INSTALLATION INSTRUCTION

MID-EFFICIENCY

GAS-FIRED FURNACES TUBULAR

HEAT EXCHANGER SERIES

UPFLOW/HORIZONTAL MODELS: P*HU / P*UH / FL8
40 - 130 MBH INPUT

DOWNFLOW MODELS: P*DN / P*DF
40 - 130 MBH INPUT

CONTENTS

CAUTION: READ ALL SAFETY GUIDES BEFORE YOU START TO INSTALL YOUR FURNACE.

SAVE THIS MANUAL

⚠ WARNING

IMPROPER INSTALLATION MAY CREATE A CONDITION WHERE THE OPERATION OF THE PRODUCT COULD CAUSE PERSONAL INJURY OR PROPERTY DAMAGE.

IMPROPER INSTALLATION, ADJUSTMENT, ALTERATION, SERVICE OR MAINTENANCE CAN CAUSE INJURY OR PROPERTY DAMAGE. REFER TO THIS MANUAL FOR ASSISTANCE OR ADDITIONAL INFORMATION, CONSULT A QUALIFIED INSTALLER, SERVICE AGENCY OR THE GAS SUPPLIER.

⚠ CAUTION

THIS PRODUCT MUST BE INSTALLED IN STRICT COMPLIANCE WITH THE ENCLOSED INSTALLATION INSTRUCTIONS AND ANY APPLICABLE LOCAL, STATE, AND NATIONAL CODES INCLUDING BUT NOT LIMITED TO, BUILDING, ELECTRICAL AND MECHANICAL CODES.

⚠ WARNING

The furnace area must not be used as a broom closet or for any other storage purposes, as a fire hazard bay be created. Never store items such as the following on, near or in contact with the furnace.

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 items or containers; gasoline, kerosene, cigarette lighter fluid, dry cleaning fluids or other volatile fluid.*
3. *Paint thinners and other painting compounds.*
4. *Paper bags, boxes or other paper products*

Never operate the furnace with the blower door removed. To do so could result in serious personal injury and/or equipment damage.

CONTENTS

GENERAL INFORMATION

DESCRIPTION

This Category I furnace is designed for installation in a residential or commercial application. A Category I furnace has a fan assisted combustion system equipped with an integral mechanical means to draw products of combustion through the combustion chamber and heat exchanger. It may be installed in a basement, garage, equipment room, alcove, attic or any other indoor location where all required clearances to combustibles and other restrictions are met. It is designed for natural gas-fired operation, but may be converted to propane (LP).

High altitude and propane (LP) changes or conversions required in order for the appliance to satisfactorily meet the application must be made by an authorized distributor: in Canada, a certified conversion station or other qualified agency, using factory specified and/or approved parts.

Upflow/horizontal furnaces and downflow furnaces may be used only as Category I units.

The furnace must be installed so that all electrical components are protected from water.

INSPECTION

As soon as a unit is received, it should be inspected for possible damage during transit. If the damage is evident, the extent of the damage should be noted on the carrier's freight bill.

A separate request for inspection by the carrier's agent should be made in writing. Also, before installation, the unit should be checked for screws or bolts which may have loosened in transit.

NOTES, CAUTIONS & WARNINGS

The installer should pay particular attention to the words: NOTE, CAUTION and WARNING. NOTES are intended to clarify or make the installation easier. CAUTIONS are given to prevent equipment damage. WARNINGS are given to alert the installer that personal injury and/or equipment or property damage may occur if installation procedures are not handled properly.

LIMITATIONS AND LOCATION

This furnace should be installed in accordance with all national/local building/safety codes and requirements, or in the absence of local codes, with the National Fuel Gas Code, ANSI Z223.1 - (latest edition) or, in Canada, CAN/CGA B149.1 or .2 - (latest edition), and other applicable codes.

⚠ WARNING

Each furnace in this series is a Category I furnace, suitable for common venting with other gas-fired appliances as allowed by the National Fuel Gas Code, NFPA 54/ANSI Z223.1 (latest edition).

This appliance is not to be used for temporary heating of buildings or structures under construction.

Do not install this furnace in a corrosive or contaminated atmosphere.

Do not install this furnace in a mobile home or recreational vehicle.

Furnaces shall not be installed directly on carpeting, tile or other combustible material other than wood flooring.

Use only the type of gas approved for this furnace; refer to the furnace rating plate.

⚠ WARNING

Only use natural gas in furnaces designed for natural gas. Only use propane (LP) gas for furnaces that have been properly converted to use propane (LP) gas. Do not use this furnace with butane. Using wrong gas could create a hazard, resulting in damage, injury or death.

For installations above 2,000 feet, reduce input 4% for each 1,000 feet above sea level. Canadian installations must be derated 10% for elevations from 2,000 ft. to 4,500 ft. See Form 650.74-N1.1V for information to properly derate furnace.

In the U.S. only, furnace shall not be connected to a chimney flue serving a separate appliance designed to burn solid fuel.

Check the rating plate and power supply to be sure that electrical characteristics match. All models use nominal 115 vac, 1 phase, 60 Hz. power supply.

A furnace installed in a residential garage must be located so that all burners and burner ignition devices are located no less than 18" above the garage floor, and located or protected to prevent damage by vehicles.

The size of the unit should be based on an acceptable heat loss calculation for the structure. ACCA, Manual J or other approved methods may be used.

The furnace should be located using these guidelines:

1. Where a minimum amount of vent piping and elbows will be required.
2. As centralized with the air distribution as possible.
3. 3.Where adequate combustion air will be available.
4. In an area where ventilation facilities provide for safe limits of ambient temperature under normal operating conditions.
5. Where it will not interfere with proper air circulation in the confined space.
6. Where the vent will not be blocked or restricted.
7. Where sufficient space is provided to allow proper service access. Minimum recommended service clearances are as follows:

   Twenty-four (24) inches between the front of the furnace and an adjacent wall or another appliance, when access is required for servicing and cleaning.

   Eighteen (18) inches at the side where access is required for passage to the front when servicing or for inspection or replacement of flue/vent connections.
8. Where it will not interfere with the cleaning, servicing or removal of other appliances.

CLEARANCES TO COMBUSTIBLES

Minimum clearances from combustible construction are shown in Table 1 on page 4, (Unit Clearances to Combustibles).

UNIT INSTALLATION

COMBUSTION AIR

All installations must comply with Section 5.3, Air for Combustion and Ventilation of the National Fuel Gas Code, ANSI Z223.1 or Sections 7.2, 7.3 or 7.4 of CAN/CGA B149.1 or .2 Installation Code - latest editions.

An unconfined space is not less than 50 cubic feet per 1000 Btu/hr input rating for all appliances installed in that area.

Rooms communicating directly with the space containing the appliances are considered part of the unconfined space, if openings are not furnished with doors.

A confined space is an area with less than 50 cubic feet per 1000 Btu/hr input rating for all appliances installed in that area.

TABLE 1: UNIT CLEARANCES TO COMBUSTIBLES

APPLICATION	TOP	FRONT	REAR	LEFT SIDE	RIGHT SIDE	FLUE	FLOOR/ BOTTOM	CLOSET	ALCOVE	ATTIC	LINE CONTACT
UPFLOW / HORIZONTAL MODELS P*HU/P*UH & FL8											
UPFLOW	1	6	0	0	3[1]	6	COMBUSTIBLE	YES	YES	YES	NO
UPFLOW B-VENT	1	3	0	0	0	1	COMBUSTIBLE	YES	YES	YES	NO
HORIZONTAL	3[2]	6	0	1	0	6	COMBUSTIBLE	NO	YES	YES	YES[3]
HORIZONTAL B-VENT	0	3	0	1	0	1	COMBUSTIBLE	NO	YES	YES	YES[3]
DOWNFLOW MODELS P*DN/P*DF											
DOWNFLOW	1	6	0	0	3[1]	6	1"[4]	YES	YES	YES	NO
DOWNFLOW B-VENT	1	3	0	0	0	1	1"[4]	YES	YES	YES	NO

1. 14-1/2” cabinet models only - all other units “0” clearance
2. 14-1/2” cabinet left airflow applications only - all other units and all right hand air flow applications “0” clearance.
3. Line contact only permitted between lines formed by the intersection of the rear panel and side panel (top in horizontal postion) of the furance jacket and building joists, studs or framing.
4. Special floor base or air conditioning coil required for use on combustible floor.

The following must be considered to obtain proper air for combustion and ventilation in confined spaces.

Air Source from Inside the Building -

Two permanent openings, one within 12 inches of the top of the confined space and one within 12 inches of the bottom, shall each have a free area of not less than one square inch per 1,000 Btuh of total input rating of all appliances located in the space. The openings shall communicate freely with interior areas having adequate infiltration from the outside.

NOTE: At least 100 square inches free area shall be used for each opening.

Air Source from Outdoors -

1. Two permanent openings, one within 12 inches of the top of the confined space and one within 12 inches of the bottom, shall communicate directly, or by means of ducts, with the outdoors or to such crawl or attic spaces that freely communicate with the outdoors.

    a. **Vertical Ducts -** Each opening must have a free area of not less than one square inch per 4,000 Btuh of total input of all appliances located in the space.

EXAMPLE:

Total Input of All Appliances =Square Inches Free Area4000

    b. **Horizontal Ducts -** Each opening must have a free area of not less than one square inch per 2,000 Btuh of total input of all appliances located in the space.

NOTE: Ducts must have the same cross-sectional area as the free area in the opening to which they are connected. The minimum dimension of rectangular ducts shall be three inches.

2. One permanent opening, commencing within 12 inches of the top of the enclosure shall be permitted where the equipment has clearances of at least 1 inch from the sides and back and 6 inches from the front of the appliance. The opening shall communicate through a vertical or horizontal duct to the outdoors, or spaces (crawl or attic) that freely communicate with the outdoors and shall have a minimum free area of:

    a. 1 sq. in. per 3000 Btu per hr of the total input rating of all equipment located in the enclosure.

    b. Not less than the sum of the areas of all vent connectors in the confined space.

3. Louvers, Grilles and Screens

    a. In calculating free area, consideration must be given to the blocking effects of louvers, grilles and screens.

    b. To estimate free area of a specific louver or grille: Refer to Table 2 on page 5.

TABLE 2: ESTIMATED FREE AREA

Wood or Metal Louvers or Grilles	Wood 20-25%[1] Metal 60-70%[1]
Screens[2]	1/4 in. mesh or larger 100%

1. Do not use less than 1/4 in. mesh
2. Free area or louvers an grilles varies widely; installer should follow louver or grille manufacturer's instructions.

NOTE: If mechanically operated louvers are used, a means to prevent main burner ignition and operation must be provided should louvers close during startup or operation.

Special Combustion and Ventilation Considerations

Operation of a mechanical exhaust, such as an exhaust fan, kitchen ventilation system, clothes dryer or fireplace may create conditions requiring special attention to avoid unsatisfactory operation of gas appliances.

Specially Engineered Installations

The above requirements shall be permitted to be waived where special engineering, approved by the authority having jurisdiction, provides an adequate supply of air for combustion, ventilation and dilution of flue gases.

