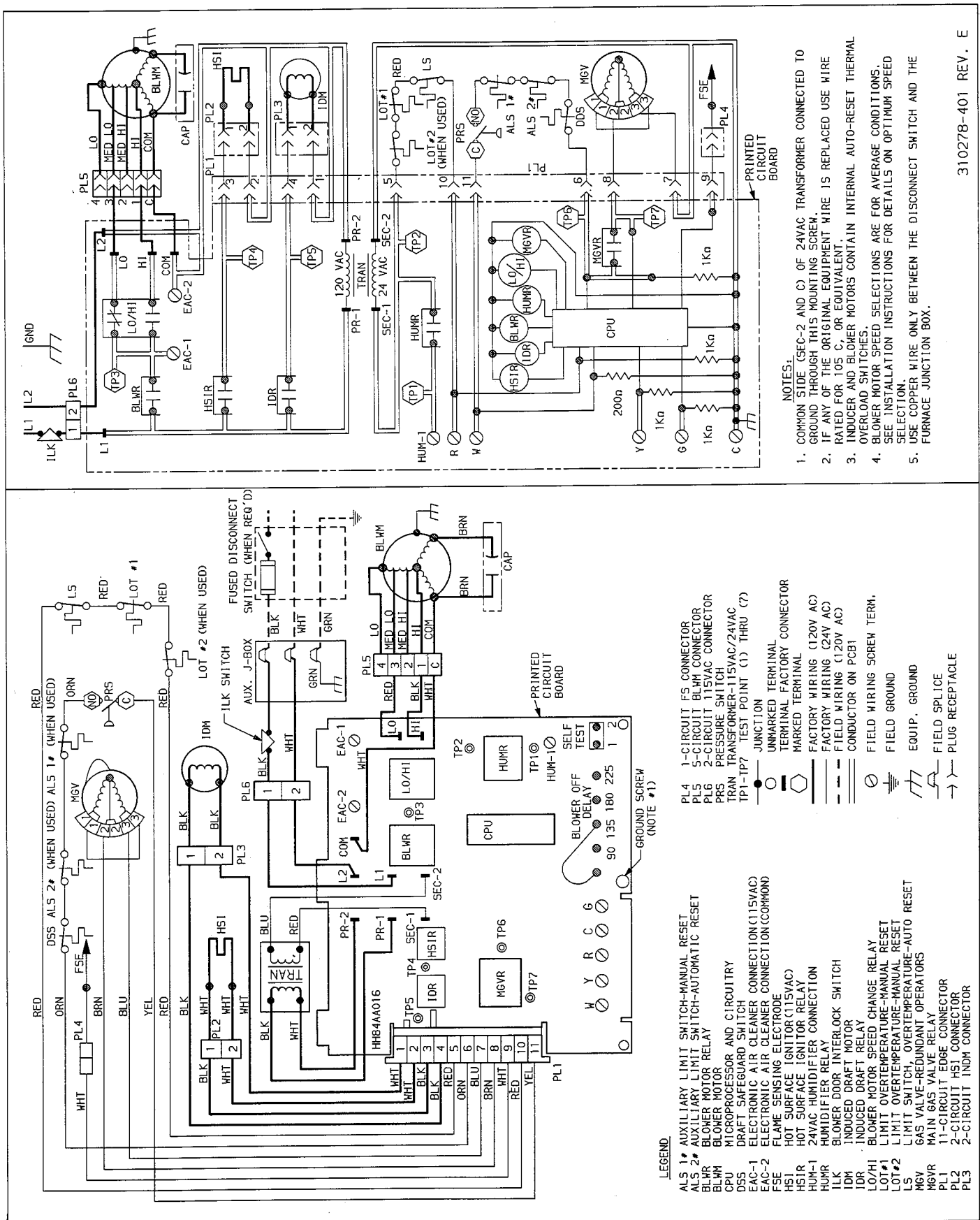
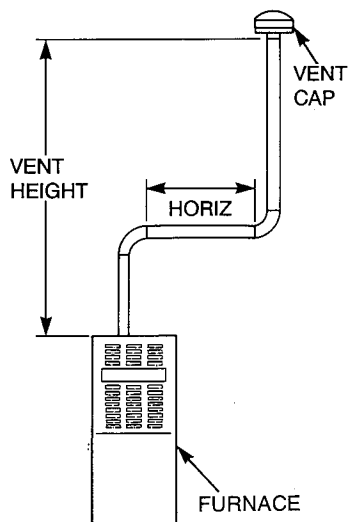


Figure 9—Unit Wiring Diagram

- Each table is for a specific size of furnace, depending upon the rated furnace input.
- The horizontal length of vent must not exceed the vertical length of the system.

C. Venting Tables For Common Vented Furnaces (two or more 395C Furnaces)

- When common venting two or more furnaces, determine the total heat input to the venting system, and select the smallest vent size which will meet that rated input.



