Carrier®
HEATING & COOLING

58TUA
2-Speed, 2-Stage
Induced-Combustion Gas Furnace

Visit www.carrier.com

Installation, Start-Up, and Operating Instructions
Size 040-135, Series 120 or 130

NOTE: Read the entire instruction manual before starting the installation.
This symbol → indicates a change since the last issue.

REGISTERED QUALITY SYSTEM

SAFETY CONSIDERATIONS

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

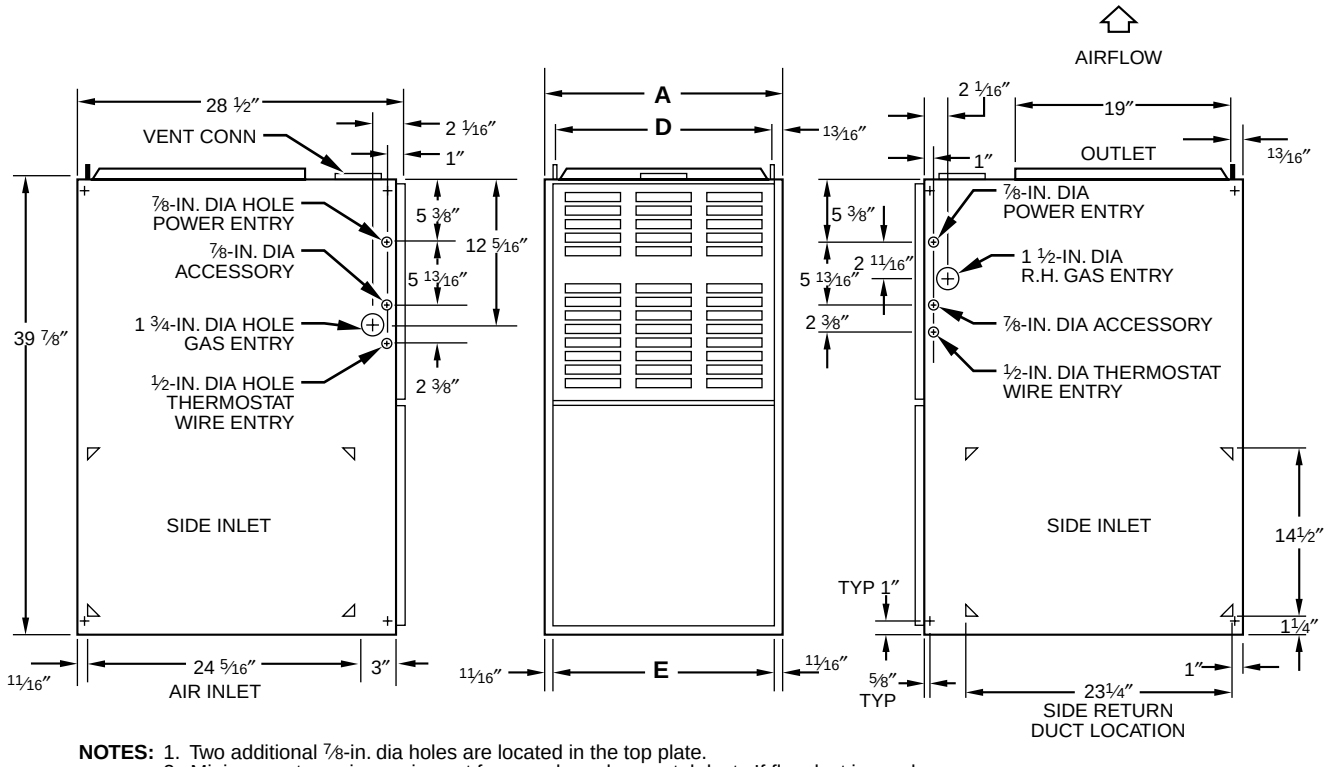
Untrained personnel can perform basic maintenance functions such as cleaning and replacing air filters. All other operations must be performed by trained service personnel. When working on heating equipment, observe precautions in the literature, on tags, and on labels attached to or shipped with the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

Follow all safety codes. In the United States, refer to the National Fuel Gas Code (NFGC) NFPA No. 54-1996/ANSI Z223.1-1996. In Canada, refer to the current edition of the National Standard of Canada CAN/CGA- B149.1- and .2-M95 Natural Gas and Propane Installation Codes (NSCNGPIC) and Amendment No. 1. Wear safety glasses and work gloves. Have fire extinguisher available during start-up and adjustment procedures and service calls.

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

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

These instructions cover minimum requirements and conform to existing national standards and safety codes. In some instances, these instructions exceed certain local codes and ordinances, especially those that may not have kept up with changing residential construction practices. We require these instructions as a minimum for a safe installation.



NOTES: 1. Two additional ⅞-in. dia holes are located in the top plate.
2. Minimum return-air openings at furnace, based on metal duct. If flex duct is used, see flex duct manufacturer's recommendations for equivalent diameters.
   a. For 800 CFM–16-in. round or 14½ x 12-in. rectangle.
   b. For 1200 CFM–20-in. round or 14½ x 19½-in. rectangle.
   c. For 1600 CFM–22-in. round or 14½ x 23¼-in. rectangle.
   d. For airflow requirements above 1800 CFM, see Air Delivery table in Product Data literature for specific use of single side inlets. The use of both side inlets, a combination of 1 side and the bottom, or the bottom only will ensure adequate return air openings for airflow requirements above 1800 CFM.

A00210

→ **Fig. 1—Dimensional Drawing**

Table 1—Dimensions (In.)

UNIT SIZE	A	D	E	FLUE COLLAR	SHIP. WT
040-12	14-3/16	12-9/16	12-11/16	4	124
060-08	14-3/16	12-9/16	12-11/16	4	132
060-12	14-3/16	12-9/16	12-11/16	4	134
080-14	17-1/2	15-7/8	16	4	150
080-16	21	19-3/8	19-1/2	4	154
100-12	17-1/2	15-7/8	16	4	160
100-16	21	19-3/8	19-1/2	4	166
100-20	24-1/2	22-7/8	23	4	184
120-16	21	19-3/8	19-1/2	5	178
120-20	24-1/2	22-7/8	23	5	194
135-20	24-1/2	22-7/8	23	5	204

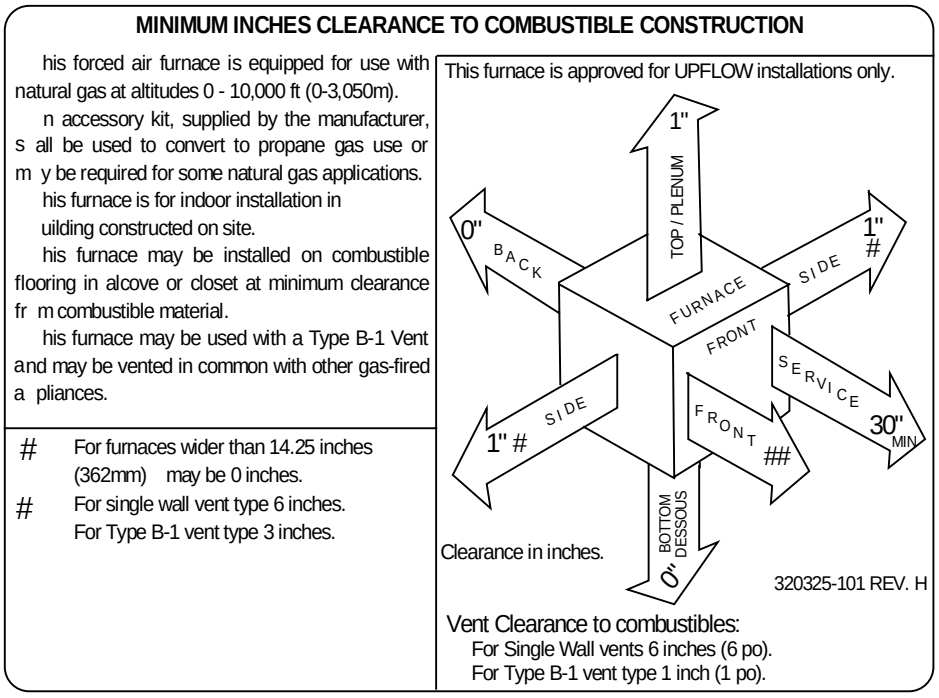


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Fig. 2—Clearances to Combustibles

ELECTROSTATIC DISCHARGE (ESD) PRECAUTIONS PROCEDURE

⚠ CAUTION

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

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

INTRODUCTION

The model 58TUA Series 120 or 130 Furnace is available in sizes 40,000 through 133,000 Btuh input capacities.

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

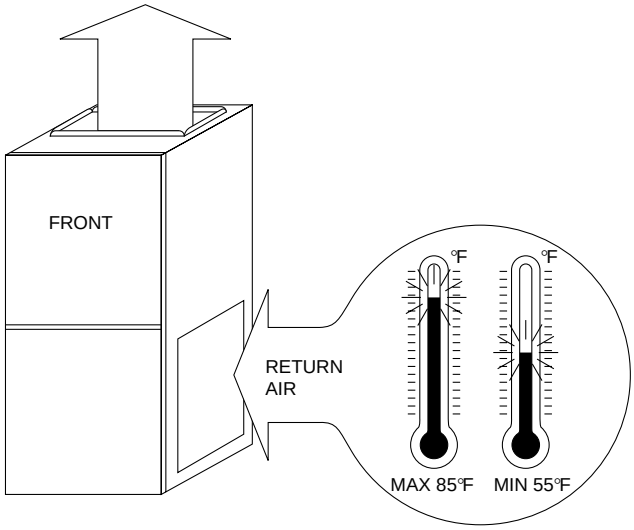
Before installing the furnace, refer to the current edition of the NFGC and the NFPA 90B. Canadian installations must be installed in accordance NSCNGPIC and all authorities having jurisdiction. For a copy of the NFGC NFPA54/Z223.1, contact International Approval Services U.S. Inc., 8501 E. Pleasant Valley Road, Cleveland, OH 44131 or National Fire Protection Association Inc., Batterymarch Park, Quincy, MA 02269. For a copy of NFPA 90B, contact National Fire Protection Association Inc., Batterymarch Park, Quincy, MA 02269.

Before installing the furnace in Canada, refer to the current edition of the NSCNGPIC. Contact Standards Department of Canadian Gas Association, 55 Scarsdale Road, Don Mills, Ontario, Canada M3B 2R3.

⚠ CAUTION

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

To aid in installation, troubleshooting, and service, a status code label is located on the blower compartment door. This label explains how to use the LED status indicator on the furnace control which is viewed through the sight glass on the door.



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NOTE: These furnaces are designed for a minimum continuous return-air temperature of 60°F or intermittent operation down to 55°F such as when used with a night setback thermostat. Return-air temperature must not exceed a maximum of 85°F. Failure to follow these return-air temperature limits may affect reliability of heat exchangers, motors, and controls.

⚠ WARNING

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

For high-altitude installations, the high-altitude conversion kit MUST be installed at or above 5500 ft above sea level.

For accessory installation details, refer to applicable installation literature.

NOTE: Remove all shipping brackets and materials before operating furnace.

Step 1—Location

GENERAL

⚠ CAUTION

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

⚠ CAUTION

Do not install furnace in a corrosive or contaminated atmosphere. Make sure all combustion and circulating air requirements are met.

This furnace must be installed so the electrical components are protected from water.

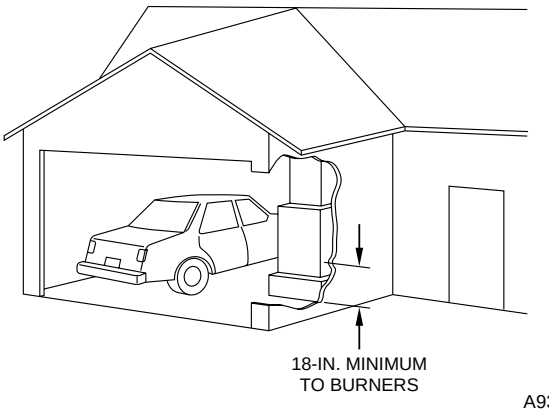
Locate furnace as near the center of the air distribution system and chimney or vent as possible. The furnace should be installed as level as possible. When a furnace is installed so that supply ducts carry air to areas outside the space containing the furnace, return air must also be handled by a duct(s) sealed to the furnace casing and terminating outside the space containing the furnace.

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

LOCATION RELATIVE TO COOLING EQUIPMENT

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

HAZARDOUS LOCATIONS



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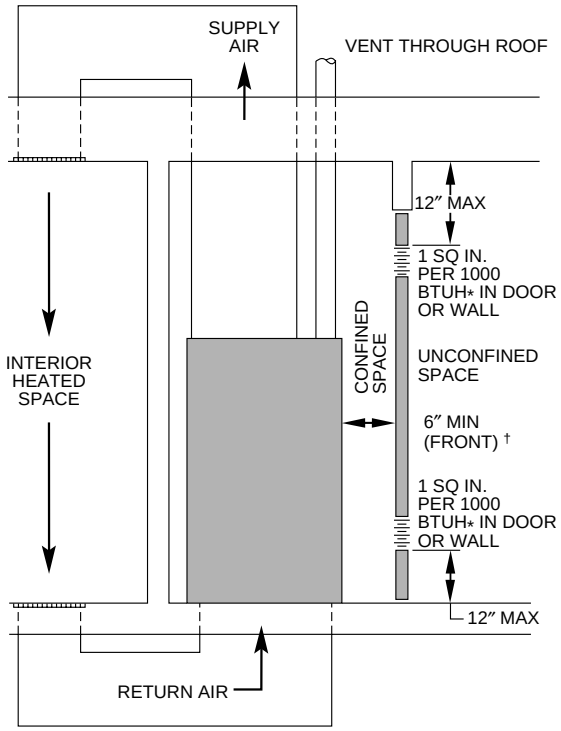
⚠ WARNING

When furnace is installed in a residential garage, it must be installed so that burners and ignition sources are located a minimum of 18 in. above floor. The furnace must be located or protected to avoid physical damage by vehicles. When furnace is installed in a public garage, airplane hangar, or other building having a hazardous atmosphere, unit must be installed in accordance with requirements of National Fire Protection Association, Inc.

