INSTALLATION INSTRUCTION

GAS-FIRED FURNACES UPFLOW & DOWNFLOW MODELS STYLE A

Supersedes: 650.55-N6W (1189) | 650.55-N6W (1289)

035-08708

MODELS PDSU, DS, CU, DC; STYLE A

GENERAL

These Category I furnaces are designed for residential installation in a basement, closet, recreation room. attic or garage. They are designed for natural gas-fired operation. A propane (LP) conversion kit (except Lo Nox units) is available to qualilfied distributors and dealers.

Any additions, changes or conversions required in order for the appliance to satisfactorily meet the application must be made by a CES distributor or other qualified agency, using factory specified and/or approved parts.

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.

NOMENCLATURE

P D SU – L D20 N 080

Product Category
P=Furnaces

Product Generation

Product Identifier
SU=Upflow, Stdg. Pilot
DS=Downflow, Stdg. Pilot
CU=Upflow, Spark Ignition
DC=Downflow, Spark Ignition

Voltage Code

Type Drive and CFM

Type Gas
N=Natural Gas
P=Propane
L=Low NOx Natural Gas

Nominal Capacity

NOTE: A complete list of model numbers appears in Table 1.

LIMITATIONS

These furnaces should be installed in accordance with all national and local building/safety codes and requirements, or, in the absence of local codes, with the National Fuel Gas Code, ANSI Z223.1-latest edition.

See Table 1 for application limitations. A.G.A. design certification does not include mobile home installations. A combustible floor base accessory is required for all combustible floor applications of downflow furnaces.

A gas-fired furnace for installation in a residential garage must be installed so that the burners and the ignition source are located at least 18 inches above the floor and positioned or protected to avoid physical damage by vehicles.

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

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

The furnace area must not be used as a broom closet or for any other storage purposes, as a fire hazard may be created.

WARNING: Blower and burners must never be operated without blower door in place. This is to prevent drawing of dangerous fumes (which could contain hazardous carbon monoxide) into the home, which could result in personal injury or death.

The draft hood shall be installed so as to be in the same atmospheric pressure zone as the combustion air inlet to the furnace.

WARNING: If this furnace is replacing a previously commonvented furnace, it may be necessary to resize the existing vent line and chimney to prevent oversizing problems for the other remaining appliance(s). See National Fuel Gas Code (ANSI Z223.1-latest edition).

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

1. Seal any unused openings in the common venting system.
2. Visually inspect venting system for proper size and horizontal pitch and determine 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 in between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any 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 inspected in operation. Adjust thermostat so appliance will operate continuously.
5. Test for spillage at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, cigar or pipe.
6. After it has been determined that each appliance remaining connected to the common 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 previous tests, the common venting system must be corrected.
8. Any corrections to the common venting system must be in accordance with the National Fuel Gas Code Z223.1-latest edition. 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.

CLEARANCE FOR ACCESS

Ample clearances should be provided to permit easy access for cleaning of the unit. The following minimum clearances are recomended:

1. Twenty-four inches between the front of the furnace and an adjacent wall or another appliance, when access is required for servicing and cleaning
2. Eighteen (18) inches at the side where access is required for passage to the front when servicing or for inspection or replacement of draft hood or flue connections.

NOTE: In all cases, accessibility clearances shall take precedence over clearances for combustible materials, where accessibility clearances are greater.

TABLE 1 – LIMITATIONS AND PHYSICAL DATA

Model Number	Htg. Cap. Input MBH	SS Output MBH	Air Temp. Rise °F	CFM @ Mean Air Temp. Rise	Max. Outlet Air Temp. °F	Blower			Max. Over-Current Prot.	Unit Ampacity	Min. Wire Size (AWG) @75' Cir. (One-Way)
						D (in.)	W (in.)	HP			
UPFLOW MODELS											
†PDCU-LD10L030	30	23	25 - 55	520	150	10	6	1/4	15.0	8.0	14
PDSU/CU-LD06N040	38	29	35 - 65	555	165	9	4	1/6	15.0	2.0	14
PDSU/CU-LD10N040	38	29	20 - 50	795	150	9	6	1/4	15.0	8.0	14
†PDCU-LD12L060	57	45	40 – 70	725	170	10	6	1/4	15.0	9.0	14
PDSU/CU-LD08N065	65	51	45 – 75	755	175	9	6	1/5	15.0	8.0	14
PDSU/CU-LD12N065	65	51	35 – 65	900	165	10	6	1/4	15.0	9.0	14
†PDCU-LD16L075	75	60	30 - 60	1155	160	10	10	1/3	15.0	9.0	14
PDSU/CU-LD08N080	75	56	55 – 85	795	185	9	6	1/5	15.0	8.0	14
PDSU/CU-LD12N080	78	59	40 – 70	1010	170	10	6	1/4	15.0	9.0	14
PDSU/CU-LD12N090	90	69	50 - 80	960	180	9	9	1/4	15.0	9.0	14
PDSU-LD16N090	90	69	30 - 60	1390	160	10	10	1/3	15.0	9.0	14
†PDCU-LD20L090	90	72	40 – 70	1135	170	11	10	1/2	20.0	17.0	12
PDSU/CU-LD12N105	105	80	55 – 85	1040	185	9	9	1/4	15.0	9.0	14
PDSU/CU-LD16N105	105	80	35 – 65	1460	165	10	10	1/3	15.0	9.0	14
*PDSU/CU-LD20N105	105	80	30 - 60	1620	160	11	10	1/2	20.0	17.0	12
PDSU/CU-LD16N120	117	88	40 – 70	1515	170	10	10	1/3	15.0	9.0	14
*PDSU/CU-LD20N120	117	88	35 – 65	1665	165	11	10	1/2	20.0	17.0	12
PDSU/CU/-LD16N140	140	106	55 - 85	1390	185	10	10	1/3	15.0	9.0	14
*PDSU/CU-LD20N160	157	118	45 – 75	1850	175	11	10	1.0	20.0	17.0	12
*PDCU-MB30N180	DATA TO BE AVAILABLE AT A LATER DATE										
DOWNFLOW MODELS											
PDDS/DC-LD08N065	65	50	35 – 65	905	165	10	6	1/4	15.0	8.0	14
PDDS/DC-LD12N080	78	60	35 – 65	1110	165	10	8	1/4	15.0	8.0	14
PDDS/DC-LD14N105	105	80	50 – 80	1120	180	10	8	1/3	15.0	9.0	14
PDDS/DC-LD16N120	117	89	45 – 75	1390	175	10	10	1/2	20.0	17.0	12
*PDDS/DC-LD20N140	140	106	45 – 75	1620	175	11	11	1.0	20.0	17.0	12

NOTES: * For side return applications, these models require either both side inlets or the use of the optional single side double return filter cabinet accessory to provide the necessary filter area (1FF0315).

† These units are Lo Nox emission models that meet South Coast and Bay Area Lo Nox standards.
All filters supplied with the furnace are high-velocity, cleanable type.
UG/CG models are standing pilot furnaces.
US/CS models are equipped with spark ignition.

UNIT PREPARATION

Make sure all shipping material has been removed from the furnace. See the tag taped to the gas manifold for removal of shipping support.

REMOVE SHIPPING SCREWS

Upflow Models–Remove the shipping screws from the angle at the top rear of the heat exchanger.

Downflow Models–Remove the shipping screws from the bottom of the rear panel to free the heat exchanger. Also remove shipping brace from the front of the motor housing.

Belt-Drive Models–Remove the shipping angle at the motor adjusting bolt.

CLEARANCES TO COMBUSTIBLES

Minimum clearances from combustilble construction are in inches.

PD Clearances	Upflow 030, 040 Only Pri.	Upflow 030, 040 Only Alt.	Upflow 60 and Above Pri.	Upflow 60 and Above Alt.	Downflow All
Top	2	1	2	1	1
Front	6	6	6	6	6
Rear	0	0	0	0	0
Sides					
Single Wall Vent	2	2	0	1	0
B-1 Vent	0	1	0	1	0
Flue					
Single Wall Vent	6	6	6	6	6
B-1 Vent	1	1	1	1	1

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. Meet the requirements and recommendations of ACCA (Air Conditioning Contractors of America).

3. Be installed in accordance with standards of NFPA (National Fire Protection Association) as outlined in NFPA pamphlets 90A and 90B.

4. Create a closed duct system. The supply duct 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.

5. 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.

DUCT CONNECTIONS

After the unit is in the desired position, fasten the supply and return ductwork to the furnace duct flanges. Flexible duct connectors are recommended to connect both the supply and return ducts to the furnaces.

DOWNFLOW FURNACES

Before connecting the return air ductwork to a downflow furnace, see the downflow furnace filter section of this instruction. The supply air ductwork connects to the bottom of the furnace.