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Figure 10—Dedicated Vent

TABLE V—DEDICATED TYPE-B VENT FOR 395CAV024040 AND 036040 MAXIMUM HORIZONTAL LENGTH ALLOWED (Feet)

Height	Number of 90° Elbows						Vent Pipe
	0	1	2	3	4	5	
5	0	5	5	4	NA	NA	4-INCH DIAMETER
10	0	10	10	10	10	10	
15	0	10	10	10	10	10	
20	0	6	6	6	6	6	
20*	0	20*	20*	20*	20*	20*	
25	0	NA	NA	2	2	2	
25*	0	25*	25*	25*	25*	25*	
30	NA	NA	NA	NA	NA	NA	
30*	0	30*	30*	30*	30*	30*	5-INCH DIAMETER
5	0	5	5	5	5	5	
10	0	4	4	4	4	4	
15	0	NA	NA	NA	NA	NA	
15*	0	15*	15*	15*	15*	15*	
20	NA	NA	NA	NA	NA	NA	
20*	0	20*	20*	20*	20*	20*	
25	NA	NA	NA	NA	NA	NA	
25*	0	25*	25*	25*	25*	25*	
30	NA	NA	NA	NA	NA	NA	
30*	0	30*	30*	30*	30*	30*	

NA—Not allowed. Condensation or positive pressure in vent system could occur.

*Insulated with 1-inch of foil-backed insulation.

TABLE VI—DEDICATED TYPE-B VENT FOR 395CAV024055 AND 036055 MAXIMUM HORIZONTAL LENGTH ALLOWED (Feet)

Height	Number of 90° Elbows						Vent Pipe
	0	1	2	3	4	5	
5	0	5	NA	NA	NA	NA	4-INCH DIAMETER
10	0	10	10	10	NA	NA	
15	0	15	15	15	15	15	
20	0	20	20	20	20	20	
25	0	18	16	16	18	18	
25*	0	25*	25*	25*	25*	25*	
30	0	4	4	4	16	16	
30*	0	30*	30*	30*	30*	30*	5-INCH DIAMETER
5	0	5	5	5	NA	NA	
10	0	10	10	10	10	10	
15	0	15	15	15	15	15	
20	0	12	12	12	14	14	
20*	0	20*	20*	20*	20*	20*	
25	0	8	8	8	10	10	
25*	0	25*	25*	25*	25*	25*	
30	0	4	4	4	8	8	
30*	0	30*	30*	30*	30*	30*	

NA—Not allowed. Condensation or positive pressure in vent system could occur.

*Insulated with 1-inch of foil-backed insulation.

TABLE VII—DEDICATED TYPE-B VENT FOR 395CAV036075 AND 048075 MAXIMUM HORIZONTAL LENGTH ALLOWED (Feet)

Height	Number of 90° Elbows						Vent Pipe
	0	1	2	3	4	5	
5	NA	NA	NA	NA	NA	NA	4-INCH DIAMETER
10	0	10	NA	NA	NA	NA	
15	0	15	15	15	NA	NA	
20	0	20	20	20	16	10	
25	0	25	25	25	25	20	
30	0	30	30	30	30	30	
5	0	5	5	5	NA	NA	5-INCH DIAMETER
10	0	10	10	10	10	10	
15	0	15	15	15	15	15	
20	0	20	20	20	20	20	
25	0	22	22	22	22	22	
30	0	20	20	20	22	22	

NA—Not allowed. Condensation or positive pressure in vent system could occur.

TABLE VIII—DEDICATED TYPE-B VENT FOR 395CAV036090, 048090, AND 060090 MAXIMUM HORIZONTAL LENGTH ALLOWED (Feet)

Height	Number of 90° Elbows						Vent Pipe
	0	1	2	3	4	5	
5	NA	NA	NA	NA	NA	NA	4-INCH DIAMETER
10	NA	10	NA	NA	NA	NA	
15	0	15	8	6	NA	NA	
20	0	20	20	16	12	4	
25	0	25	25	24	18	12	
30	0	30	30	30	28	22	5-INCH DIAMETER
5	0	5	2	NA	NA	NA	
10	0	10	10	10	NA	NA	
15	0	15	15	15	15	15	
20	0	20	20	20	20	20	
25	0	25	25	25	25	25	
30	0	30	30	30	30	30	

NA—Not allowed. Condensation or positive pressure in vent system could occur.

**TABLE IX—DEDICATED TYPE-B VENT FOR
395CAV048110 AND 060110 MAXIMUM
HORIZONTAL LENGTH
ALLOWED (Feet)**

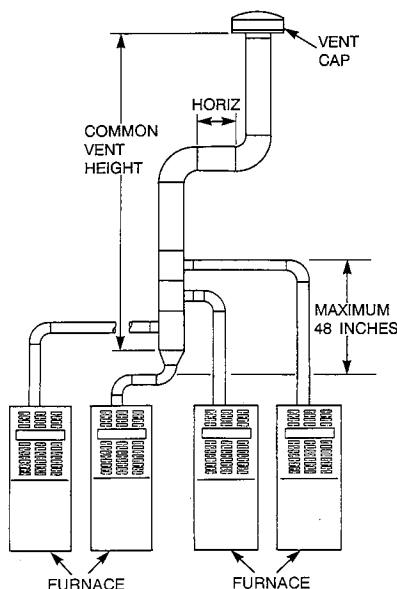
Height	Number of 90° Elbows						Vent Pipe
	0	1	2	3	4	5	
5	NA	NA	NA	NA	NA	NA	5-INCH DIAMETER
10	0	10	6	NA	NA	NA	
15	0	15	15	15	15	6	
20	0	20	20	20	20	20	
25	0	25	25	25	25	25	
30	0	30	30	30	30	30	
5	0	5	5	4	NA	NA	6-INCH DIAMETER
10	0	10	10	10	10	10	
15	0	15	15	15	15	15	
20	0	20	20	20	20	20	
25	0	25	25	25	25	25	
30	0	30	30	30	30	30	

NA—Not allowed. Condensation or positive pressure in vent system could occur.