Combustion Air Quality

The recommended source of combustion air is to use the outdoor air supply. Excessive exposure to contaminated combustion air will result in safety and performance related problems. However, the use of indoor air in most applications is acceptable, except as follows:

1. If the furnace is installed in a confined space it is recommended that the necessary combustion air come from the outdoors by way of attic, crawl space, air duct or direct opening.
2. If outdoor combustion air is used, there must be no exposure to the installations or substances listed in 3" below.
3. The following types of installations may require OUTDOOR AIR for combustion, due to chemical exposure.

    a. Commercial buildings

    b. Buildings with indoor pools

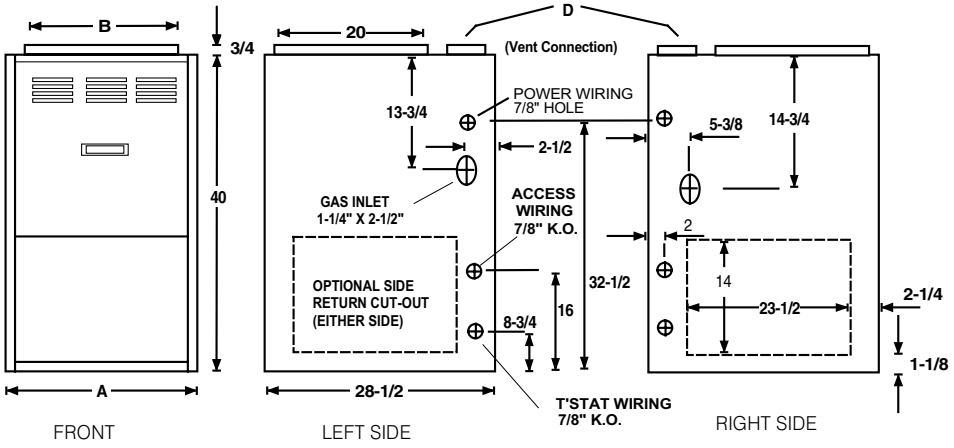
    c. Furnaces installed in laundry rooms

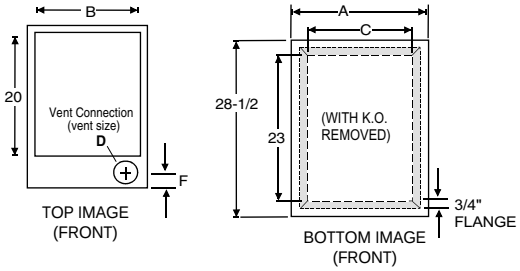
    d. Furnaces installed in hobby or craft rooms

    e. Furnaces installed near chemical storage areas

Exposure to the following substances in the combustion air supply may also require OUTDOOR AIR for combustion.

    f. Permanent wave solutions





All dimensions are in inches and are approximate.

MODELS P*HU/P*UH & FL8[1,2]	A	B	C	D	E	F
40 / 32 / 800 / "A"	14-1/2	13-1/4	10-1/8	3	10-1/8	4-3/16
40 / 32 / 1200 / "A"	14-1/2	13-1/4	10-1/8	3	10-1/8	4-3/16
57 / 46 / 800 / "A"	14-1/2	13-1/4	10-1/8	3	10-1/8	4-3/16
57 / 46 / 1200 / "A"	14-1/2	13-1/4	10-1/8	3	10-1/8	4-3/16
80 / 64 / 1200 / "A"	14-1/2	13-1/4	10-1/8	4	10-1/8	3-3/4
80 / 64 / 1600 / "B"	17-1/2	16-1/4	13-1/8	4	11-5/8	3-3/4
80 / 64 / 2000 / "C"	21	19-3/4	16-5/8	4	13-3/8	3-3/4
100 / 80 / 1200 / "B"	17-1/2	16-1/4	13-1/8	4	11-5/8	3-3/4
100 / 80 / 1600 / "B"	17-1/2	16-1/4	13-1/8	4	11-5/8	3-3/4
100 / 80 /2000 / "C"	21	19-3/4	16-5/8	4	13-3/8	3-3/4
115 / 92 / 1600 / "C"	21	19-3/4	16-5/8	4	13-3/8	3-3/4
115 / 92 / 2000 / "C"	21	19-3/4	16-5/8	4	13-3/8	3-3/4
130 / 105 / 2000 / "D"	24-1/2	23-1/4	20-1/8	4	15-1/8	3-3/4

1. Input / Output / CFM / Cabinet
2. An “L” in the 2nd or 8th position of the model number indicates a LoNox unit.

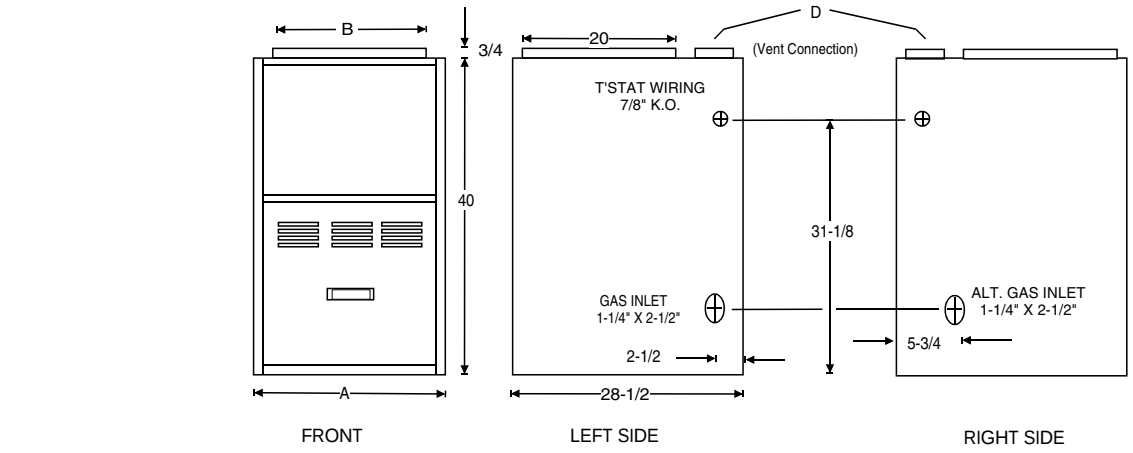
FIGURE 1: UPFLOW/HORIZONTAL FURNACE DIMENSIONS

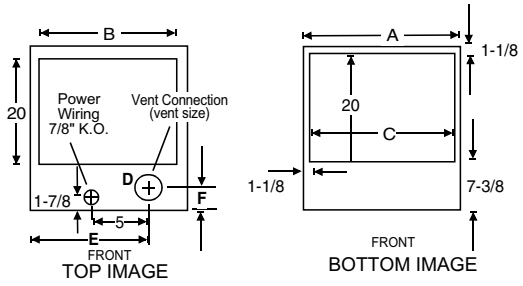
TABLE 3: UPFLOW/HORIZONTAL RAITINGS & PHYSICAL/ELECTRICAL DATA

P*HU/P*UH & FL8			CABINET WIDTH	AFUE[1]	AIR TEMP RISE	MAX. OUTLET TEMP. °F	BLOWER		TOTAL UNIT AMPS	MAX.OVER-CURRENT PROTECT[2]	MIN. WIRE SIZE (AWG) @ 75 FT. ONE WAY	OPER. WGT. (LBS)
INPUT MBH	OUTPUT MBH	NOM CFM					HP	SIZE				
40	32	800	"A" 14-1/2	80	30 - 60	160	1/4	9 x 6	9.0	20	14	100
40	32	1200	"A" 14-1/2	80	25 - 55	155	1/3	10 x 7	9.0	20	14	105
57	46	800	"A" 14-1/2	80	30 - 60	160	1/4	9 x 6	9.0	20	14	105
57	46	1200	"A" 14-1/2	80	25 - 55	155	1/3	10 x 7	9.0	20	14	110
80	64	1200	"A" 14-1/2	80	35 - 65	170	1/3	10 x 7	9.0	20	14	117
80	64	1600	"B" 17-1/2	80	25 - 55	155	3/4	11 x 8	12.0	20	14	126
80	64	2000	"C" 21	80	25 - 55	165	1	11 x 10	12.0	20	12	140
100	80	1200	"B" 17-1/2	80	40 - 70	170	1/2	10 x 8	12.0	20	14	128
100	80	1600	"B" 17-1/2	80	35 - 65	165	1/2	10 x 10	12.0	20	14	134
100	80	2000	"C" 21	80	25 - 55	155	1	11 x 10	12.0	20	12	145
115	92	1600	"C" 21	80	35 - 65	170	1/2	10 x 10	12.0	20	14	145
115	93	2000	"C" 21	80	30 - 60	170	1	11 x 10	12.0	20	12	147
130	105	2000	"D" 24-1/2	80	35 - 65	165	1	11 x 10	14.0	20	12	158

1. AFUE numbers are determined in accordance with DOE test procedures.
2. Wire size and overcurrent protection must comply with teh National Electrical Code (NFPA-70-latest edition)

- For altitudes above 2,000 ft., reduce capacity 4% for each 1,000 ft. above sea level. Refer to Form 650.74-N1,1V.
- Wire size based on copper conductors, 60° C, 3% voltage drop.
- Continuous return air temperature must not be below 55°F.





All dimensions are in inches and are approximate.

MODELS P*DN/ P*DF[1,2]	A	B	C	D	E	F
40 / 32 / 800 / "A"	14-1/2	13-1/4	12-1/4	3	10-1/8	4-3/16
57 / 46 / 800 / "A"	14-1/2	13-1/4	12-1/4	3	10-1/8	4-3/16
57 / 46 / 1200 / "A"	14-1/2	13-1/4	12-1/4	3	10-1/8	4-3/16
80 / 64 / 1200 / "B"	14-1/2	13-1/4	12-1/4	4	10-1/8	3-3/4
80 / 64 / 1600 / "B"	17-1/2	16-1/4	15-1/4	4	11-5/8	3-3/4
100 / 80 / 1200 / "B"	17-1/2	16-1/4	15-1/4	4	11-5/8	3-3/4
100 / 80 / 2000 / "C"	21	19-3/4	18-3/4	4	13-3/8	3-3/4
115 / 92 / 1600 / "C"	21	19-3/4	18-3/4	4	13-3/8	3-3/4
115 / 92 / 2000 / "C"	21	19-3/4	18-3/4	4	13-3/8	3-3/4
130 / 204 / 2000 / "C"	24-1/2	23-1/4	22-1/4	4	15-1/8	3-3/4

1. Input / Output / CFM / Cabinet
2. An “L” in the 2nd or 8th position of the model number indicates a LoNox unit.

FIGURE 2 : DOWNFLOW FURNACE DIMENSIONS

TABLE 4: RATINGS & PHYSICAL/ELECTRICAL DATA

MODELS P*DN / P*DF			CABINET WIDTH	AFUE[1]	AIR TEMP RISE	MAX. OUTLET TEMP. °F	BLOWER		TOTAL UNIT AMPS	MAX.OVER -CURRENT PROTECT[2]	MIN. WIRE SIZE (AWG) @ 75 FT. ONE WAY2	OPER. WGT. (LBS)
INPUT MBH	OUTPUT MBH	NOM CFM					HP	SIZE				
40	32	800	"A" 14-1/2	80	20 - 50	150	1/4	10 x 6	9.0	20	14	100
57	46	800	"A" 14-1/2	80	35 - 65	165	1/4	10 x 6	9.0	20	14	110
57	46	1200	"A" 14-1/2	80	25 - 55	155	1/2	10 x 8	12.0	20	14	110
80	64	1200	"A" 14-1/2	80	35 - 65	165	1/2	10 x 8	12.0	20	14	120
80	64	1600	"B"17-1/2	80	25 - 55	160	3/4	11 x 10	12.0	20	14	130
100	80	1200	"B" 17-1/2	80	40 - 70	170	1/2	10 x 8	12.0	20	14	125
100	80	2000	"C" 21	80	25 - 55	155	1	11 x 10	14.0	20	12	140
115	92	1600	"C" 21	80	35 - 65	165	3/4	11 x 10	12.0	20	14	150
115	92	2000	"C" 21	80	30 - 60	160	1	11 x 10	14.0	20	12	150
130	104	2000	"D" 24-1/2	80	40 - 70	170	1	11 x 10	14.0	20	12	160

1. AFUE numbers are determined in accordance with DOE test procedures.
2. Wire size and overcurrent protection must comply with teh National Electrical Code (NFPA-70-latest edition)

- For altitudes above 2,000 ft., reduce capacity 4% for each 1,000 ft. above sea level. Refer to Form 650.74-N1,1V.
- Wire size based on copper conductors, 60° C, 3% voltage drop.
- Continuous return air temperature must not be below 55°F.

g. Chlorinated waxes and cleaners
h. Chlorine based swimming pool chemicals
i. Water softening chemicals
j. De-icing salts or chemicals
k. Carbon tetrachloride
l. Halogen type refrigerants
m. Cleaning solvents (such as perchloroethylene)
n. Printing inks, paint removers, varnishes, etc.
o. Hydrochloric acids
p. Cements and glues
q. Antistatic fabric softeners for clothes dryers
r. Masonry acid washing chemicals

VENTING

CATEGORY I VERTICAL VENTING

Category I venting consists of vertically venting one or more appliances in B-vent or masonry chimney (as allowed), using single wall metal pipe or B-vent connectors. Type B-vent system extends in a general vertical direction and does not contain offsets exceeding 45 degrees, except that a vent system having not more than one 60-degree offset is permitted.

NOTE: This appliance may be common vented with another gas appliance as allowed by the following codes and standards.

The furnace rating plate lists the maximum vent gas temperature. This temperature must be used to select appropriate venting materials and clearances. A typical example is shown below.

CATEGORY 1 - 450 F. MAX. VENT TEMP.