UPFLOW FURNACES

Ductwork may be connected to an upflow furnace in one of the following three ways:

1. Bottom Return – Before attaching the ductwork to the furnace botom flanges, see the upflow furnace filter section of this instruction.

2. Side Return – Cut a hole in the side panel of the furnace using the right-angle markings (See Fig. 1) as a guide for position and size of the opening. Install a single side return filter frame accessory if one is required. If this accessory is not needed, the ductwork can be fastened directly to the furnace opening.

WARNING: *The right angle markings (See Fig 1) indicate the area required for proper operation of the furnace.*

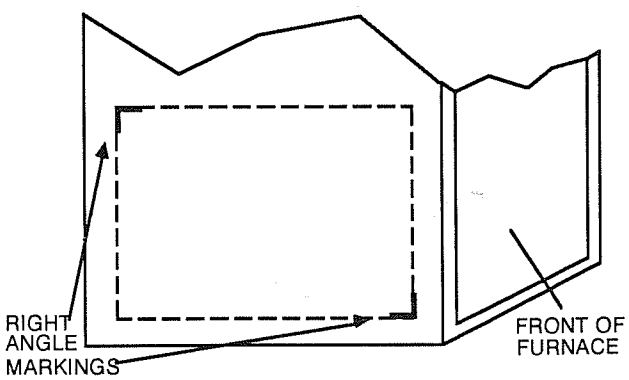
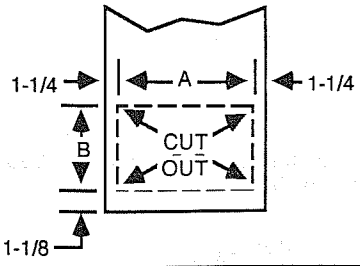


FIGURE 1 – SIDE RETURN CUTOUT MARKINGS

CAUTION: *The 26-1/4" (cabinet width) models will require both side inlets or the use of the optional double filter single side return or one side and bottom filter frame to provide the necessary filter area.*

3. Rear Return–Make an opening in the rear panel of the furnace using the dimensions and location shown in Figure 2. Dimension A will vary with the furnace casing width. Install the return air plenum accessory if one is required. If a plenum accessory is not needed, the ductwork can be fastened directly to the furnace opening. In this case, filters must be field-supplied and of the high-velocity type.



WIDTH	12-1/4	16-1/4	22-1/4	26-1/4	32-1/4
DIMENSION A	9-3/4	13-3/4	19-3/4	23-3/4	29-3/4
DIMENSION B	14	14	14	14	17-1/2

FIGURE 2 – PROPER OPENING LOCATION FOR REAR RETURN APPLICATIONS

FLUE CONNECTIONS

Connect the flue piping from the chimney to the draft hood. Be sure the flue piping is installed properly.

For furnaces for connection to gas vents or chimneys, vent installations shall be in accordance with Part 7, Venting of Equipment, of the National Fuel Gas Code, ANSI Z223.1-latest edition, or applicable provisions of the local building codes.

Vent connectors serving Category I and Category II appliances shall not be connected into any portion of mechanical draft systems operating under positive pressure.

CAUTION: When installing downflow furnaces, you must extend the flue pipe through the flue housing in the blower section and attach it to the collar on the draft hood. If this is not done, harmful flue gases will enter the blower section (See Fig. 3).

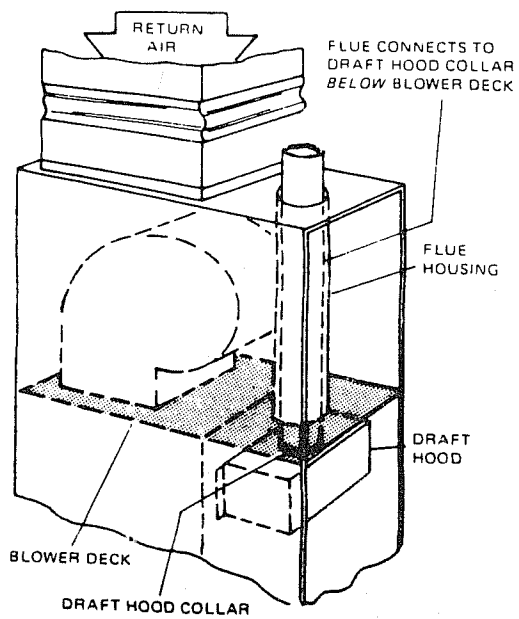


FIGURE 3 – DOWNFLOW FLUE CONNECTION

WARNING: This furnace shall be connected to a factory built chimney or vent complying with a recognized standard, or a masonry chimney lined with a lining material acceptable to the authority having jurisdiction.

WARNING: The draft hood must be in the atmospheric pressure zone as the combustion air inlet to the furnace.

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

LOCATION

Allow clearance from combustible materials as listed under "CLEARANCES", ensuring that service access is allowed for both the burner and blower. The unit must be installed in a level position.

When the furnace is used in conjunction with a cooling unit, the furnace must be installed parallel with or on the upstream side of the cooling unit to avoid condensation in the heat exchanger. When a parallel flow arrangement is used, the dampers or other means used to control air flow shall be adequate to prevent chilled air from entering the furnace, and is manually operated, must be equipped with means to prevent operation of either unit unless the damper is in the full heat or cool position.
The furnace should be located:

1. As near the chimney or vent as is practical.
2. As centralized with the air distribution system as possible.
3. In an area where ventilation facilities provide:
   a. Satisfactory combustion of gas.
   b. Proper venting.
   c. Safe limits of ambient temperature under normal operating conditions.
4. Where it will not interfere with proper air circulation in the confined space. When normal infiltration does not meet air requirements, outside air should be introduced.
5. Where the flow of combustion and ventilating air through the air openings and into the combustion chamber will not be blocked.
6. Where it will not interfere with the cleaning, servicing or removal of other appliances.

CONFINED SPACE INSTALLATION

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

1. 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 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.

2. Air Source From Outdoors –
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 shall 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:

$$\frac{\text{Total input of all appliances}}{4000} = \text{Square inches of free area}$$

   b. Horizontal Ducts - Each opening shall 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 shall have the same cross-sectional area as the free area of the opening to which they are connected. The minimum dimension of rectangular ducts shall be three (3) inches.

3. Louvers, Grilles and Screens.
   a. In calculating free area, consideration must be given to the blocking effect of louvers, grilles and screens.
   b. If the free area of a specific louver or grille is not known, refer to Table 2 to estimate free area.

TABLE 2 – ESTIMATED FREE AREA

Wood or Metal Louvers or Grilles	Wood 20-25%† Metal 60-75%†
Screens*	1/4" mesh or larger 100%

* Do not use less than 1/4" mesh
† Free area of louvers and grilles varies widely; installer should follow louver or grille manufacturer's specifications.

4. 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.
The size of combustion air openings previously discussed shall not necessarily govern when special engineering assures an adequate supply of air for combustion, ventilation, and draft hood dilution.

Where the return duct system is not complete, the return connection must be run full size from furnace 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-latest edition.

VENTING SYSTEMS

CHIMNEY

All gas furnaces must be vented. The area of the chimney shall not be less than the area of the largest vent connector - plus 50% of the areas of any additional vent connectors attached to it. The following table lists the required chimney areas for various sizes of vent connectors.

Required Chimney Vent Areas

Vent Pipe Diameter (Inches)	Chimney Area (Square Inches)
4	12.6
5	19.7
6	28.3
7	38.5

NOTE: For oval pipe, use applicable round pipe size.

Existing chimneys should be:

1. Free from soot, leaks and obstructions.
2. Of the proper height to prevent downdrafts (See Fig 4).
3. The furnace cannot be vented into a chimney which serves a mechanical draft system operating under positive pressure.

New chimneys should conform to local building codes, and utilities should be contacted for requirements.

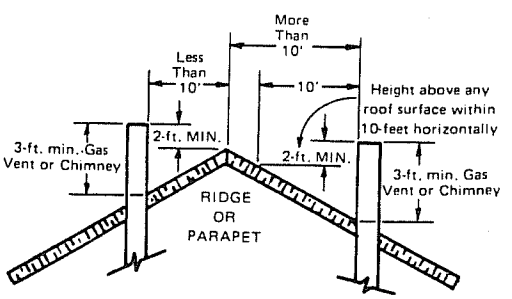


FIGURE 4 – TYPICAL CHIMNEY LOCATIONS, BACKDRAFT REDUCTION

VENT CONNECTOR PIPE

The vent pipe should be the same size as the draft hood outlet opening, and should slope upward 1/4-inch per linear foot from the unit to the chimney, using the least number of elbows possible. Aluminum or galvanized pipe is satisfactory to most gas applications, but local practice will generally determine the material to be used.

The furnace cannot be vented into a chimney which serves a mechanical draft system operating under positive pressure.

