Carrier
HEATING & COOLING

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

Installation, Start-up, and Operating Instructions
Sizes 040-140, Series 100

NOTE: Read the entire instruction manual before starting the installation.

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, tags, and labels attached to or shipped with the unit and other safety precautions that may apply.

Follow all safety codes. In the United States, follow all safety codes including the National Fuel Gas Code NFPA No. 54-1992/ANSI Z223.1-1992. In Canada, refer to the current edition of the National Standard of Canada CAN/CGA- B149.1- and .2-M91 Natural Gas and Propane Gas Installation Codes. 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 word DANGER, WARNING, or 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 that **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.

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.

Table 1—Minimum Clearances From Combustible Materials (In.)

UNIT SIZE		040 AND 060	080	100 THRU 140
Sides	Single-Wall Vent	1	0	0
	Type B-1 Double-Wall Vent	0	0	0
	Special Gas Vents† Diameter	3	3	4
	Clearance	0	0	2*
Back		0	0	0
Plenum Top		1	1	1
Vent	Single-Wall Vent	6	6	6
	Type B-1 Double-Wall Vent	1	1	1
	Special Gas Vents† Diameter	3	3	4
	Clearance	5	5	9
Front	Single-Wall Vent	6	6	6
	Type B-1 Double-Wall Vent	3	3	3
	Special Gas Vents† Diameter	3	3	4
	Clearance	5	5	9

*May be 0 for furnaces 24 in. wide.
†Listed for Category III appliances per UL 1738 (high temperature plastic pipe rated for 480°F).

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

INTRODUCTION

The Model 58TUA, Series 100 Furnace is available in sizes 40,000 through 140,000 Btuh input capacities.

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

Before installing the furnace, refer to the current edition of the National Fuel Gas Code NFPA No. 54-1992/ANSI Z223.1-1992. Canadian installations must be installed in accordance with CAN/CGA-B149 Installation Codes and all authorities having jurisdiction. For further information, the National Fuel Gas Code is available from National Fire Protection Association Inc. Batterymarch Park, Quincy, MA 02269, American Gas Association, 1515 Wilson Boulevard, Arlington, VA 22209, or from Literature Distribution.

Installation must conform to the regulations of the serving gas supplier and the local building, heating, and plumbing codes in effect in the area in which the installation is made, or in the absence of local codes, with the requirements of the National Fuel Gas Code.

⚠ CAUTION

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

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

To aid in installation, trouble shooting, 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 sightglass on the door.

⚠ 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 for conventional Category I (negative pressure) vertical vents at or above 5500 ft above sea level. For Category III vertical or horizontal high temperature plastic Special Gas Vents, the kit must be installed at or above altitudes of 4000 ft above sea level.

For accessory installation details, refer to the applicable instruction literature.

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

Step 1—LOCATION

GENERAL

⚠ CAUTION

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

⚠ CAUTION

Do not use this furnace during construction when adhesives, sealers, and/or new carpets are being installed. If the furnace is required during construction, use clean outside air for combustion and ventilation. Compounds of chlorine and fluorine, when burned in combustion air, form acids which will cause corrosion of the heat exchangers and metal vent systems. 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.

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

Locate the furnace as near the center of the air distribution system as possible. The furnace should be installed as level as possible.

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.

When venting vertically with Category I vent materials, locate furnace close to the chimney or vent.

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

LOCATION WITH RESPECT TO COOLING EQUIPMENT

The cooling coil must be installed parallel with, or on the downstream side of, the furnace to avoid condensation in the 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 the furnace. If the dampers are manually operated, they must be equipped with means to prevent operation of either unit unless the damper is in the full-heat or full-cool position.

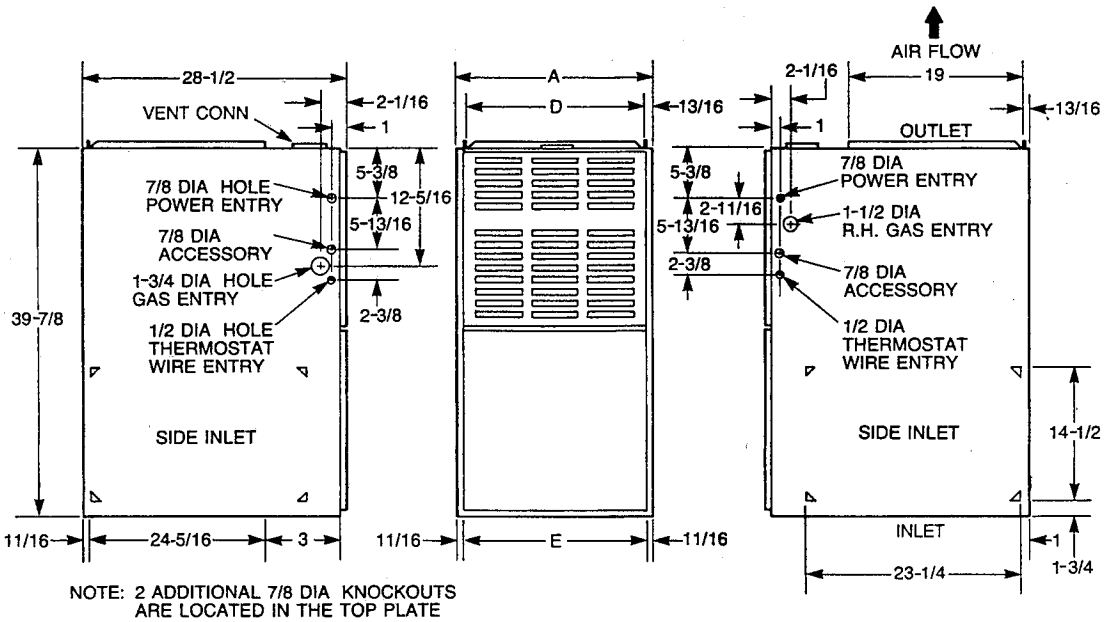
HAZARDOUS LOCATIONS

When the furnace is installed in a residential garage, it must be installed so that the burners and ignition source are located at least 18 in. above the floor. Also, the furnace should be protected from physical damage by vehicles. When a furnace is installed in public garages, airplane hangars, or other buildings having hazardous atmospheres, the unit must be installed in accordance with the recommended good practice requirements of the 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 National Fuel Gas Code, ANSI Z223.1-1992, or applicable provisions of the local building codes.

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



NOTE: 2 ADDITIONAL 7/8 DIA KNOCKOUTS ARE LOCATED IN THE TOP PLATE

NOTE: AIR DELIVERY ABOVE 1800 CFM REQUIRES THAT BOTH SIDES OF FURNACE BE USED, OR A COMBINATION OF 1 SIDE AND BOTTOM, OR BOTTOM ONLY FOR RETURN AIR.

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Fig. 1—Dimensional Drawing

Table 2—Dimensions (In.)

UNIT SIZE	A	D	E	VENT CONN	SHIP. WT
040-08	14-3/16	12-9/16	12-11/16	4	122
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
140-20	24-1/2	22-7/8	23	5	204

⚠ CAUTION

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

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

⚠ CAUTION

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

Combustion air requirements are determined by whether the furnace is in an UNCONFINED or CONFINED space. A confined space is one whose volume is less than 50 cubic ft per 1000 Btuh of the total input rating for all appliances installed in that space.