All installations must be vented in accordance with the National Fuel Gas Code, NFPA 54/ANSI Z223.1 - latest edition. For reference, the National Fuel Gas Code Handbook, available from NFPA (item JP-54HB96) is recommended. The appliance must also be vented in compliance with all local utility and code requirements. In Canada, the furnace must be vented in accordance with the National Standard of Canada, CAN/CGA-B149.1 and .2 - latest editions.

⚠ WARNING

A furnace shall not be connected to a chimney flue serving a separate appliance designed to burn solid fuel.

HORIZONTAL SIDEWALL VENTING

For applications where vertical venting is not possible, the only approved method of horizontal venting is through the use of an auxiliary power venter. Approved power venters are Fields Controls Model SWG-4Y or Tjernlund Model GPAK-JT. Follow all application and installation details provided by the manufacturer of the power venter.

VENT SAFETY CHECK PROCEDURE

⚠ WARNING

If this furnace is replacing a common-vented furnace, it may be necessary to resize the existing vent line and chimney to prevent oversizing problems for the new combination of units. Refer to the National Fuel Gas Code, ANSI Z223.1 or CAN/CGA B149.1 or .2 Installation Code - latest editions.

The following steps shall be followed with each appliance connected to the venting system placed in operation, while any other appliances connected to the common venting system are not in operation.

1. Seal any unused openings in the common venting system.
2. Inspect venting system for proper size and horizontal pitch, as required in the National Fuel Gas Code ANSI Z223.1 or the CAN/CGA B149 Installation Codes and these instructions. Determine that there is no blockage or restriction, leakage, corrosion or other deficiencies which could cause an unsafe condition.
3. Insofar as is practical, close all building doors and windows and all doors between the space in which the appliance(s) connected to the venting system are located and other spaces of the building. Turn on clothes dryers and any other appliances not connected to the common venting system.

   Turn on any exhaust fans, such as range hoods and bathroom exhausts so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
4. Follow the lighting instructions. Place the appliance being operated in operation. Adjust thermostat so appliance will operate continuously.
5. Test for draft hood equipped appliance spillage at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle.
6. After it has been determined that each appliance connected to the venting system properly vents when tested

as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas-burning appliance to their previous conditions of use.

7. If improper venting is observed during any of the above tests, the venting system must be corrected.
8. Any corrections or resizing of the common venting system must be in accordance with the National Fuel Gas Code, ANSI Z223.1 or Section 7, Venting Systems and Air Supply for Appliances, CAN/CGA B149.1 or .2 Installation Code - latest editions. If the common vent system must be resized, it should be resized to approach the minimum size as determined using the appropriate tables in Appendix G of the above codes or the venting tables supplied with the furnace.

DUCTWORK

The duct system's design and installation must:

1. Handle an air volume appropriate for the served space and within the operating parameters of the furnace specifications.
2. Be installed in accordance with standards of NFPA (National Fire Protection Association) as outlined in NFPA pamphlets 90A and 90B (latest editions).
3. Create a closed duct system. The supply system must be connected to the furnace outlet and the return duct system must be connected to the furnace inlet. Both supply and return duct systems must terminate outside the space containing the furnace.
4. Generally complete a path for heated or cooled air to circulate through the air conditioning and heating equipment and to and from the conditioned space.

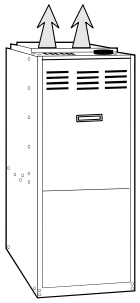
⚠ CAUTION

The cooling coil must be installed in the supply air duct downstream of the furnace.

When the furnace is used in conjunction with a cooling coil, the furnace must be installed parallel with, or on the upstream side of the cooling unit to avoid condensation in the primary heat exchanger.

When a parallel flow arrangement is used, the dampers or other means used to control air flow must be adequate to prevent chilled air from entering the furnace, and if manually operated, must be equipped with means to prevent operating of either unit unless the damper is in the full heat or cool position.

UPFLOW/HORIZONTAL MODELS - UPFLOW APPLICATION



Supply Plenum Connection

Attach the supply plenum to the furnace outlet duct connection flanges. This is typically through the use of S cleat material when a metal plenum is used. The use of an approved flexible duct connector is recommended on all installations. This connection should be sealed to prevent air leakage.

If a matching cooling coil is used, it may be placed directly on the furnace outlet and sealed to prevent leakage. Follow the coil instructions for installing the supply plenum.

On all installations without a coil, a removable access panel is recommended in the outlet duct such that smoke or reflected light would be observable inside the casing to indicate the presence of leaks in the heat exchanger. This access cover shall be attached in such a manner as to prevent leaks.

Return Duct Connection

Return air may enter the furnace through the side(s) or bottom depending on the type of application. Return air may not be connected into the rear panel of the unit. See the specific type application installation for details. Be sure to see the Filters section of this instruction.

FILTERS INSTALLATION - (UPFLOW/HORIZONTAL)

All applications require the use of a filter. A high velocity filter and retainer are provided for field installation.

Internal Installation

1. Select desired filter position (left/right side, or bottom). Remove the corresponding cabinet cut-outs per instructions provided.
2. Install snap-in retainer clips into the corresponding slots from the outside rear of the cabinet (Refer to Figure 3 on page 10). To prevent cabinet air leaks, install snap-in plugs (provided) into the unused slots at the outside rear of the cabinet.
3. Install the wire retainer inside the cabinet. Insert the open ends of the wire retainer into the clip loops at the rear of the blower compartment. The retainer wire should pivot freely like a hinge, on the clips at the rear of the cabinet. (Refer to Figure 4 on page 10).
4. Install the filter(s) provided. Cut filter if necessary to match air opening in cabinet. Filter should extend beyond opening edge as much as possible to prevent air

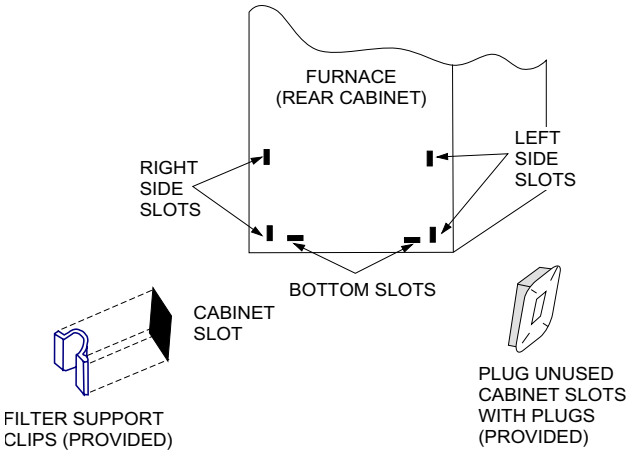


FIGURE 3 : FURNACE FILTER SLOT LOCATIONS

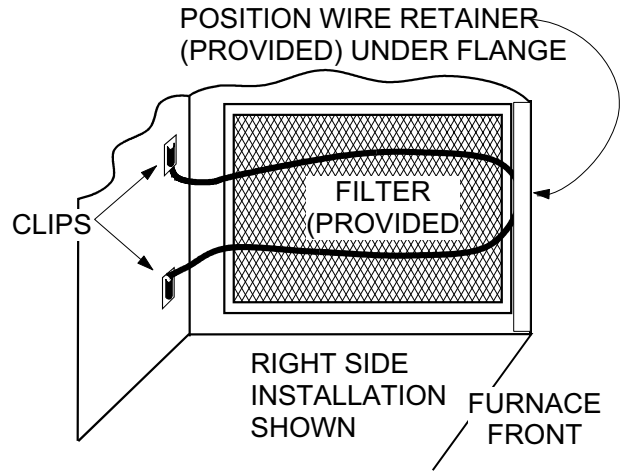


FIGURE 4 : SIDE FILTER RETAINER PLACEMENT

from bypassing the filter. DO NOT remove stiffening rods from inside the filter. Shorten the rods, if necessary, to match final filter size.

5. Position the filter between the wire retainer and the cabinet wall (or floor) so it completely covers the cabinet air opening and secure the filter in place at the front of the cabinet by fastening the closed (looped) end of the retainer wire under the flanged edge of the cabinet. When properly installed the filter should fit flush with all four sides of the cabinet wall.

NOTE: Air velocity through throw-away type filters may not exceed 300 feet per minute. All velocities over this require the use of high velocity filters.

Side Return - External Filter

Locate and knock out the square corner locaters. These indicate the size of the cutout to be made in the furnace side panel, (Refer to Figure 5 on page 10)

Install the side filter rack following the instructions provided with that accessory. If a filter(s) is provided at another location in the return air system, the ductwork may be directly attached to the furnace side panel.

NOTE: Some accessories such as electronic air cleaners and pleated media may require a larger side opening.

⚠ CAUTION

All installations must have a filter installed.

The return duct may be attached to the furnace by S-cleat, bend tabs or other approved methods. Be sure to seal the duct to the furnace to prevent air leakage.

Those applications over 1800 CFM require either return from two sides, one side and the bottom, or bottom only. For bottom only application, see data and notes on blower performance data tables in this manual.

Where the return duct system is not complete, the return connection must run full size to a location outside the utility room or basement. For further details, consult Section 5.3 (Air for Combustion and Ventilation) of the National Fuel Gas Code, ANSI Z223.1, or CAN/CGA B149.1 or .2, Installation Code - latest editions. .

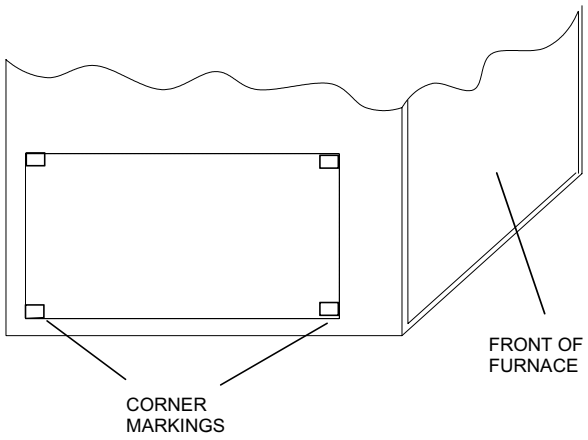


FIGURE 5 : SIDE RETURN CUTOUT MARKINGS

Bottom Return

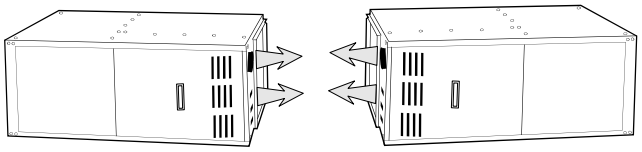
Bottom return applications normally pull return air through a base platform or return air plenum. Be sure the return platform structure is suitable to support the weight of the furnace. (Refer to Figure 1 on page 6) for unit dimensions and Table 3 for unit weights. Be sure to seal the furnace to plenum connection to prevent air leakage.

The bottom panel is equipped with a perforated opening for easy removal. Tabs must be cut with sheet metal snips to allow removing knock-out. Scribe marks are included for forming flanges for attachment of the return air ductwork.

NOTE: If an external mounted filter rack is being used, see the instructions provided with that accessory for proper hole cut size.

Upflow attic installations must meet all minimum clearances to combustibles and have floor support with required service accessibility.

UPFLOW/HORIZONTAL MODELS HORIZONTAL APPLICATION



Upflow furnaces may be installed horizontally with the supply airflow toward the left or right by laying the unit on the left or right side panel.

⚠ WARNING

Do not install the unit on the rear panel.

After determining the best orientation, lay the unit on top of the shipping carton to protect the finish.

The appropriate electrical knock-outs for power wiring, control wiring and gas piping should be removed at this time.

For horizontal application, return air may enter through the bottom, left side or right side panel or any combination of these openings. **Return air may not be connected into the rear panel of the unit.**

To convert the upflow model furnace to open bottom,refer to the upflow applicaion, “Bottom Return” section on page 11 of this manual.

ATTIC INSTALLATION

This appliance is design certified for line contact for furnaces installed horizontally. The intersection of the furnace top and sides form a line.

This line may be in contact with combustible material. However, refer to “VENTING” section on page 8 and “Clearances to Combustibles” section on page 4, in this manual for additional information.

Secure a platform constructed of plywood or other building material to the floor joists. Sheet metal, 12" in front of the furnace combustion air openings is recommended. (Refer to Figure 6 on page 11).

⚠ WARNING

When a furnace is installed in an attic or other insulated space, keep all insulating materials at least 12" away from furnace and burner combustion air openings.