FILTER DATA

The type and size of filter(s) to be used are shown in Table 1.

DOWNFLOW FURNACE FILTERS

Downflow furnace filters are installed above the furnace, extending into the ductwork as shown in Figure 5. Branch ducts must enter above the height of dimension FH.

The filter rack should be secured to the center of the front and rear flanges at the furnace's return air opening. Drill a hole through the rear duct flange into the filter rack and secure it with a sheet metal screw.

CASING SIZE	DIMENSION FH
16-1/4	12-3/4"
22-1/4	11"
26-1/4	8-1/4"

FH = THE MAX. HEIGHT THAT FILTERS WILL EXTEND INTO THE RETURN DUCT WORK.

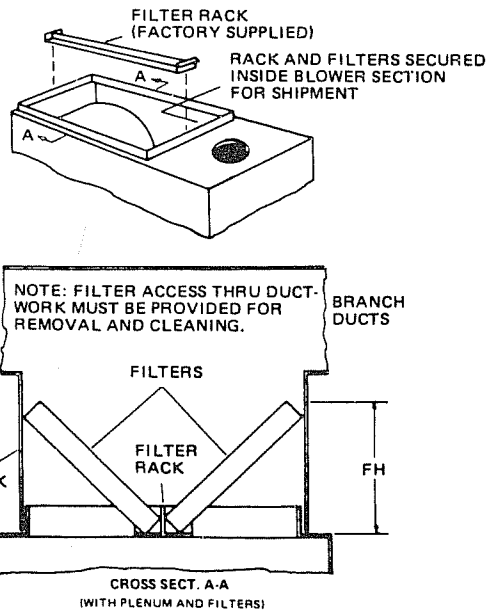


FIGURE 5 – DOWNFLOW FILTERS

UPFLOW FURNACE FILTERS –
12-1/4, 16-1/4 and 22-1/4 inch widths

All 12-1/4, 16-1/4 and 22-1/4 inch wide furnaces are shipped with filters mounted on the left side. Filters may be relocated to the bottom or right side as follows:

The wire retainer must be moved if the return air application requires moving of the filter from the side to the bottom location or vice versa. When relocating filters, it may be necessary to trim the filter to the proper size.

The ends of the retainer are attached to the rear panel in two metal loops (See Fig. 6). The ends must be squeezed together to free them from the loops. The retainer may then be moved to the new location, and the ends inserted in the loops on the rear panel at the new location. Loops are provided for retainer location to accommodate filter application on the bottom or either side of the furnace.

To remove a filter from the bottom location, push the closed end of the filter retainer to the left until it clears the clip on the furnace base, which acts as a catch for the retainer. When the retainer is clear of the clip, lift up. The retainer will pivot in the loops. This will expose the filter to allow removal. To re-install the filter, simply reverse this procedure. To remove a filter from the side location, push the closed end of the filter retainer down until it clears the clip on the furnace base, which acts as a catch for the retainer. When the retainer is clear of the clip, it will pivot in the loops. Swing the retainer toward the center of the furnace. this will expose the filter to allow removal. To re-install the filter, simply reverse this procedure.

UPFLOW FURNACE FILTERS –
26-1/4 inch casing width

26-1/4 inch wide furnaces are shipped with filters mounted in the bottom. In addition, the 26-1/4 inch model has a side filter.

For filter removal in 26-1/4 inch models, follow the same procedure as with the smaller cabinet width furnaces.

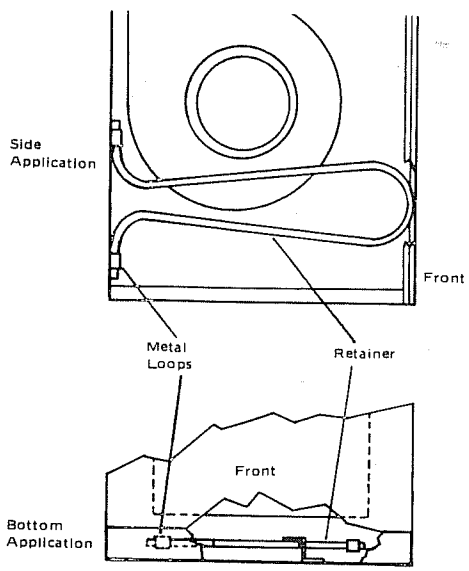


FIGURE 6 – FILTER RETAINER

GAS PIPING

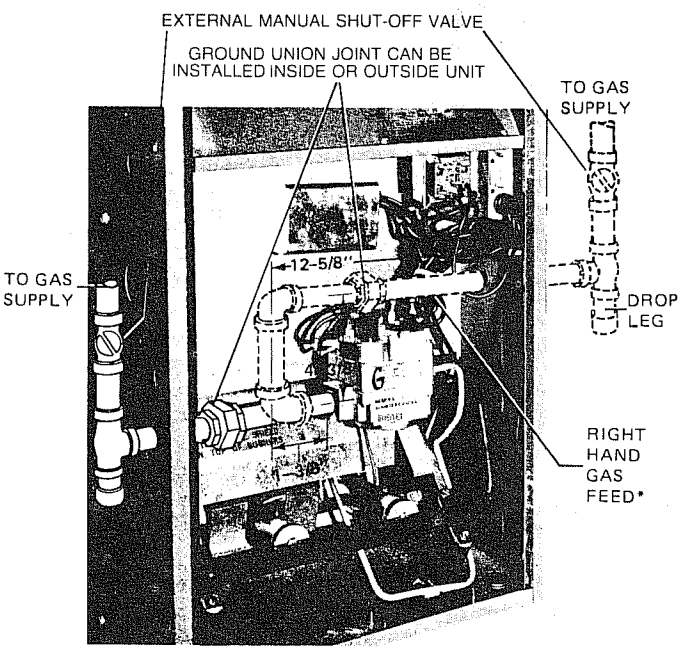
NOTE: An external, manual shutoff valve must be installed upstream of the furnace gas controls and within 6 feet of the furnace.

A 1/8" NPT plugged tapping, accessible for test gauge connection, must be installed immediately upstream of the gas supply connection to 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 ecess of 1/2 psig.

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.

CAUTION: Never apply pipe wrench to body of combination automatic gas valve. Wrench must be placed on projection or wrench boss of this valve when installing piping to it.



* ALL EXCEPT 030 AND 040 MODELS

FIGURE 7 – RECOMMENDED GAS PIPING

With the exception of 30 AND 40 MBH models, 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. The gas supply should be a separate line, installed in accordance with the American National Standard Z223.1-latest edition, National Fuel Gas Code.

Some utility companies require pipe sizes larger than the maximum sizes listed. Using the properly sized wrought iron or steel pipe, make gas connections to the unit. Installation of a drop leg and ground union joint is required (see Figure 7).

WARNING: Compounds used on threaded joints of gas piping must be resistant to the action of liquefied petroleum gases. After the connections are made, leak-test the pipe connections.

WARNING: Do not use an open flame or other source of ignition for leak testing. Set the manual gas valve to the OFF position.

ELECTRICAL DATA

Use Copper Conductors Only

Field wiring to the unit must conform to and be grounded in accordance with the provisions of National Electrical Code ANSI/NFPA No. 70-1987 or the latest edition and/or local codes. Electrical wires which are field installed shall conform with the temperature limitation for type T wire (63°F/35°C Rise) when installed in accordance with the instructions.

ELECTRICAL 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 gas valve and the low-voltage transformer. Set the heat anticipator on the thermostat to 0.41 amps (standing pilot) or 0.6 amps (spark ignition).

The furnace's control system depends on correct polarity of the power supply. Connect the power supply as shown on the unit wiring label on the inside of the blower section door.

Provide 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.

START-UP

When the gas supply is initially connected to the furnace, the gas piping many be full of air. In order to purge this air, it is recomended that the ground joint union be loosened until the odor of gas is detected. When the gas is detected, immediately retighten the union and check for leaks. Allow 5 minutes for any gas to dissipate before continuing with the start-up procedure.

All electrical connections made in the field and in the factory should be checked for proper tightness.

After the duct and flue connections have been made, and the gas piping and electrical wiring are completed, the unit may be started.

Standing Pilot Models

Light the pilot by following the instructions on the unit instruction data plate.

Open the manual gas shutoff valve. Turn the automatic combination gas valve to the pilot position. Depress the valve knob, light the pilot, and hold the knob down until the pilot remains lit when the knob is released.

Adjust the pilot flame to surround the end of the thermocouple for a distance of 3/8" to 1/2". The adjusting screw for the pilot flame is located under the screw-off cap on the main gas valve. 'Pilot Adj.' is stamped next to this cap. Remove the cap and adjust the pilot flame.