UNCONFINED SPACE

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

For Example:

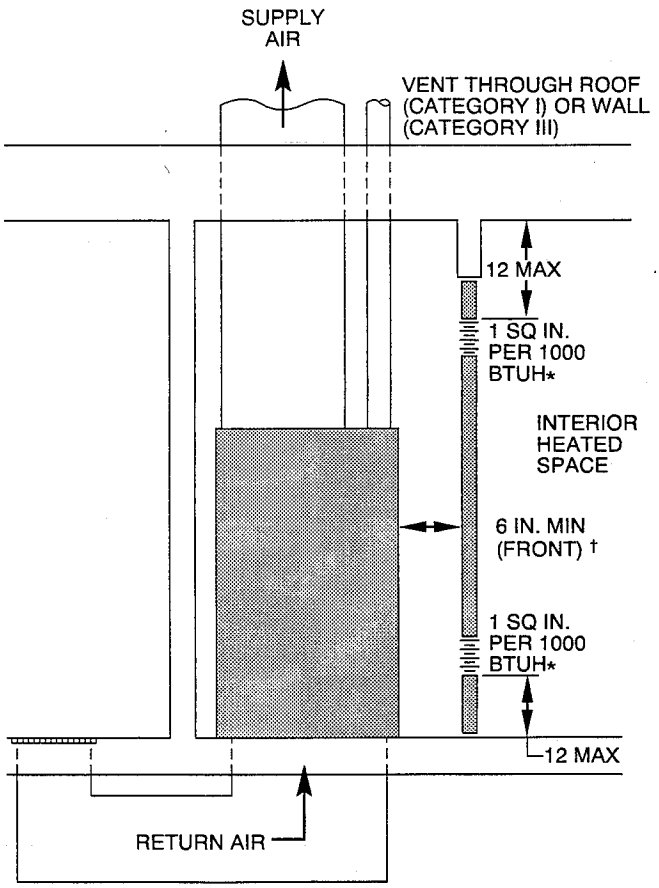
58TUA FURNACE HIGH FIRE INPUT BTUH	MINIMUM SQ FT WITH 7-1/2 FT CEILING
40,000	267
60,000	400
80,000	534
100,000	667
120,000	800
140,000	934

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 MUST have 2 permanent openings, 1 within 12 in. of the ceiling, and the other within 12 in. of the floor. (See Fig. 2.)

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



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

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

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Fig. 2—Air For Combustion and Ventilation (Inside Air)

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

1. All air from inside the structure

   Each opening MUST have at least 1 square in. of free area per 1000 Btuh of the total input for all equipment within the confined space, but not less than 100 square in. per opening. (See Fig. 2.) The minimum dimension of air openings shall be not less than 3 in.
   For Example:

58TUA FURNACE HIGH FIRE INPUT BTUH	FREE AREA OPENING (SQUARE IN.)
40,000	100
60,000	100
80,000	100
100,000	100
120,000	120
140,000	140

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

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

2. All air from outdoors

   a. If combustion air is taken from outdoors through vertical ducts, the openings and ducts MUST have at least 1 square in. of free area per 4000 Btuh of the total input for all equipment within the confined space. (See Fig. 3.)
   For Example:

58TUA FURNACE HIGH FIRE INPUT BTUH	FREE AREA PER OPENING (SQUARE IN.)	ROUND PIPE (IN. DIA)
40,000	10.0	4
60,000	15.0	5
80,000	20.0	6
100,000	25.0	6
120,000	30.0	7
140,000	35.0	7

   b. If combustion air is taken from the outdoors through horizontal ducts, the openings and ducts MUST have at least 1 square in. of free area per 2000 Btuh of the total input for all equipment within the confined space. (See Fig. 3)
   For Example:

58TUA FURNACE HIGH FIRE INPUT BTUH	FREE AREA PER OPENING (SQUARE IN.)	ROUND PIPE (IN. DIA)
40,000	20.0	6
60,000	30.0	7
80,000	40.0	8
100,000	50.0	8
120,000	60.0	9
140,000	70.0	10

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

⚠ WARNING

Do not install the furnace on its back or sides. Safety control operation will be adversely affected. Never connect return-air ducts to the back of the furnace. A failure to follow this warning can cause a fire, personal injury, or death.

Step 3—FILTER ARRANGEMENT

The factory-supplied filter(s) is shipped in the blower compartment. Determine location for the filter and move filter retaining hardware, if necessary, before attaching the return-air duct. After the return-air duct has been connected to the furnace, install the filter(s) inside the furnace blower compartment. See Fig. 4 for side return application and Fig. 5 for bottom return application.

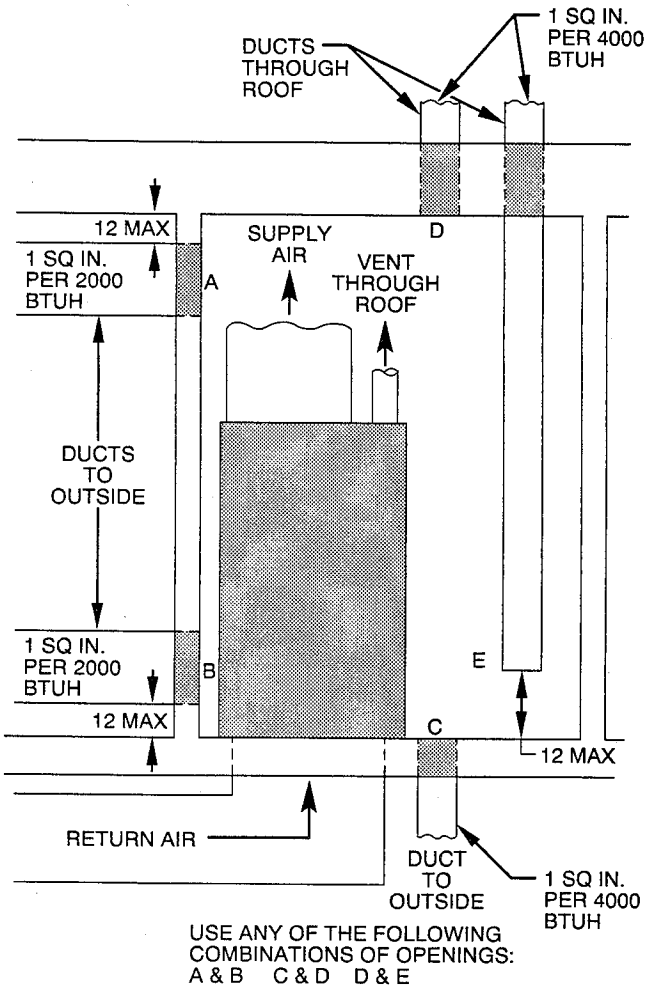

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Fig. 3—Air For Combustion and Ventilation (Outside Air)

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

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. 4.)

For bottom return applications, remove the brackets (front and back) 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 the bottom front plate as shown in Fig. 5, once the bottom enclosure has been removed. Rotate filter supports 180° so filter will rest on support, and

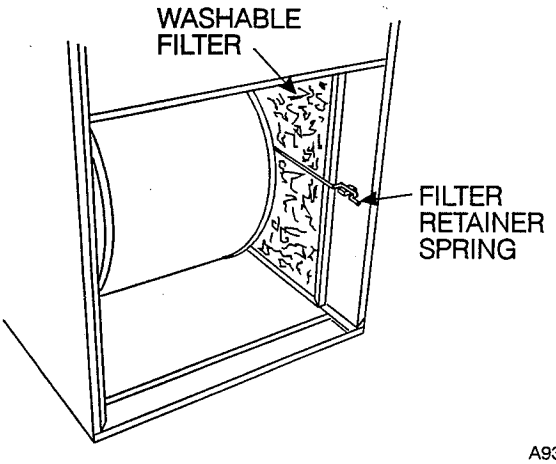

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Fig. 4—Side Filter Arrangement

reinstall. (Do not reinstall in 17-1/2 in. casing.) Install the filter retaining rod (small U-shaped end) in the rear bracket, and the front of the filter retainer rod as shown in Fig. 5. 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.

NOTE: Furnaces with a 17-1/2 in. wide casing require an additional procedure when locating the 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 the filter as shown in Fig. 5. Drive 2 screws through the casing side and into the filler strip to secure it in place. Filter is to rest on top of the filler strip when installed.

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	(2) 16 X 25 X 1†	(1) 24 X 25 X 1	Cleanable

*Filters can be field-modified by cutting the frame as marked and folding to the desired size. Alternate sizes can be ordered from your distributor or dealer.
†Factory provided with the furnace.

⚠ 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.

Step 4—LEVELING LEGS (If Required)

When the furnace is used with side inlet(s) and leveling legs are required, refer to Fig. 6 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. 6.
2. Install nut on bolt and install bolt and nut in hole. (Install flat washer if desired.)
3. Install another nut on other side of furnace base. (Install flat washer if desired.)
4. Adjust outside nut to provide desired height, and tighten inside nut to secure arrangement.