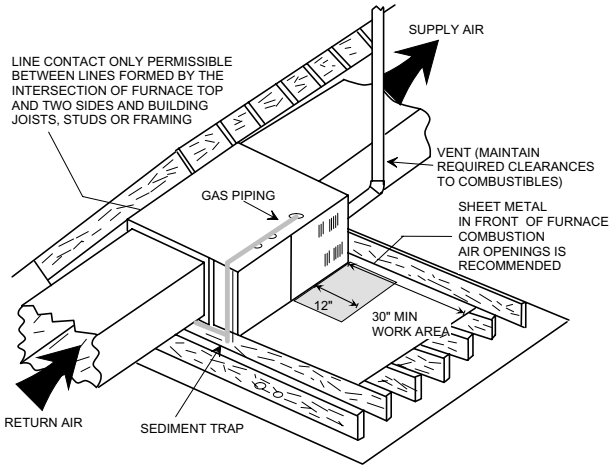


FIGURE 6 : TYPICAL ATTIC INSTALLATION

NOTE: See crawl space installation for suspending the furnace in attic installations.

CRAWL SPACE INSTALLATION

The furnace can be hung from floor joists or installed on suitable blocks or pad. Blocks or pad installations shall provide adequate height to ensure the unit will not be subject to water damage.

When suspending the furnace from rafters or floor joists using rod, pipe or straps, Refer to Table 3 on page 6, for furnace weights to determine suitable means of suspension.

Angle supports should be placed at the supply air end and near the blower deck. (Refer to Figure 7 on page 12). **Do not support at return air end of unit**.

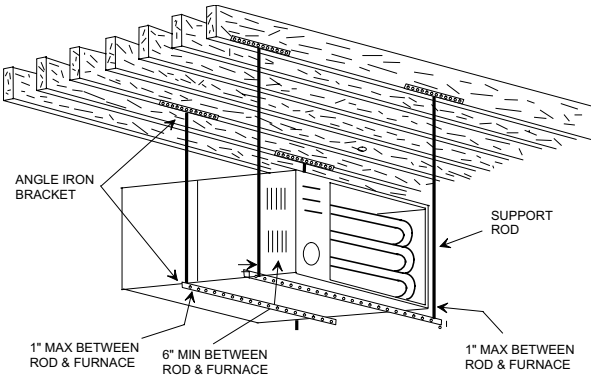


FIGURE 7 : TYPICAL FURNACE INSTALLATION USING SUSPENSION MATERIALS

Units may also be suspended by using straps or other material at the same location. All four suspension points must be level to ensure quiet furnace operation.

DOWNFLOW MODEL APPLICATION DOWNFLOW FILTERS

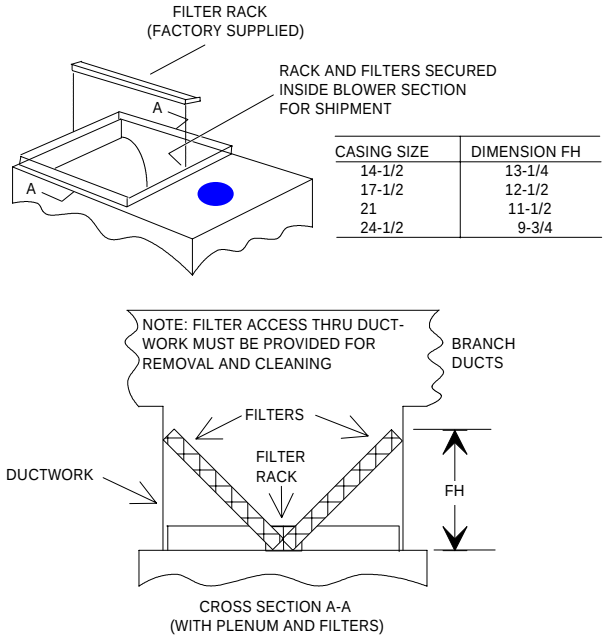
A top return filter rack is supplied with the furnace. Two 14" x 20" permanent washable filters are supplied with each unit. Refer to the “downflow model application” section on page 12, for details.

Downflow furnaces typically are installed with the filters located above the furnace, extending into the return air duct.

Any branch duct must attach to the vertical ductwork above the filter height (FH). See dimensions for proper installation. (Refer to Figure 8 on page 12)

The filter rack (provided) should be secured to the center of the front and rear flanges at the furnace top. Drill a hole through the front and rear duct flange into the filter rack and secure it with a sheet metal screw.

Refer to the unit rating plate for furnace model then see the dimensions page of this instruction for return air plenum dimensions. Install the plenum following instructions under Ductwork in this instruction.



CASING SIZE	DIMENSION FH
14-1/2	13-1/4
17-1/2	12-1/2
21	11-1/2
24-1/2	9-3/4

FIGURE 8 : DOWNFLOW FILTERS

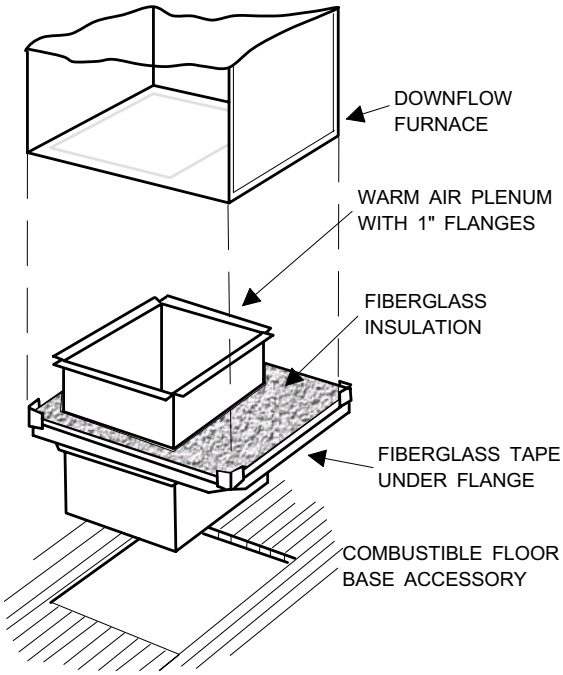


FIGURE 9 : COMBUSTIBLE FLOOR BASE ACCESS’Y

SUPPLY AIR DUCTS

Installations on combustible material or floors must use a combustible floor base (Refer to Figure 9 on page 12) 1CB0314, 17, 21 & 24, as specified on the rating plate or a matching cooling coil. Follow the instructions supplied with the combustible floor base accessory.

This base can be replaced with a matching cooling coil, properly sealed to prevent leaks. Follow the cooling coil instructions for installing the plenum.

GAS PIPING

⚠ WARNING

An overpressure protection device, such as a pressure regulator, which conforms to the National Fuel Gas Code, ANSI Z223.1 (U.S.) or CAN-B149.1 or .2 (Canada) and acts to limit the downstream pressure to value that does not exceed 0.5 PSI (14" w.c.), must be installed in the gas piping system upstream of the furnace. Failure to do so may result in a fire or explosion or cause damage to the furnace or some of its components.

NOTE: An accessible manual shutoff valve must be installed upstream of the furnace gas controls and within 6 feet of the furnace.

The furnace and its individual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of 1/2 psig (3.48 kPa).

The furnace must be isolated from the gas supply piping system by closing its individual external manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 psig (3.48 kPa).

⚠ CAUTION

Never apply a pipe wrench to the body of the combination automatic gas valve. A wrench must be placed on the projection or wrench boss of the valve when installing piping to it.

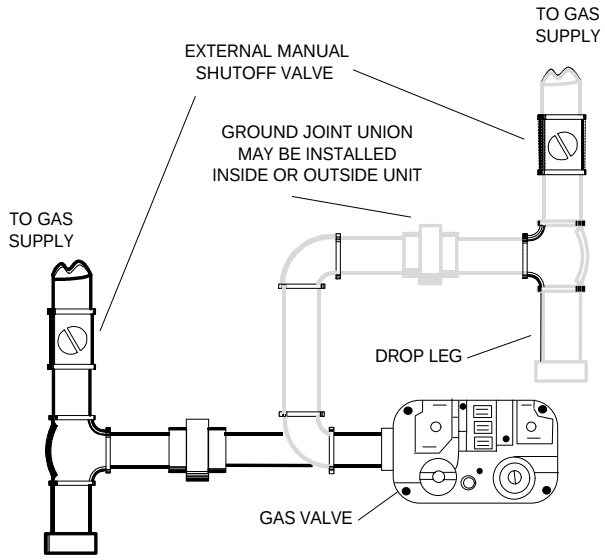


FIGURE 10 : GAS PIPING

Gas piping may be connected from either side of the furnace. Sizing and installation of the supply gas line should comply with the local utility requirements.

INLET GAS PRESSURE RANGE		
	Natural Gas	Propane (LP)
Minimum	4.5 In. W.C.	11 In. W.C.
Maximum	13.8 In W.C.	13.8 In. W.C.

The gas supply should be a separate line, installed in accordance with the National Fuel Gas Code, ANSI Z223.1, or CAN/CGA B149.1 or .2 Installation Codes - (latest editions).

Some utility companies, or local codes, require pipe sizes larger than the minimum sizes listed. Using the properly sized wrought iron, approved flexible or steel pipe, make gas connections to the unit. Installation of a drop leg and ground union is required (Refer to Figure 10 on page 13).

⚠ WARNING

Compounds used on threaded joints of gas piping must be resistant to the action of liquefied petroleum gases.

NOTE: a 1/8" NPT plug is included in the inlet side of the gas valve for measuring incoming gas pressure.

⚠ WARNING

After all gas piping connections are completed, leak test all joints, fittings and furnace connections with rich soap and water solution, commercial available bubble type leak detection fluid, or other approved means.

Do not use an open flame or other source of ignition for leak testing.

ELECTRICAL POWER CONNECTION

Field wiring to the unit must conform to and be grounded in accordance with the provisions of the National Electrical Code ANSI/NFPA No. 70 - latest edition, Canadian Electric Code C22.1 Part 1 - (latest edition) and/or local codes. Electrical wires which are field installed shall conform with the temperature limitation for 63F/35C rise wire when installed in accordance with instructions. Specific electrical data is given on the furnace rating plate.

Provide a power supply separate from all other circuits. Install overcurrent protection and disconnect switch per local/national electrical codes. The switch should be reasonably close to the unit for convenience in servicing. With the disconnect switch in the OFF position, check all wiring against the unit wiring label. Also, see the wiring diagram in this instruction.

Note: The furnace's control system depends on correct polarity of the power supply and a proper ground connection. Refer to the furnace control diagnostics section for symptoms of reversed power supply polarity.

⚠ WARNING

Use copper conductors only.

Connect the power supply as shown on the unit wiring label on the inside of the blower compartment door, . The black furnace lead must be connected to the L1 (hot) wire from the power supply.

The white furnace lead must be connected to neutral. Also, the green equipment ground wire must be connected to the power supply ground.

Remove the screw retaining the wiring box. Route the power wiring through the unit side panel with a conduit connector or

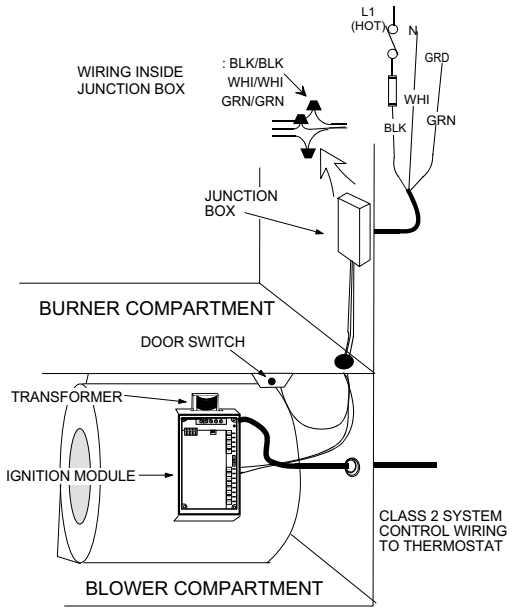


FIGURE 11 : ELECTRICAL WIRING - UPFLOW MODELS P*HU/P*UH & FL8

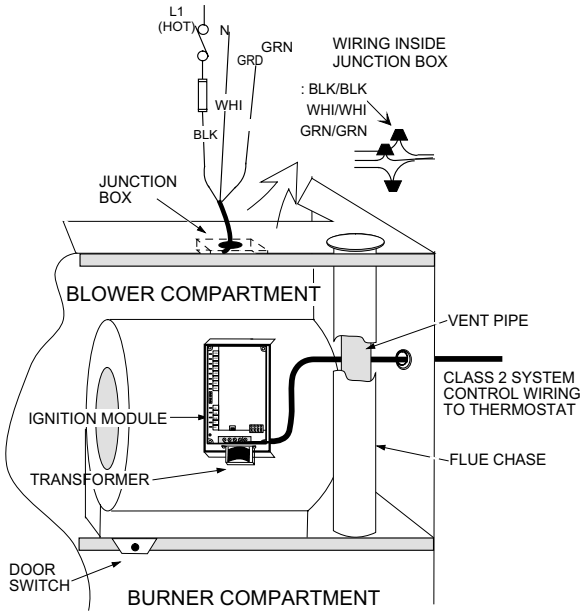


FIGURE 12 : ELECTRICAL WIRING - DOWNFLOW MODELS P*DN/P*DF

other proper connection. Make wiring connections, (Refer to Figure 11 on page 14). Replace the wiring box and screw.