NOTE: The screw-off caps for both the pilot and the pressure regulator must be removed entirely to gain access to the adjustment screws. Loosening or tightening the caps does not adjust the flow of gas.

After power has been supplied to the unit, turn the manual selection knob on the gas valve to the ON position. When the thermostat calls for heat, the main burners should light and remain lit. Check all gas connections for leaks. Be sure to replace any cap(s) removed from the gas valve.

SEQUENCE OF OPERATION

Spark Ignition Models–100% Shutoff System

WARNING: These units are manufactured for use with a specific type of fuel. Natural gas units must not be converted to liquefied petroleum gas except by using factory approved conversion kits (Low Nox units are not be be converted). Deviation from this system could cause a hazardous condition resultng in personal injury or damage to unit or property.

Do not attempt to light the pilot burner in a spark-ignition furnace by hand (with a match or any other means). There may be a potential shock hazard from the components of the spark-ignition system. The pilot burner can only be lit automatically by the furnace's spark-ignition system.

1. The operation cycle begins with a call for heat from the thermostat.
2. The pilot gas valve is opened and the spark ignition control lights the pilot burner by spark. The intermittent pilot burns during each running cycle of the furnace.
3. The pilot flame is detected by the sensing probe at the pilot burner, and the spark ignition system is turned off.
4. The main burner gas valve is opened and the main burners are lit by the pilot. The heating cycle is now in normal operation.
5. When the temperature setting on the thermostat is reached, the main burner valve and the pilot valve are both closed, and both flames go out.

NOTE: If the pilot flame goes out during the main burner operation, the sensing probe at the pilot burner detects the absence of the flame and closes the main burner gas valve. The spark ignition control then relights the pilot and starts the cycle again.

S86H CONTROL MODULE FUNCTIONS AND OPERATION

The S86H Control Module performs the following basic functions, which occur in two stages:

1. Opening and closing the first (pilot) operator.
2. Providing a spark for igniting the pilot.
3. Sensing the pilot flame.
4. Shutting off the spark.
5. Opening and closing the second (main) operator

First Stage – Trial for Pilot Ignition

On every call for heat, the S86H Control Module performs an internal safe-start check. A system start is prevented if the check shows that a flame or flame-simulating condition is already present at the pilot burner.

During a normal start, the S86H opens the first operator in the gas control valve. This allows gas to flow to the pilot burner. At the same time, the electronic spark generator in the S86H produces a 30,000 volt spark pulse output. This voltage produces a spark at the pilot burner igniter-sensor rod, igniting the gas flowing around the electrode.

If the pilot flame is not detected during the trial for pilot ignition, the S86H will continue trying for pilot ignition for 90 seconds. If the pilot flame is not detected in 90 seconds, the S86H will lock out. The thermostat must be turned off/down for 30 seconds, then back up before the module will function again.

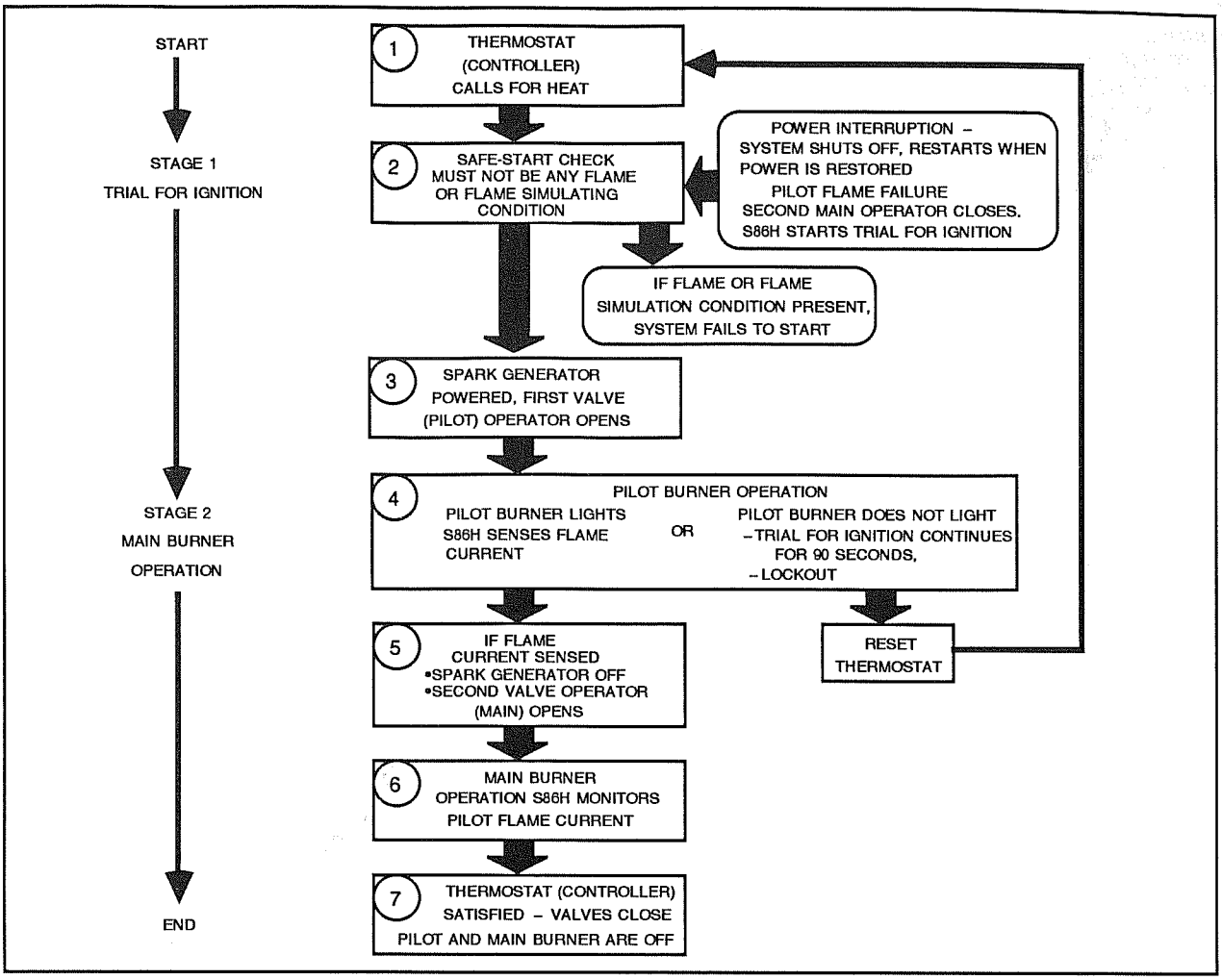
Second Stage – Main Burner Operation

When the pilot flame is established, a flame rectification circuit is completed to the burner ground. The S86H Control Module's flame sensing circuit detects the flame current and shuts off the spark generator. At the same time, the second (main) operator is opened in the gas control valve, allowing gas to flow to the main burner. The pilot flame ignites the main burners.

IGNITION SYSTEM CHECKOUT/ADJUSTMENT

Spark Ignition Models

1. Turn the control system power ON, and turn the gas supply OFF.
2. Check the S86H Control Module operation as follows:
   a. Set the thermostat above room temperature to call for heat.
   b. Watch for the spark at the pilot burner.
   c. Turn the thermostat down to end the call for heat.
3. Turn the gas supply ON.



4. Set the thermostat above room temperature to call for heat.

5. Start the system as follows:

   a. The spark will turn on and the pilot gas valve open immediately. The pilot burner will light after the gas reaches the burner.

   b. The spark ignition unit will go off when the pilot flame is established.

   c. The main gas valve will open and the main gas burner will light after the gas reaches the burnerports.

   NOTE: Burner ignition may not be satisfactory until the gas input and combustion air have been adjusted.

6. With the main burner in operation, paint the pipe joints, pilot gas tubing connections, and valve gasket lines with a rich soap and water solution. Bubbles indicate gas leakage. To stop the leaks, tighten all joints and screws. If the leak persists, replace the component.

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

Pilot Flame Adjustment

Adjust the pilot flame to surround the end of the insulated rod on the igniter-sensor for a distance of 3/8″ to 1/2″. The adjusting screw for the pilot flame is located under the screw-off cap on the main gas valve. Remove the cap and adjust the pilot flame, if necessary. Turn the screw clockwise to decrease the length of the pilot flame, and counter-clockwise to increase the length of the flame.