Step 5—GAS PIPING

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

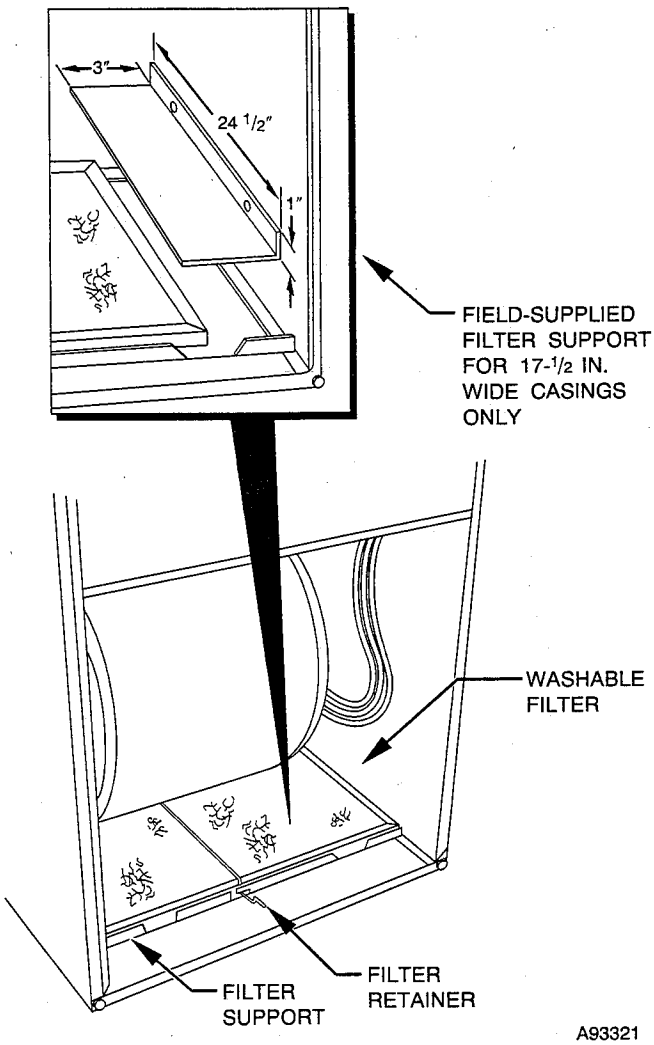

Fig. 5—Bottom Filter Arrangement

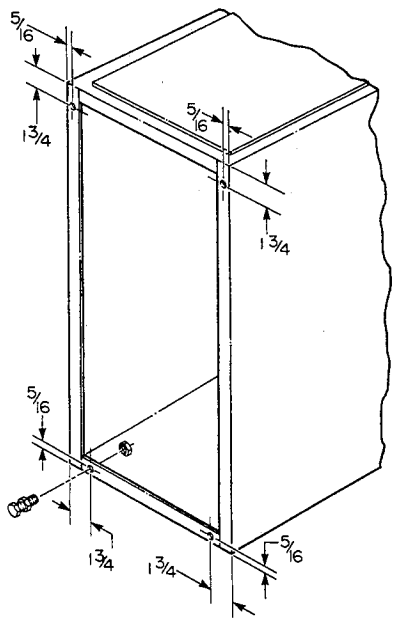

Fig. 6—Leveling Leg Installation

Canadian installations must be installed in accordance with CAN/CGA-B149 Installation Codes, 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 the recommended gas pipe size. Risers must be used to connect to the furnace and the 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 pressure drop of 0.5-in. wc (based on a 0.60 specific gravity gas). Ref: Table 10-2, NFPA 54-1992.

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

Install a sediment trap in the riser leading to the furnace. The trap can be installed by connecting a tee to the riser leading from the furnace. Connect a capped nipple into the lower end of the tee. The capped nipple should extend below the level of the gas controls. (See Fig. 7.)

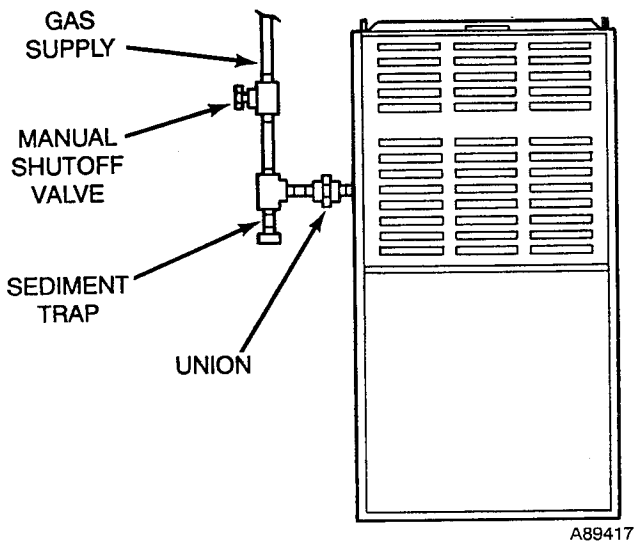

Fig. 7—Typical Gas Pipe Arrangement

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

Install an accessible manual shut-off valve upstream of the furnace gas controls and within 72 in. of the furnace. A 1/8-in. NPT plugged tapping, accessible for test gage connection, must be

Table 5—Electrical Data

UNIT SIZE	VOLTS-HERTZ-PHASE	OPERATING VOLTAGE RANGE		MAX UNIT AMPS	MIN WIRE GAGE	MAX WIRE LENGTH (FT)‡	MAX FUSE OR HACR-TYPE CKT BKR AMPS†
		Max*	Min*				
040-08	115—60—1	127	104	6.1	14	45	15
040-12	115—60—1	127	104	8.5	14	33	15
060-08	115—60—1	127	104	6.1	14	46	15
060-12	115—60—1	127	104	8.9	14	32	15
080-14	115—60—1	127	104	9.2	14	31	15
080-16	115—60—1	127	104	10.6	14	27	15
100-12	115—60—1	127	104	8.2	14	34	15
100-16	115—60—1	127	104	10.3	14	27	15
100-20	115—60—1	127	104	14.6	12	30	20
120-16	115—60—1	127	104	10.3	14	27	15
120-20	115—60—1	127	104	13.5	12	33	20
140-20	115—60—1	127	104	14.2	12	31	20

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

installed immediately upstream of the gas supply connection to the furnace and downstream of the manual shut-off valve. Place ground joint union between the gas control manifold and the manual shut-off valve.

⚠ WARNING

Use the proper length of pipes 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.

⚠ 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 6—ELECTRICAL CONNECTIONS

115-V WIRING

Refer to the 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 ANSI/NFPA 70-1993 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 National Electrical Code, ANSI/ NFPA 70-1993 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 auxiliary junction box can be moved to the right-hand side of the furnace when a right-side power supply is desired. Remove the 2 screws holding the auxiliary junction box. Mount the junction box on the right-hand side of the furnace. The blower door interlock switch must also be moved to the right side of the furnace due to the length of the wiring harness. (Holes have been provided in casing). When moved, tuck the wiring harness behind the 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 will flash code 02 on the status LED and prevent heating operation.

24-V WIRING

Make field 24-v connections at the 24-v terminal strip. (See Fig. 10.) Connect terminal Y as shown in Fig. 8 or 9 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 the 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 the fuse needs replacement.