Step 2—Air for Combustion and Ventilation

Provisions for adequate combustion and ventilation air must be provided in accordance with Section 5.3, Air for Combustion and Ventilation, of the NFGC or applicable provisions of the local building codes.

Canadian installations must be in accordance with NSCNGPIC and all authorities having jurisdiction.



* Minimum opening size is 100 sq in. with minimum dimensions of 3 in.

† Minimum of 3 in. when type-B1 vent is used.

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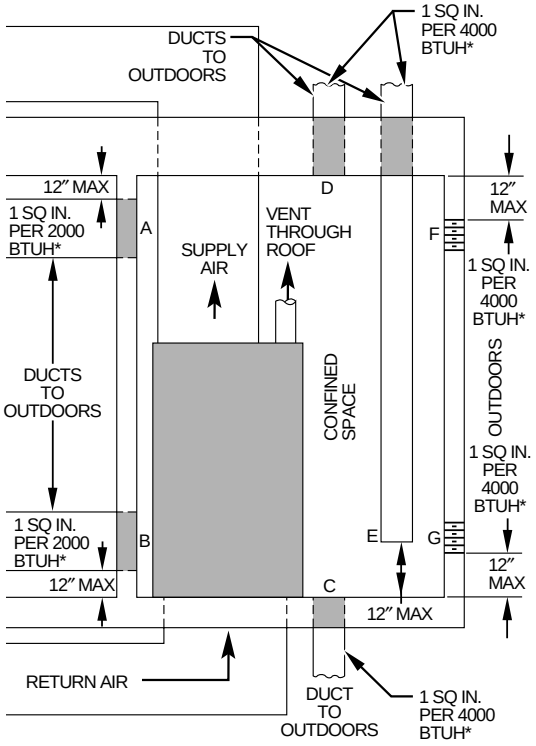
Fig. 3—Confined Space: Air for Combustion and Ventilation from an Unconfined Space



*Minimum dimensions of 3 in.

NOTE: Use any of the following combinations of openings:
A & B C & D D & E F & G

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Fig. 4—Confined Space: Air for Combustion and Ventilation from Outdoors

⚠ CAUTION

Air for combustion must not be contaminated by halogen compounds, which include fluoride, chloride, bromide, and iodide. These elements are found in aerosol sprays, detergents, bleaches, cleaning solvents, salts, air fresheners, and other household products.

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

⚠ CAUTION

The operation of exhaust fans, kitchen ventilation fans, clothes dryers, or fireplaces could create a negative air pressure condition at the furnace. Make-up air must be provided for these devices, in addition to that required by the furnace.

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

UNCONFINED SPACE

An unconfined space must have at least 50 cu ft for each 1000 Btuh of input for all appliances (such as furnaces, clothes dryer, water heaters, etc.) in the space.

For Example:

58TUA FURNACE HIGH-FIRE INPUT BTUH	MINIMUM SQ FT WITH 7-1/2 FT CEILING
40,000	267
60,000	400
80,000	534
100,000	667
120,000	800
133,000	887

If the unconfined space is of unusually tight construction, air for combustion and ventilation MUST come from either the outdoors or spaces freely communicating with the outdoors. Combustion and ventilation openings must be sized the same as for a confined space as defined below. Return air must not be taken from the room unless an equal or greater amount of air is supplied to the room.

CONFINED SPACE

A confined space is defined as a space whose volume is less than 50 cu ft per 1000 Btuh of total input ratings of all appliances installed in that space. A confined space MUST have provisions for supplying air for combustion, ventilation, and dilution of flue gases using 1 of the following methods. (See Fig. 3 and Table 2.)

NOTE: In determining free area of an opening, the blocking effect of louvers, grilles, and screens must be considered. If free area of louver or grille design is unknown, assume that wood louvers have a 20 percent free area and metal louvers or grilles have a 60 percent free area. Screens, when used, must not be smaller than 1/4-in. mesh. Louvers and grilles must be constructed so they cannot be closed.

Table 2—Free Area Of Combustion Air Opening

58TUA FURNACE HIGH-FIRE INPUT (BTUH)	AIR FROM UNCONFINED SPACE	OUTDOOR AIR THROUGH VERTICAL DUCTS		OUTDOOR AIR THROUGH HORIZONTAL DUCTS		OUTDOOR AIR THROUGH SINGLE DUCT	
	Free Area of Opening (Sq In.)	Free Area of Opening and Duct (Sq In.)	Round Pipe (In. Dia)	Free Area of Opening and Duct (Sq In.)	Round Pipe (In. Dia)	Free Area of Opening and Duct (Sq In.)	Round Pipe (In. Dia)
40,000	100	10.0	4	20.0	6	13.4	5
60,000	100	15.0	5	30.0	7	20.0	6
80,000	100	20.0	6	40.0	8	26.7	6
100,00	100	25.0	6	50.0	8	33.4	7
120,000	120	30.0	7	60.0	9	40.0	8
133,000	133	33.3	7	66.5	10	44.4	8

The size of the openings depends upon whether air comes from outside of the structure or an unconfined space inside the structure.

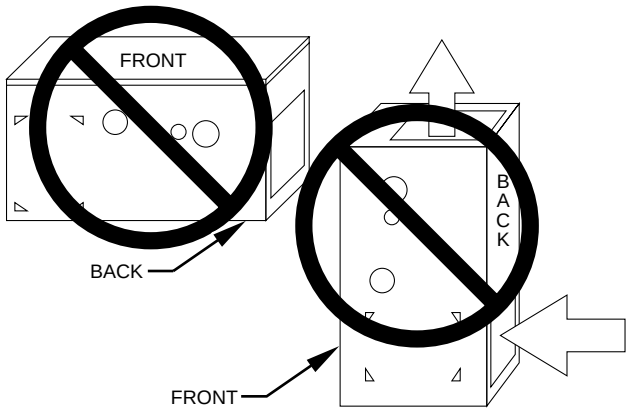
1. All air from inside the structure requires 2 openings (for structures not usually tight):
   a. Each opening MUST have at least 1 sq in. of free area per 1000 Btuh of total input for all equipment within the confined space, but not less than 100 sq in. per opening. (See Fig. 3 and Table 2.) The minimum dimension of air openings shall not be less than 3 in.
   b. If building is constructed unusually tight, a permanent opening directly communicating with the outdoors shall be provided. See item 2 below.
   c. If furnace is installed on a raised platform to provide a return-air plenum, and return air is taken directly from hallway or space adjacent to furnace, all air for combustion must come from outdoors.
2. Air from outside the structure requires 1 of the following methods:
   a. If combustion air is taken from outdoors through 2 vertical ducts, the openings and ducts MUST have at least 1 sq in. of free area per 4000 Btuh of total input for all equipment within the confined space. (See Fig. 4 and Table 2.)
   b. If combustion air is taken from outdoors through 2 horizontal ducts, the openings and ducts MUST have at least 1 sq in. of free area per 2000 Btuh of total input for all equipment within the confined space. (See Fig. 4 and Table 2.)
   c. If combustion air is taken from outdoors through a single opening or duct (horizontal or vertical) commencing within 12 in. of the top of the confined space, opening and duct MUST have at least 1 sq in. of free area per 3000 Btuh of the total input for all equipment within the confined space and not less than the sum of the areas of all vent connectors in the confined space. (See Fig. 4 and Table 2.) Equipment clearances to the structure shall be at least 1 in. from the sides and back and 6 in. from the front of the appliances.

When ducts are used, they must be of the same cross-sectional area as the free area of the openings to which they connect. The minimum dimension of ducts must not be less than 3 in. (See Fig. 4.)

AIR DUCTS

Step 1—General Requirements

The duct system should be designed and sized according to accepted national standards such as those published by: Air Conditioning Contractors Association (ACCA), Sheet Metal and Air Conditioning Contractors National Association (SMACNA) or American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE). Or consult factory *The Air Systems Design Guidelines* reference tables available from your local distributor. The duct system should be sized to handle the required system design CFM at the design static pressure.



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⚠ WARNING

Do not install furnace on its back. Safety control operation will be adversely affected. Never connect return-air ducts to back of furnace. Failure to follow this warning could result in fire, personal injury, or death.

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

Secure ductwork with proper fasteners for type of ductwork used. Seal supply- and return-duct connections to furnace with code approved tape or duct sealer.

Flexible connections should be used between ductwork and furnace to prevent transmission of vibration. Ductwork passing through unconditioned space should be insulated to enhance system performance. When air conditioning is used, a vapor barrier is recommended.

Maintain a 1-in. clearance from combustible materials to supply air ductwork for a distance of 36 in. horizontally from the furnace. See NFPA 90B or local code for further requirements.

Step 2—Ductwork Acoustical Treatment

Metal duct systems that do not have a 90 degree elbow and 10 ft of main duct to the first branch take-off may require internal acoustical lining. As an alternative, fibrous ductwork may be used if constructed and installed in accordance with the latest edition of SMACNA construction standard on fibrous glass ducts. Both acoustical lining and fibrous ductwork shall comply with NFPA 90B as tested by UL Standard 181 for Class 1 Rigid air ducts.

Step 3—Supply Air Connections

UPFLOW FURNACES

Connect supply-air duct to 3/4-in. flange on furnace supply-air outlet. The supply-air duct attachment must ONLY be connected to furnace supply-/outlet-air duct flanges or air conditioning coil casing (when used). DO NOT cut main furnace casing to attach supply side air duct, humidifier, or other accessories. All accessories MUST be connected external to furnace main casing.

Step 4—Return Air Connections

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⚠ CAUTION

For airflow requirements above 1800 CFM, see Air Delivery table in Product Data literature for specific use of single side inlets. The use of both side inlets, a combination of 1 side and the bottom, or the bottom only will ensure adequate return air openings for airflow requireemnts above 1800 CFM.

UPFLOW FURNACES

The return-air duct must be connected to bottom , sides (left or right), or a combination of bottom and side(s) of main furnace casing as shown in Fig. 1. Bypass humidifier may be attached into unused side return air portion of the furnace casing. DO NOT connect any portion of return-air duct to back of furnace casing.

Step 5—Filter Arrangement

→ The air filter arrangement will vary due to application and filter type. The filter may be installed in an external Filter/Media cabinet (if provided) or the furnace blower compartment. Factory supplied washable filters are shipped in the blower compartment.

→ If a factory-supplied external Filter/Media cabinet is provided, instructions for its application, assembly, and installation are packaged with the cabinet. The Filter/Media cabinet can be used with the factory-supplied washable filter or a factory-specified high-efficiency disposable filter (see cabinet instructions).

If installing the filter in the furnace blower compartment, determine location for filter and move filter retaining hardware, if necessary, before attaching return-air duct. After return-air duct has been connected to furnace, install filter(s) inside furnace blower compartment. See Fig. 5 for side return application and Fig. 6 for bottom return application.

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

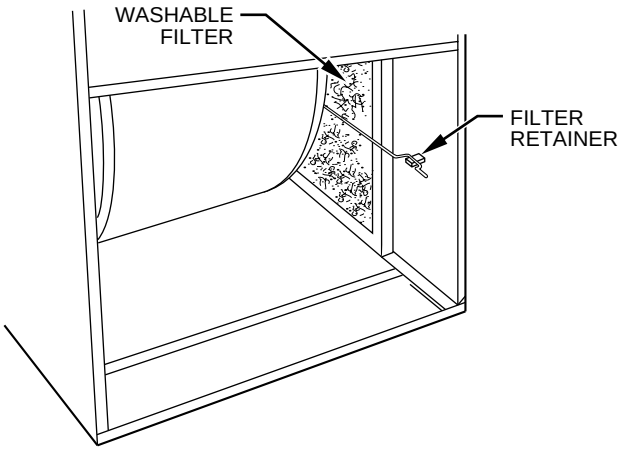

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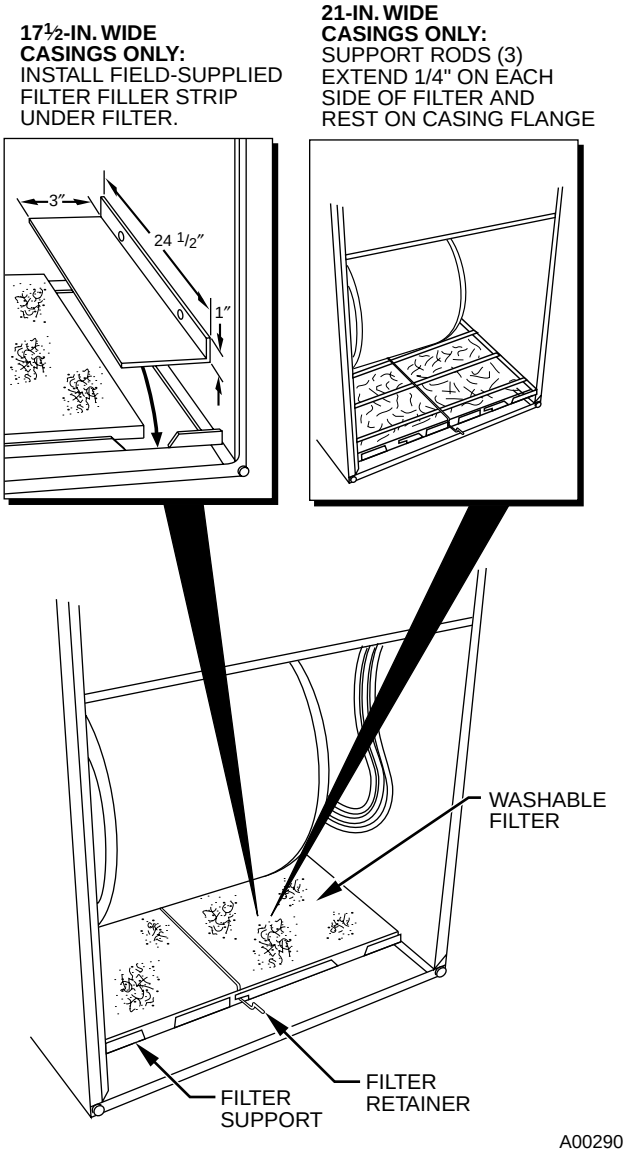
Fig. 5—Side Filter Arrangement

Filter retaining brackets, supports, and retainers are factory assembled and shipped installed for side return application, with 1 set of all required hardware on each furnace. (See Fig. 5.)