**TABLE X—DEDICATED TYPE-B VENT FOR
395CAV060130 MAXIMUM HORIZONTAL LENGTH
ALLOWED (Feet)**

Height	Number of 90° Elbows						Vent Pipe
	0	1	2	3	4	5	
5	NA	NA	NA	NA	NA	NA	5-INCH DIAMETER
10	0	10	10	NA	NA	NA	
15	0	15	15	15	15	15	
20	0	20	20	20	20	20	
25	0	25	25	25	25	25	
30	0	30	30	30	30	30	
5	0	5	5	5	NA	NA	6-INCH DIAMETER
10	0	10	10	10	10	10	
15	0	15	15	15	15	15	
20	0	20	20	20	20	20	
25	0	25	25	25	25	25	
30	0	30	30	30	30	30	

NA—Not allowed. Condensation or positive pressure in vent system could occur.



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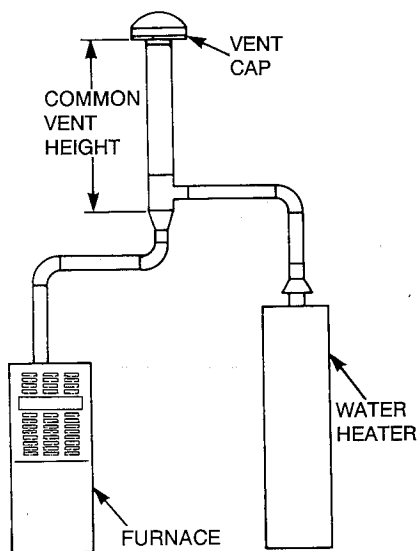
Figure 11—Common Venting of Furnaces

- No more than four furnaces may be vented together into a common vent system. See Figure 11 and Table XI.
- Refer to the tables shown in Section B for information to correctly size the vent connector for each furnace.
- Vent connectors should be as short and direct as possible, and must be made of Type-B vent or insulated single-wall vent pipe. To connect each furnace to the Type-B vent, a listed single-wall to Type-B vent adapter may be used. Refer to Section A.5 for insulation information.
- The vent connectors should be spaced at least 1 foot apart when entering the common vent system (1-foot rise).
- The vent connectors and vent system must be insulated if any part of the vent is exposed to ambient temperatures of 30 degrees Fahrenheit or less. Refer to Section A.5 for insulation information.
- For multi-story installation, refer to Appendix G of National Fuel Gas Code or Canadian standards CAN/CGA.B149 for additional information in sizing the common vent. Individual vent connectors should be sized per the single appliance tables shown in Section B.

**TABLE XI—COMMON VENTING OF MULTIPLE
FURNACES**

Number of Furnaces	395C Size	Common Vent Height (Ft)		Vent Dia (Inches)
		Minimum	Maximum*	
2	024040 or 036040	8	40	5
		6	40	6
3		14	40	5
		8	40	6
4		14	40	6
		8	40	7
2	024055 or 036055	14	40	5
		8	40	6
3		14	40	6
		8	40	7
4		14	40	7
		10	40	8
2	036075 or 048075	10	40	6
		8	40	7
3		14	40	7
		8	40	8
4		14	40	8
		10	40	9
2	036090, 048090, or 060090	14	40	6
		10	40	7
3		10	40	8
		8	40	9
4		10	40	9
		10	40	10
2	048110 or 060110	14	40	7
		8	40	8
3		10	40	9
		8	40	10
4		16	40	9
		10	40	10
2	060130	10	40	7
		6	40	8
3		6	40	9
		14	40	8
4		8	40	9
		8	40	10
		18	40	8
		14	40	9
		10	40	10

*For applications requiring vent heights greater than 40 ft, contact your Distributor/Dealer for more information.



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Figure 12—Common With Water Heater

TABLE XII—COMMON VENT WITH WATER HEATER (NO HORIZONTAL)

395C Size	Vent Connector Length (Ft)	Common Vent Height (Ft)		Common Vent Dia (Inches)
		Minimum	Maximum*	
024040 or 036040†	5	12	30	4
		6	30	5
	10	12	30	4
		6	24	5
	15	12	26	4
		6	16	5
024055 or 036055†	5	18	30	4
		8	30	5
	10	20	30	4
		8	30	5
	15	20	30	4
		8	30	5
036075 or 048075‡	5	10	30	5
		5	30	6
	10	10	30	5
		5	30	6
	15	10	30	5
		5	30	6
036090, 048090, or 060090†	5	14	30	5
		6	30	6
	10	14	30	5
		6	30	6
	15	14	30	5
		6	30	6
048110 or 060110‡	5	10	30	6
		5	30	7
	10	10	30	6
		5	30	7
	15	10	30	6
		5	30	7
060130‡	5	8	30	6
		6	30	7
		6	30	8
	10	8	30	6
		6	30	7
		6	30	8
	15	10	30	6
		6	30	7
		6	30	8

*For applications requiring vent heights greater than 30 ft, contact your Distributor/Dealer for more information.