An alternate wiring method is to use a field provided 2 x 4 box and cover on the outside of the furnace. Route the furnace leads into the box using a protective bushing where the wires pass through the furnace panel.

NOTE: The power connection leads and wiring box on upflow units may be relocated to the left side of the furnace. Remove the screws and cut wire tie holding excess wiring. Reposition on the left side of the furnace and fasten using holes provided.

ELECTRICAL CONTROL CONNECTIONS

Install the field-supplied thermostat. The thermostat instructions for wiring are packed with the thermostat. With the thermostat set in the OFF position and the main electrical source disconnected, complete the low-voltage wiring from the thermostat to the terminal board on the low-voltage transformer. Connect Class 2 control wiring, (Refer to Figure 13 on page 15).

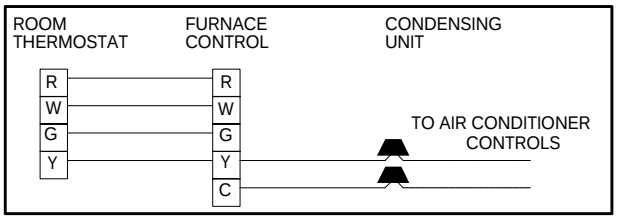


FIGURE 13 : TYPICAL HEATING AND COOLING

Set the heat anticipator in the room thermostat to .45 amps. Setting it lower will cause short cycles. Setting it higher wil cause the room temperature to exceed the setpoint.

Apply strain relief to thermostat wires passing through the cabinet.

NOTE: Some electronic thermostats do not have adjustable heat anticipators. They may have other type cycle rate adjustments. Follow the thermostat manufacturer's instructions.

The 24-volt, 40 VA transformer is sized for the furnace components only, and should not be connected to auxiliary devices such as humidifiers, air cleaners, etc. The transformer may provide power for an air conditioning unit contactor.

SAFETY CONTROLS

Blower Door Safety Switch: This unit is equipped with an electrical interlock switch mounted in the blower compartment. This switch interrupts all power at the unit when the panel covering the blower compartment is removed.

⚠ WARNING

Blower and burner must never be operated without the blower panel in place.

Electrical supply to the unit is dependent upon the panel that covers the blower compartment being in place and properly positioned.

⚠ CAUTION

Main power supply to the unit must still be interrupted at the main power disconnect switch before any service or repair work is to be done to the unit. Do not rely upon the interlock switch as a main power disconnect.

Rollout Switch Controls: These controls are mounted on the burner assembly. If the temperature in the burner compartment exceeds its set point, the igniter control and the gas valve are de-energized. This is a manual reset control and must be reset before operation can continue.

The operation of this control indicates a malfunction in the combustion air blower or a blocked vent pipe connection.

Pressure Switch: This furnace is supplied with a differential pressure switch which monitors the flow through the furnace and venting system. This switch de-energizes the ignition control module and the gas valve if any of the following conditions are present:

1. Blockage of internal flue gas passageways.
2. Blockage of vent piping.
3. Failure of combustion air blower/motor.

Limit Control: The high temperature limit control is located on the furnace vestibule panel just to the right and above the gas valve. This is an automatic reset control and provides over temperature protection due to reduced airflow, such as a dirty filter.

Auxiliary Limit Controls: These high temperature limit controls are located in the blower compartment, one on each side on upflow/horizontal unit. Downflow units have a single limit mounted on the blower asembly. These are manual reset controls and give high temperature protection when the unit is applied in the horizontal position.

Control Circuit Fuse:A 3 amp fuse is provided to protect the 24 volt transformer from overload caused by control circuit

wiring errors. This is an ATO 3, automotive type fuse and is located in the unit wiring harness between the control transformer and the furnace control.

START-UP AND ADJUSTMENTS

The initial start-up of the furnace requires the following additional procedures.

1. When the gas supply is initially connected to the furnace, the gas piping may be full of air. In order to purge this air, it is recommended that the ground joint union be loosened until the odor of gas is detected. When gas is detected, immediately retighten the union and check for leaks. Allow five minutes for any gas to dissipate before continuing with the start-up procedure.
2. All electrical connections made in the field and in the factory should be checked for proper tightness.

IGNITION SYSTEM CHECKOUT/ADJUSTMENT

1. Turn the gas supply ON at external valve and main gas valve.
2. Set the thermostat above room temperature to call for heat.
3. System start-up will occur as follows:
   a. The venter motor will start and come up to speed. Shortly after venter start-up, the hot surface igniter will glow for about 17 seconds.
   b. After this warm-up cycle, the ignition module will energize (open) the main gas valve for seven seconds.

NOTE: Burner ignition may not be satisfactory on first start-up due to residual air in gas line, or until gas pressure (manifold) is adjusted.

4. With the furnace in operation, paint the pipe joints and valve gasket lines with a rich soap and water solution. Bubbles indicate a gas leak. Take appropriate steps to stop the leaks. If the leak persists, replace the component.

⚠ WARNING

DO NOT omit this test! NEVER use a flame to check for gas leaks.

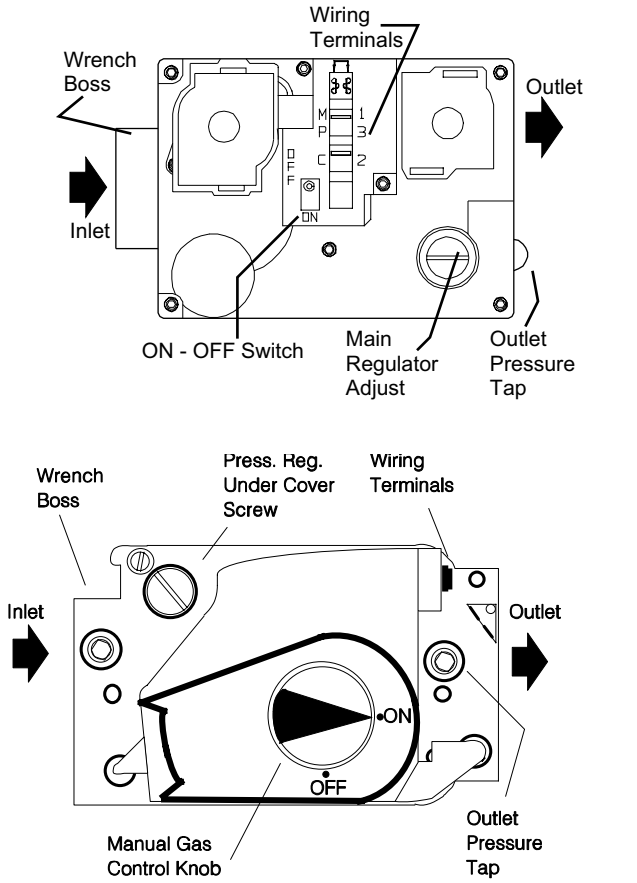


FIGURE 14 : GAS VALVES -
(TOP) WHITE-RODGERS 36E24
(BOTTOM) HONEYWELL VR8205
(approved for field replacement)

CHECKING GAS INPUT

1. Turn off all other gas appliances connected to gas meter.
2. With the furnace turned on, measure the time needed for one revolution of the hand on the smallest dial on the meter. A typical domestic gas meter usually has a 1/2 or 1 cubic foot test dial.
3. Using the number of seconds for each revolution and the size of the test dial increment, find the cubic feet of gas consumed per hour. Refer to Table 5 on page 17.

NOTE: To find the Btuh input, multiply the number of cubic feet of gas consumed per hour by the BTU content of the gas in your particular locality. Contact your gas company for this information, as it varies widely from city to city.

EXAMPLE: It is found by measurement that it takes 26 seconds for the hand to turn on the 1 cubic foot dial to make a revolution with only a 120,000 Btuh furnace running. Using

TABLE 5 : GAS RATE (CUBIC FEET PER HOUR)

SECONDS FOR ONE REVOLUTION	SIZE OF TEST DIAL	
	1/2 CUBIC FOOT	1 CUBIC FOOT
10	180	360
12	150	300
14	129	257
16	113	225
18	100	200
20	90	180
22	82	164
24	75	150
26	69	138
28	64	129
30	60	120
32	56	113
34	53	106
36	50	100
38	47	95
40	45	90
42	43	86
44	41	82
46	39	78
48	37	75
50	36	72
52	35	69
54	34	67
56	32	64
58	31	62
60	30	60

this information, locate 26 seconds in the first column of Table 5 .

Read across to the column headed 1 Cubic Foot where you will see that 138 cubic feet of gas per hour are consumed by the furnace at that rate. Multiply 138 by 850 (the BTU rating of the gas obtained from the local gas company). The result is 117,300 Btuh, which is close to the 120,000 Btuh rating of the furnace.

If the actual input is not within 2% of the furnace rating, with allowance being made for the permissible range of the regulator setting (0.3 inches W.C.), replace the orifice spuds with spuds of the proper size.

⚠ CAUTION

Be sure to relight any gas appliances that were turned off at the start of this input check.

ADJUSTMENT OF MANIFOLD GAS PRESSURE

1. Turn gas off at main gas valve. Remove 1/8" plug /outlet pressure tap in the main gas valve body and install proper manometer tube adapter fitting. Connect line from gas valve tap to manometer.
2. (Refer to Figure 14 on page 16) for location of pressure regulator adjustment cap and screw on main gas valve.

NOTE: The screw-off cap for the pressure regulator must be removed entirely to gain access to the adjustment screw.

⚠ WARNING

The cap must be replaced in order for the furnace to operate properly.

3. Turn gas and electrical supplies ON. Start furnace and observe manifold pressure on manifold.
4. Adjust manifold pressure by adjusting gas valve regulator screw.

MANIFOLD PRESSURE	
NATURAL GAS	3.5” W.C.
PROPANE (LP) GAS	10.0” W.C.

If gas valve regulator is turned in, or clockwise, manifold pressure is increased. If screw is turned out, or counterwise, manifold pressure will decrease.

⚠ WARNING

The manifold pressure must be checked with the screw-off cap in place on the pressure regulator.

If manifold pressure is too high, an over-fire condition exists which could cause heat exchanger failure. If the manifold pressure is too low, sooting and eventual clogging of the heat exchanger could occur.

5. Once the correct gas pressure to the burners has been established, turn the gas valve switch to OFF and turn the electrical supply switch OFF; then, remove the pressure tap at the gas valve and re-install the plug using a compound (on the threads) resistant to the action of LP gases.
6. Turn the electrical and gas supplies back on, and, with the burners in operation, check for gas leakage around the plug with a soap and water solution.

⚠ WARNING

Be sure that the gas valve pressure regulator cap is replaced.

ADJUSTMENT OF TEMPERATURE RISE

The temperature rise, or temperature difference between the return air and the heated air from the furnace, must be within the range shown on the furnace rating plate and within the application limitations shown in Tables 3 or 4. After the temperature rise has been determined, the cfm can be calculated.

After about 20 minutes of operation, determine the furnace temperature rise. Take readings of both the return air and the heated air in the ducts, about six feet from the furnace where they will not be affected by radiant heat.

Increase the blower speed to decrease the temperature rise; decrease the blower speed to increase the rise.

All direct-drive blowers have multi-speed motors. The blower motor speed taps are located on the control module in the blower compartment. (Refer to Figure 15 on page 18) and the unit wiring label to change the blower speed.

You may select a heating speed and a cooling speed. They may be the same speed or a different speed.