For bottom return applications, remove front and back brackets and supports from each side. The back bracket(s) are installed in the rear of the furnace casing. Dimples are provided to mark mounting screw locations.

The front bracket(s) are installed on bottom front plate, as shown in Fig. 6, once bottom enclosure has been removed. Rotate filter supports 180° so filter will rest on support and reinstall. Do not reinstall in 17-1/2 in. casing. Install small U-shaped end of filter retaining rod in rear bracket and front of filter retainer rod as shown in Fig. 6. Two sets of hardware are needed for furnaces in 24-1/2 in. casings using 2 filters for bottom return. All hardware is provided for filter installation.



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→**Fig. 6—Bottom Filter Arrangement**

⚠ WARNING

Never operate unit without a filter or with filter access door removed. A failure to follow this warning can cause a fire, personal injury, or death.

NOTE: Furnaces with a 17-1/2 in. wide casing require an additional procedure when locating filter for bottom return-air application. Field-fabricate a sheet metal filler strip 1 X 3 X 24-1/2

in. and install it along side of filter as shown in Fig. 6. Drive 2 screws through casing side and into filler strip to secure it in place. Filter is to rest on top of the filler strip when installed.

⚠ CAUTION

→ Use care when cutting support rods in filters to protect against flying pieces and sharp rod ends. Wear safety glasses, gloves, and appropiate protective clothing. Failure to follow this caution could result in personal injury.

Step 6—Leveling Legs (If Required)

→Table 3—Filter Information (In.)

FURNACE CASING WIDTH	FILTER SIZE*		FILTER TYPE
	Side Return	Bottom Return	
14-3/16	(1) 16 X 25 X 1†	(1) 14 X 25 X 1	Cleanable
17-1/2	(1) 16 X 25 X 1†	(1) 16 X 25 X 1†	Cleanable
21	(1) 16 X 25 X 1	(1) 20 X 25 X 1†	Cleanable
24-1/2	(1 or 2) 16 X 25 X 1	(1) 24 X 25 X 1†	Cleanable

* Filters may be field modified by cutting filter material and support rods (3) in filters. Alternate sizes and additional filters may be ordered from your distributor or dealer.
† Factory provided with the furnace.

When furnace is used with side inlet(s) and leveling legs are required, refer to Fig. 7 and install field-supplied, corrosion-resistant 5/16-in. machine bolts and nuts.

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

1. Lay furnace on its back. Locate and drill 5/16-in. diameter hole in each bottom corner of furnace as shown in Fig. 7.
2. Install nut on bolt and install bolt and nut in hole. (Install flat washer if desired.)
3. Install another nut on other side of furnace base. (Install flat washer if desired.)
4. Adjust outside nut to provide desired height and tighten inside nut to secure arrangement.

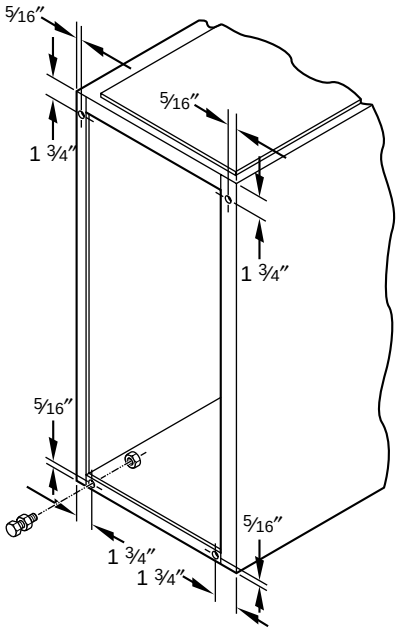

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Fig. 7—Leveling Leg Installation

Step 7—Gas Piping

Gas piping must be installed in accordance with national and local codes. Refer to the NFGC NFPA 54-1999/ANSI Z223.1-1999. Canadian installations must be installed in accordance with NSC-NGPIC and all authorities having jurisdiction.

The gas supply line should be a separate line running directly from the gas meter to the furnace, if possible. Refer to Table 4 for recommended gas pipe size. Risers must be used to connect to furnace and meter.

⚠ CAUTION

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

Table 4—Maximum Capacity of Pipe*

NOMINAL IRON PIPE SIZE (IN.)	INTERNAL DIAMETER (IN.)	LENGTH OF PIPE (FT)				
		10	20	30	40	50
1/2	0.622	175	120	97	82	73
3/4	0.824	360	250	200	170	151
1	1.049	680	465	375	320	285
1-1/4	1.380	1400	950	770	660	580
1-1/2	1.610	2100	1460	1180	990	900

* Cubic ft of gas per hr for gas pressures of 0.5 psig (14-in. wc) or less, and a supply line pressure drop of 0.5-in. wc (based on a 0.60 specific gravity gas). Ref: Table 10-2, NFPA 54-1999.

Piping should be pressure tested in accordance with local and national plumbing and gas codes before furnace has been attached. If test pressure exceeds 0.5 psig (14-in. wc), the gas supply pipe must be disconnected from the furnace and capped before pressure test. If test pressure is equal to or less than 0.5 psig (14-in. wc), turn OFF electric shutoff switch before test. (See Fig. 7.) It is recommended that the ground joint union be loosened before pressure testing. After all connections have been made, purge lines and check for leakage with regulated gas supply pressure.

Install a sediment trap in riser leading to furnace. The trap can be installed by connecting a tee to riser leading from the furnace. Connect a capped nipple into lower end of the tee. The capped nipple should extend below level of gas controls. (See Fig. 8.)

Apply joint compound (pipe dope) sparingly and only to male threads of each joint. The compound must be resistant to action of propane gas.

Install an accessible manual shutoff valve upstream of furnace gas controls and within 72 in. of furnace. A 1/8-in. NPT plugged tapping is provided on the gas valve for test gage connection. Installation of an additional 1/8-in. NPT plugged tapping, accessible for test gage connection, installed immediately upstream of gas supply connection to furnace and downstream of manual shutoff valve, is not required. Place ground joint union between gas control manifold and manual shutoff valve.

⚠ WARNING

Use the proper length of pipes and adequate piping support to avoid stress on the gas control manifold. A failure to follow this warning can cause a gas leak resulting in a fire, explosion, personal injury, or death.

⚠ CAUTION

Use a backup wrench at the furnace gas control when connecting the gas pipe to the furnace to avoid damaging gas controls or manifold.

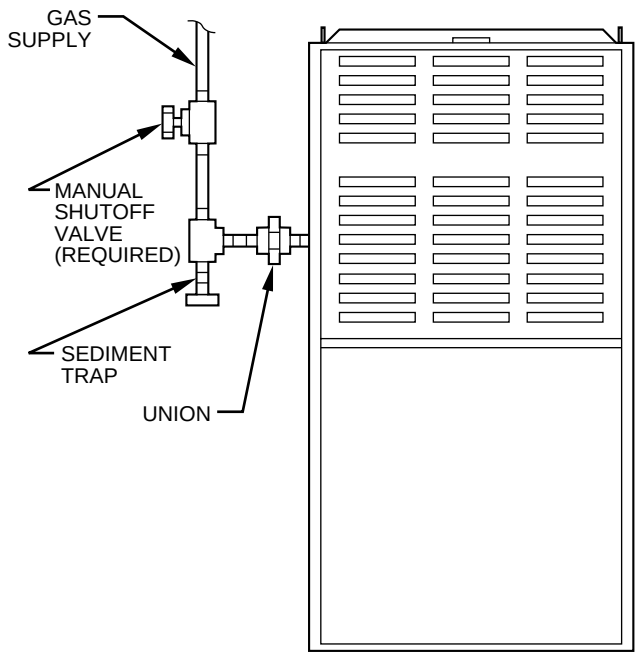

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Fig. 8—Typical Gas Pipe Arrangement

⚠ WARNING

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

Step 8—Electrical Connections

115-V WIRING

Refer to unit rating plate or Table 5 for equipment electrical requirements. The control system requires an earth ground for proper operation.

⚠ CAUTION

Do not connect aluminum wire between disconnect switch and furnace. Use only copper wire.

→ Make all electrical connections in accordance with the National Electrical Code (NEC) ANSI/NFPA 70-1999 and local codes or ordinances that might apply. For Canadian installations, all electrical connections must be made in accordance with CSA C22.1 Canadian Electrical Code, or authorities having jurisdiction.

⚠ WARNING

The cabinet MUST have an uninterrupted or unbroken ground according to NEC ANSI/NFPA 70-1999 and Canadian Electrical Code, CSA C22.1 or local codes to minimize personal injury if an electrical fault should occur. This may consist of electrical wire or conduit approved for electrical ground when installed in accordance with existing electrical codes. Do not use gas piping as an electrical ground.

The junction box can be moved to left-hand side of furnace when a left-hand side power supply is desired. Remove 2 screws holding junction box. Mount junction box on left-hand side of furnace. The blower door interlock switch must also be moved to left-hand side of furnace due to length of wiring harness. (Holes have been provided in casing). When moved, tuck wiring harness behind clip provided to keep extra wire lengths out of the way.

NOTE: Proper polarity must be maintained for 115-v wiring. If polarity is incorrect, the furnace control status LED will flash rapidly and prevent heating operation.

24-V WIRING

Refer to ESD Precautions Procedure before proceeding with 24-v connections.

Make field 24-v connections at 24-v terminal block. (See Fig. 11.) Connect terminal Y/Y2 as shown in Fig. 9 or 10 for proper cooling operation. Use only AWG No. 18 or larger, color-coded copper thermostat wire.

The 24-v circuit contains an automotive-type, 3-amp fuse located on main control. Any 24-v electrical shorts during installation, service, or maintenance could cause this fuse to blow. If fuse replacement is required, use ONLY a 3-amp fuse. The control will flash code 24 when fuse needs replacement.

ACCESSORIES

1. Electronic air cleaner (EAC)

   A terminal block (EAC-1 [hot] and EAC-2 [neutral]) is provided for EAC connection. (See Fig. 11.) The terminals are energized with 115v, 1-amp maximum during blower motor operation.

2. Humidifier (HUM)

   Screw terminals (HUM and COM) are provided for 24-v humidifier connection. The terminals are energized with 24v, 0.5-amp maximum when the gas valve is energized.

Step 9—Venting

Refer to the enclosed Installation Instructions, (Vent Tables For 1- and 2-Stage Category I Fan-Assisted Furnaces) for quick, easy reference, and national or local installation code such as National Fuel Gas Code NFPA 54-1999/ANSI Z223.1-1999 in the United States, or the National Standard of Canada Natural and Propane Installation Codes CAN/CGA-B149.1- and .2-M95 in Canada, for proper vent sizing and installation requirements.

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

The horizontal portion of the venting system shall maintain a minimum of 1/4-in. upward slope per linear ft, and it shall be rigidly supported every 5 ft or less with hangers or straps to ensure that there will be no movement after installation.

Step 10—Start-Up, Adjustment, and Safety Check

GENERAL

The furnace must have a 115-v power supply properly connected and grounded. Correct polarity must be maintained to enable gas heating operation.

The gas service pressure must not exceed 0.5 psig (14-in. wc), and no less than 0.16 psig (4.5-in. wc).

Thermostat wire connections at R and W/W1 are the minimum required for gas heating operation. W2 must be connected for 2-stage heating thermostats. COM, Y/Y2, and G are required for cooling, heat pumps, and some clock thermostats. These must be made at the 24-v terminal block on the control. (See Fig. 11.)