ACCESSORIES

1. Electronic air cleaner (EAC)

   A terminal block (EAC-1 and EAC-2) is provided for electronic air cleaner connection. (See Fig. 10.) 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 7— VENTING

For conventional Category I vertical venting, refer to the enclosed Installations Instructions. GAMA venting table for category I furnaces, and QUIK•VENT™ table for Category I fan-assisted

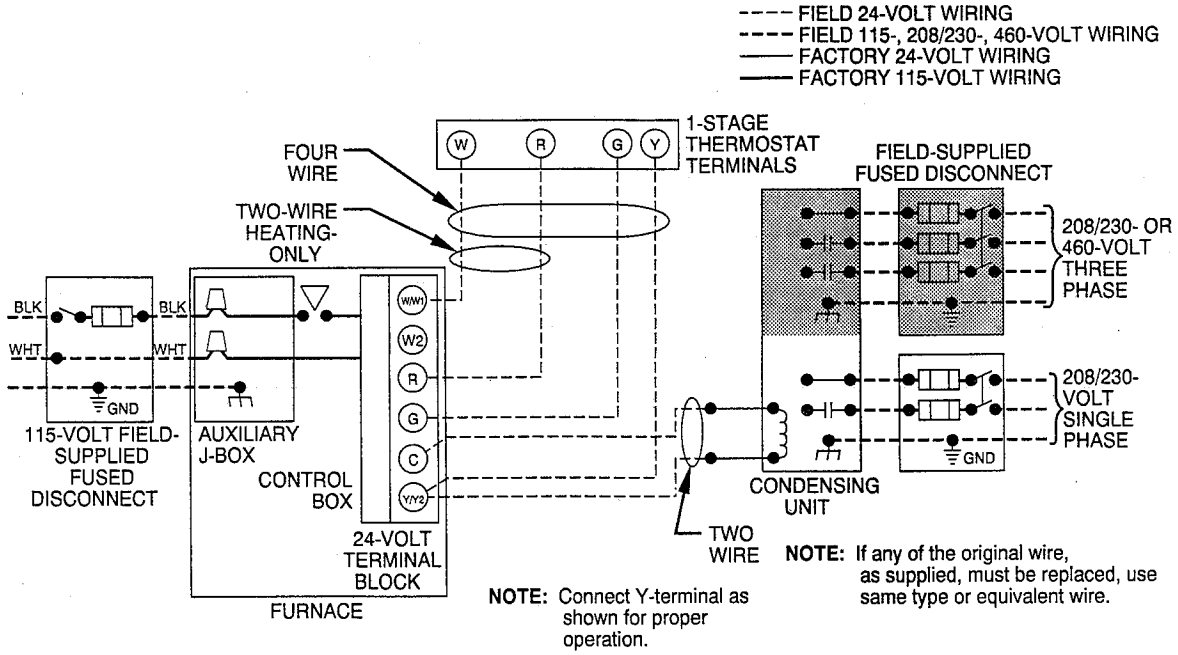

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Fig. 8—Heating and Cooling Application Wiring Diagram 1-Stage Thermostat and Condensing Unit

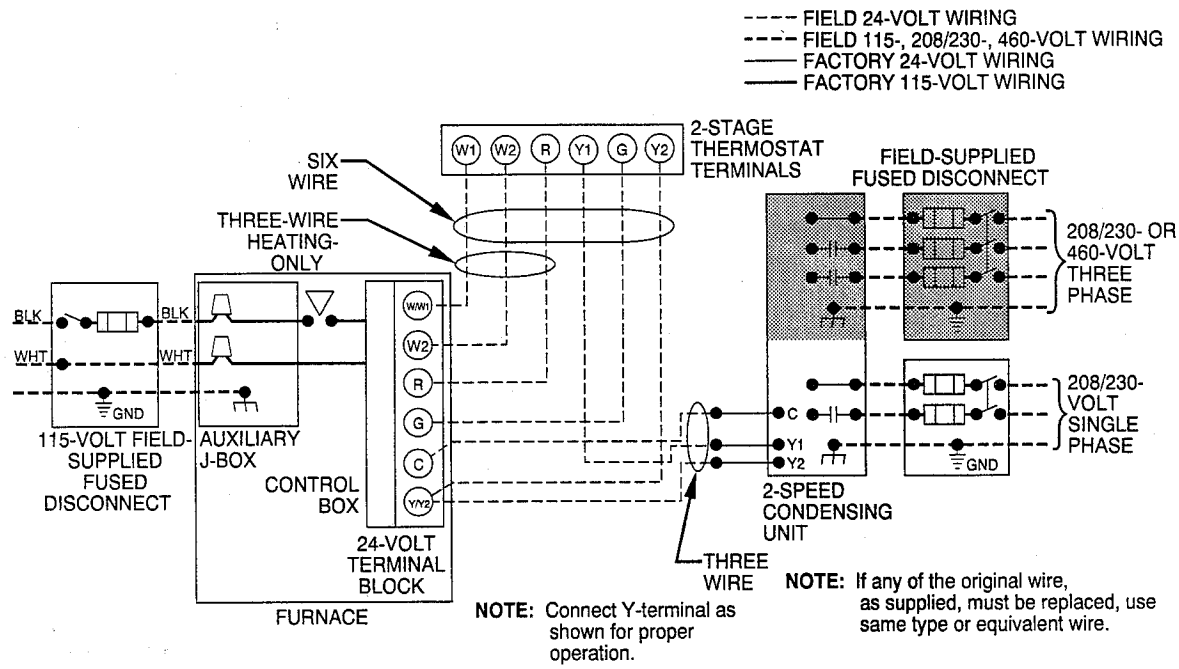

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Fig. 9—Heating and Cooling Application Wiring Diagram 2-Stage Thermostat and Condensing Unit

furnaces. The horizontal portion of the venting system shall maintain a minimum of 1/8-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.

This furnace may also be installed with a Category III vertical or horizontal (sidewall) vent system using the accessory kit listed on the vent label on the top plate of the furnace. This kit MUST be used for Category III venting. Refer to the kit instructions for detailed information about Category III venting.

⚠ WARNING

DO NOT install a Category III vent system without the accessory conversion kit. Category III vents without the accessory kit will have nuisance shutdowns on draft safeguard switch, and may cause vent and furnace component failure resulting in property damage, personal injury, or death.

Only special gas vent pipe listed per UL 1738 for Category III appliances may be used. See accessory kit instructions for allowable vent pipe and fittings part numbers.

⚠ WARNING

When this furnace is converted to Category III it must have its own dedicated vent. DO NOT common vent with any other appliance. Common venting with other appliances will result in spillage of flue gas and failure of vent system which may cause property damage, personal injury, or death.

A gastight heat dissipator, condensate drain tube and clamps, condensate trap and mounting bracket, and draft safeguard modification plate
are provided in the kit. No substitution for any of the components may be made when installing furnace with a Category III vent system.

⚠ WARNING

Table 6 lists the required vent size for furnace sizes based on high-fire input. Refer to the furnace rating plate and Table 6 to determine size of Special Gas Vent pipe. An incorrectly sized vent may cause inadequate wind resistance, poor operation, or vent failure. Vent failure may result in property damage, or flue gas spillage, resulting in personal injury or death.

Table 6—Vent Pipe Size*

HIGH-FIRE INPUT (BTUH)NORMAL POSITION	PIPE DIAMETER
40,000—84,000	3 in.
85,000—140,000	4 in.

*Only Category III conversion kit specified on furnace and pipe size listed for furnace input shall be used.

All joints in the vent system, between vent system and heat dissipator, and between heat dissipator and furnace must be sealed airtight with only the high temperature RTV specified by the special gas vent pipe manufacturer. The accessory kit contains provisions for vent condensate drainage. Drain and trap must be installed per kit instructions. Incorrect drain installations may cause furnace component failure. Furnace installations in unconditioned spaces where temperature may fall below 32°F REQUIRE freeze protection (heat tape) on condensate trap.

HIGH TEMPERATURE PLASTIC, SPECIAL GAS VENT INSTALLATION

Cutting

1. Hand cut piping with a sharp saw. Saw blade must have at least 24 teeth per in.
2. Cut pipe squarely. Use of a miter box when cutting pipe is recommended.

NOTE: DO NOT cut with power saw. Doing this may cause immediate or eventual cracking or shattering of pipe. DO NOT cut or alter fittings.

Adhesive Joining

Pipe and fittings are joined together using high temperature RTV adhesive/sealants. Use ONLY adhesives listed by vent manufacturer. Do not use any other adhesives or sealants. Do not use solvent cements.

Do not drill holes in pipe or fittings. Do not use sheet metal or other types of screws to join plastic piping or fittings. Do not use rivets to join piping or fittings.

Before applying sealant, pipe ends must be smooth and clean.