†Installed with a 40,000 Btuh gas-fired water heater

‡Installed with a 50,000 Btuh gas-fired water heater

D. Venting Tables For Common Vents (one 395C Furnace and gas hot water heater)

1. When common venting a furnace and a hot water heater, determine the total heat input to size the venting system. Refer to the water heater rating plate for the heat input rate typical input is 40,000 Btuh.
2. Size vent system using Tables XII and XIII.
3. Vent connectors should be as short and as direct as possible. The vent connector for the 395C Furnace must be made of Type-B vent. A minimum length of insulated single-wall vent connector may be used. A listed single-wall to Type-B vent adapter is also acceptable. See Figure 12.
4. Refer to tables in Section B to size the vent connector for the 395C Furnace. The water heater vent connector should be sized per the National Fuel Gas Code.
5. If the vent connector is exposed to ambient temperature of 30 degrees Fahrenheit or less, it must be insulated as indicated per Section A.5.
6. The vent connectors must be spaced within 3 feet of each other (3-foot rise).
7. Where possible, locate the vent closer to or directly over the smaller appliance connector.

TABLE XIII—COMMON VENT WITH WATER HEATER (UP TO 10 FEET HORIZONTAL)

395C Size	Vent Connector Length (Ft)	Insulation Required	Common Vent Height (Ft)		Common Vent Dia (Inches)
			Minimum	Maximum*	
024040† or 036040†	5	—	8	22	5
		yes	6	30	5
	10	—	8	14	5
		yes	6	30	5
	15	—	NA	NA	5
		yes	6	30	5
024055† or 036055†	5	—	8	30	5
		yes	8	30	5
	10	—	10	30	5
		yes	8	30	5
	15	—	10	22	5
		yes	8	30	5
036075† or 048075‡	5	—	10	30	5
		—	5	23	6
	10	—	10	30	5
		—	5	30	6
	15	—	10	30	5
		—	5	30	6
036090†, 048090†, or 060090†	5	—	14	30	5
		—	6	30	6
	10	—	14	30	5
		—	6	30	6
	15	—	14	30	5
		—	6	30	6
048110‡ or 060110‡	5	—	10	30	6
		—	5	30	7
	10	—	10	30	6
		—	5	30	7
	15	—	10	30	6
		—	5	30	7
060130‡	5	—	10	30	6
		—	8	30	7
		—	6	30	8
	10	—	10	30	6
		—	8	30	7
		—	6	30	8
	15	—	10	30	6
		—	8	30	7
		—	6	30	8

*For applications requiring vent heights greater than 30 ft, contact your Distributor/Dealer for more information.

†Installed with a 40,000 Btuh gas-fired water heater

‡Installed with a 50,000 Btuh gas-fired water heater

8. For multi-story installation, refer to Appendix G of National Fuel Gas Code or Canadian standards CAN/CGA.B149 for additional information to size the common vent. Individual vent connector for the furnace should be sized per single appliance tables found in Section B. The water heater vent connector must be sized per the National Fuel Gas Code.

E. Removal of Existing Furnaces From Common Vent Systems

1. These steps shall be followed with each appliance remaining connected to the common vent system placed in operation, while the other appliances remaining connected to the common vent system are not in operation.
2. Seal any unused openings in the common vent system.
3. Visually inspect the vent system for proper size and horizontal pitch, and determine there is no blockage or restriction, leakage, corrosion, and other deficiencies which could cause an unsafe condition.
4. Insofar as practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common vent system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common vent system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
5. Follow the lighting instructions and place the appliance in operation. Adjust the thermostat so appliance will operate continuously.
6. Test for flue gas spillage at the draft hood relief opening (or draft safeguard tube opening) after 5 minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, etc.
7. After it has been determined that each appliance remaining connected to the common vent system properly vents when tested as above, return doors, windows, exhaust fans, fireplace dampers, any other gas-burning appliances to their previous condition of use.
8. If improper venting is observed during any of the above tests, the common vent system must be corrected. The vent system or vent connectors may need to be resized. Resize any 395C Furnaces according to these instructions. For any other appliances when resizing vent systems or vent connectors, the system or connector must be sized to approach the minimum size as determined using the appropriate table found in Appendix G of the National Fuel Gas Code, or Section 5 of CAN/CGA.B149 for Canadian standards.

VIII. STARTUP, ADJUSTMENT, AND SAFETY CHECK

A. General

The furnace must have a 115-VAC power supply properly connected and grounded. Thermostat wire connections at R, W, C, and Y must be made at the 24-voltage terminal block on the control board. The gas service pressure must not exceed 0.5 psig (14 inch wc), but must be no less than 0.16 psig (4.5 inch wc).

Before lighting the furnace, check each manual reset switch for continuity. If necessary, press the button to reset the switch.