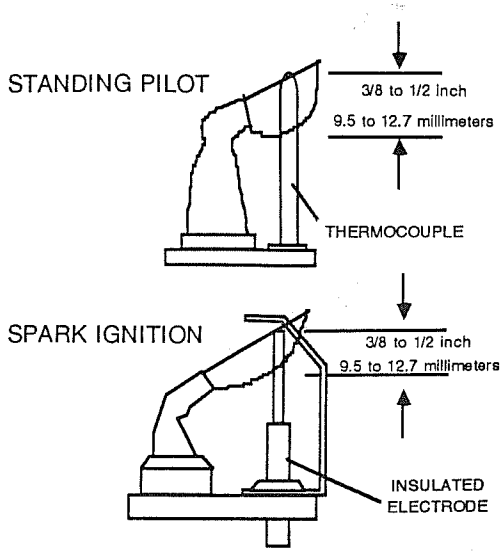


FIGURE 8 – PROPER PILOT FLAME ADJUSTMENT

NOTE: The screw-off caps for both the pilot and the pressure regulator must be removed entirely to gain access to the adjustment screws. Loosening or tightening the caps does not adjust the flow of gas.

If the pilot flame is properly adjusted but goes out during normal operation, check the igniter-sensor and pilot burner assembly for loose connections or improper positioning.

ADJUSTMENT OF MANIFOLD GAS PRESSURE

Measure the gas manifold pressure. The manifold pressure should be set as follows:

Natural Gas- 3.5 inches water column
Propane Gas-10.0 inches water column

Refer to Figure 9 (Gas Valves) for plug location for installing pressure tap to check gas pressure to burners.

WARNING: The stated gas pressure should always be used. If the pressure is too high, overfiring and premature failure of the heat exchanger could occur. If the pressure is too low, sooting and eventual clogging of the heat exchanger could occur, causing flue products to back up into the living space.

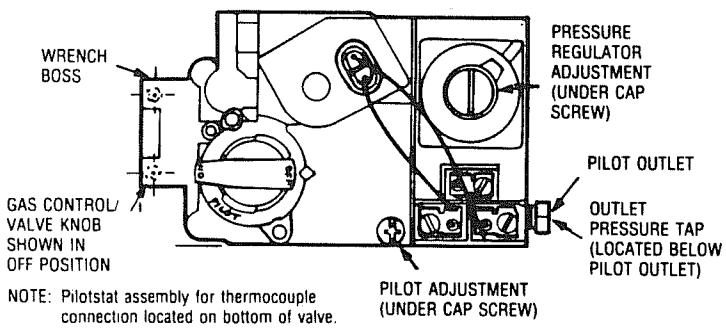
On natural gas furnaces, the gas flow may be adjusted by turning the pressure regulator adjustment screw clockwise to increase the pressure or counter-clockwise to decrease the pressure.

On propane gas furnaces, the manifold gas pressure may be adjusted by the gas supplier at the external regulator on the gas tank or at the pressure regulator adjustment screw on the gas valve. After the pressure has been adjusted, it must be checked to be sure it is 10.0 inches water column at the pressure tap installed on the gas valve.

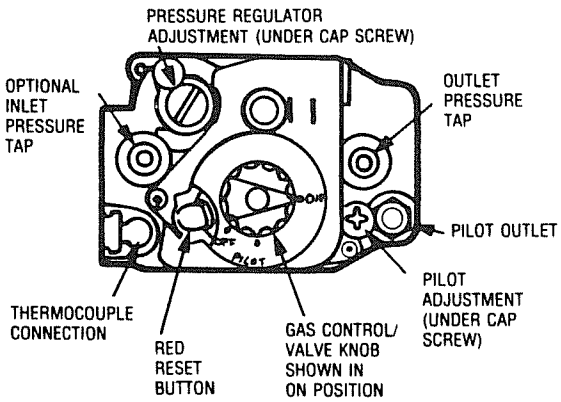
WARNING: Once the correct gas pressure to the burners has been established, turn the gas valve knob to OFF and turn the electrical supply switch OFF, then remove the pressure tap at the gas valve and re-install the plug, using a compound (on the threads) resistant to the ation of LP gases.

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.

STANDING PILOT GAS CONTROL/VALVE

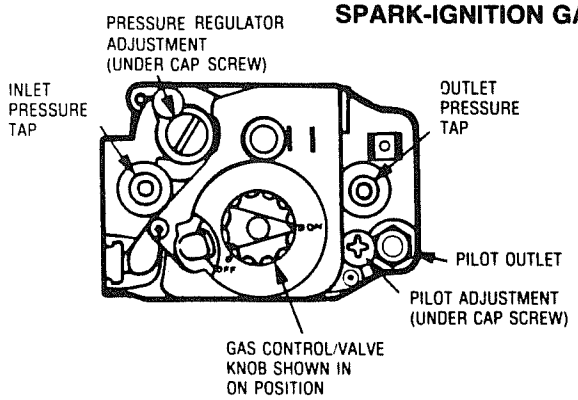


HONEYWELL SERIES VR800 GAS CONTROL

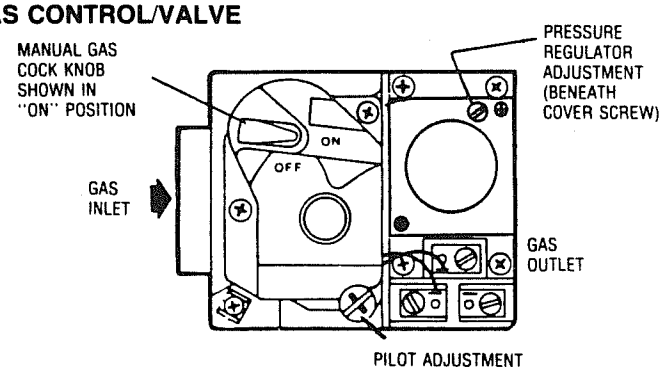


HONEYWELL SERIES VR8200 GAS CONTROL

SPARK-IGNITION GAS CONTROL/VALVE



HONEYWELL SERIES VR8204 GAS CONTROL



HONEYWELL SERIES VR8440 GAS CONTROL

FIGURE 9 – GAS VALVES

ADJUSTMENT OF PRIMARY AIR

The main burners should be in operation for 15 minutes before making the primary air adjustment. The burner flame should not contain any yellow color. With the furnace operating at full input, adjust the primary air of the burners as follows:

To adjust the flame, loosen the retaining screw, then pull the air shutter toward the gas orifice very slowly until the flame turns yellow. Then slowly push the air shutter away from the gas orifice until all the yellow color disappears. After adjusting all the primary air shutters, tighten all screws, turn burners on and off a few times. Burners should light promptly.

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 Table 1. 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.

Direct-Drive Blower

All direct-drive blowers have multi-speed motors. Refer to the unit wiring diagram and connect the blower motor for the desired speed.

ADJUSTMENT OF FAN CONTROL SETTINGS

Place a thermometer in the heated air duct, about six feet from the furnace where it won't be affected by radiant heat. Usually the fan control is set so that the thermometer reads about 125°F when the blower starts, and about 85°F when it stops.

The Fan On setting of the fan control must be high enough to allow the air in the furnace to be heated enough so that no cold air is blown into the heated space, but not so high that the furnace might be damaged by excessive heat.
To adjust the Fan On setting:

1. Turn the furnace on.
2. Read the thermometer when the blower starts.
3. If this temperature is too high when the blower starts, lower the Fan On setting. If this temperature is too low when the blower starts, raise the setting.
4. If adjustments are made to the Fan On setting, check the operation of the furnace by repeating the previous steps.

The Fan Off setting must be low enough to adequately cool the furnace, but not so low that cold air is blown into the heated space.

To adjust the Fan Off setting:

1. Turn the furnace on.
2. Let the furnace operate for 20 minutes.
3. Turn the furnace off.
4. Read the thermometer when the blower stops.
5. If this temperature is too high when the blower stops, lower the Fan Off setting. If this temperature is too low when the blower stops, raise the setting.
6. If adjustments are made to the Fan Off setting, check the operation of the furnace by repeating the previous steps.

CAUTION: When Fan On and Fan Off adjustments are made, be careful not to rotate the fan control dial. If the dial is allowed to rotate, the control could be damaged and operate erratically.

THERMOSTAT

Adjust the thermostat heat anticipator setting per the instructions packed with the thermostat.

.41 amps for Standing Pilot Models
0.6 amps for Spark Ignition Models

CHECKING GAS INPUT

Natural Gas

1. Turn off all other gas appliances connected to the gas meter. Allow unit to operate for 15 minutes.
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 from Table 3.

TABLE 3 – GAS RATE – CUBIC FEET PER HOUR

Seconds for one Rev.	Size of Test Dial	
	1/2 cu. ft.	1 cu.ft.
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

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 on the 1 cubic foot dial to make a revolution with only a 120,000 Btuh furnace running.

Using this information, locate 26 seconds in the first column of Table 3. 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 5% of the furnace rating, with allowance being made for the permissible range of the regulator setting, 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.

ADDITIONAL SAFETY CONTROLS

WARNING: The opening of any safety device should be investigated by a qualified service person.