1. Apply minimum 1/4-in. bead of adhesive/sealant entirely around pipe end no more than 1/8-in. from end.
2. Push pipe and fitting together while twisting pipe into fitting.
3. Inspect joint for complete seal. Full curing of joints takes 24 hr.

⚠ WARNING

Failure to ensure complete seal of all joints between furnace, heat dissipator, vent pipes, and fittings will allow spillage of flue gas, which may result in personal injury or death.

Inspect each joint after the adhesive/sealant has cured to ensure that all joints are sealed. Reapply adhesive/sealant to any joints that are suspected of flue gas leakage.

Vent Installation

Minimum vent length is 5 ft of straight pipe, one 90° long-radius (sweep) elbow or equivalent, condensate drain assembly, and termination (coupling and bird screen).

Maximum vent length is 40 ft of straight pipe, four 90° long-radius (sweep) elbows, condensate drain assembly, and termination (coupling and bird screen).

Length and number of elbows may be adjusted according to equivalent ft of pipe for fittings shown in Table 7.

Example: If adding an additional 90° long-radius (sweep) elbow, in a 3-in. diameter vent system, maximum vent length must be reduced to 35 ft.

A coupling and bird screen are the recommended vent termination for both horizontal and vertical vents. If a tee and 2 bird screens are required for vertical vents, the allowable vent length must be adjusted according to Table 7. No elbows shall be used as terminations.

Table 7—Equivalent Pressure Drop in Length of Straight Pipe for Fittings

FITTING	EQUIVALENT FT OF PIPE	
	3-In. Diameter	4-In. Diameter
90° Elbow	10	N/A
90° Sweep Elbow (Long-Radius)	5	6
45° Elbow	5	5-1/2
Tee Used as an Elbow	10	10
Tee Used as a Termination	5	5

N/A—Not applicable

All horizontal runs of piping must slope backward towards drain tee 1/4 in. per ft. The horizontal run between the drain tee and the furnace must also slope towards the drain tee. Vent system must be supported at least every 5 ft and at every elbow on horizontal runs.

Vertical runs must be supported at least every 10 ft by supports listed by vent pipe manufacturer. Frame opening in floor using lumber which is dimensionally consistent with structural members. Framing must be level and must provide required air space clearance to pipe.

Vertical Vent Termination

Where vent passes through roof, a listed flashing and storm collar must be used to maintain required clearances and to keep weather out. Framed opening must be large enough to maintain required air clearance taking into account slope of roof. Install flashing and storm collar as directed by vent manufacturer. Vertical termination must be at least 2 ft horizontally from roof surface, at least 8 ft away from any vertical wall, and must extend above roof as required in kit instructions. Vents extending 2-1/2 ft or more above roof must be securely guyed or braced according to vent manufacturer's Installation Instructions. Terminate with a coupling and a bird screen.

Table 8—Horizontal Vent Termination Clearances

LOCATION	CLEARANCE (FT)	
	U.S.A.	Canada
Above anticipated snow depth	1	1‡
From mechanical fresh air intake	1	6
For furnaces with an input capacity less than 100,000 Btuh from any nonmechanical air supply (such as a door or window) or combustion-air opening	4 below 4 horizontally 1 above	1
For furnaces with an input capacity greater than 100,000 Btuh from any nonmechanical air supply (such as a door or window) or combustion-air opening		3
From service regulator vent, electric and gas meters and relief equipment	4*	6†
Above grade when adjacent to public walkway	7	7

*Horizontal distance.

†36 in. to electric meter.

‡18 in. above roof surface in Canada.

Horizontal Vent Termination

NOTE: Do not locate the vent termination close to shrubbery. Flue gas may stunt growth or kill shrubs. Combustion products may affect unprotected building material surfaces. Sealing or shielding of exposed surfaces with a corrosion resistant material may be required in these cases.

NOTE: In U.S.A., vent must terminate 3 ft above any mechanical fresh air intake within 10 ft.

After vent system is installed, inspect all joints and supports. If all joints are secure, fully seated, and well supported by straps, furnace may be started, adjusted per furnace Installation Instructions, and placed into operation. See vent pipe manufacture's Installation Instructions: cure time may be required before operating furnace.

Step 8—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 operation.

The gas service pressure must not exceed 0.5 PSIG (14-in. wc), but be 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. 10.)

This furnace can be installed with either a single-stage heating or a 2-stage heating thermostat. For single-stage thermostats, connect thermostat R to W/W1 at the furnace control terminal block. (See Fig. 8.) For single-stage thermostats, the control will determine, based on length of previous heating 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. 11 and Tables 9 and 10 for setup switch information.

Table 9—Blower Off Delay Setup Switch Position

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

Table 10—Setup Switch (SW) Description

SETUP SWITCH NO.	NORMAL POSITION	DESCRIPTION OF USE
SW-1 High Gas Heat	OFF	Turn switch ON to obtain 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	OFF	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 is closed.
SW-3, and SW4	ON, OFF	Switches control gas heating mode blower off delay. See Table 9.

If a 2-stage heating thermostat is to be used, move SW2 to the ON position at the end of the furnace installation. This will override the built-in control process for selecting high and low fire and allow the 2-stage thermostat to select heating modes. The W2 from the thermostat must be connected to W2 on the control terminal block. (See Fig. 9.)

⚠ 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 and reset the switch.

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

SEQUENCE OF OPERATION

Using the schematic diagram in Fig. 12, follow the sequence of operation through the different modes. Read and follow the diagram very carefully.

NOTE: If a power interruption occurs during a 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 LED red light will flash code 12 during the 90-sec period, after which the LED will be ON continuous, as long as no faults are detected. After the 90-sec

period, the furnace will respond to the thermostat normally.

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

1. Single-Stage Thermostat with 2-Stage Heating — adaptive mode. (See Fig. 8 for thermostat connections.)

NOTE: With the high heat only switch SW1 (see Fig.10) OFF, the Low-Heat-Only switch SW2 selects either the low-heat only operation mode when on, (see item 2 below) or the adaptive heating mode when OFF in response to a call for heat. When the high heat only switch (SW1) is in the ON position it will always cause high gas heat operation when the R to W circuit is closed, regardless of the setting of the low heat only switch (SW2).

This furnace can operate as a 2-stage furnace with a single-stage thermostat because the 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 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 the power is interrupted, the stored history is erased. When this happends the control CPU will select low gas heat for up to 16 minutes and then switch to high gas heat, as long as thermostat continues to call for heat. Subsequent selection is based on stored history of the thermostat cycle times.

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

a. Inducer prepurge period—As the inducer motor IDM comes up to Low-Speed or High Speed, the low heat pressure switch contacts LPS close to begin a 15 sec prepurge period.

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

c. Trial-for-ignition sequence—When the 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 the furnace control CPU selects high gas heat operation, the high heat gas valve solenoid GV is also energized after the normally-closed high heat pressure switch relay HPSR closes and after the inducer motor IDM goes to high speed and provides sufficient pressure to close the high heat pressure switch HPS. (HPSR is open while the furnace is powered in standby mode.) If the high-heat pressure switch HPS fails to close and the low heat pressure switch LPS closes, the furnace will operate at low heat gas flow rate until the high heat pressure switch closes.

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

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

e. Blower on delay—If the burner flame is proven, 45 sec after the 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 electronic air cleaner terminals EAC-1 and EAC-2 are energized and remain energized as long as the blower motor BLWM is energized.

f. Switching from low to high gas heat—If the furnace control CPU switches from low gas heat to high gas heat, the control CPU will switch the inducer motor IDM speed from low to high. The high heat pressure switch relay HPSR will close. When the 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 will switch speed for high gas heat 5 sec after the control CPU switches from low gas heat to high gas heat.

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.

g. Blower off delay—When the thermostat is satisfied, the R to W circuit is opened, de-energizing the gas valve GV, stopping gas flow to the burners, and de-energizing the humidifier terminals HUM and COM. The inducer motor IDM will remain energized for a 5 sec post-purge period. The blower motor BLWM and air cleaner terminals EAC-1 and EAC-2 will remain energized for 90, 135, 180, or 225 sec (depending on selection at blower off delay switches SW3 and SW4). The furnace control CPU is factory-set for a 135-sec blower off delay.