CAUTION: This furnace is equipped with a manual reset limit switch in the vestibule area. The switch will open and shutoff power to the gas valve if an overheating condition occurs in the vestibule area. *Do not* bypass the switch. Correct inadequate combustion air supply and reset the switch.

The blower compartment door must be in place to complete the 115-VAC circuit to the furnace.

B. Sequence of Operation

Using the schematic diagram, Figure 9, follow the sequence of operation through the different modes. This furnace has a new and unique control system, therefore, read and follow the wiring diagram very carefully.

1. Heating

The wall thermostat "calls for heat," closing the R and W circuit. The furnace control performs a selfcheck, verifies the pressure switch contacts are open, and starts the inducer motor.

- a. Prepurge period—As the inducer motor comes up to speed, the pressure switch contacts close to begin a 15 second prepurge period.
- b. Ignitor warm up—At the end of the prepurge period, the ignitor is energized for a 17 second ignitor warm-up period. If ignition is not established during the first cycle, the next warm-up period is increased to 45 seconds. All subsequent ignition cycles will be 45 seconds, or until the 115-VAC power supply is interrupted. By interrupting the 115-VAC power supply, the warm-up period is automatically reset to 17 seconds.
- c. Ignition sequence—When the ignitor warm-up period is completed the gas valve opens, permitting gas flow to the burners where it is ignited. After 5 seconds, the ignitor is deenergized and a 2 second flame sensing period begins.
- d. Flame sensing—When burner flame is sensed, the control begins the blower "on" delay period and continues holding the gas valve open. If burner flame is not sensed, the control will close the gas valve.
- e. Blower on delay—60 seconds after burner flame is proven, the blower motor is energized on heating speed. Simultaneously, the humidifier and electronic air cleaner terminals (HUM-1 and C for humidifier, EAC-1 and EAC-2 for electronic air cleaner) are energized.
- f. Blower off delay—When the thermostat is satisfied, the circuit between R and W is broken, deenergizing the gas valve stopping gas flow to the burners. The blower motor, humidifier, and air cleaner will remain energized 90, 135, 180, or 225 seconds (depending on the blower off-time selection). The furnace is factory-set for a 135-second blower off delay.
- g. Post purge—The inducer motor will remain energized 5 seconds after the burners are extinguished.

2. Cooling Mode

The thermostat "calls for cooling" closing R-G and R-Y circuits. The R-Y circuit starts the outdoor condensing unit, and the combined R-Y and R-G circuit starts the furnace blower motor on cooling speed. The electronic air cleaner EAC terminals are energized with 115 VAC when the blower is operating on cooling speed.

When the thermostat is satisfied, R-G and R-Y circuits are broken. The furnace blower will continue operating on cooling speed for an additional 90 seconds.

3. Continuous blower mode

When the R-G circuit is made, the blower motor will operate on heating speed. During a call for heat, the blower will stop allowing the furnace heat exchangers to heat up more quickly.

The blower will revert to continuous operation after the heating cycle is completed.

When the thermostat "calls for cooling," the blower will operate on cooling speed. When the thermostat is satisfied, the blower will operate an additional 90 seconds before reverting back to continuous operation on heating speed.

C. Startup Procedures

1. Self test—The furnace features a self-test system to help diagnose a system problem in the case of a component failure. Two test pins (ST-1 and ST-2) are located in the lower left-hand corner of the control board as shown in Figure 7. To initiate the self-test procedure, momentarily short across the two pins. The self-test sequence is as follows:
 - a. The furnace control will check itself and then operate the inducer motor for 10 seconds, then off.
 - b. The hot surface ignitor is then energized for 15 seconds, then off.
 - c. The humidifier relay is then energized for 10 seconds, then off.
 - d. The blower motor will operate on cooling speed for 10 seconds, then off.
 - e. The blower motor will operate on heating speed for 10 seconds, then off.
2. Purge gas lines—After all connections have been made, purge the lines and check for leaks.

WARNING: Never purge a line into a combustion chamber. Never use matches, candles, flame or other sources of ignition for the purpose of checking leakage. Use a soap-and-water solution to check for leakage. A failure to adhere to this warning can cause a fire, explosion, physical injury, or death.

3. To light furnace, follow procedures on lighting instructions label attached to furnace.
4. With furnace operating, set thermostat below room temperature and observe that furnace goes off. Set thermostat above room temperature and observe that furnace restarts.

D. Adjustments

1. Set gas input rate.

There are two methods of adjusting the gas input rate. The preferred method is by using Table XVI and Step A. The second method is by clocking the gas meter and Step B.

The gas valve regulator has been nominally-set at 3.5 inches wc for natural gas. When adjusting input rate, do not set manifold pressure above 3.8 or below 3.2 inches wc.

a. Check gas input rate using Table XVI.

- (1.) Obtain average yearly heat value for local gas supply.
- (2.) Obtain average yearly specific gravity for local gas supply.
- (3.) Verify furnace model. Table XVI can only be used for Model 395C Furnaces.
- (4.) Check and verify orifice size in furnace. NEVER ASSUME THE ORIFICE SIZE, ALWAYS CHECK AND VERIFY.

(5.) Find natural gas heat value and specific gravity in Table XVI.

(6.) Follow heat value and specific gravity lines to point of intersection. Find orifice size and manifold pressure settings for proper operation at given natural gas conditions.