All furnaces outlined in this installation instruction include the following controls:

Vent Safety Switch

This switch is a thermally operated, manually reset device located in the draft hood or diverter area. Its function is to monitor the temperature in the draft hood. Should vent line or chimney restriction or blockage occur during operation, vent products will spill from the draft hood, heat the vent safety switch which will in turn shut off the main gas valve. This control will also trip open (OFF), shutting of the main gas valve if a negative pressure occurs, such as created by an exhaust fan. If the vent safety switch should trip open (OFF), investigate the cause before resetting (closing).

Flame Rollout Switch

This control is a thermally operated, manually reset device located in the main burner shield entrance area. Its function is to monitor the temperature near the burner entrance. Should partial heat exchanger, flue, vent or chimney blockage occur, the temperature in the burner area will increase and be sensed by the flame rolllout control which will shut off the main gas valve. This control could also open if a negative pressure occurs around the furnace, such as created by an exhaust fan or lock of proper combustion air volume. If the flame rollout control should open, always investigate the cause before resetting.

Blower Door Safety Switch

This control consists of a mechanical-electrical switch located in the main blower compartment. The switch is closed when the blower door is properly closed, allowing normal operation of the furnace. Should the blower door be removed or improperly closed, the switch may open, shutting off all power to the furnace.

CONTROL CHECKOUT

Standing Pilot Models

Before leaving, the installer should check to see that all controls are functioning properly as follows:

1. Light the pilot burner following the instructions on the data plate. Leave the main control knob on the automatic gas valve in the PILOT position and raise the thermostat setting above room temperature. The burners should not light.

2. Turn the knob on the gas valve to the ON position. the burners should now light. Wait for the blower to start. Cycle the burners several times from the thermostat.

3. With the main burners operating, cover all return air grilles with paper to restrict the flow of return air. In a few minutes, the burners should be shut off by the limit control. Remove the return air restrictions, and the burners should soon relight.

4. Check the safety pilot by turning off the gas supply to the pilot burner (turn the pilot adjustment screw in until the pilot burner goes out). In a few seconds, the main burners should go out. Return the pilot adjustment screw to its normal setting and relight the pilot burner.

5. Turn the knob on the gas valve to the ON position and set the thermostat to the desired temperature.

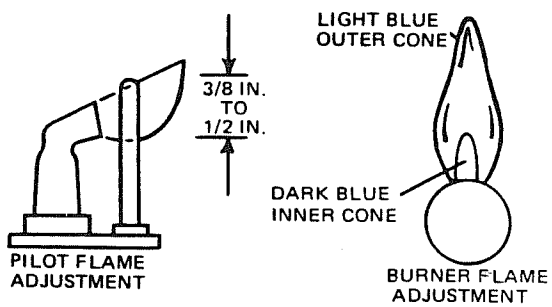


FIGURE 10 – PROPER FLAME ADJUSTMENT & APPEARANCE

Spark Ignition Models

Before leaving, the installer should observe a complete operating cycle to see that all controls are functioning properly. Follow the Ignition System Checkout/Adjustment section of this instruction, beginning on page 8.

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. See page 6 for filter removal instructions. On new construction, check the filters every week for the first four weeks. Inspect the filters at least every three weeks after that, especially if the system is running constantly.

All filters supplied 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 reinstalling it in the furnace. When replacing filters, be sure to use the same size and type as originally supplied.

Burners

The pilot and main burners should be checked periodically for dirt accumulation. The pilot flame should surround the end of the thermocouple for a distance of 3/8″ to 1/2″ (See Start-Up instructions and Figure 10). The burner ports should be free of dirt and the flame should be blue (see Adjustment or Primary Air and Figure 10).

It is recommended that a certified dealer/serviceman inspect and adjust the furnace at the beginning of each heating season.

Visual checks of the burners and pilot flame should be made, and the flames should appear as shown in Figure 10.

CLEANING THE HEAT EXCHANGER

1. Turn off the main manual gas valve external to the furnace.
2. Turn off electrical power to the furnace.
3. Disconnect the gas supply piping and control wiring from the gas valve.
4. Remove the burner shield.
5. Remove the screws holding the burner assembly to the heat exchanger.
6. Remove the burner assembly.
7. Remove the flue baffle or restrictor, when used.
8. With a stiff wire brush, brush out any loose scale or soot.
9. Vacuum the burner assembly and heat exchanger.
10. Replace all parts removed for cleaning before placing furnace into operation.
11. Reconnect all wiring and gas piping.
12. Restore electrical power and gas supply to the furnace.

LUBRICATION

Blower motors in these furnaces are of the permanently lubricated type and do not require periodic oiling.

SPARK IGNITION SYSTEM TROUBLESHOOTING

The following visual checks should be made before troubleshooting:

1. Check to see that the power to the furnace and the S86H Control Module is ON.
2. The manual shutoff valve(s) in the gas line to the furnace must be open.
3. Make sure all wiring connections are secure.
4. Review the sequence of operation of the S86H Control Module.

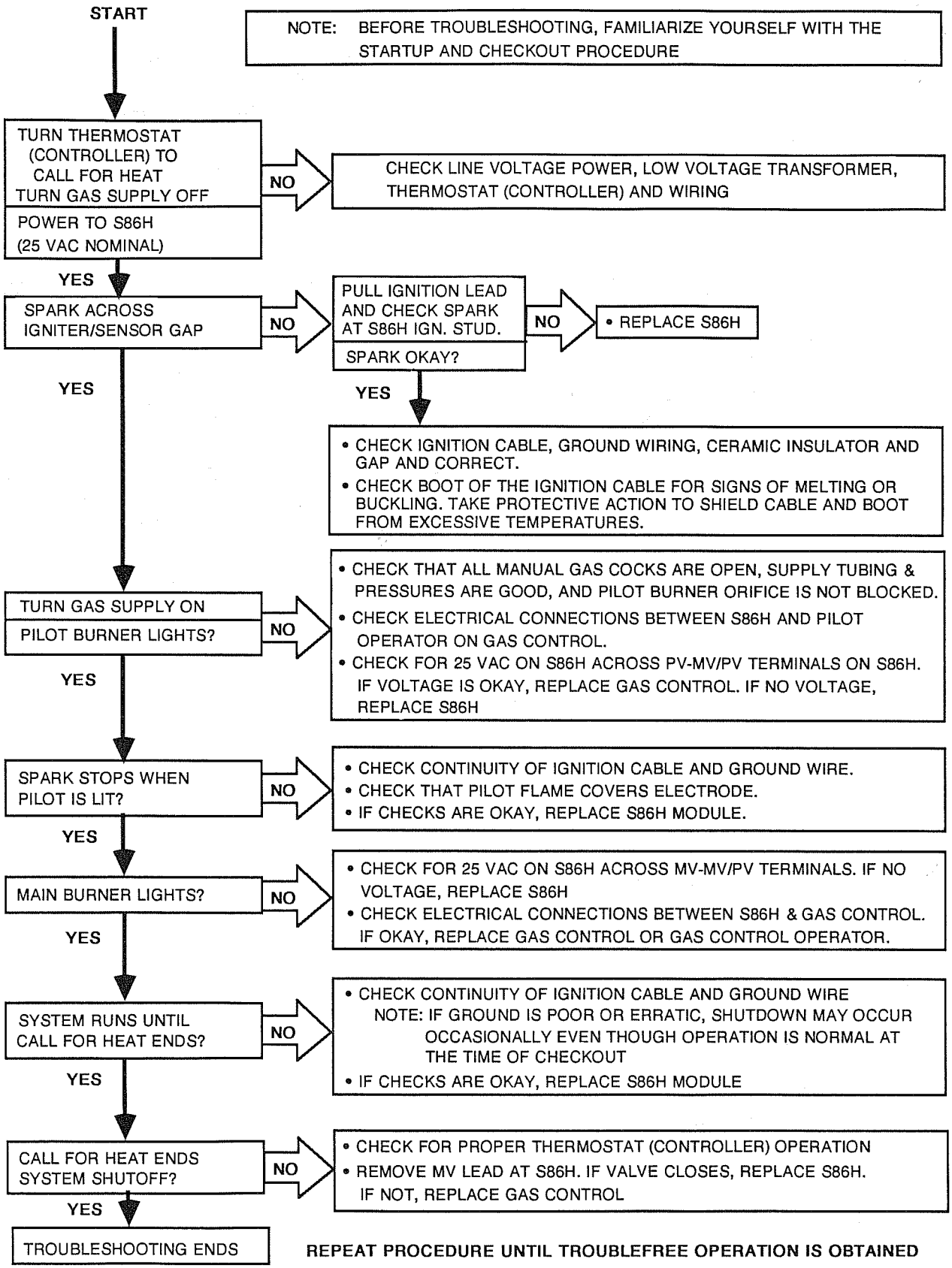
Start the system by setting the thermostat above the room temperature. Observe the system's response. Then use the S86H Intermittent Pilot System Troubleshooting Table (page 14) to check the system's operation.