2. Two-Stage Thermostat and 2-Stage Heating mode (See Fig. 9 for thermostat connections).

NOTE: The low heat only switch SW2 in ON position selects the low heat only operation mode in response to closing the thermostat R to W1 circuit. When the high heat only switch SW1 is in OFF position, closing the thermostat R to W1 and W2 circuits is required for high gas heat operation. When the high heat only switch SW1 is ON it will always cause high gas heat operation when the R to W1 circuit is closed, regardless of the setting of the low heat only switch SW2 and regardless of whether the R to W2 circuit is closed or open.

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

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

a. Switching from low to high gas heat—If the thermostat R to W1 circuit for low gas heat is closed and the R to W2 circuit for high gas heat closes, the control CPU will switch the inducer motor IDM speed from low to high. The high heat pressure switch relay HPSR will close. When the 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 will switch speed for high gas heat 5 sec after the R to W2 circuit closes.

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

3. Cooling Mode

a. Single-Speed cooling outdoor unit.

See Figure 8 for thermostat connections.

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

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

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

b. Two-Speed cooling outdoor unit

See Figure 9 for thermostat connections.

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

NOTE: 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 Y2 (for high cooling speed).

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

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

4. Continuous-blower mode

a. When the R to G circuit is closed by the thermostat, the blower motor BLWM will operate on low gas heat speed (identical to low cooling speed. Terminals EAC-1 and EAC-2 are energized as long as the blower motor BLWM is energized.

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

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

(1.) When the thermostat "calls for Low-Cooling", the blower motor BLWM will continue to operate on low gas heat speed. When the thermostat is satisfied, the blower motor BLWM will continue on continuous blower speed.

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

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

5. Heat Pump

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 circuit to start the furnace blower motor BLWM on high cooling speed. The Y input to the furnace control is necessary to provide adequate cooling airflow.

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

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

b. Two-speed heat pump cooling

(1.) The thermostat closes the R to G circuits for low cooling or closes the R to G-and-Y2 circuits for high cooling. The thermostat R to G circuit starts the furnace blower motor BLWM on low cooling speed. The thermostat R to G-and-Y2 circuits start the furnace blower motor BLWM on high cooling speed.

(2.) The furnace control CPU controls blower motor BLWM speed by sensing only G for low cooling speed and Y2 for high cooling speed.

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

(4.) When the thermostat is satisfied, the furnace blower motor BLWM will continue operating on the 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 circuits start the furnace blower motor BLWM on heat pump high heat speed (identical to high cooling speed).

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

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

d. Two-speed heat pump heating

(1.) The thermostat closes the R to G circuit for low heating and starts the furnace blower motor BLWM on heat pump low heat speed (identical to low cooling speed). Closing the R-to-Y2 circuit to the furnace will provide 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 electronic air cleaner terminals EAC-1 and EAC-2 are energized with 115v when the blower motor BLWM is operating on either heating speed.

(3.) When the thermostat is satisfied, the R to G or R to G-and-Y2 circuits are opened. After opening the R to G-and Y2 circuit, the furnace blower motor BLWM will continue operating on the heating speed for an additional 90 sec.

(4.) Opening only the R to Y2 circuit will reduce the blower motor BLWM speed to heat pump low heat speed.

6. Defrost

a. When the furnace control R to W/W1-and-Y/Y2 circuits are closed, the furnace control CPU will continue blower motor BLWM operation at the heat pump heating speed until the end of the purge period, then shut 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 the blower off time to 22 sec during the HSI ignitor on period. After 17 sec of the 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 to W/W1 circuit is opened, the furnace control CPU will begin the normal inducer post purge period and the blower motor BLWM will remain on for the blower off delay period. If the R to G circuit remains closed, the blower motor BLWM will revert 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. 10 for terminal locations.)

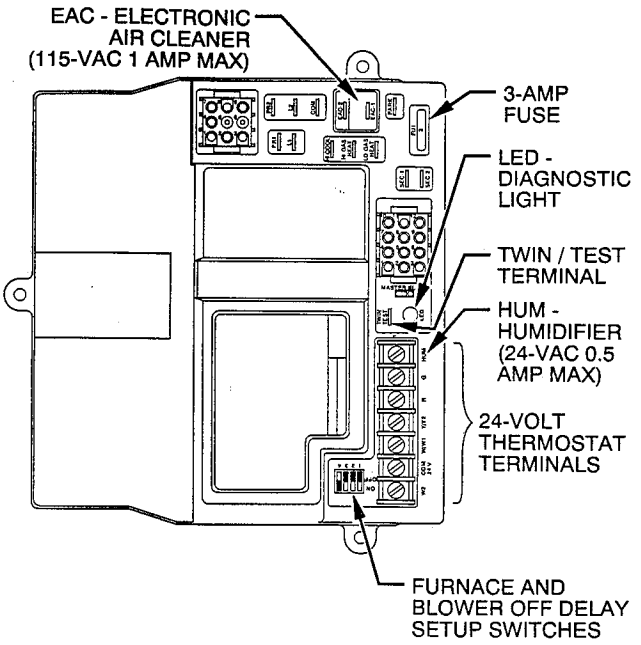

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Fig. 10—Control Center

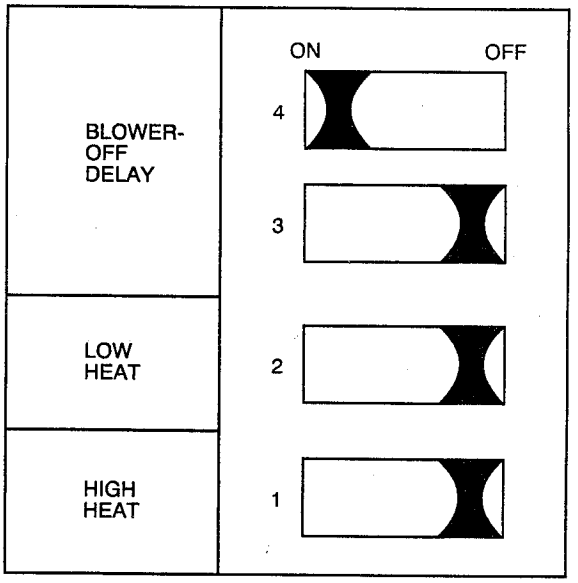

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Fig. 11—Setup Switches on Control Center (Factory Settings)

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 turns off.

b. The hot surface ignitor is energized for 15 sec, then turns off.

c. The blower motor operates on low gas heat/heat pump low heat/low cooling/continuous fan speed for 7 sec.

d. The blower motor operates on high gas heat for 7 sec.