To use the same speed tap for heating and cooling, the heat terminal and cool terminal must be connected using a jumper wire and connected to the desired motor lead. Place all unused motor leads on Park terminals. Two are provided.

⚠ CAUTION

Do not energize more than one motor speed at a time or damage will result.

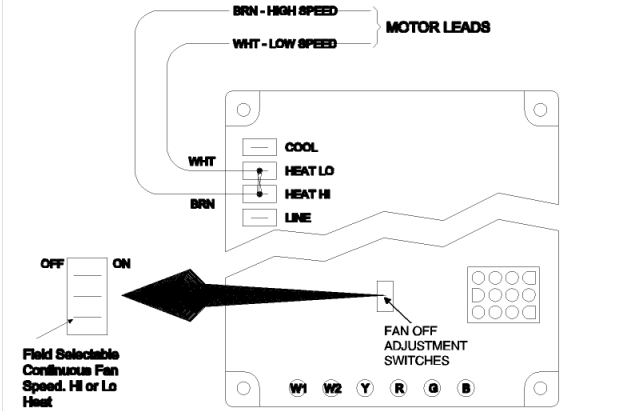
ADJUSTMENT OF FAN-OFF CONTROL SETTINGS

This furnace is equipped with a time-on/time-off heating fan control. The fan on is fixed at 30 seconds. The fan off is field adjustable from 60 to 180 seconds. The fan off is factory set to 60 seconds.

The fan-off setting must be long enough to adequately cool the furnace, but not so long that cold air is blown into the heated space.

The fan-off timing may be adjusted by setting the option switches located (Refer to Figure 15 on page 18) on the control board as follows:

WHITE-RODGERS CONTROL ONLY		
TO DELAY FAN-OFF BY:	SET SWITCH	
	1	2
60 Sec.	On	On
90 Sec.	On	Off
120 Sec.	Off	On
180 Sec.	Off	Off



TYPICAL HEAT/COOL SPEED TAP CONNECTIONS

ACCESSORY CONNECTIONS

The furnace control will allow power switching control of various accessories. (Refer to Figure 16 on page 19) for connection details.

Electronic Air Cleaner Connection

Two 1/4" spade terminals (EAC and EAC N) for electronic air cleaner connections are located on the control board. The terminals provide 115 VAC (1.0 amp maximum) during circulating blower operation.

Humidifier Connection

Two 1/4" spade terminals (HUM and HUM N) for humidifier connections are located on the control board. The terminals provide 115 VAC (1.0 amp maximum) during heating system operation.

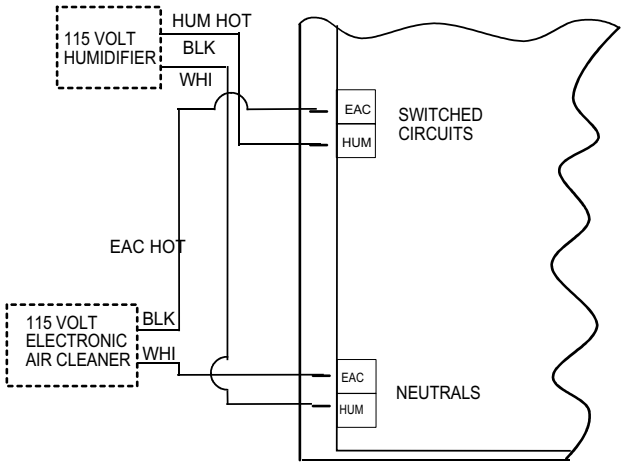


FIGURE 16 : ACCESSORY CONNECTIONS

FURNACE ACCESSORIES

ELECTRICAL	
2TH07700124	Single Stage Thermostat, One-Stage Heat/One-Stage Cool
2TH13700424	Deluxe 24V Thermostat - with heat only subbase (must be used w/subbase 2TB17700424)
2TB17700424	Subbase (24V) One-Stage Heat/One-Stage Cool
2ET07700224	Programmable, Electronic Thermostat, One-Stage Heat/One-Stage Cool
2TC03700124	Twinning Control
NON-ELECTRICAL	
1NP0347	Propane (LP) Conversion Kit
1NP0348	Propane (LP) Conversion Kit
1PS0301	High Altitude Pressure Switch (See Form 650.74-N1.1V for proper application)
1PS0302	
1PS0311	
1PS0312	
1SR0302	External Side Filter Rack (6-Pack)
1BR0314	External Bottom Filter Rack - Cabinet “A”
1BR0317	External Bottom Filter Rack - Cabinet “B”
1BR0321	External Bottom Filter Rack - Cabinet “C”
1BR0324	External Bottom Filter Rack - Cabinet “D”
1PS0313	High Altitude Pressure Switch Kit
1PS0314	High Altitude Pressure Switch Kit
1CB0314	Combustible Floor Base - Cabinet “A”
1CB0317	Combustible Floor Base - Cabinet “B”
1CB0321	Combustible Floor Base - Cabinet “C”
1CB0324	Combustible Floor Base - Cabinet “D”

TABLE 6: BLOWER PERFORMANCE CFM - UPFLOW/HORIZONTAL (INCLUDES FILTER)

NOTE: Data below reflects air flows with single return opening, either left or right side or bottom.

MODELS P*HU/P*UH/ FL8[1]	SPEED TAP	EXTERNAL STATIC PRESSURE, INCHES W.C.									
		0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00
40 / 32 / 800 / "A" 57 / 46 / 800 / "A"	HIGH	1084	1033	973	908	828	743	624	438	—	—
	MED	960	914	846	809	747	664	549	372	—	—
	LOW	700	683	666	625	576	512	411	299	—	—
40 / 32 / 1200 / "A" 57 / 46 / 1200 / "A" 80 / 64 / 1200 / "A"	HIGH	1510	1447	1387	1318	1234	1158	1057	956	820	664
	MED	1156	1128	1088	1040	994	938	860	756	634	496
	LOW	882	862	837	803	764	711	645	567	467	324
100 / 80 / 1200 / "B"	HIGH	1606	1547	1485	1412	1342	1266	1172	1080	971	800
	MED	1377	1340	1302	1249	1196	1130	1051	967	850	688
	LOW	1034	1027	1018	997	971	939	884	806	708	598
80 / 64 / 1600 / "B"	HIGH	1926	1852	1782	1706	1647	1551	1466	1364	1262	1135
	MED	1443	1431	1409	1366	1334	1279	1024	1143	1055	947
	LOW	1205	1203	1196	1189	1160	1114	1061	999	914	779
100 / 80 / 1600 / "B"	HIGH	1933	1858	1772	1679	1582	1491	1372	1255	1113	886
	MED	1598	1588	1548	1508	1443	1353	1270	1137	993	800
	LOW	1377	1297	1284	1271	1246	1194	1125	1005	851	727
115 / 92 / 1600 / "C"	HIGH	1927	1855	1780	1693	1611	1503	1382	1224	1039	833
	MED	1649	1608	1556	1502	1423	1342	1218	1075	910	723
	LOW	1324	1292	1266	1248	1208	1138	1044	940	802	631
80 / 64 / 2000 / "C"	HIGH	2217	2147	2072	1998	1918	1825	1728	1613	1490	1375
	MED	1915	1864	1811	1758	1691	1622	1531	1440	1336	1208
	LOW	1562	1548	1531	1502	1454	1396	1336	1243	1151	1026
100 / 80 / 2000 / "C"	HIGH	2176	2099	2020	1942	1862	1772	1662	1552	1442	1316
	MED	1924	1868	1805	1740	1680	1603	1512	1414	1318	1191
	LOW	1565	1537	1504	1464	1414	1355	1280	1205	1115	1006
115 / 92 / 2000 / "C"	HIGH	2068	2032	1959	1873	1793	1709	1613	1516	1390	1273
	MED	1884	1827	1770	1713	1648	1586	1503	1402	1279	1174
	LOW	1543	1522	1501	1461	1412	1363	1294	1213	1111	999
130 / 104 / 2000 / "D"	HIGH	2203	2127	2074	1983	1911	1825	1707	1637	1514	1390
	MED	1901	1876	1831	1787	1732	1665	1593	1486	1382	1284
	LOW	1503	1469	1447	1424	1376	1337	1287	1218	1134	1029
NOTE: Data below reflects air flows with two return openings, two sides or one side and bottom.											
80 / 64 / 2000 / "C"	HIGH	2352	2287	2212	2133	2051	1965	1870	1765	1641	1527
	MED	1945	1917	1883	1837	1775	1720	1646	1556	1454	1358
	LOW	1571	1556	1539	1525	1496	1456	1402	1317	1240	1159
100 / 80 / 2000 / "C"	HIGH	2363	2268	2178	2093	2007	1920	1833	1726	1599	1482
	MED	1974	1941	1891	1837	1789	1708	1620	1530	1420	1311
	LOW	1537	1527	1505	1476	1435	1394	1335	1259	1174	1077
115 / 92 / 2000 / "C"	HIGH	2305	2236	2155	2080	1997	1915	1815	1697	1580	1445
	MED	1930	1886	1846	1795	1742	1677	1597	1497	1397	1271
	LOW	1506	1492	1470	1441	1397	1353	1284	1216	1121	1026
130 / 104 / 2000 / "D"	HIGH	2334	2274	2203	2130	2043	1964	1870	1758	1646	1510
	MED	1973	1939	1878	1828	1816	1736	1670	1604	1508	1370
	LOW	1525	1499	1477	1457	1430	1390	1338	1276	1205	1120

1. Input / Output / CFM / Cabinet Width (A=14-1/2, B=17-1/2, C=21, D=24-1/2)

NOTES:

- Airflow is expressed in standard cubic feet per minute.
- Motor voltage at 115V

TABLE 7: BLOWER PERFORMANCE CFM - DOWNFLOW (INCLUDES FILTER)

MODELS P*DN & P*DF[1]	SPEED TAP	EXTERNAL STATIC PRESSURE, INCHES W.C.									
		0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00
40 / 32 / 800 / "A" 57 / 46 / 800 / "A"	HIGH	1160	1117	1077	1038	984	921	845	762	671	549
	MED	945	928	897	864	814	759	700	626	536	443
	LOW	648	630	611	588	553	522	475	422	350	252
57 / 46 / 1200 / "A" 80 / 64 / 1200 / "A"	HIGH	1559	1496	1418	1348	1274	1178	1082	958	813	669
	MED	1347	1289	1239	1181	1125	1064	964	851	725	594
	LOW	1024	1018	1002	970	930	882	798	722	622	508
80 / 64 / 1600 / "B"	HIGH	2047	1992	1911	1842	1780	1688	1607	1513	1412	1284
	MED	1862	1826	1764	1698	1629	1558	1496	1408	1310	1177
	LOW	1673	1658	1605	1550	1489	1438	1358	1283	1202	1086
100 / 80 / 1200 / "B"	HIGH	1602	1532	1460	1374	1297	1209	1107	980	855	706
	MED	1384	1330	1284	1216	1146	1072	985	882	756	611
	LOW	1042	1036	1021	995	957	900	845	749	642	523
100 / 80 / 2000 / "C" 115 / 92 / 2000 / "C"	HIGH	2302	2220	2135	2051	1961	1869	1764	1651	1520	1338
	MED	1950	1927	1868	1818	1756	1664	1594	1500	1401	1258
	LOW	1517	1517	1518	1465	1443	1387	1340	1262	1174	1074
115 / 92 / 1600 / "C"	HIGH	2147	2083	2016	1934	1859	1764	1677	1570	1461	1321
	MED	1921	1883	1821	1756	1717	1620	1543	1468	1339	1206
	LOW	1632	1624	1600	1573	1518	1454	1394	1321	1219	1093
130 / 104 / 2000 / "D"	HIGH	2281	2209	2134	2056	1976	1878	1769	1666	1549	1430
	MED	1947	1900	1876	1809	1755	1679	1610	1485	1395	1286
	LOW	1538	1505	1474	1440	1406	1358	1290	1221	1134	1035

1. Input / Output / CFM / Cabinet Width (A=14-1/2, B=17-1/2, C=21, D=24-1/2)

NOTES:

- Airflow is expressed in standard cubic feet per minute.
- Motor voltage at 115V

OPERATION AND MAINTENANCE

SEQUENCE OF OPERATION

The following describes the sequence of operation of the furnace. Refer to the schematic wiring diagrams for component location. (Refer to Figure 17 on page 26) for event schedule.