EXAMPLE:

Heat value 1070 Btu/cu ft

Specific gravity 0.58

Therefore; Orifice No. 44*

Manifold pressure 3.3 inches wc

*The furnace is shipped with No. 43 orifices. Therefore, in this example all main burner orifices must be changed.

(7.) Proceed to Step C to adjust manifold pressure.

b. Check gas input rate by clocking gas meter.

(1.) Obtain average yearly heat value for local gas supply.

(2.) Obtain average yearly specific gravity for local gas supply.

(3.) Check and verify orifice size in furnace. NEVER ASSUME THE ORIFICE SIZE, ALWAYS CHECK AND VERIFY.

TABLE XIV—GAS RATE CU FT/HR

Seconds for one Revolution	SIZE OF TEST DIAL			Seconds for one Revolution	SIZE OF TEST DIAL		
	1 cu ft	2 cu ft	5 cu ft		1 cu ft	2 cu ft	5 cu ft
10	360	720	1800	50	72	144	360
11	327	655	1636	51	71	141	355
12	300	600	1500	52	69	138	346
13	277	555	1385	53	68	136	340
14	257	514	1286	54	67	133	333
15	240	480	1200	55	65	131	327
16	225	450	1125	56	64	129	321
17	212	424	1059	57	63	126	316
18	200	400	1000	58	62	124	310
19	189	379	947	59	61	122	305
20	180	360	900	60	60	120	300
21	171	343	857	62	58	116	290
22	164	327	818	64	56	112	281
23	157	313	783	66	54	109	273
24	150	300	750	68	53	106	265
25	144	288	720	70	51	103	257
26	138	277	692	72	50	100	250
27	133	267	667	74	48	97	243
28	129	257	643	76	47	95	237
29	124	248	621	78	46	92	231
30	120	240	600	80	45	90	225
31	116	232	581	82	44	88	220
32	113	225	563	84	43	86	214
33	109	218	545	86	42	84	209
34	106	212	529	88	41	82	205
35	103	206	514	90	40	80	200
36	100	200	500	92	39	78	196
37	97	195	486	94	38	76	192
38	95	189	474	96	38	75	188
39	92	185	462	98	37	74	184
40	90	180	450	100	36	72	180
41	88	176	439	102	35	71	178
42	86	172	429	104	35	69	173
43	84	167	419	106	34	68	170
44	82	164	409	108	33	67	167
45	80	160	400	110	33	65	164
46	78	157	391	112	32	64	161
47	76	153	383	116	31	62	155
48	75	150	375	120	30	60	150
49	73	147	367				

TABLE XV—CANADIAN ORIFICE SIZE

Gas	Sea Level 0—2500 ft	High Altitude 2500—4500 ft
Natural	43	44
Propane	54	55

TABLE XVI—MODEL 395C ORIFICE SIZE AND MANIFOLD PRESSURE FOR CORRECT INPUT RATE
(Tabulated data based on altitude up to 2000 ft and 22,000 Btuh per burner.)