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

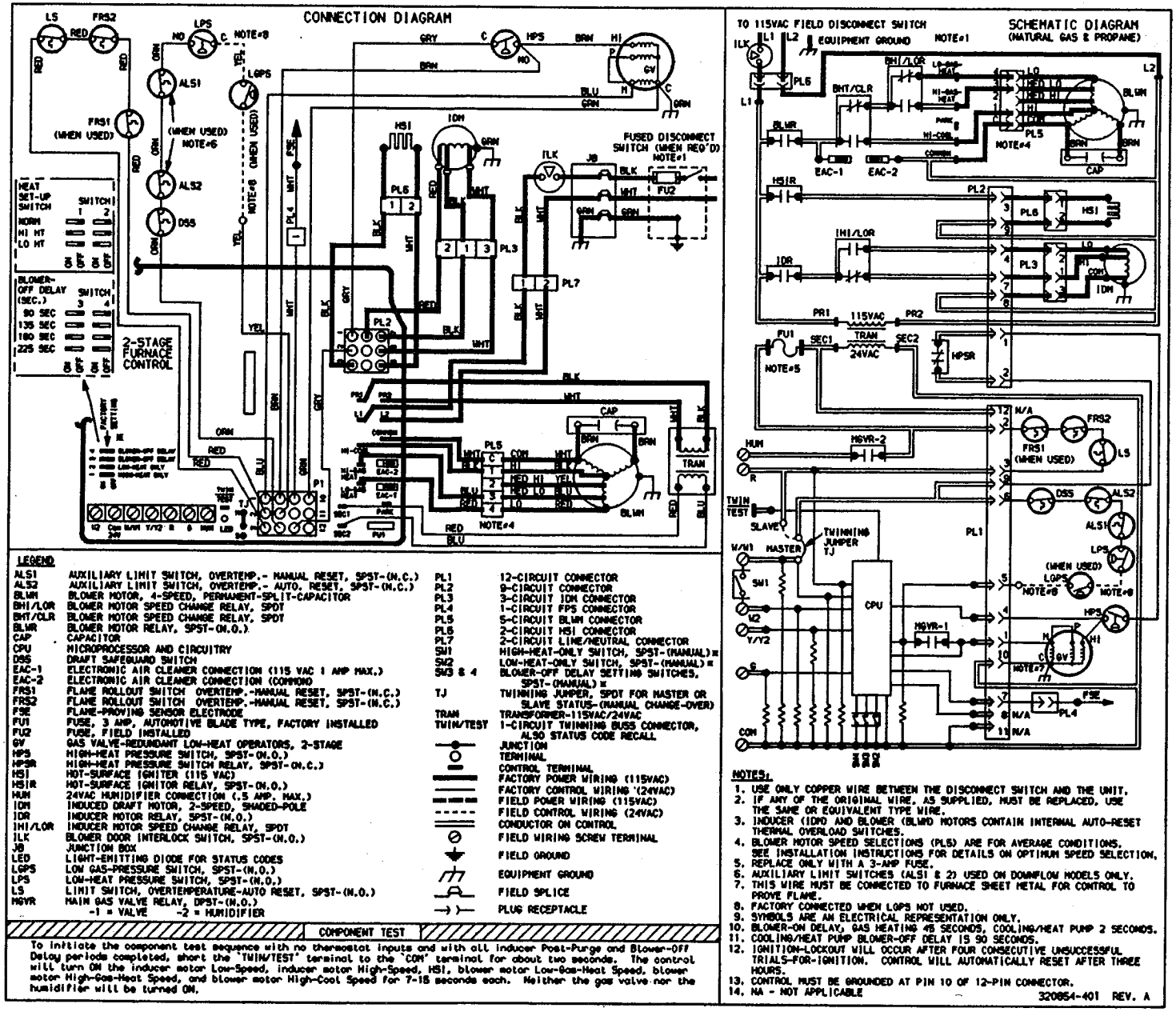

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Fig. 12—Unit Wiring Diagram

Table 11—Model 58TUA Orifice Size and Manifold Pressure for Correct Input Rate (Tabulated Data Based on Altitude Up to 2000 ft and 20,000 Btuh High Heat/13,000 Btuh Low Heat Per Burner)

GAS HEAT VALUE (BTU/CU FT)	SPECIFIC GRAVITY OF NATURAL GAS															
	0.58		0.60		0.62		0.64		0.66		0.68		0.70		0.72	
	Orf No.	Heat High/Low	Orf No.	Heat High/Low	Orf No.	Heat High/Low	Orf No.	Heat High/Low	Orf No.	Heat High/Low	Orf No.	Heat High/Low	Orf No.	Heat High/Low	Orf No.	Heat High/Low
860	43	3.7/1.6	43	3.8/1.6	42	3.2/1.4	42	3.3/1.4	42	3.4/1.5	41 42	3.2/1.4 3.6/1.5	41 42	3.3/1.4 3.7/1.5	41 42	3.4/1.4 3.8/1.6
875	43	3.6/1.5	43	3.7/1.6	43	3.8/1.6	42	3.2/1.4	42	3.3/1.4	42	3.4/1.4	41 42	3.2/1.3 3.5/1.5	41 42	3.3/1.4 3.6/1.5
890	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	42	3.3/1.4	42	3.4/1.4	41 42	3.2/1.3 3.5/1.5
905	43 44	3.3/1.3 3.7/1.5	43	3.5/1.4	43	3.6/1.5	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
920	43 44	3.2/1.3 3.7/1.5	43 44	3.3/1.4 3.8/1.6	43	3.5/1.4	43	3.6/1.5	43	3.7/1.5	43	3.8/1.5	42	3.2/1.3	42	3.3/1.3
935	44	3.6/1.5	43 44	3.2/1.4 3.7/1.6	43 44	3.3/1.4 3.8/1.6	43	3.5/1.5	43	3.6/1.5	43	3.7/1.5	43	3.8/1.6	42	3.2/1.3
950	44	3.5/1.5	44	3.6/1.5	43 44	3.2/1.4 3.7/1.6	43 44	3.3/1.4 3.8/1.6	43	3.4/1.5	43	3.6/1.5	43	3.7/1.5	43	3.8/1.6
965	44	3.4/1.4	44	3.5/1.5	44	3.6/1.5	43 44	3.2/1.4 3.7/1.6	43 44	3.3/1.4 3.8/1.6	43	3.4/1.5	43	3.5/1.5	43	3.6/1.5
980	44	3.3/1.4	44	3.4/1.4	44	3.5/1.5	44	3.6/1.5	43 44	3.2/1.4 3.7/1.6	43 44	3.3/1.4 3.8/1.6	43	3.4/1.5	43	3.5/1.5
995	44 45	3.2/1.3 3.8/1.6	44	3.3/1.4	44	3.4/1.4	44	3.5/1.5	44	3.6/1.5	43 44	3.2/1.4 3.7/1.6	43 44	3.3/1.4 3.8/1.6	43	3.4/1.4
1010	45	3.7/1.6	44 45	3.2/1.3 3.8/1.6	44	3.3/1.4	44	3.4/1.4	44	3.5/1.5	44	3.6/1.5	43 44	3.2/1.4 3.7/1.6	43 44	3.3/1.4 3.8/1.6
1025	45 46	3.6/1.5 3.8/1.6	45	3.7/1.6	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	43 44	3.2/1.4 3.7/1.6
1040	45 46	3.5/1.5 3.7/1.6	45 46	3.6/1.5 3.8/1.6	45	3.7/1.6	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
1055	45 46	3.4/1.4 3.6/1.5	45 46	3.5/1.5 3.7/1.6	45 46	3.6/1.5 3.8/1.6	45	3.8/1.6	44	3.2/1.3	44	3.3/1.4	44	3.4/1.4	44	3.5/1.5
1070	45 46	3.3/1.4 3.5/1.5	45 46	3.4/1.4 3.6/1.5	45 46	3.5/1.5 3.7/1.6	45 46	3.7/1.5 3.8/1.6	45	3.8/1.6	44	3.2/1.4	44	3.3/1.4	44	3.4/1.4
1085	45 46 47	3.2/1.4 3.4/1.4 3.8/1.6	45 46	3.3/1.4 3.5/1.5	45 46	3.4/1.5 3.6/1.5	45 46	3.6/1.5 3.7/1.6	45	3.7/1.5	45	3.8/1.6	44	3.2/1.4	44	3.3/1.4
1100	46 47	3.3/1.4 3.7/1.6	45 46	3.2/1.4 3.4/1.4	45 46	3.4/1.4 3.5/1.5	45 46	3.5/1.5 3.6/1.5	45 46	3.6/1.5 3.8/1.6	45	3.7/1.6	45	3.8/1.6	44	3.2/1.4

f. 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. Purge gas lines—After all connections have been made, purge the lines and check for leaks.

⚠ WARNING

Never purge a line into a combustion chamber. Never use matches, candles, flame or other sources of ignition for the purpose of checking leakage. Use a soap-and-water solution to check for leakage. A failure to 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.

   The gas input rate must be set for both high-fire and low-fire. Each adjustment is independently made at the gas control regulators.

There are 2 methods of adjusting the gas input rate. The preferred method is by using Table 11 and item a. The second method is by clocking the gas meter as outlined in item b.

The Procedure in item b. MUST be used for altitudes above 2000 ft.