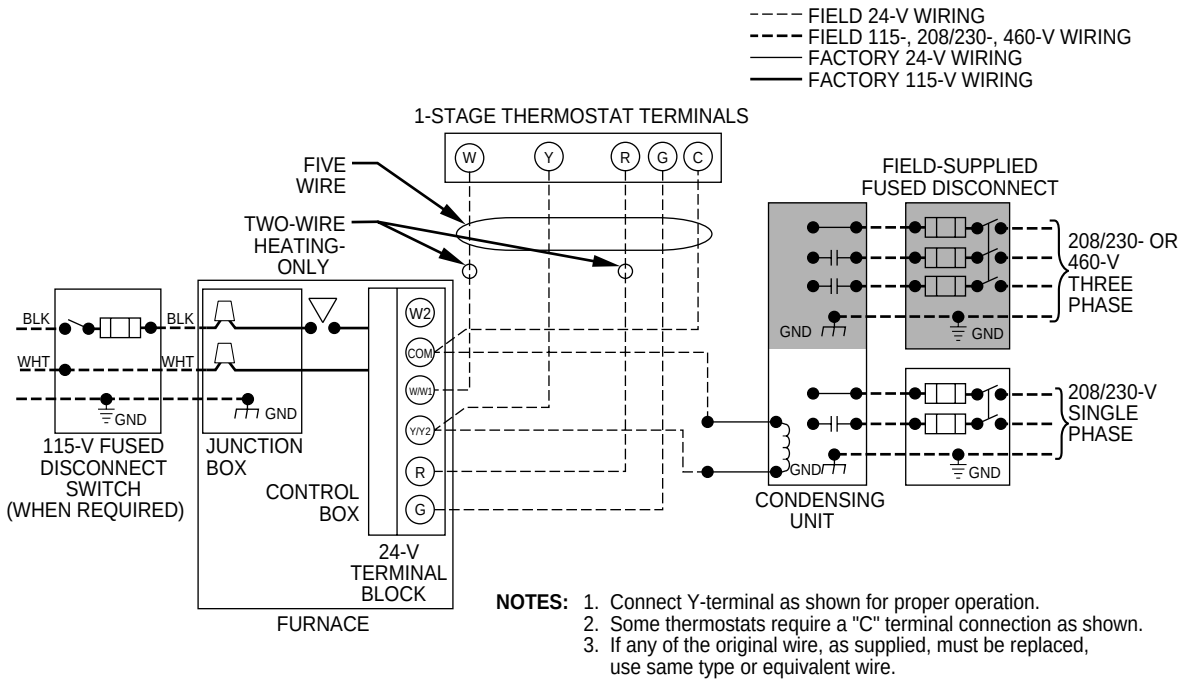
This furnace can be installed with either a single-stage heating or a 2-stage heating thermostat.

For single-stage thermostats, connect thermostat W to W/W1 at furnace control terminal block. (See Fig. 9.) For single-stage

Table 5—Electrical Data

UNIT SIZE	VOLTS—HERTZ—PHASE	OPERATING VOLTAGE RANGE		MAX UNIT AMPS	MIN WIRE GAGE	MAX WIRE LENGTH (FT)‡	MAXIMUM FUSE OR CKT BKR AMPS†
		Max*	Min*				
040-12	115—60—1	127	104	11.4	14	32	15
060-08	115—60—1	127	104	8.2	14	45	15
060-12	115—60—1	127	104	10.6	14	34	15
080-12	115—60—1	127	104	11.7	14	31	15
080-16	115—60—1	127	104	13.4	14	27	15
100-12	115—60—1	127	104	10.5	14	35	15
100-16	115—60—1	127	104	13.2	14	28	15
100-20	115—60—1	127	104	17.7	12	32	20
120-16	115—60—1	127	104	13.2	14	28	15
120-20	115—60—1	127	104	18.2	12	31	20
135-20	115—60—1	127	104	17.4	12	33	20

* Permissible limits of the voltage range at which the unit will operate satisfactorily.
† Time-delay type is recommended.
‡ Length shown is as measured 1 way along wire path between unit and service panel for maximum 2 percent voltage drop.



NOTES: 1. Connect Y-terminal as shown for proper operation.
2. Some thermostats require a "C" terminal connection as shown.
3. If any of the original wire, as supplied, must be replaced, use same type or equivalent wire.

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Fig. 9—Heating and Cooling Application Wiring Diagram 1-Stage Thermostat and Condensing Unit

Table 6—Setup Switch Description

SETUP SWITCH NO.	NORMAL POSITION	DESCRIPTION OF USE
SW-1 Only High-Gas Heat	OFF (Staged Gas Heat)	Turn switch on to obtain only high-gas-heat operation on any call for heat regardless of whether R-W/W1, or R-W/W1, -W2 is closed. SW-1 overrides SW-2.
SW-2 Low-Gas Heat (Adaptive Mode)	OFF (Single-Stage Thermostat)	Turn switch off for installations with single-stage thermostats; control selects low-gas-heat or high-gas-heat operation based on previous cycles. Turn switch on for installations with 2-stage thermostats to permit only low-gas-heat operation in response to closing R-W/W1. High-gas heat is supplied only when R to W/W1 and W2 are closed.
SW-3 and SW4	ON, OFF	Switches control gas heating mode blower off delay. (See Table 7.)

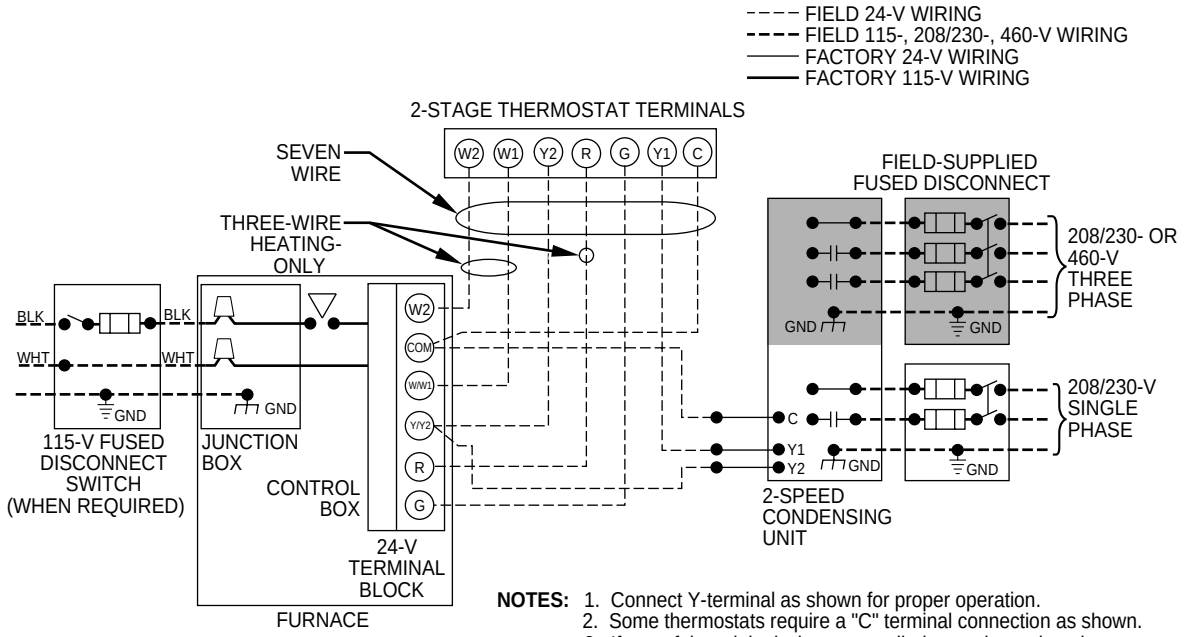

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Fig. 10—Heating and Cooling Application Wiring Diagram 2-Stage Thermostat and Condensing Unit

thermostats, the control will determine, based on length of previous heating on and off cycles, when to operate in low- and high-gas heat for optimum comfort. Setup switch-2 (SW-2) must be in the factory-shipped OFF position. See Fig. 12 and Tables 6 and 7 for setup switch information.

If a 2-stage heating thermostat is to be used, move SW-2 to ON position at end of furnace installation. This overrides built-in control process for selecting high and low fire and allows the 2-stage thermostat to select gas heating modes. The W2 from thermostat must be connected to W2 on control terminal block. (See Fig. 10.)

⚠ CAUTION

This furnace is equipped with a manual reset limit switch in the gas control area. The switch will open and shut off power to the gas valve if a flame rollout or overheating condition occurs in the gas control area. DO NOT bypass the switch. Correct inadequate combustion-air supply, component failure, or restricted flue gas passageway before resetting the switch.

Before operating furnace, check each manual reset switch for continuity. If necessary, press and release button to reset switch.

SEQUENCE OF OPERATION

Table 7—Blower Off Delay Setup Switch (SW) Position

DESIRED HEATING MODE BLOWER OFF DELAY (SEC)	SETUP SWITCH	
	SW-3	SW-4
90	OFF	OFF
135	OFF	ON
180	ON	OFF
225	ON	ON

Using schematic diagram in Fig. 13, follow the sequence of operation through the different modes. Read and follow diagram very carefully.

NOTE: If power interruption occurs during "call for heat" (W/W1 or W/W1 and W2) and if the thermostat is still calling for gas heating, the control will start a 90-sec blower only on period 2 sec after power is restored. The red LED will flash code 12 during 90-sec period, after which the LED will be on continuously as long as no faults are detected. After 90-sec period, furnace will respond to the thermostat normally.

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

1. Adaptive Heating Mode—Single-Stage Thermostat with 2-Stage Heating

   (See Fig. 9 for thermostat connections.)

NOTE: With high-heat-only switch SW-1 off, low-heat-only switch SW-2 selects either the low-heat-only operation mode when on (see item 2 below), or adaptive heating mode when off in response to a call for heat. (See Fig. 11.) When high-heat-only switch (SW-1) is in ON position, it always causes high-gas-heat operation when R-W/W1 circuit is closed, regardless of setting of low-heat-only switch (SW-2).

This furnace can operate as a 2-stage furnace with a single-stage thermostat because furnace control CPU includes a programmed adaptive sequence of controlled operation, which selects low-gas-heat or high-gas-heat operation. This selection is based upon the stored history of the length of previous gas heating on/off periods of the single-stage thermostat.

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

If power is interrupted, the stored history is erased. When this happens, the control CPU selects low-gas heat for up to 16 minutes and then switches to high-gas heat, as long as the thermostat continues to call for heat. Subsequent selection is based on stored history of thermostat cycle times.

When wall thermostat "calls for heat", R-W/W1 circuit closes. The furnace control performs a self check, verifies the low-heat and high-heat pressure switch contacts LPS and HPS are open, and starts inducer motor IDM in low speed or high speed as appropriate.

a. Inducer prepurge period—As inducer motor IDM comes up to low speed or high speed, the low-heat pressure switch contacts LPS (or LPS and HPS) close to begin a 15 sec prepurge period.

b. Ignitor warm-up—At end of prepurge period, the hot surface ignitor HSI is energized for a 17-sec ignitor warm-up period.

c. Trial-for-ignition sequence—When ignitor warm-up period is completed, the main gas valve relay contacts MGVR-1 and -2 close to energize the low-heat gas valve solenoid GV. The gas valve opens, and 24-v power is supplied for a field-installed humidifier at terminals HUM and COM. The low-heat gas valve solenoid GV permits gas flow to the burners where it is ignited. After 5 sec, the ignitor HSI is de-energized, and a 2-sec flame-proving period begins.

   If high-heat gas valve solenoid GV is also energized after normally closed high-heat pressure switch relay HPSR closes and after inducer motor IDM goes to high speed and provides sufficient pressure to close high-heat pressure switch HPS. HPSR is open while furnace is powered in standby mode. If high-heat pressure switch HPS fails to close and low-heat pressure switch LPS closes, furnace operates at low-heat gas flow rate until high-heat pressure switch closes.

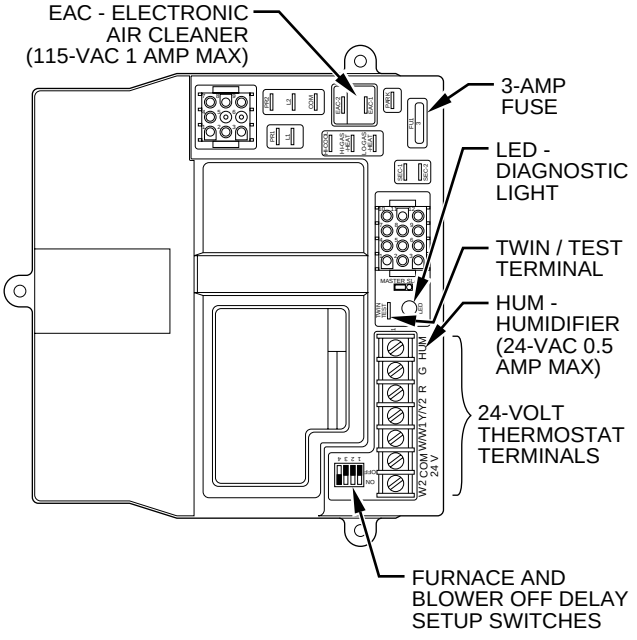

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Fig. 11—Control Center

d. Flame-proving—When burner flame is proved at flame-proving sensor electrode FSE, the control CPU begins blower on delay period and continues to hold gas valve GV open. If burner flame is not proved within 2 sec, the control CPU closes gas valve GV, and the control CPU repeats the ignition sequence for up to 3 more trials-for-ignition before going to ignition lockout. LOCKOUT IS RESET AUTOMATICALLY after 3 hr, or by momentarily interrupting 115-v power to furnace, or by interrupting 24-v power at SEC1 or SEC2 to the control CPU (not at W/W1, G, R, etc.). Opening thermostat R-W circuit will not reset an ignition lockout.

   If flame is proved when flame should not be present, the control CPU locks out of gas heating mode and operates inducer motor IDM on high speed until flame is no longer proved.