Gas Heat Value (Btu/cu ft)	SPECIFIC GRAVITY OF NATURAL GAS																	
	0.56		0.58		0.60		0.62		0.64		0.66		0.68		0.70		0.72	
	Orf No.	Mnfl Press	Orf No.	Mnfl Press	Orf No.	Mnfl Press	Orf No.	Mnfl Press	Orf No.	Mnfl Press	Orf No.	Mnfl Press	Orf No.	Mnfl Press	Orf No.	Mnfl Press	Orf No.	Mnfl Press
860	41	3.2	41	3.3	41	3.4	41	3.5	41	3.7	41	3.8	39	3.4	38	3.2	38	3.3
	42	3.6	42	3.7	42	3.8	40	3.3	39	3.2	39	3.3	40	3.6	39	3.5	39	3.6
	—	—	—	—	40	3.2	—	—	40	3.4	40	3.5	—	—	40	3.7	40	3.8
875	42	3.4	41	3.2	41	3.3	41	3.4	41	3.5	41	3.6	41	3.8	39	3.3	38	3.2
	—	—	42	3.6	42	3.7	42	3.8	40	3.3	39	3.2	39	3.3	40	3.6	39	3.4
	—	—	—	—	—	—	40	3.2	—	—	40	3.4	40	3.5	—	—	40	3.7
890	42	3.3	42	3.4	41	3.2	41	3.3	41	3.4	41	3.5	41	3.6	41	3.7	41	3.8
	—	—	—	—	42	3.6	42	3.7	42	3.8	40	3.2	40	3.3	39	3.2	39	3.3
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	40	3.4	40	3.5
905	42	3.2	42	3.3	42	3.4	41	3.2	41	3.3	41	3.4	41	3.5	41	3.6	41	3.7
	—	—	—	—	—	—	42	3.6	42	3.7	42	3.8	40	3.2	40	3.3	39	3.2
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	40	3.4
920	43	3.8	42	3.2	42	3.3	42	3.4	41	3.2	41	3.3	41	3.4	41	3.5	41	3.6
	—	—	—	—	—	—	—	—	42	3.5	42	3.7	42	3.8	40	3.2	40	3.3
935	43	3.7	43	3.8	42	3.2	42	3.3	42	3.4	41	3.2	41	3.3	41	3.4	41	3.5
	—	—	—	—	—	—	—	—	—	—	42	3.5	42	3.7	42	3.8	40	3.2
950	43	3.6	43	3.7	43	3.8	42	3.2	42	3.3	42	3.4	41	3.2	41	3.3	41	3.4
	—	—	—	—	—	—	—	—	—	—	—	—	42	3.5	42	3.6	42	3.7
965	43	3.4	43	3.6	43	3.7	43	3.8	42	3.2	42	3.3	42	3.4	41	3.2	41	3.3
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	42	3.5	42	3.6
980	44	3.8	43	3.5	43	3.6	43	3.7	43	3.8	42	3.2	42	3.3	42	3.4	41	3.2
	43	3.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	42	3.5
995	44	3.7	44	3.8	43	3.5	43	3.6	43	3.7	43	3.8	42	3.2	42	3.3	42	3.4
	43	3.2	43	3.4	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1010	44	3.6	44	3.7	44	3.8	43	3.5	43	3.6	43	3.7	43	3.8	42	3.2	42	3.3
	—	—	43	3.3	43	3.4	—	—	—	—	—	—	—	—	—	—	—	—
1025	44	3.5	44	3.6	44	3.7	43	3.4	43	3.5	43	3.6	43	3.7	43	3.8	42	3.2
	—	—	43	3.2	43	3.3	—	—	—	—	—	—	—	—	—	—	—	—
1040	44	3.4	44	3.5	44	3.6	44	3.7	43	3.4	43	3.5	43	3.6	43	3.7	43	3.8
	—	—	—	—	43	3.2	43	3.3	—	—	—	—	—	—	—	—	—	—
1055	44	3.3	44	3.4	44	3.5	44	3.6	44	3.8	43	3.4	43	3.5	43	3.6	43	3.7
	—	—	—	—	—	—	43	3.2	43	3.3	—	—	—	—	—	—	—	—
1070	44	3.2	44	3.3	44	3.4	44	3.5	44	3.7	44	3.8	43	3.4	43	3.5	43	3.6
	—	—	—	—	—	—	—	—	43	3.2	43	3.3	—	—	—	—	—	—
1085	45	3.8	44	3.2	44	3.3	44	3.4	44	3.6	44	3.7	44	3.8	43	3.4	43	3.5
	—	—	—	—	—	—	—	—	—	—	43	3.2	43	3.3	—	—	—	—
1100	45	3.7	45	3.8	44	3.2	44	3.4	44	3.5	44	3.6	44	3.7	44	3.8	43	3.4
	—	—	—	—	—	—	—	—	—	—	—	—	43	3.2	43	3.3	—	—

- (4.) Turn off all gas appliances and pilots.
- (5.) Start furnace and let run for 3 minutes.
- (6.) Measure time (in seconds) for gas meter to complete one revolution.
- (7.) Refer to Table XIV for cubic feet of gas per hour.
- (8.) Multiply gas rate cu ft/hr × heating value (Btu/cu ft).

EXAMPLE:

Btu heating input = Btu/cu ft times cu ft/hr

Heating value of gas = 1070 Btu/cu ft

Time for one revolution of 2-cu/ft dial = 72 seconds

Gas rate = 100 x 1070 = 107,000 Btuh

- (9.) Measured gas input should not exceed gas input on unit rating plate.
- (10.) Proceed to Step C to adjust manifold pressure.

CAUTION: DO NOT redrill burner orifices.

c. Adjust gas input.

- (1.) Remove regulator seal cap.
- (2.) Turn adjusting screw counterclockwise to decrease input. Turn screw clockwise to increase input. DO NOT set manifold pressure less than 3.2 or more than 3.8 maximum inches wc for natural gas. Make any major adjustments by changing main burner orifices.

- (3.) When correct input is obtained, replace regulator seal cap. Main burner flame should be clear blue, almost transparent. See Figure 14.
- d. Approved input ratings.
The USA ratings are approved for altitudes up to 2000 feet for natural and propane gases. Refer to National Fuel Gas Code Appendix F, Table F-4 for proper orifice sizing at high altitudes.
- e. Canadian installations only.
The Canadian ratings are approved for altitudes up