CONTINUOUS BLOWER

On cooling/heating thermostats with fan switch, when the fan switch is set in the ON position, a circuit is completed between terminals R and G of the thermostat. The blower motor is energized through the cool fan terminal and runs on the selected speed.

INTERMITTENT BLOWER - COOLING

On cooling/heating thermostats with fan switch, when the fan switch is set in the auto position and the thermostat calls for cooling, a circuit is completed between the R, Y and G terminals. The motor is energized through the cool fan terminal and runs on the selected speed. The fan off setting is fixed at 60 seconds for SEER enhancement.

HEATING CYCLE

⚠ CAUTION

Label all wires prior to disconnecting when servicing controls. Wiring errors can cause improper and dangerous operation. Verify proper operation after servicing.

When the system switch is set on HEAT and the fan is set on AUTO, and the room thermostat calls for heat, a circuit is completed between terminals R and W of the thermostat. When the proper amount of combustion air is being provided, a pressure switch activates the ignition control.

The ignition control provides a 17-second warm-up period. The gas valve then opens for seven seconds.

As gas starts to flow and ignition occurs, the flame sensor begins its sensing function. If a flame is detected within seven seconds after ignition, normal furnace operation continues until the thermostat circuit between R and W is opened. After flame is present for 30 seconds, the circulating blower is energized.

When the thermostat circuit opens, the ignition control is deenergized. With the ignition control deenergized, the gas flow stops and the burner flames are extinguished. The venter continues to operate for 15 seconds after the gas flow stops.

The blower motor continues to operate for the amount of time set by the fan-off delay dip switches located on the control board. The heating cycle is then complete, and the unit is ready for the start of the next heating cycle.

If flame is not detected within the seven second sensing period, the gas valve is deenergized. The control is equipped with a re-try option. This provides a 60 second wait following an unsuccessful ignition attempt (flame not detected).

After the 60 second wait, the ignition sequence is restarted with an additional 10 seconds of igniter warm-up time. If this ignition attempt is unsuccessful, one more re-try will be made before lockout.

A momentary loss of gas supply, flame blowout, or a shorted or open condition in the flame probe circuit will be sensed within 0.8 seconds. The gas valve will deenergize and the control will restart the ignition sequence after waiting 60 seconds.

Recycles will begin and the burner will operate normally if the gas supply returns, or the fault condition is corrected prior to the last ignition attempt. Otherwise, the control will lockout.

The control will repeat the ignition sequence for a total of four recycles if flame is lost within the first 10 seconds of establishment.

If flame is established for more than 10 seconds after ignition, the control will clear the ignition attempt (retry) counter. If flame is lost after 10 seconds, it will restart the ignition sequence. This can occur a maximum of five times.

During burner operation, a momentary loss of power of 50 milliseconds or longer will drop out the main gas valve. When the power is restored, the gas valve will remain deenergized and a restart of the ignition sequence will begin immediately.

Hot Surface Ignition System

⚠ WARNING

Do not attempt to light this furnace by hand (with a match or any other means). There may be a potential shock hazard from the components of the hot surface ignition system. The furnace can only be lit automatically by its hot surface ignition system.

MAINTENANCE

Air Filters

The filters should be checked periodically for dirt accumulation. Dirty filters greatly restrict the flow of air and overburden the system.

Clean the filters at least every three months. On new construction, check the filters every week for the first four weeks. Inspect the filters every three weeks after that, especially if the system is running constantly.

All filters used with the furnace are the high-velocity, cleanable type. Clean these filters by washing in warm water. Make sure to shake all the water out of the filter and have it reasonably dry before installing it in the furnace. When replacing filters, be sure to use the same size and type as originally supplied.

⚠ WARNING

When replacing filters DO NOT use a type with excessively high pressure drop. Some high efficiency filters available will cause the furnace to operate improperly and could result in a safety hazard.

Upflow / Horizontal Installations

1. Turn off electrical power supply to the furnace at disconnect switch. Remove access doors.
2. In the blower compartment disengage the looped end of the filter retainer wire from the front edge of the cabinet. The wire will now pivot on the hinged ends at the rear of the cabinet.
3. Remove the filter and follow the cleaning instructions above. DO NOT remove the filter stiffener rods, if provided.
4. When reinstalling the filter, be sure the filter completely covers the cabinet opening and is secured in place by the wire retainer.

Downflow Installations

1. Turn off electrical power supply to the furnace at disconnect switch. Remove access doors.
2. Filters are installed in the plenum area above the blower assembly. Filters rest against the side of the plenum wall and are supported in the middle by a frame. Lift filter slightly to dislodge and remove for service.
3. Remove the filter and follow the cleaning instructions above. DO NOT remove the filter stiffener rods, if provided. When reinstalling the filter(s) be sure it completely covers the plenum opening.

Lubrication

Blower and ventor motors in these furnaces are permanently lubricated and do not require periodic oiling.

BLOWER CARE

Even with good filters properly in place, blower wheels and motors will become dust laden after long months of operation. The entire blower assembly should be inspected annually. If the motor and wheel are heavily coated with dust, they can be brushed and cleaned with a vacuum cleaner.

The procedure for removing the direct drive blower assembly for cleaning is as follows:

Upflow / Horizontal installations

1. Turn off electrical power supply to the furnace at disconnect switch. Remove access doors.
2. Remove the two auxiliary limit wires on the left side of the blower deck inside the blower compartment.
3. Remove blower assembly mounting screws and slide the blower assembly out of the slots in the deck. If the two shipping screws were not previously removed, also remove and discard these two screws located on each front corner of the blower assembly.
4. Note the wire/terminal location and then remove the blower wiring from the furnace control. Remove the protective boot and disconnect run capacitor wires. Remove the screws securing the electrical panel to the blower housing. Pull blower assembly out of the unit. When cleaning or servicing the blower assembly, DO NOT remove or change the balance clips on the blower wheel.
5. To reassemble, reverse the procedure, restore power to the furnace and verify operation.

Downflow Installations

1. Disconnect the electrical supply to the furnace and remove the access doors.
2. Remove the two wires leading to the auxiliary limit mounted on the side opposite the blower motor.
3. Remove four top panel screws and lift the top panel enough to disengage and remove the flue chase assembly.
4. Remove blower assembly mounting screws and slide the blower assembly out of the slots in the deck. If the two shipping screws were not previously removed, also remove and discard these two screws located on each front corner of the blower assembly.
5. Note the wire/terminal location and then remove the blower wiring from the furnace control. Remove the protective boot and disconnect run capacitor wires. Remove the screws securing the electrical panel to the blower

housing. Pull blower assembly out of the unit. When cleaning or servicing the blower assembly, DO NOT remove or change the balance clips on the blower wheel.

6. To reassemble, reverse the procedure, restore power to the furnace and verify operation.

Burner Removal/Cleaning

The main burners should be checked periodically for dirt accumulation.

If cleaning is required, follow this procedure:

1. Turn off the electrical power to the unit and turn off gas supply at the shutoff valve.
2. Remove the blower and burner compartment access doors.
3. Unplug igniter from the wire harness and remove the igniter/bracket assembly from the burner air shield. Handle the ignitor carefully as it is fragile and easily broken.
4. Note the location and then disconnect the sensor and rollout switch wires located on the top of the air shield and remove the shield.
5. Remove the two screws securing each burner to the burner assembly. Note the orientation of the burner (flanged side down) before removing. Burners may be cleaned by rinsing in hot water or by using a vacuum cleaner.

CLEANING THE HEAT EXCHANGER

Lower Heat Exchanger Access

1. Turn off the electrical power to the unit and turn off gas supply at the shutoff valve.
2. Remove the blower and burner compartment access doors. Disconnect the gas supply piping at the union to permit removal of the entire burner and gas control assembly from the vestibule panel. Use the wrench boss on the gas valve when removing or installing this piping.
3. Unplug the igniter from the wire harness. Disconnect sensor and rollout switch wires located on top of the air shield. Identify and note the location of all leads for ease of reinstallation. Also disconnect the wires at the side rollout switches (upflow only) and the gas valve wires.
4. Remove the screws holding the burner assembly to the vestibule panel and remove this assembly. Handle the assembly carefully since it contains the igniter which is fragile and easily broken. The lower portion of the heat exchanger will now be exposed. To clean the burner assembly, use a vacuum cleaner, or remove the burners as outlined in burner cleaning, and clean in hot water.

UPPER HEAT EXCHANGER ACCESS

1. Perform steps 1-4 above.
2. Disconnect vent piping from the vent motor assembly at the top panel on the furnace (upflow only). On downflow installations this is not necessary.
3. Unplug the venter motor wires and ground wire. Remove the pressure switch tubing at the tap on the venter motor housing.

NOTE: It is recommended that replacement gaskets be available before removing venter motor.

4. Remove six mounting screws that hold the venter motor to the restrictor plate. The surface is gasketed and gasket can be reused if it is carefully removed. It is necessary to remove this assembly to gain access to the restrictor plate mounting holes. The assembly may be vacuumed if cleaning is necessary. If any vent assembly parts are damaged, replace with an entire new assembly (except for gaskets).
5. Remove the perimeter screws attaching the restrictor plate assembly to the vestibule panel. The surface is also gasketed. The assembly, including the flue baffle plate (rear) may be vacuumed or cleaned with hot water if necessary.
6. The upper portion of the heat exchanger is now accessible. With a long flexible wire brush, clean inside each tube at both the top and bottom. The brush must pass around the rear heat exchanger tubes. Vacuum loose scale and dirt from each tube.
7. Clean - Replace all components in reverse order. Regasket all surfaces which required a gasket. Reconnect all wiring. Reattach vent pipe and gas supply lines before restoring service to furnace. Restore electrical power, check gas supply piping for leaks, then verify furnace operation.

TROUBLESHOOTING

The following visual checks should be made before troubleshooting:

1. Check to see that the power to the furnace and the ignition control module is ON.
2. The manual shutoff valves in the gas line to the furnace must be open.
3. Make sure all wiring connections are secure.
4. Review the sequence of operation.

Start the system by setting the thermostat above the room temperature. Observe the system's response. Then use the troubleshooting section in this manual to check the system's operation.

FURNACE CONTROL DIAGNOSTICS

The furnace has built-in, self diagnostic capability. If a system problem occurs, a fault code is shown by a blinking LED. It is located behind a clear view port in the blower compartment door. DO NOT remove the furnace blower compartment panel OR turn off furnace power as either action will clear the control's memory of the fault.

The control continuously monitors its own operation and the operation of the system. If a failure occurs, the LED will indicate the failure code. If the failure is internal to the control, the light will stay on continuously. In this case, the entire control should be replaced as the control is not field repairable.

If the sensed failure is in the system (external to the control), the LED will flash in the following flash-pause sequences to indicate failure status.

Flash sequence codes 2 thru 8 are as follows. LED will turn on for 1/4 second and off for 1/4 second. This pattern will be repeated the number of times equal to the code. For example, six on flashes equals a number 6 fault code.

All flash code sequences are broken by a 2 second off period.

50A50-241 IGNITION CONTROL (P/N 031-01266-000)

Normal flame sense current is approximately

2.0 microamps DC (υa)

Low flame signal control lockout point is

0.15 microamps DC (υa)

CONTINUOUS FLASHING (1 sec on - 1 sec off): This indicates that flame was sensed when there was not a call for heat. With this fault code the control will also turn on both the inducer motor and supply air blower. This fault would typically be caused by a gas valve that leaks through or is slow closing.

2 FLASH: This indicates that the normally open pressure switch contacts are stuck in the closed position. The control confirms these contacts are open at the beginning of each heat cycle. This would indicate a faulty pressure switch or mis-wiring.

3 FLASH: This indicates the normally open pressure switch contact did not close at the beginning of the heat cycle. This could be caused by a number of problems; faulty inducer, blocked vent pipe, broken pressure switch hose or faulty pressure switch.

4 FLASH: This indicates that a primary or auxiliary limit switch has opened its normally closed contacts. With this fault code the control will operate the supply air blower and inducer. This condition may be caused by: dirty filter, improperly sized duct system, incorrect blower speed setting, incorrect firing rate or faulty blower motor.

5 FLASH: This fault is indicated if the normally closed contacts in the rollout switch opens. The rollout control is manually reset. If it has opened, check for proper combustion air, proper inducer operation, primary heat exchanger failure or burner problem. Be sure to reset the switch after correcting the failure condition.

6 FLASH: This indicates that after the unit was operating, the pressure switch opened 5 times during the call for heat. This could be caused by a number of problems; blocked vent or chimney, faulty inducer, cracked pressure switch hose.