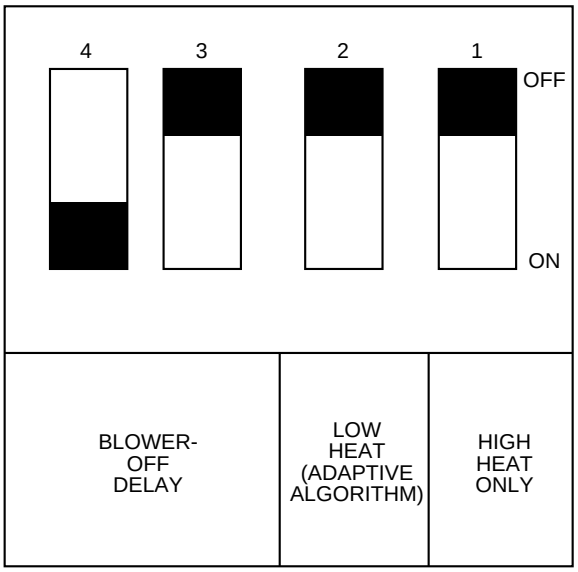

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Fig. 12—Setup Switches on Control Center (Factory Settings)

e. Blower on delay—If burner flame is proven, 45 sec after gas valve GV is opened the blower motor BLWM is energized on the appropriate heating speed, low-gas-heat or high-gas-heat speed. Simultaneously, the EAC terminals EAC-1 and EAC-2 are energized with 115v and remain energized as long as blower motor BLWM is energized.

f. Switching from low- to high-gas heat—If furnace control CPU switches from low-gas heat to high-gas heat, the control CPU switches inducer motor IDM speed from low to high. The high-heat pressure switch relay HPSR closes. When inducer motor IDM provides sufficient pressure to close the high-heat pressure switch HPS, the high-heat gas valve solenoid GV is energized. The blower motor BLWM switches speed for high-gas heat 5 sec after the control CPU switches from low-gas heat to high-gas heat.

g. Switching from high- to low-gas heat—The control CPU will not switch from high-gas heat to low-gas heat while the thermostat R to W circuit is closed when a single-stage thermostat is used.

h. Blower off delay—When thermostat is satisfied, the R-W circuit is opened, de-energizing gas valve GV, stopping gas flow to burners, and de-energizing humidifier terminals HUM and COM. The inducer motor IDM remains energized for a 5 sec post-purge period. The blower motor BLWM and EAC terminals EAC-1 and EAC-2 remain energized for 90, 135, 180, or 225 sec (depending on selection at blower off delay switches SW-3 and SW-4). The furnace control CPU is factory set for a 135-sec blower off delay.

2. Non-Adaptive Heating Mode—Two-Stage Thermostat and 2-Stage Heating

   (See Fig. 10 for thermostat connections).

NOTE: The low-heat-only switch SW-2 in ON position selects low-heat-only operation mode in response to closing the thermostat R-W1 circuit. When high-heat-only switch SW-1 is in OFF position, closing the thermostat R to W1 and W2 circuits is required for high-gas-heat operation. When high-heat-only switch SW-1 is on, it always causes high-gas-heat operation when R-W1 circuit is closed, regardless of the setting of the low-heat-only switch SW-2 and regardless of whether R-W2 circuit is closed or open.

When the wall thermostat "calls for heat", R-W/W1 circuit closes for low-gas heat or R to W1-and-W2 circuits close for high-gas heat. The furnace control performs a self check, verifies low-heat and high-heat pressure switch contacts LPS and HPS are open, and starts inducer motor IDM in low speed or high speed as appropriate.

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

a. Switching from low- to high-gas heat—If thermostat R-W/W1 circuit for low-gas heat is closed and R-W2 circuit for high-gas- heat closes, the control CPU switches the inducer motor IDM speed from low to high. The high-heat pressure switch relay HPSR closes. When inducer motor IDM provides sufficient pressure to close high-heat pressure switch HPS, the high-heat gas valve solenoid GV is energized. The blower motor BLWM switches speed for high-gas heat 5 sec after R-W2 circuit closes.

b. Switching from high- to low-gas heat—If thermostat R-W2 circuit for high-gas heat opens and R to W/W1 circuit for low-gas heat remains closed, the control CPU will switch inducer motor IDM speed from high to low. The high-heat pressure switch relay HPSR will open to de-energize high-heat gas valve solenoid GV. When inducer motor IDM reduces pressure sufficiently, the high-heat pressure switch HPS will open. The low-heat gas valve solenoid GV remains energized as long as low-heat pressure switch LPS remains closed. The blower motor BLWM switches speed for low-gas heat 5 sec after R-W2 circuit opens.

3. Cooling Mode

a. Single-Speed Cooling Outdoor Unit

(See Fig. 9 for thermostat connections.)

(1.) The thermostat closes R to G-and-Y circuits. The R-Y circuit starts the outdoor unit, and R to G-and-Y circuits start the furnace blower motor BLWM on high-cool speed.

(2.) The EAC terminals EAC-1 and EAC-2 are energized with 115v when blower motor BLWM is operating.

(3.) When thermostat is satisfied, the R to G-and-Y circuits are opened. The outdoor unit stops, and furnace blower motor BLWM continues operating on high-cool speed for an additional 90 sec.

b. Two-Speed Cooling Outdoor Unit

(See Fig. 10 for thermostat connections.)

(1.) The thermostat closes R to G-and-Y1 circuits for low cooling or closes R to G-and-Y1-and-Y/Y2 circuits for high cooling. The R to Y1 circuits start the outdoor unit on low-cooling speed, and the R-G circuit starts furnace blower motor BLWM on low-cooling speed (same speed as for low-gas heat). The R to Y1-and-Y2 circuits start the outdoor unit on high-cooling speed, and the R to G-and-Y2 circuits start furnace blower motor BLWM on high-cooling speed.

NOTE: Y1 is found in the outdoor unit. The furnace control CPU controls blower motor BLWM speed by sensing only G for low-cooling speed and Y/Y2 for high-cooling speed.

(2.) The EAC terminals EAC-1 and EAC-2 are energized with 115v when blower motor BLWM is operating on either cooling speed.

(3.) When thermostat is satisfied, the R to G-and-Y1 or R to G-and-Y1-and-Y/Y2 circuits open. The outdoor unit stops, and furnace blower continues operating on cooling speed for an additional 90 sec.

4. Continuous Blower Mode

a. When R to G circuit is closed by thermostat, the blower motor BLWM operates on low-gas heat speed (identical to low-cool speed). Terminals EAC-1 and EAC-2 are energized with 115v as long as blower motor BLWM is energized.

b. During a "call for heat," the blower motor BLWM stops during ignitor warm-up (17 sec), ignition (7 sec), and blower on delay (45 sec), allowing furnace heat exchangers to heat up quickly.

c. The blower motor BLWM reverts to continuous blower speed after the heating cycle is completed. In high-gas heat, the furnace control CPU holds the blower motor BLWM at high-gas-heat speed during the selected blower off delay period before reverting to continuous blower speed.

(1.) When thermostat "calls for low-cooling," the blower motor BLWM continues to operate on low-cool speed. When thermostat is satisfied, the blower motor BLWM continues on continuous blower speed.

(2.) When thermostat "calls for high-cooling," the blower motor BLWM operates on high-cool speed. When the thermostat is satisfied, the blower motor BLWM operates an additional 2 sec on high-cool speed before reverting back to continuous blower speed.

(3.) When R-G circuit is opened, the blower motor BLWM continues operating for an additional 90 sec if no other function requires blower motor BLWM operation.

5. Heat Pump Mode

NOTE: An accessory interface kit is required with single-speed heat pumps. See interface kit Installation Instructions for single-speed heat pump thermostat and interface connections. No interface kit is needed for 2-speed heat pumps. See 2-speed heat pump Installation Instructions for thermostat connections.

a. Single-Speed Heat Pump Cooling

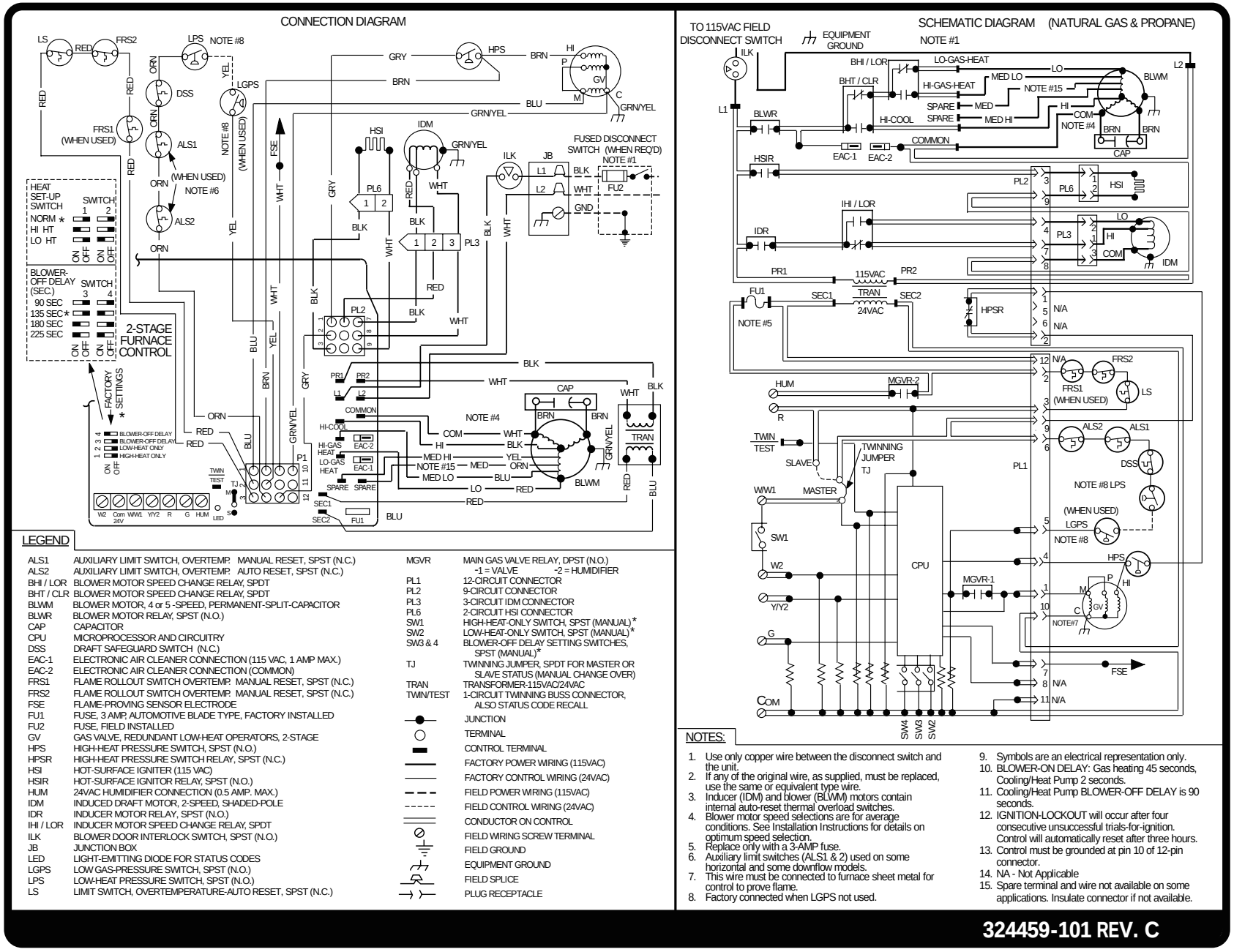
(1.) The thermostat and interface kit close the R to G-and-Y/Y2 circuit to start the furnace blower motor BLWM on high-cooling speed. The Y/Y2 input to the furnace control is necessary to provide adequate cooling airflow.

(2.) The EAC terminals EAC-1 and EAC-2 are energized with 115v when the blower motor BLWM is operating.

(3.) When thermostat is satisfied, furnace blower motor BLWM continues operating on high-cool speed for an additional 90 sec.

b. Two-Speed Heat Pump Cooling

(1.) The thermostat R to G circuits start the furnace blower motor BLWM on low-cool speed. The thermostat R to G-and-Y/Y2 circuits start the furnace blower motor BLWM on high-cool speed.