Use the table by reading the upper left-hand box and then following the instructions in each box. If the condition described in the box is true (Yes answer), go down to the next box. If the condition is not true (No answer), go to the box to the right.

Continue checking and answering the questions in the boxes until the problem is explained and corrective action is described. After any maintenance or repair, the troubleshooting sequence should be repeated until normal system operation is obtained.

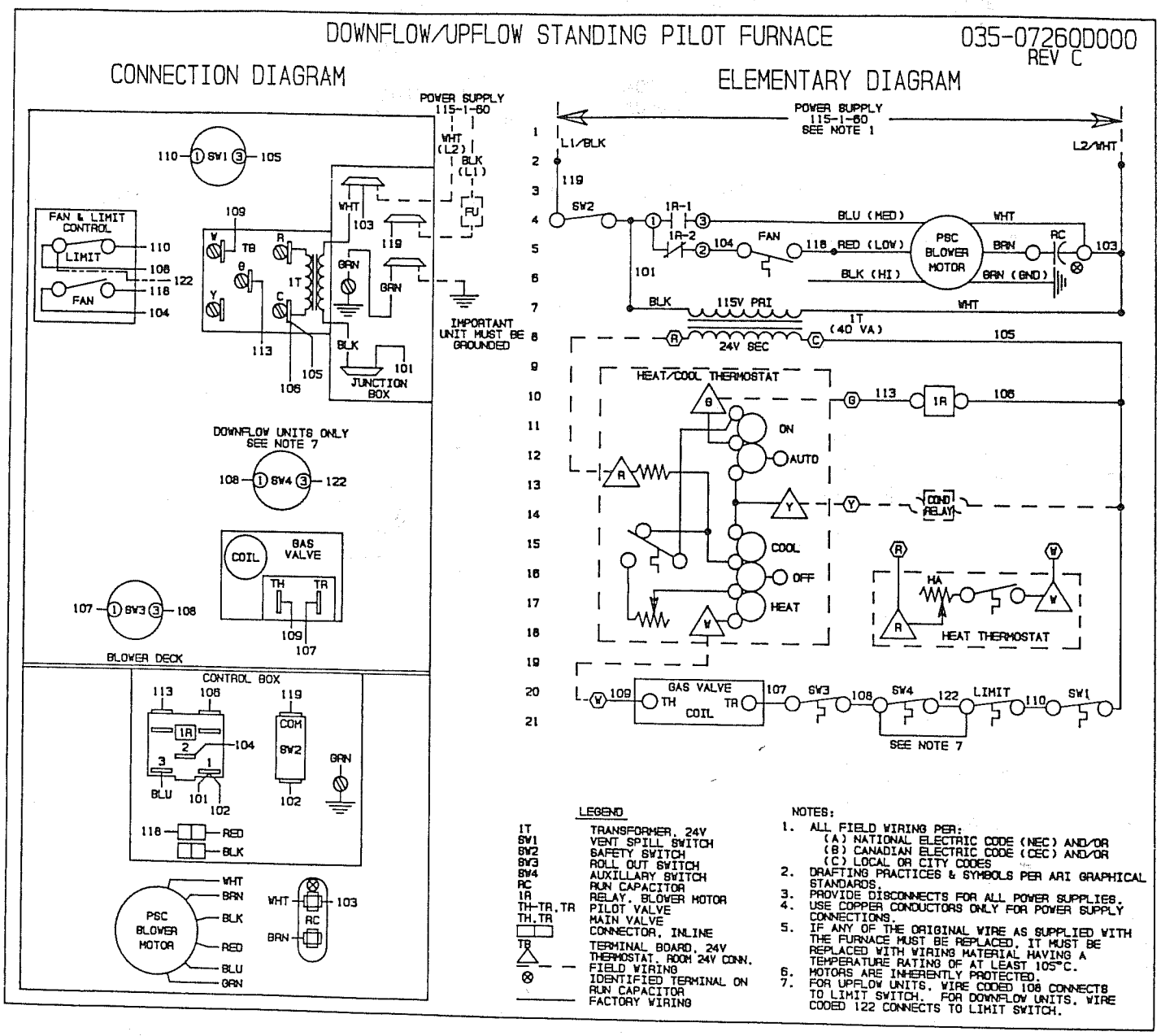
WARNING: *Do not try to repair controls. Replace defective controls with CES Service Parts.*