7 FLASH: This fault code indicates that flame could not be established. This no-light condition occurred 3 times during the call for heat before locking out. This may be caused by low gas pressure, faulty gas valve, faulty hot surface igniter or burner problem..

POWER SUPPLY POLARITY - 50A50-241 CONTROL ONLY

If the power supply polarity is reversed, the following unit operation will occur. On a call for heat, the inducer will run, the HSI will glow and the gas valve will energize and teh burners will ignite. The burners will immediately extinguish and the unit will recycle. This will occur 3 times and tehn the unit will lockout. A “7” flash code will be displayed. This code means the flame could not be established. This occurs because the conrol cannot sense flame with teh power supply polarity reversed.

8 FLASH: This fault is indicated if the flame is lost 5 times during the heating cycle.This could be caused by low gas pressure or faulty gas valve.

LED ON CONSTANTLY: This indicated an internal fault in the furnace control discovered during its self-check procedure. Replace the control.

60 MINUTE AUTOMATIC RESET FROM LOCKOUT: This control includes a watchdog type circuit that will reset from a lockout condition after 60 minutes. Operational faults 6, 7 & 8 will be reset. This provides protection to an unoccupied structure if a temporary conditions exists causing a unit malfunction. An example would be a low incoming gas supply pressure condition preventing unit operation. When the gas pressure was restored, at some point the watchdog would restart the unit and provide heat for the house.

NOTE: The control will blink one time when initially powered. .
This is normal and not an indication of any malfunction.

⚠ WARNING

Never jump pressure switch to allow furnace operation. To do so will allow furnace to operate under potentially hazardous conditions.

Do not try to repair controls. Replace defective controls with UPG Source 1 Parts.

Never adjust pressure switch to allow furnace operation.

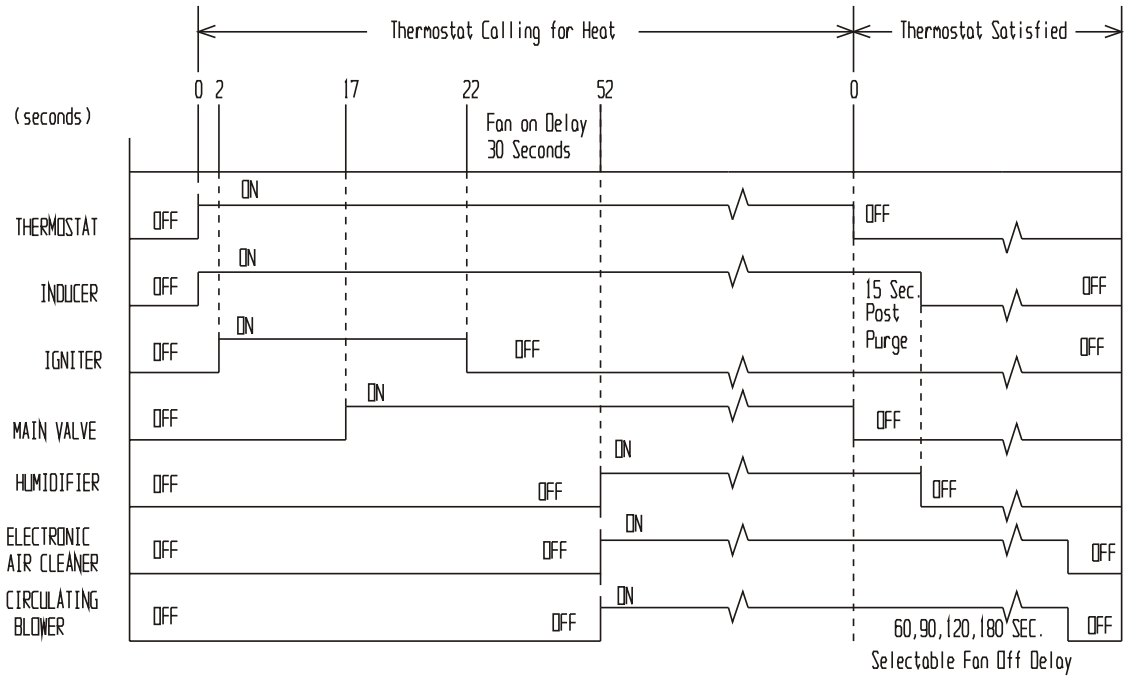
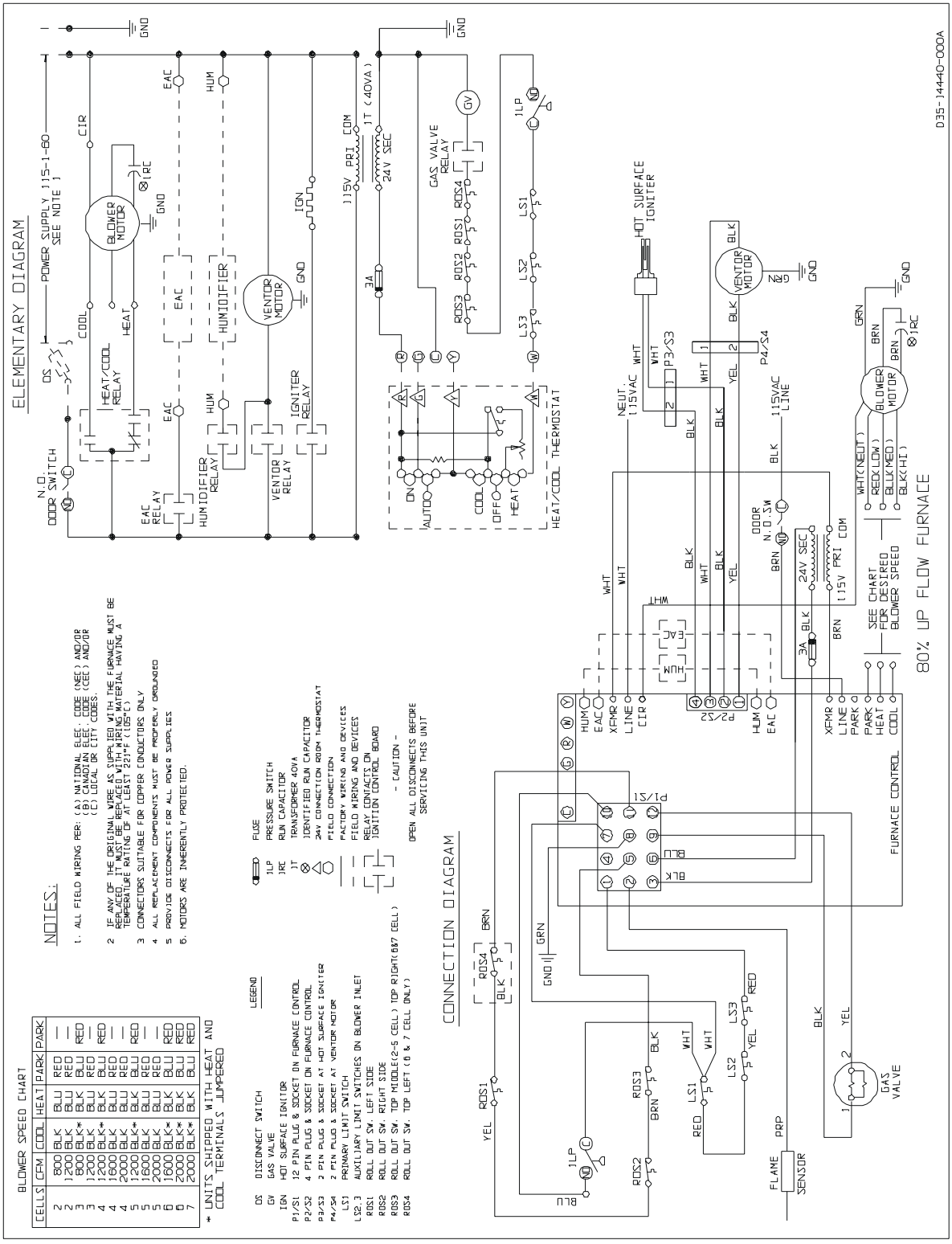


FIGURE 17 : FURNACE EVENT CONTROL SCHEDULE

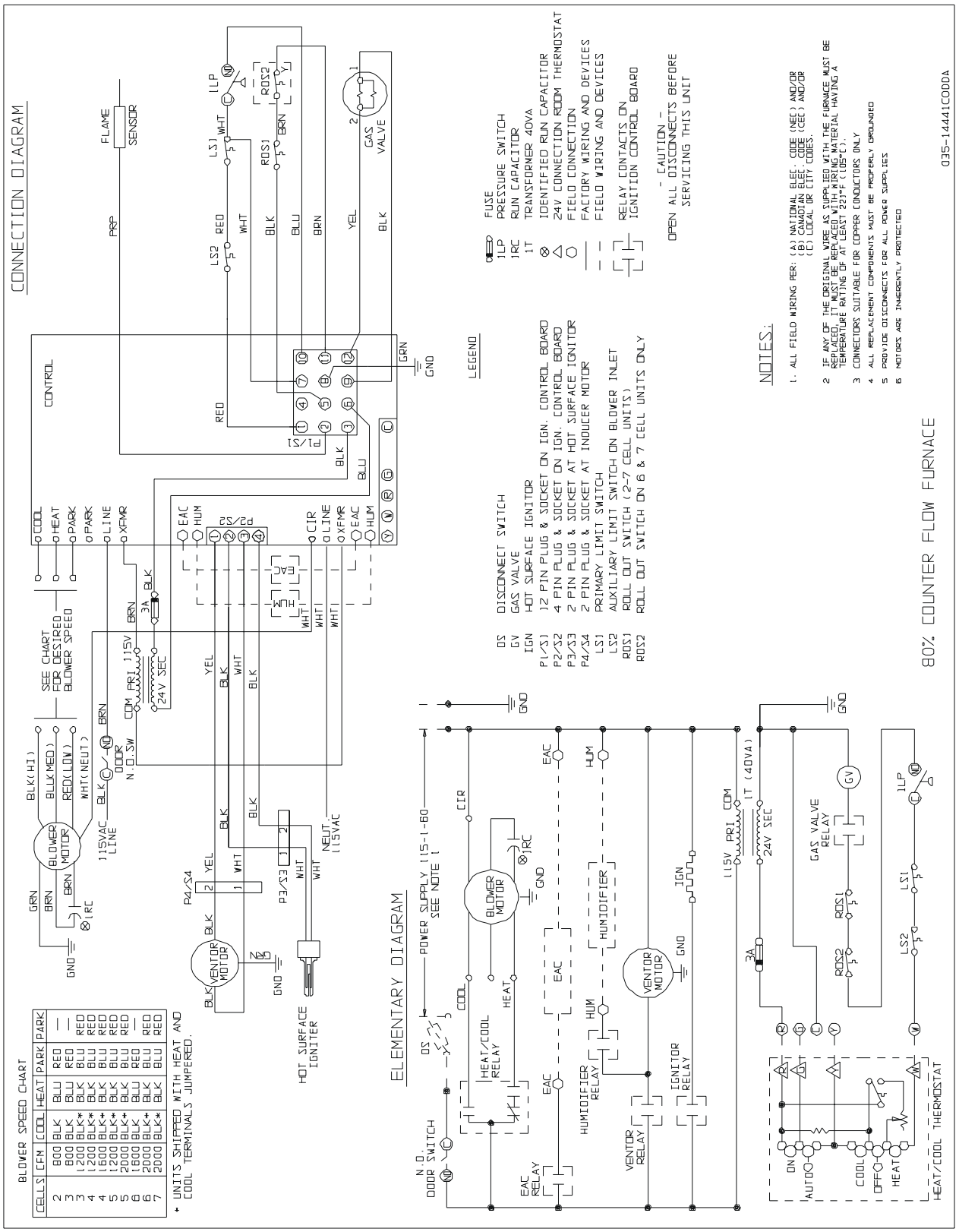
WIRING DIAGRAM - UPFLOW/HORIZONTAL MODELS P*HU/P*UH & FL8

(*NOTE: The furnace's control system depends on correct polarity of the power supply.*)



WIRING DIAGRAM - DOWNFLOW MODELS P*DN/P*DF

(*NOTE: The furnace's control system depends on correct polarity of the power supply.*)



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Supersedes: 650.74-N1U (399)
650.74-N1U (699)

Unitary Product Group
5005 York Drive North
Norman OK 73069