ALS1	AUXILIARY LIMIT SWITCH, OVERTEMP. MANUAL RESET, SPST (N.C.)
ALS2	AUXILIARY LIMIT SWITCH, OVERTEMP. AUTO RESET, SPST (N.C.)
BHI / LOR	BLOWER MOTOR SPEED CHANGE RELAY, SPDT
BHT / CLR	BLOWER MOTOR SPEED CHANGE RELAY, SPDT
BLWM	BLOWER MOTOR, 4 or 5 -SPEED, PERMANENT-SPLIT-CAPACITOR
BLWR	BLOWER MOTOR RELAY, SPST (N.O.)
CAP	CAPACITOR
CPU	MICROPROCESSOR AND CIRCUITRY
DSS	DRAFT SAFEGUARD SWITCH (N.C.)
EAC-1	ELECTRONIC AIR CLEANER CONNECTION (115 VAC, 1 AMP MAX.)
EAC-2	ELECTRONIC AIR CLEANER CONNECTION (COMMON)
FRS1	FLAME ROLLOUT SWITCH OVERTEMP. MANUAL RESET, SPST (N.C.)
FRS2	FLAME ROLLOUT SWITCH OVERTEMP. MANUAL RESET, SPST (N.C.)
FSE	FLAME-PROVING SENSOR ELECTRODE
FU1	FUSE, 3 AMP, AUTOMOTIVE BLADE TYPE, FACTORY INSTALLED
FU2	FUSE, FIELD INSTALLED
GV	GAS VALVE, REDUNDANT LOW-HEAT OPERATORS, 2-STAGE
HPS	HIGH-HEAT PRESSURE SWITCH, SPST (N.O.)
HPSR	HIGH-HEAT PRESSURE SWITCH RELAY, SPST (N.C.)
HSI	HOT-SURFACE IGNITER (115 VAC)
HSIR	HOT-SURFACE IGNITOR RELAY, SPST (N.O.)
HUM	24VAC HUMIDIFIER CONNECTION (0.5 AMP. MAX.)
IDM	INDUCED DRAFT MOTOR, 2-SPEED, SHADED-POLE
IDR	INDUCER MOTOR RELAY, SPST (N.O.)
IHI / LOR	INDUCER MOTOR SPEED CHANGE RELAY, SPDT
ILK	BLOWER DOOR INTERLOCK SWITCH, SPST (N.O.)
JB	JUNCTION BOX
LED	LIGHT-EMITTING DIODE FOR STATUS CODES
LGPS	LOW GAS-PRESSURE SWITCH, SPST (N.O.)
LPS	LOW-HEAT PRESSURE SWITCH, SPST (N.O.)
LS	LIMIT SWITCH, OVERTEMPERATURE-AUTO RESET, SPST (N.C.)
MGVR	MAIN GAS VALVE RELAY, DPST (N.O.) -1 = VALVE -2 = HUMIDIFIER
PL1	12-CIRCUIT CONNECTOR
PL2	9-CIRCUIT CONNECTOR
PL3	3-CIRCUIT IDM CONNECTOR
PL6	2-CIRCUIT HSI CONNECTOR
SW1	HIGH-HEAT-ONLY SWITCH, SPST (MANUAL)*
SW2	LOW-HEAT-ONLY SWITCH, SPST (MANUAL)*
SW3 & 4	BLOWER-OFF DELAY SETTING SWITCHES, SPST (MANUAL)*
TJ	TWINNING JUMPER, SPDT FOR MASTER OR SLAVE STATUS (MANUAL CHANGE OVER)
TRAN	TRANSFORMER-115VAC/24VAC
TWIN/TEST	1-CIRCUIT TWINNING BUSS CONNECTOR, ALSO STATUS CODE RECALL
	JUNCTION
	TERMINAL
	CONTROL TERMINAL
	FACTORY POWER WIRING (115VAC)
	FACTORY CONTROL WIRING (24VAC)
	FIELD POWER WIRING (115VAC)
	FIELD CONTROL WIRING (24VAC)
	CONDUCTOR ON CONTROL
	FIELD WIRING SCREW TERMINAL
	FIELD GROUND
	EQUIPMENT GROUND
	FIELD SPLICE
	PLUG RECEPTACLE

1. Use only copper wire between the disconnect switch and the unit.
2. If any of the original wire, as supplied, must be replaced, use the same or equivalent type wire.
3. Inducer (IDM) and blower (BLWM) motors contain internal auto-reset thermal overload switches.
4. Blower motor speed selections are for average conditions. See Installation Instructions for details on optimum speed selection.
5. Replace only with a 3-AMP fuse.
6. Auxiliary limit switches (ALS1 & 2) used on some horizontal and some downflow models.
7. This wire must be connected to furnace sheet metal for control to prove flame.
8. Factory connected when LGPS not used.
9. Symbols are an electrical representation only.
10. BLOWER-ON DELAY: Gas heating 45 seconds, Cooling/Heat Pump 2 seconds.
11. Cooling/Heat Pump BLOWER-OFF DELAY is 90 seconds.
12. IGNITION-LOCKOUT will occur after four consecutive unsuccessful trials-for-ignition. Control will automatically reset after three hours.
13. Control must be grounded at pin 10 of 12-pin connector.
14. NA - Not Applicable
15. Spare terminal and wire not available on some applications. Insulate connector if not available.

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→Fig. 13—Unit Wiring Diagram

NOTE: The furnace control CPU controls blower motor BLWM speed by sensing only G for low-cool speed and Y2 for high-cool speed.

(2.) The EAC terminals EAC-1 and EAC-2 are energized with 115v when the blower motor BLWM is operating on either cooling speed.

(3.) When thermostat is satisfied, the furnace blower motor BLWM continues operating on cooling speed for an additional 90 sec.

c. Single-Speed Heat Pump Heating

(1.) The thermostat and accessory interface kit R to G-and-Y/Y2 circuits start the furnace blower motor BLWM on heat pump high-heat speed (identical to high-cool speed).

(2.) The EAC terminals EAC-1 and EAC-2 are energized with 115v when the blower motor BLWM is operating.

(3.) When thermostat is satisfied, the furnace blower motor BLWM continues operating on heat pump high-heat speed for an additional 90 sec.

d. Two-Speed Heat Pump Heating

(1.) The thermostat closes R-G circuit for low heat and starts furnace blower motor BLWM on heat pump low-heat speed (identical to low-cooling speed). Closing R-Y/Y2 circuit to furnace provides blower motor BLWM heat pump high-heat speed.

NOTE: The furnace control CPU controls blower motor BLWM speed by sensing only G (for heat pump low-heat speed) and Y2 (for heat pump high-heat speed).

(2.) The EAC terminals EAC-1 and EAC-2 are energized with 115v when the blower motor BLWM is operating on either heating speed.

(3.) When thermostat is satisfied, the furnace blower motor BLWM continues operating on heating speed for an additional 90 sec.

(4.) Opening only R-Y/Y2 circuit reduces blower motor BLWM speed to heat pump low-heat speed.

6. Defrost

a. When furnace control R to W/W1-and-Y/Y2 circuits are closed, furnace control CPU continues blower motor BLWM operation at heat pump heating speed until the end of the prepurge period, then shuts off until the end of the HSI ignitor-on period (22 sec).

b. When installed with a heat pump, the furnace control CPU automatically holds blower off time to 22 sec during HSI ignitor on period. After 17 sec of HSI ignitor-on period, a trial for ignition sequence occurs as described above for gas heating. After flame is proved and without a blower on delay, the blower motor BLWM will operate on high-gas-heat speed during defrost. For both single-speed and 2-speed heat pumps, defrost mode is in high-gas heat only.

c. When furnace control R-W/W1 circuit is opened, the furnace control CPU begins the normal inducer post purge period and the blower motor BLWM remains on for the blower off delay period. If R-G circuit remains closed, blower motor BLWM reverts to continuous operation.

START-UP PROCEDURES

1. Component test—The furnace features a component test system to help diagnose a system problem in the case of a component failure. To initiate the component test procedure, ensure that there are no thermostat inputs to the control and all time delays have expired. Short the TWIN/TEST terminal to ground or COM for 1 to 4 sec. (See Fig. 11.)

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

The component test sequence is as follows:

a. The furnace control checks itself, operates the inducer motor on low speed for 7 sec and on high speed for 7 sec, then stops.

b. The hot surface ignitor is energized for 15 sec, then de-energized.

c. The blower motor operates on low-gas-heat/heat pump low-heat/low-cool/continuous fan speed for 7 sec, then stops.

d. The blower motor operates on high-gas heat for 7 sec, then stops.

e. The blower motor operates on heat pump high-heat/high-cool speed for 7 sec, then stops.

The gas valve and humidifier terminal HUM are not energized for safety reasons.

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

2. After all connections have been made, purge gas lines and check for leaks.

⚠ WARNING

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

3. To operate furnace, follow procedures on operating instructions label attached to furnace.

4. With furnace operating, set thermostat below room temperature and observe that furnace goes off. Set thermostat above room temperature and observe that furnace restarts.

ADJUSTMENTS

1. Set gas input rate.

Furnace gas input rate on rating plate is for installations at altitudes up to 2000 ft.

In the U.S.A., input rating for altitudes above 2000 ft must be reduced by 4 percent for each 1000 ft above sea level.

In Canada, input rating must be derated by 10 percent for altitudes of 2000 ft to 4500 ft above sea level.

Furnace input rate must be within ±2 percent of input on furnace rating plate.

2. Determine natural gas orifice size and manifold pressure for correct input.

a. Obtain yearly heat value average (at installed altitude) from local gas supplier.

b. Obtain yearly specific gravity average from local gas supplier.

c. Verify furnace model. Table 9 can only be used for model 58TUA Furnaces.

d. Find installation altitude in Table 9.

NOTE: For Canada altitudes of 2000 to 4500 ft, use U.S.A. altitudes of 2001 to 3000 ft in Table 9.

e. Find closest natural gas heat value and specific gravity in Table 9.

f. Follow heat value and specific gravity lines to point of intersection to find orifice size and low- and high-heat manifold pressure settings for proper operation.

EXAMPLE: (0—2000 ft altitude)
Heating value = 1075 Btu/cu ft
Specific gravity = 0.62
Therefore: Orifice No. 45
Manifold pressure: 3.4-in. wc for high heat
1.4-in. wc for low heat
* Furnace is shipped with No. 45 orifices. In this example, all main burner orifices are the correct size and do not need to be changed to obtain proper input rate.

g. Check and verify burner orifice size in furnace. NEVER ASSUME ORIFICE SIZE; ALWAYS CHECK AND VERIFY.

3. Adjust manifold pressure to obtain input rate.
   a. Remove caps that conceal adjustment screws for low- and high-heat gas valve regulators. (See Fig. 14.)
   b. Move setup switch SW-2 on control center to ON position. (See Fig. 12.) This keeps furnace locked in low-heat operation.
   c. Jumper R and W/W1 thermostat connections on control center to start furnace.
   d. Turn low-heat adjusting screw (5/64 hex Allen wrench) counterclockwise (out) to decrease input rate or clockwise (in) to increase input rate.

NOTE: DO NOT set low-heat manifold pressure less than 1.3-in. wc or more than 1.7-in. wc for natural gas. If manifold pressure is outside this range, change main burner orifices.

⚠ CAUTION

DO NOT bottom out gas valve regulator adjusting screw. This can result in unregulated manifold pressure and result in excess overfire and heat exchanger failures.

NOTE: If orifice hole appears damaged or it is suspected to have been redrilled, check orifice hole with a numbered drill bit of correct size. Never redrill an orifice. A burr-free and squarely aligned orifice hole is essential for proper flame characteristics.

   e. Move setup switch SW-2 to OFF position after completing low-heat adjustment.
   f. Jumper R and W2 thermostat connections on control center. (See Fig. 11.) This keeps furnace locked in high-heat operation.
   g. Turn high-heat adjusting screw (5/64 hex Allen wrench) counterclockwise (out) to decrease input rate or clockwise (in) to increase rate.

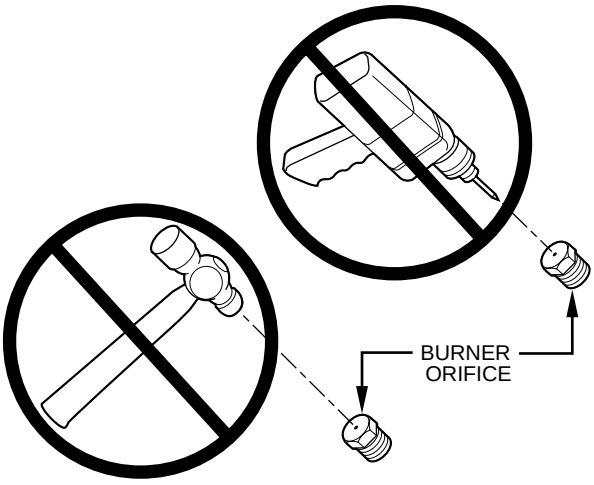
NOTE: DO NOT set high-heat manifold pressure less than 3.2-in. wc or more than 3.8-in. wc for natural gas. If manifold pressure is outside this range, change main burner orifices.

   h. When correct input is obtained, replace caps that conceal gas valve regulator adjustment screws. Main burner flame should be clear blue, almost transparent. (See Fig. 15.)
   i. Remove jumper R to W2.

4. Verify natural gas input rate by clocking gas meter.
   a. Calculate high-altitude adjustment (if required).

      UNITED STATES

      At altitudes above 2000 ft, this furnace has been approved for a 4 percent derate for each 1000 ft above sea level. See Table 8 for derate multiplier factor and example.



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⚠ CAUTION

DO NOT redrill orifices. Improper drilling (burrs, out-of-round holes, etc.) can cause excessive burner noise and misdirection of burner flames. This can result in flame impingement of burners and heat exchangers, causing failures.

Table 8—Altitude Derate Multiplier for U.S.A.

ALTITUDE (FT)	% OF DERATE	DERATE MULTIPLIER FACTOR FOR U.S.A.*
0—2000	0	1.00
2001—3000	8—12	0.90
3001—4000	12—16	0.86
4001—5000	16—20	0.82
5001—6000	20—24	0.78
6001—7000	24—28	0.74
7001—8000	18—32	0.70
8001—9000	32—36	0.66
9001—10,000	36—40	0.62

* Derate multiplier factor is based on midpoint altitude for altitude range.

EXAMPLE:
85,000 Btuh input furnace installed at 4300 ft.

Furnace Input Rate at Sea Level		Derate Multiplier Factor		Furnace Input Rate at Installation Altitude
85,000	X	0.82	=	69,700

CANADA

At installation altitudes from 2000 to 4500 ft, this furnace must be derated 10 percent by an authorized Gas Conversion Station or Dealer. To determine correct input rate for altitude, see example above and use 0.82 as derate multiplier factor.

   b. Check that gas valve adjustment caps are in place for proper input to be clocked.
   c. Obtain yearly heat value average for local gas supply.

NOTE: Be sure heating value of gas used for calculations is correct for your altitude. Consult local gas utility for altitude adjustment of gas heating value.

   d. Check and verify orifice size in furnace. NEVER ASSUME THE ORIFICE SIZE. ALWAYS CHECK AND VERIFY.