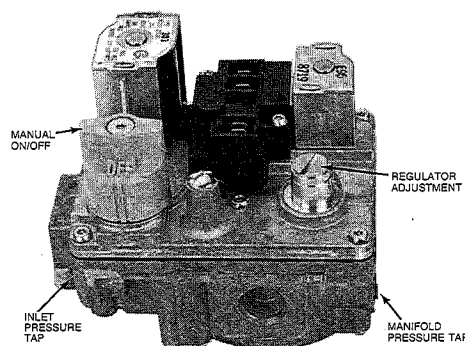


Figure 13—Redundant Automatic Gas Control Valve

A87230

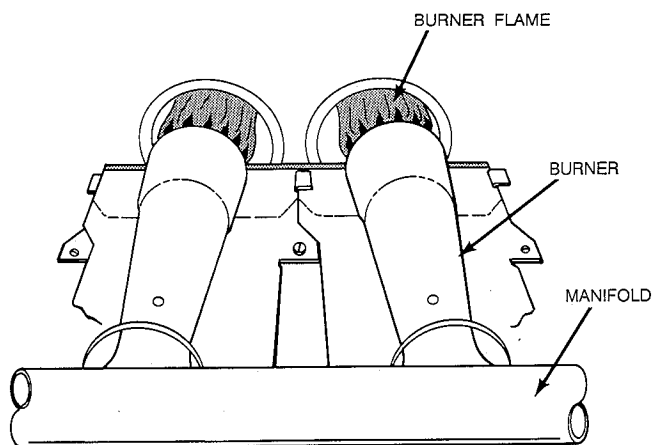


Figure 14—Burner Flame

A89020

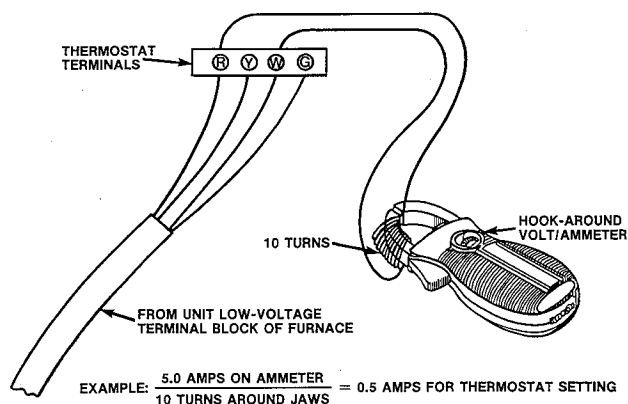


Figure 15—Amp Draw Check With Ammeter

A80201

to 2500 feet for natural and propane gases. High altitude ratings are from 2500 feet to 4500 feet above sea level. See Table XV for nominal burner orifice size.

2. Set temperature rise.

Do not exceed the temperature rise range specified on the unit rating plate. Determine the air temperature rise as follows:

- Place duct thermometers in return and supply ducts as near furnace as possible. Be sure thermometers do not "see" heating element so that radiant heat will not affect thermometer readings. This is particularly important with straight-run ducts.
- When thermometer readings stabilize, subtract return-air temperature from supply-air temperature to determine temperature rise.
- Adjust air temperature rise by adjusting blower speed. Increase blower speed to reduce temperature rise. Decrease blower speed to increase temperature rise.

WARNING: Disconnect the electrical power before changing the speed tap. A failure to adhere to this warning can cause personal injury.

- To change motor speed taps, remove the motor tap lead (see Table XVII) and relocate it on the desired terminal on the plug-in terminal block/speed selector located on the blower housing.

TABLE XVII—SPEED SELECTOR

Speed	Tap No.*
Common	C
Hi	1
Med-Hi	2
Med-Low	3
Low	4

*White wire from control box to common; black wire from control box to cooling speed selection; red wire from control box to heating and constant fan speed selection.

CAUTION: Recheck the temperature rise. It must be within the limits specified on the unit rating plate. Recommended operation at mid point of rise or above.

3. Set thermostat heat anticipator.

The thermostat heat anticipation must be set to match the amp draw of the electrical components in the R-W circuit. Accurate amp draw readings can be obtained at thermostat subbase terminals R & W. Figure 15 illustrates an easy method of obtaining the actual amp draw. The amp reading should be taken after the blower motor has started. See the thermostat manufacturer's instructions for adjusting the heat anticipator and for varying the heating cycle length.

E. Check Safety Controls

The flame sensor, gas valve, and pressure switch were all checked in the Startup Section as part of normal operation.

1. Check Primary limit control.

This control shuts off the combustion control system and energizes the circulating-air blower motor if the furnace overheats.

The preferred method of checking the limit control is to gradually block off the return air after the furnace has been operating for a period of at least 5 minutes. As soon as the limit has shutoff the burners the return-air opening should be unblocked. By using this method to check the limit control, it can be established that the limit is functioning properly and will "operate" if there is a motor failure.

2. Check draft safeguard switch.

The purpose of this control is to permit the safe shut-down of the furnace during certain blocked vent conditions.

- Disconnect power to furnace and remove vent connector from furnace outlet collar. Be sure to allow time for vent pipe to cool down before removing.
- Set room thermostat above room temperature and restore power to furnace.
- After normal startup, allow furnace to operate for 2 minutes, then block (100%) flue outlet. Furnace should cycle off within 2 minutes.
- Remove blockage and reconnect vent pipe to furnace outlet collar.
- Wait 5 minutes and then reset draft safeguard switch.

3. Check flow-sensing switch.

This control proves operation of draft inducer blower.

- a. Turn off 115-volt power to furnace.
- b. Remove control door and disconnect inducer motor lead wires from wire harness.
- c. Turn on 115-volt power to furnace.
- d. Close thermostat switch as if making normal furnace start. If the hot surface ignitor does not glow, then the flow-sensing switch is functioning properly.
- e. Turn off 115-volt power to furnace.

- f. Reconnect inducer motor wires, replace control door, and turn on 115-volt power.

F. Check List

1. Put away tools, instruments, and cleanup debris.
2. Verify manual reset switches have continuity.
3. Blower and control 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. Leave literature packet near furnace.