TABLE 4 – S86H INTERMITTENT PILOT SYSTEM TROUBLESHOOTING TABLE



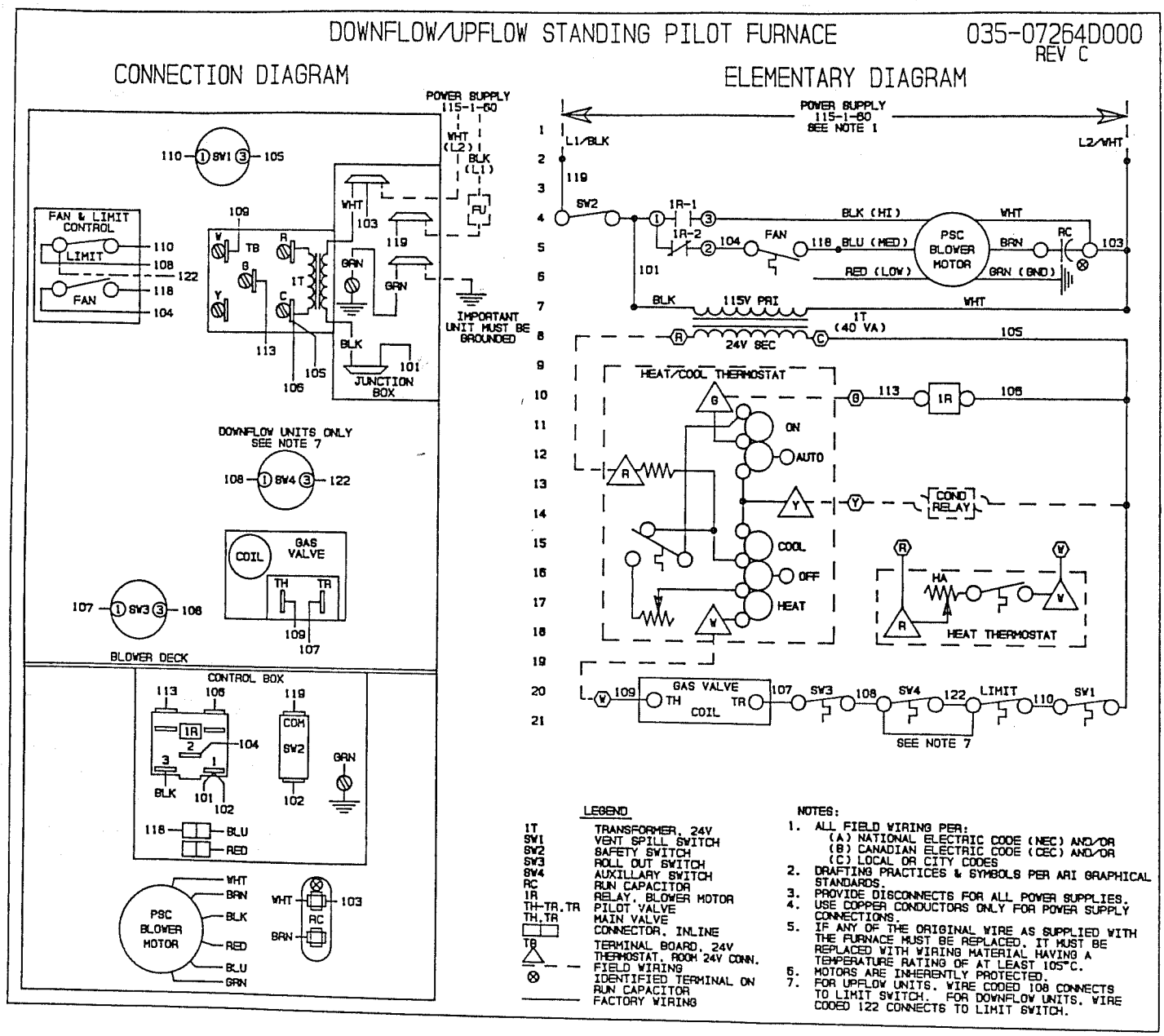
WIRING DIAGRAMS

PDDS-LD08N065A
PDSU-LD20N160A



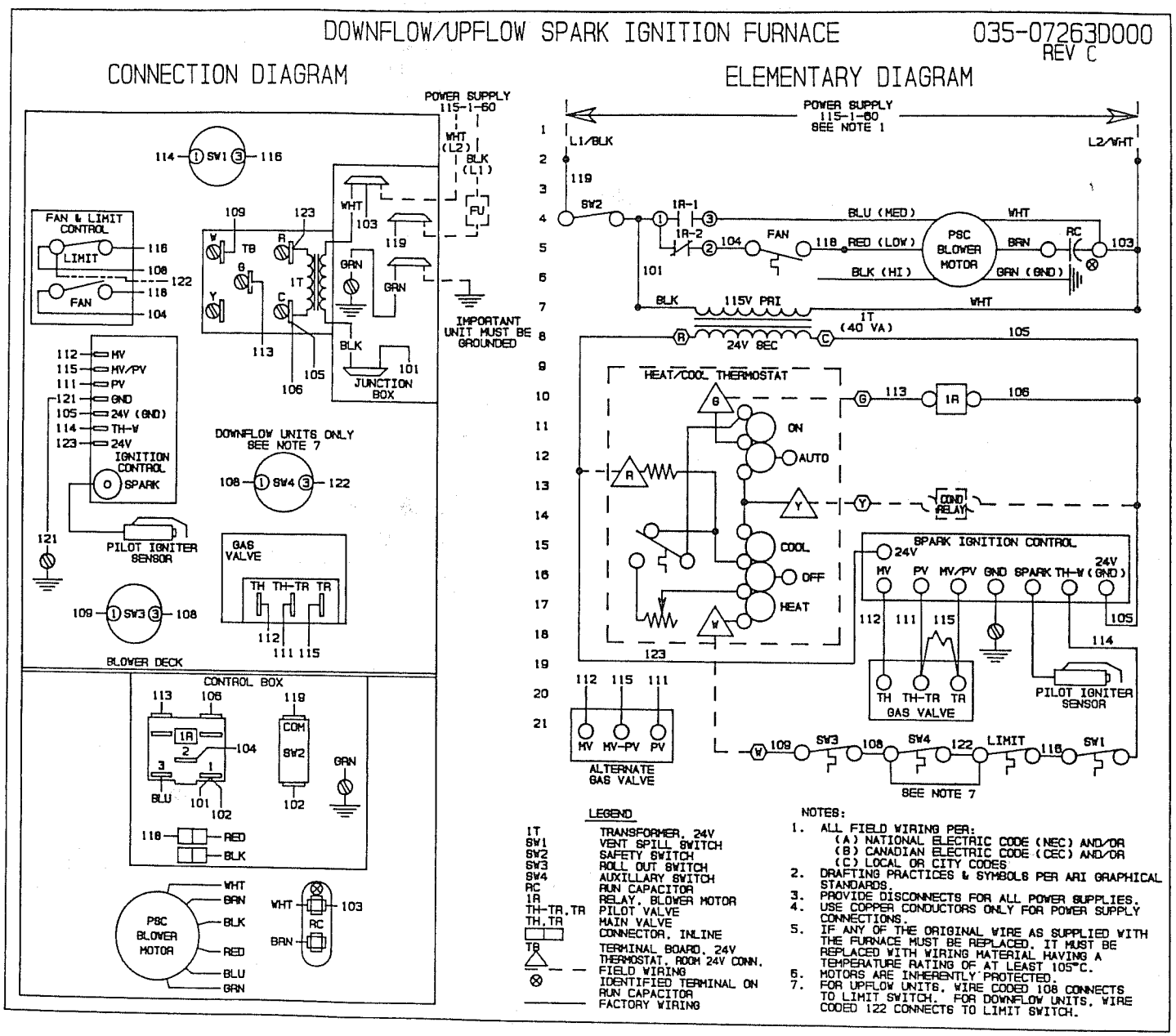
WIRING DIAGRAMS

PDSU-LD06N040A
PDSU-LD10N040A
PDSU-LD08N065A
PDSU-LD12N065A
PDSU-LD08N080A
PDSU-LD12N080A
PDSU-LD12N090A
PDSU-LD16N090A
PDSU-LD12N105A
PDSU-LD16N105A
PDSU-LD20N105A
PDSU-LD16N120A
PDSU-LD20N120A
PDDS-LD12N080A
PDDS-LD14N105A
PDDS-LD16N120A
PDDS-LD20N140A



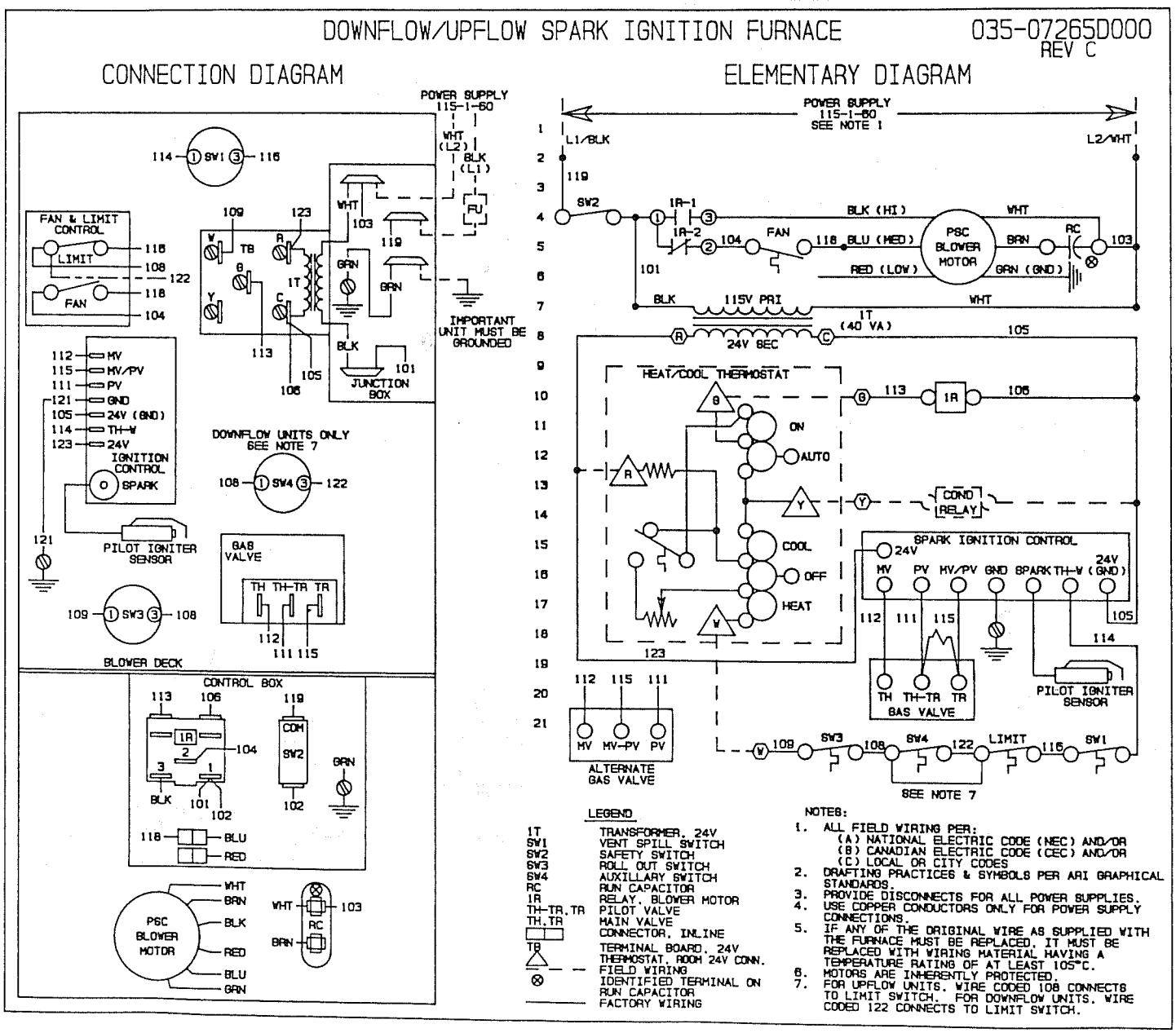
WIRING DIAGRAMS

PDDC-LD08N065A
PDCU-LD20N160A



WIRING DIAGRAMS

PDCU-LD06N040A
PDCU-LD10N040A
PDCU-LD08N065A
PDCU-LD12N065A
PDCU-LD16L075A
PDCU-LD08N080A
PDCU-LD12N080A
PDCU-LD12N090A
PDCU-LD20L090A
PDCU-LD12N105A
PDCU-LD16N105A
PDCU-LD20N105A
PDCU-LD16N120A
PDCU-LD20N120A
PDCU-LD16N140A
PDDC-LD12N080A
PDDC-LD14N105A
PDDC-LD16N120A
PDDC-LD20N140A



WIRING DIAGRAMS

PDCU-LD10L030A
PDCU-LD12L060A