Table 9—Model 58TUA Orifice Size and Manifold Pressure for Correct Input (Tabulated Data Based on 20,000 Btuh High Heat/13,000 Btuh Low Heat per Burner Derated 4% for Each 1000 Ft Above Sea Level)*

ALTITUDE RANGE (FT)		AVG GAS HEAT VALUE AT ALTITUDE (BTU/CU FT)	SPECIFIC GRAVITY OF NATURAL GAS									
			0.58		0.60		0.62		0.64		0.66	
			Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low
U.S.A. and Canada		850	43	3.7/1.5	43	3.8/1.6	42	3.2/1.4	42	3.3/1.4	42	3.4/1.4
		875	43	3.5/1.5	43	3.6/1.5	43	3.7/1.6	43	3.8/1.6	42	3.2/1.4
		900	44	3.7/1.6	43	3.4/1.4	43	3.5/1.5	43	3.6/1.5	43	3.7/1.6
	0	925	44	3.5/1.5	44	3.7/1.6	44	3.8/1.6	43	3.4/1.4	43	3.5/1.5
		950	44	3.4/1.4	44	3.5/1.5	44	3.6/1.5	44	3.7/1.6	44	3.8/1.6
	to	975	44	3.2/1.3	44	3.3/1.4	44	3.4/1.4	44	3.5/1.5	44	3.6/1.5
		1000	**45**	**3.7/1.6**	**45**	**3.8/1.6**	44	3.2/1.4	44	3.4/1.4	44	3.5/1.5
	2000	**1025**	**45**	**3.5/1.5**	**45**	**3.6/1.5**	**45**	**3.7/1.6**	44	3.2/1.3	44	3.3/1.4
		1050	**45**	**3.3/1.4**	**45**	**3.4/1.5**	**45**	**3.6/1.5**	**45**	**3.7/1.6**	**45**	**3.8/1.6**
		1075	**45**	**3.2/1.3**	**45**	**3.3/1.4**	**45**	**3.4/1.4**	**45**	**3.5/1.5**	**45**	**3.6/1.5**
		1100	47	3.6/1.5	47	3.7/1.6	**45**	**3.2/1.4**	**45**	**3.4/1.4**	**45**	**3.5/1.5**

ALTITUDE RANGE (FT)		AVG GAS HEAT VALUE AT ALTITUDE (BTU/CU FT)	SPECIFIC GRAVITY OF NATURAL GAS									
			0.58		0.60		0.62		0.64		0.66	
			Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low
U.S.A. and Canada	U.S.A.	775	43	3.4/1.4	43	3.5/1.5	43	3.6/1.5	43	3.7/1.6	43	3.8/1.6
	Altitudes	800	44	3.6/1.5	44	3.8/1.6	43	3.4/1.4	43	3.5/1.5	43	3.6/1.5
	2001	825	44	3.4/1.4	44	3.5/1.5	44	3.7/1.5	44	3.8/1.6	43	3.4/1.4
	to	850	44	3.2/1.4	44	3.3/1.4	44	3.4/1.5	44	3.6/1.5	44	3.7/1.5
	3000	875	**45**	**3.7/1.6**	**45**	**3.8/1.6**	44	3.2/1.4	44	3.4/1.4	44	3.5/1.5
	or	900	**45**	**3.5/1.5**	**45**	**3.6/1.5**	**45**	**3.7/1.6**	**45**	**3.8/1.6**	44	3.3/1.4
	Canada	925	**45**	**3.3/1.4**	**45**	**3.4/1.4**	**45**	**3.5/1.5**	**45**	**3.6/1.5**	**45**	**3.7/1.6**
	Altitudes	950	47	3.7/1.6	**45**	**3.2/1.4**	**45**	**3.3/1.4**	**45**	**3.4/1.5**	**45**	**3.6/1.5**
	2000	975	47	3.5/1.5	47	3.6/1.5	**45**	**3.2/1.3**	**45**	**3.3/1.4**	**45**	**3.4/1.4**
	to	1000	48	3.8/1.6	47	3.5/1.5	47	3.6/1.5	47	3.7/1.6	**45**	**3.2/1.4**
	4500	1025	48	3.6/1.5	48	3.8/1.6	47	3.4/1.4	47	3.5/1.5	47	3.6/1.5

ALTITUDE RANGE (FT)		AVG GAS HEAT VALUE AT ALTITUDE (BTU/CU FT)	SPECIFIC GRAVITY OF NATURAL GAS									
			0.58		0.60		0.62		0.64		0.66	
			Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low
U.S.A. Only		750	44	3.6/1.5	44	3.8/1.6	43	3.4/1.4	43	3.5/1.5	43	3.6/1.5
		775	44	3.4/1.4	44	3.5/1.5	44	3.6/1.5	44	3.8/1.6	43	3.4/1.4
		800	44	3.2/1.4	44	3.3/1.4	44	3.4/1.4	44	3.5/1.5	44	3.6/1.5
	3001	825	**45**	**3.6/1.5**	**45**	**3.8/1.6**	44	3.2/1.4	44	3.3/1.4	44	3.4/1.4
		850	**45**	**3.4/1.4**	**45**	**3.5/1.5**	**45**	**3.7/1.5**	**45**	**3.8/1.6**	44	3.2/1.4
	to	875	**45**	**3.2/1.4**	**45**	**3.3/1.4**	**45**	**3.5/1.5**	**45**	**3.6/1.5**	**45**	**3.7/1.6**
		900	47	3.6/1.5	**45**	**3.2/1.3**	**45**	**3.3/1.4**	**45**	**3.4/1.4**	**45**	**3.5/1.5**
	4000	925	47	3.4/1.5	47	3.6/1.5	47	3.7/1.6	**45**	**3.2/1.4**	**45**	**3.3/1.4**
		950	48	3.7/1.6	48	3.8/1.6	47	3.5/1.5	47	3.6/1.5	47	3.7/1.6
		975	48	3.5/1.5	48	3.7/1.5	48	3.8/1.6	47	3.4/1.4	47	3.5/1.5
		1000	48	3.4/1.4	48	3.5/1.5	48	3.6/1.5	48	3.7/1.6	48	3.8/1.6

* For 135-20 sizes only, input is 19,000 Btuh for high fire. Deduct 0.1-in. from manifold pressure shown in table. Change orifice size if manifold pressure falls below 3.2-in.wc.

Table 9—Model 58TUA Orifice Size and Manifold Pressure for Correct Input—Continued (TABULATED DATA BASED ON 20,000 BTUH HIGH HEAT/13,000 BTUH LOW HEAT PER BURNER DERATED 4% FOR EACH 1000 FT ABOVE SEA LEVEL)*

ALTITUDE RANGE (FT)		AVG GAS HEAT VALUE AT ALTITUDE (BTU/CU FT)	SPECIFIC GRAVITY OF NATURAL GAS									
			0.58		0.60		0.62		0.64		0.66	
			Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low
U.S.A. Only		725	44	3.4/1.4	44	3.5/1.5	44	3.6/1.5	44	3.8/1.6	43	3.4/1.4
		750	44	3.2/1.3	44	3.3/1.4	44	3.4/1.4	44	3.5/1.5	44	3.6/1.5
		775	**45**	**3.6/1.5**	**45**	**3.7/1.6**	44	3.2/1.3	44	3.3/1.4	44	3.4/1.4
	4001	800	**45**	**3.4/1.4**	**45**	**3.5/1.5**	**45**	**3.6/1.5**	**45**	**3.7/1.6**	44	3.2/1.3
		825	**45**	**3.2/1.3**	**45**	**3.3/1.4**	**45**	**3.4/1.4**	**45**	**3.5/1.5**	**45**	**3.6/1.5**
	to	850	47	3.6/1.5	47	3.7/1.6	**45**	**3.2/1.4**	**45**	**3.3/1.4**	**45**	**3.4/1.4**
		875	48	3.8/1.6	47	3.5/1.5	47	3.6/1.5	47	3.7/1.6	**45**	**3.2/1.4**
	5000	900	48	3.6/1.5	48	3.8/1.6	47	3.4/1.4	47	3.5/1.5	47	3.6/1.5
		925	48	3.4/1.5	48	3.6/1.5	48	3.7/1.6	48	3.8/1.6	47	3.4/1.5
		950	49	3.8/1.6	48	3.4/1.4	48	3.5/1.5	48	3.6/1.5	48	3.7/1.6

ALTITUDE RANGE (FT) (FT)		AVG GAS HEAT VALUE AT ALTITUDE (BTU/CU FT)	SPECIFIC GRAVITY OF NATURAL GAS									
			0.58		0.60		0.62		0.64		0.66	
			Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low
U.S.A. Only		700	44	3.2/1.3	44	3.3/1.4	44	3.4/1.4	44	3.5/1.5	44	3.6/1.5
		725	**45**	**3.6/1.5**	**45**	**3.7/1.6**	**45**	**3.8/1.6**	44	3.3/1.4	44	3.4/1.4
		750	**45**	**3.4/1.4**	**45**	**3.5/1.5**	**45**	**3.6/1.5**	**45**	**3.7/1.6**	**45**	**3.8/1.6**
		775	**45**	**3.2/1.3**	**45**	**3.3/1.4**	**45**	**3.4/1.4**	**45**	**3.5/1.5**	**45**	**3.6/1.5**
	5001	800	47	3.5/1.5	47	3.6/1.5	**45**	**3.2/1.3**	**45**	**3.3/1.4**	**45**	**3.4/1.4**
		825	48	3.8/1.6	47	3.4/1.4	47	3.5/1.5	47	3.7/1.5	**45**	**3.2/1.3**
	to	850	48	3.6/1.5	48	3.7/1.6	48	3.8/1.6	47	3.4/1.5	47	3.5/1.5
		875	48	3.4/1.4	48	3.5/1.5	48	3.6/1.5	48	3.7/1.6	48	3.8/1.6
	6000	900	49	3.7/1.6	49	3.8/1.6	48	3.4/1.4	48	3.5/1.5	48	3.6/1.5
		925	49	3.5/1.5	49	3.6/1.5	49	3.8/1.6	48	3.3/1.4	48	3.4/1.4
		950	49	3.3/1.4	49	3.5/1.5	49	3.6/1.5	49	3.7/1.6	49	3.8/1.6
		975	50	3.7/1.6	49	3.3/1.4	49	3.4/1.4	49	3.5/1.5	49	3.6/1.5
		1000	50	3.6/1.5	50	3.7/1.6	50	3.8/1.6	49	3.3/1.4	49	3.4/1.4

ALTITUDE RANGE (FT)		AVG GAS HEAT VALUE AT ALTITUDE (BTU/CU FT)	SPECIFIC GRAVITY OF NATURAL GAS									
			0.58		0.60		0.62		0.64		0.66	
			Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low
U.S.A. Only		650	44	3.2/1.4	44	3.3/1.4	44	3.4/1.4	44	3.5/1.5	44	3.6/1.5
		675	**45**	**3.6/1.5**	**45**	**3.7/1.6**	**45**	**3.8/1.6**	44	3.3/1.4	44	3.4/1.4
		700	**45**	**3.3/1.4**	**45**	**3.5/1.5**	**45**	**3.6/1.5**	**45**	**3.7/1.6**	**45**	**3.8/1.6**
	6001	725	47	3.7/1.6	**45**	**3.2/1.4**	**45**	**3.3/1.4**	**45**	**3.4/1.5**	**45**	**3.5/1.5**
		750	47	3.5/1.5	47	3.6/1.5	47	3.7/1.6	**45**	**3.2/1.4**	**45**	**3.3/1.4**
	to	775	48	3.7/1.6	48	3.8/1.6	47	3.5/1.5	47	3.6/1.5	47	3.7/1.6
		800	48	3.5/1.5	48	3.6/1.5	48	3.7/1.6	48	3.8/1.6	47	3.5/1.5
	7000	825	49	3.8/1.6	48	3.4/1.4	48	3.5/1.5	48	3.6/1.5	48	3.7/1.6
		850	49	3.6/1.5	49	3.7/1.6	48	3.3/1.4	48	3.4/1.4	48	3.5/1.5
		875	49	3.4/1.4	49	3.5/1.5	49	3.6/1.5	49	3.8/1.6	48	3.3/1.4

* For 135-20 sizes only, input is 19,000 Btuh for high fire. Deduct 0.1-in. from manifold pressure shown in table. Change orifice size if manifold pressure falls below 3.2-in.wc.

Table 9—Model 58TUA Orifice Size and Manifold Pressure for Correct Input—Continued (TABULATED DATA BASED ON 20,000 BTUH HIGH HEAT/13,000 BTUH LOW HEAT PER BURNER DERATED 4% FOR EACH 1000 FT ABOVE SEA LEVEL)*

ALTITUDE RANGE (FT)		AVG GAS HEAT VALUE AT ALTITUDE (BTU/CU FT)	SPECIFIC GRAVITY OF NATURAL GAS									
			0.58		0.60		0.62		0.64		0.66	
			Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low
U.S.A. Only		625	**45**	**3.6/1.5**	**45**	**3.7/1.6**	44	3.2/1.3	44	3.3/1.4	44	3.4/1.4
		650	**45**	**3.3/1.4**	**45**	**3.5/1.5**	**45**	**3.6/1.5**	**45**	**3.7/1.6**	**45**	**3.8/1.6**
		675	47	3.7/1.6	**45**	**3.2/1.4**	**45**	**3.3/1.4**	**45**	**3.4/1.4**	**45**	**3.5/1.5**
	7001	700	47	3.4/1.4	47	3.5/1.5	47	3.7/1.5	**45**	**3.2/1.3**	**45**	**3.3/1.4**
		725	48	3.6/1.5	48	3.8/1.6	47	3.4/1.4	47	3.5/1.5	47	3.6/1.5
	to	750	48	3.4/1.4	48	3.5/1.5	48	3.6/1.5	48	3.8/1.6	47	3.4/1.4
		775	49	3.7/1.6	48	3.3/1.4	48	3.4/1.4	48	3.5/1.5	48	3.6/1.5
	8000	800	49	3.5/1.5	49	3.6/1.5	49	3.8/1.6	48	3.3/1.4	48	3.4/1.4
		825	49	3.3/1.4	49	3.4/1.4	49	3.5/1.5	49	3.6/1.5	49	3.8/1.6
		850	50	3.7/1.6	50	3.8/1.6	49	3.3/1.4	49	3.4/1.4	49	3.5/1.5

ALTITUDE RANGE (FT)		AVG GAS HEAT VALUE AT ALTITUDE (BTU/CU FT)	SPECIFIC GRAVITY OF NATURAL GAS									
			0.58		0.60		0.62		0.64		0.66	
			Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low
U.S.A. Only		600	**45**	**3.4/1.4**	**45**	**3.5/1.5**	**45**	**3.6/1.5**	**45**	**3.7/1.6**	**45**	**3.8/1.6**
		625	47	3.7/1.6	**45**	**3.2/1.4**	**45**	**3.3/1.4**	**45**	**3.4/1.4**	**45**	**3.5/1.5**
	8001	650	47	3.4/1.4	47	3.5/1.5	47	3.6/1.5	**45**	**3.2/1.3**	**45**	**3.3/1.4**
		675	48	3.6/1.5	48	3.7/1.6	48	3.8/1.6	47	3.5/1.5	47	3.6/1.5
	to	700	48	3.3/1.4	48	3.5/1.5	48	3.6/1.5	48	3.7/1.6	48	3.8/1.6
		725	49	3.7/1.5	49	3.8/1.6	48	3.3/1.4	48	3.4/1.5	48	3.5/1.5
	9000	750	49	3.4/1.4	49	3.5/1.5	49	3.7/1.5	49	3.8/1.6	48	3.3/1.4
		775	50	3.8/1.6	49	3.3/1.4	49	3.4/1.4	49	3.5/1.5	49	3.6/1.5
		800	50	3.6/1.5	50	3.7/1.6	50	3.8/1.6	49	3.3/1.4	49	3.4/1.4

ALTITUDE RANGE (FT)		AVG GAS HEAT VALUE AT ALTITUDE (BTU/CU FT)	SPECIFIC GRAVITY OF NATURAL GAS									
			0.58		0.60		0.62		0.64		0.66	
			Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low	Orifice No.	Manifold Pressure High/Low
U.S.A. Only		575	47	3.7/1.6	**45**	**3.2/1.4**	**45**	**3.3/1.4**	**45**	**3.4/1.4**	**45**	**3.5/1.5**
		600	47	3.4/1.4	47	3.5/1.5	47	3.6/1.5	47	3.7/1.6	**45**	**3.2/1.4**
	9001	625	48	3.6/1.5	48	3.7/1.6	48	3.8/1.6	47	3.5/1.5	47	3.6/1.5
		650	48	3.3/1.4	48	3.4/1.4	48	3.5/1.5	48	3.6/1.5	48	3.7/1.6
	to	675	49	3.6/1.5	49	3.7/1.6	49	3.8/1.6	48	3.4/1.4	48	3.5/1.5
		700	49	3.3/1.4	49	3.4/1.5	49	3.6/1.5	49	3.7/1.6	49	3.8/1.6
	10,000	725	50	3.7/1.6	50	3.8/1.6	49	3.3/1.4	49	3.4/1.4	49	3.5/1.5
		750	50	3.4/1.5	50	3.6/1.5	50	3.7/1.6	50	3.8/1.6	49	3.3/1.4
		775	51	3.8/1.6	50	3.3/1.4	50	3.4/1.5	50	3.5/1.5	50	3.7/1.5

* For 135-20 sizes only, input is 19,000 Btuh for high fire. Deduct 0.1-in. from manifold pressure shown in table. Change orifice size if manifold pressure falls below 3.2-in.wc.

e. Turn off all other gas appliances and pilots.

f. Move setup switch SW-2 to ON position. (See Fig. 12.) This keeps furnace locked in low-heat operation.

g. Jumper R to W/W1.

h. Let furnace run for 3 minutes in low-heat operation.

i. Measure time (in sec) for gas meter to complete 1 revolution. Note reading.

j. Refer to Table 10 for cubic ft of gas per hr.

k. Multiply gas rate cu ft/hr by heating value (Btu/cu ft).

l. Move setup switch SW-2 to OFF position and jumper R and W2 thermostat connections. (See Fig. 12.) This keeps furnace locked in high-heat operation. Repeat items h through k for high-heat operation.

EXAMPLE: (High-heat operation at 0—2000 ft altitude)
Furnace input from rating plate is 85,000 Btuh
Btu heating input = Btu/cu ft X cu ft/hr
Heating value of gas = 1050 Btu/cu ft
Time for 1 revolution of 2-cu ft dial = 92 sec
Gas rate = 80 cu ft/hr (from Table 10)
Btu heating input = 80 X 1050 = 84,000 Btuh In this example, the orifice size and manifold pressure adjustment is within ±2 percent of the furnace input rate.

NOTE: Measured gas inputs (high heat and low heat) must be within ±2 percent of that stated on furnace rating plate when installed at sea level or derated per that stated above when installed at higher altitudes.

m. Remove jumper across R, W/W1, and W2 thermostat connections to terminate call for heat.

5. Set temperature rise.

Place SW-2 in ON position. Jumper R to W/W1 and W2 to check high-gas-heat temperature rise. To check low-gas-heat temperature rise, remove jumper to W2. Determine air temperature rise for both high and low fire. Do not exceed temperature rise ranges specified on unit rating plate for high and low fire.

a. Place duct thermometers in return and supply ducts as near furnace as possible. Be sure thermometers do not see heat exchangers so that radiant heat will not affect thermometer readings. This is particularly important with straight run ducts.

b. When thermometer readings stabilize, subtract return-air temperature from supply-air temperature to determine temperature rise.

NOTE: If the temperature rise is outside this range, first check:

(1.) Gas input for low- and high-fire operation.

(2.) Derate for altitude if applicable.

(3.) Return and supply ducts for excessive restrictions causing static pressures greater than 0.50-in. wc.

c. Adjust air temperature rise by adjusting blower speed. Increase blower speed to reduce temperature rise. Decrease blower speed to increase temperature rise. For high fire, speed selection can be med-high, med (5-speed blowers only), or med-low (factory setting). For low fire, speed selection can be low (factory setting), med-low, or med (5-speed blowers only).

Table 10—Gas Rate (Cu Ft/Hr)

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

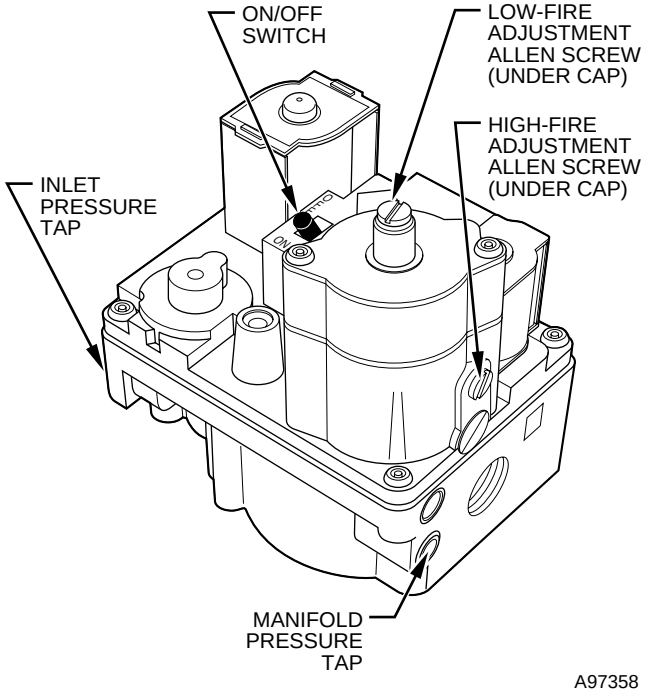

Fig. 14—Redundant Automatic Gas Control Valve

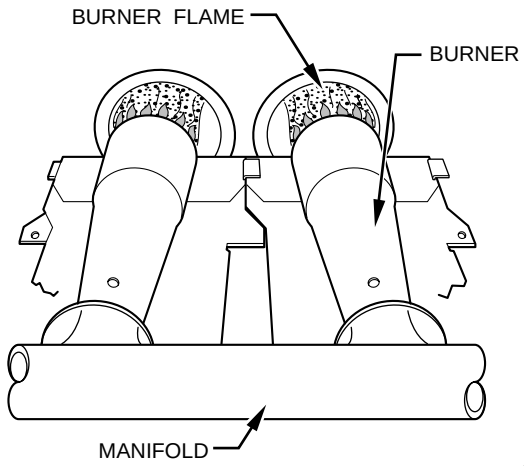

Fig. 15—Burner Flame

⚠ WARNING

Disconnect the electrical power before changing the speed tap (or removing motor lead cap, if used, on 5-speed motors). A failure to follow this warning can cause personal injury.

NOTE: For units with 5-speed motors, make sure the unused speed tap is either capped or placed on SPARE terminal on control board before power is restored.

d. To change motor speed selection for high heat, remove blower motor lead from control HIGH-GAS-HEAT terminal. (See Fig. 10 and 12.) Select desired blower motor speed lead from 1 of the other terminals and relocate it to the HIGH-GAS-HEAT terminal. (See Table 11 for lead color identification.) Reconnect original lead to the SPARE terminal (or use insulating cap, if used, in furnaces using 5-speed blower motors). Follow this procedure for proper selection of cool and low-gas-heat speed selection.

Table 11—Speed Selection

COLOR	SPEED	AS SHIPPED
White	Common	COM
Black	High	Cool
Yellow	Med-High	SPARE
Orange†	Med	SPARE or Capped
Blue	Med-Low	High-Gas Heat
Red	Low*	Low-Gas Heat

* Continuous blower speed
† Available on 5-speed blowers only.

⚠ CAUTION

Recheck the temperature rise. It must be within the limits specified on the unit rating plate. Recommended operation is at midpoint of rise range or above.

6. Set thermostat heat anticipator.

a. When using a nonelectronic thermostat, the thermostat heat anticipation must be set to match the amp draw of the electrical components in the R-W/W1 circuit. Accurate amp draw readings can be obtained at the wires normally connected to thermostat subbase terminals R and W/W1. Fig. 16 illustrates an easy method of obtaining actual amp draw. The amp reading should be taken after blower motor has started and furnace is operating in low fire. To operate furnace in low fire, first move SW-2 to ON position, THEN connect ammeter wires as shown in Fig. 16. The thermostat anticipator should NOT be in this circuit while measuring current. If thermostat has no subbase, the thermostat must be disconnected from R and W/W1 wires during current measurement. Return SW-2 to final desired location after completing the reading. See thermostat manufacturer's instructions for adjusting heat anticipator.

b. When using an electronic thermostat, set cycle rate for 3 cycles per hr.

CHECK SAFETY CONTROLS

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

1. Check primary limit control.

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

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

2. Check draft safeguard switch.

   The purpose of this control is to cause safe shutdown of the furnace during certain blocked vent conditions.

   a. Disconnect power to furnace and remove vent connector from furnace flue collar. Be sure to allow time for vent connector pipe to cool down before removing.

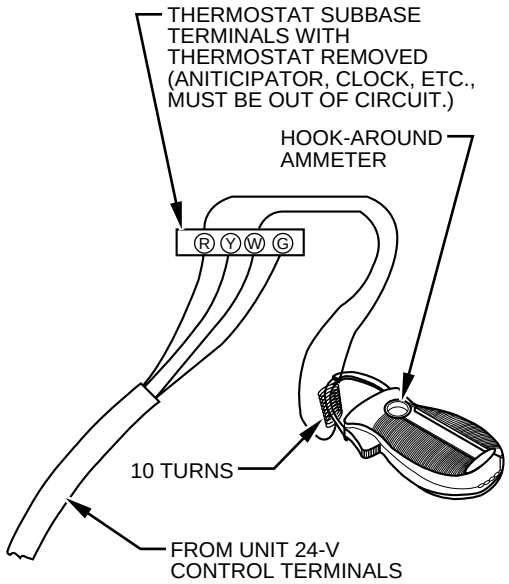

Fig. 16—Amp Draw Check With Ammeter

b. Restore power to furnace and set room thermostat above room temperature.

c. After normal start-up, allow furnace to operate for 2 minutes, then block flue outlet 100 percent. Furnace should cycle off within 2 minutes.

d. Remove blockage and reconnect vent connector to furnace flue collar.

e. Wait 5 minutes and then reset draft safeguard switch.

3. Check flow-sensing pressure switches.

This control proves operation of draft inducer blower.

a. Turn off 115-v power to furnace.

b. Remove gas control door and disconnect inducer motor lead wires from wire harness.

c. Turn on 115-v power to furnace.

d. Close thermostat switch as if making normal furnace start. If hot surface ignitor does not glow within several minutes and control flashes code 32, then flow-sensing switches are functioning properly.

e. Turn off 115-v power to furnace.

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

g. Blower will run for 90 sec before restarting furnace.

CHECKLIST

1. Put away tools and instruments, and clean up debris.
2. Check SW-1 through SW-4 after completing installation to ensure desired settings for thermostat type (SW-1 and SW-2) and blower off delay (SW-3 and SW-4).
3. Verify manual reset switches have continuity.
4. Ensure blower and gas control access doors are properly installed.
5. Cycle test furnace with room thermostat.
6. Check operation of accessories per manufacturer's instructions.
7. Review User's Manual with owner.
8. Leave literature packet near furnace.

SERVICE TRAINING

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

- Unit Familiarization
- Maintenance
- Installation Overview
- Operating Sequence

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