The gas valve regulator has been nominally set at 1.5-in. wc for low fire and 3.5-in. wc for high fire for natural gas.

a. Check gas input rate using Table 11.
   (1.) Obtain average yearly heat value for local gas supply.
   (2.) Obtain average yearly specific gravity for local gas supply.
   (3.) Verify furnace model. Table 11 can only be used for Model 58TUA Furnaces.
   (4.) Check and verify orifice size in furnace. NEVER ASSUME THE ORIFICE SIZE. ALWAYS CHECK AND VERIFY.
   (5.) Find natural gas heat value and specific gravity in Table 11.
   (6.) Follow heat value and specific gravity lines to point of intersection. Find orifice size and manifold pressure settings for proper operation at given natural gas conditions on low and high fire.

EXAMPLE:
Heat value 1040
Btu/cu ft specific gravity 0.62
Therefore; Orifice No. 45* with manifold pressure 3.7-in. wc on high fire and 1.6-in. wc on low fire. * The furnace is shipped with No. 44 orifices. Therefore, in this example all main burner orifices must be changed and manifold pressure must be adjusted.

(7.) Proceed to item c. to adjust manifold pressure.

Table 12—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	100	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				

b. Check gas input rate by clocking gas meter for low and high fire.

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

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

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

(3.) Turn off all other gas appliances and pilots.

(4.) Turn SW2 to ON. Close R to W/W1 and jumper R to W2 to start furnace in high fire and let run for 3 minutes.

(5.) Measure time (in sec) for gas meter to complete 1 revolution.

(6.) Refer to Table 12 for cubic ft of gas per hour.

(7.) Multiply gas rate (cubic ft/hr) X heating value (Btu/cubic ft).

EXAMPLE:
Btu heating input=Btu/cu ft X cu ft/hr
Heating value of gas 1070 Btu/cu ft
Time for 1 revolution of 2-cu/ft dial 72 sec
Gas rate= 100 X 1070=107,000 Btuh

(8.) Measured gas input should equal low and high fire gas inputs on unit rating plate, ± 2 percent.

NOTE: High altitude—In the United States, gas input on rating plate is for altitudes up to 2000 ft. Ratings for altitudes over 2000 ft MUST be reduced 4 percent for each 1000 ft above sea level. To obtain the altitude-adjusted rating, adjust the manifold pressure, item c., and replace the main burner orifices as needed. Refer to National Fuel Gas Code Appendix F, Table F-4 for proper orifice sizing at high altitudes.

NOTE: Canadian installations only—The Canadian ratings are approved for altitudes up to 2000 ft for natural and propane gases. High-altitude ratings are from 2000 ft to 4500 ft above sea level. High-altitude rating includes a 10 percent derate as required by Canadian standards.

(9.) Remove jumper R to W2 and repeat items 5 through 8 for low fire.

(10.) Proceed to item c. to adjust manifold pressure.

⚠ CAUTION

DO NOT redrill burner orifices. Improper drilling (burrs, out of round, etc.) can cause excessive burner operating noise and misdirection of burner flames. This could result in flame impingement on burners and heat exchanger surfaces, leading to potential failures.

c. Adjust gas input.

(1.) Move SW2 to the ON position (See Fig. 13.) to lock furnace in low-fire. Jumper R to W/W1 to call for low gas heat.

(2.) Remove gas control regulator adjustment seal caps. (See Fig. 13.)

(3.) Turn low-fire adjusting screw (5/64-in. hex Allen wrench) counterclockwise (out) to decrease input rate or clockwise (in) to increase rate. When adjusting input rate, DO NOT set 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.

(4.) Turn SW2 to the OFF position after low-fire adjustment.

(5.) Jumper R-to-W/W1 terminal connections on control to keep furnace in high-fire adjustment.

(6.) Turn high-fire adjusting screw (5/64-in. hex Allen wrench) counterclockwise (out) to decrease input rate or clockwise (in) to increase rate. When adjusting input rate, DO NOT set 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.

NOTE: If orifices are changed, both high fire and low fire input rates must be readjusted, with manifold pressures within ranges specified in items 3 and 6.

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

(7.) Remove jumper on R-W/W1-W2 after high-fire adjustments.

(8.) Replace gas control regulator adjustment caps.

(9.) Remove regulator adjustment seal cap. (See Fig. 13.)

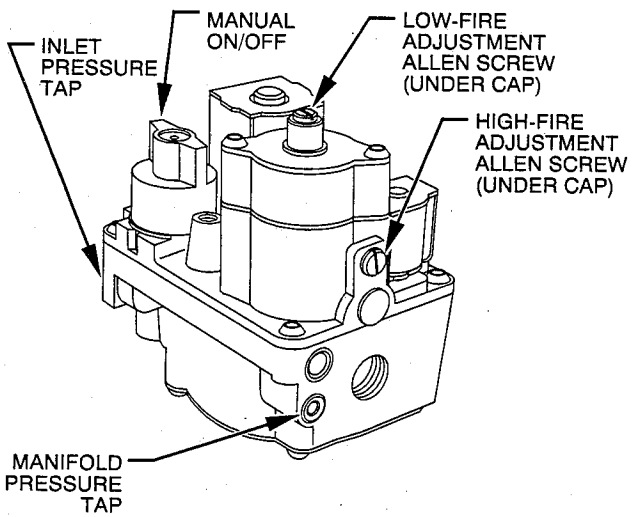
(10.) Turn adjusting screw counterclockwise to decrease input. Turn screw clockwise to increase input. DO NOT set manifold pressure less than 3.2 or more than 3.8-in. maximum wc for natural gas. Make any major adjustments by changing main burner orifices.

(11.) When correct input is obtained, replace regulator seal cap. Main burner flame should be clear blue, almost transparent. (See Fig. 14.)

2. Set temperature rise.

Place SW2 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 the temperature rise ranges specified on the 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.



A93376

Fig. 13—Redundant Automatic Gas Control Valve

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 tap selection can be 2 or 3 (factory settings). For low fire, speed tap selection can be 4, (factory setting) or 3 if high fire speed selection is 2.

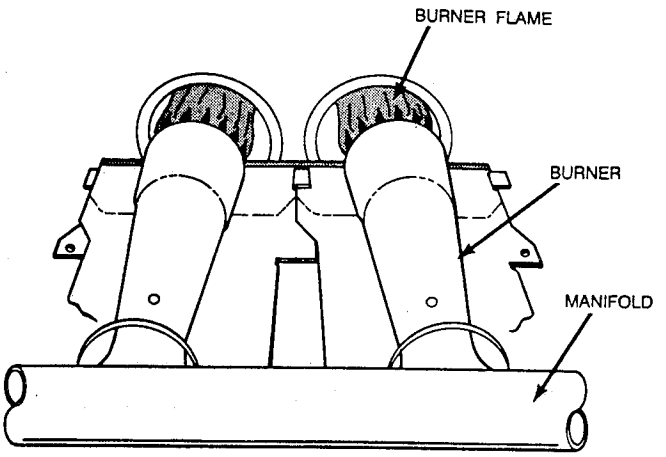


Fig. 14—Burner Flame A89020

⚠ WARNING

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

d. To change motor speed taps, remove the motor tap lead and relocate it on the desired terminal on the plug-in terminal block/speed selector located on the blower housing. (See Table 13.)

Table 13—Speed Selector

SPEED	TAP NO.*
Common	C
High	1
Med-High	2
Med-Low	3
Low	4

* White wire from control box to common; black wire from control box to high cooling speed selection; blue wire from control to high heating speed selection; and red wire from control to low heating/low cooling/continuous fan speed selection.

⚠ CAUTION

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

3. Set thermostat heat anticipator.

The thermostat heat anticipation must be set to match the amp draw of the electrical components in the R-W/W1 circuit. Accurate amp draw readings can be obtained at thermostat subbase terminals R and W. Fig. 15 illustrates an easy method of obtaining the actual amp draw. The amp reading should be taken after the blower motor has started and the furnace is operating in low fire. To operate the furnace in low fire, first move SW2 to ON position, THEN close R-W/W1, with ammeter leads connected across thermostat subbase R-W/W1. Return SW2 to final desired location after completing the reading.

NOTE: When using an electronic thermostat, set the 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 the furnace overheats.

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

2. Check draft safeguard switch. (Category I vent installation.)

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

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

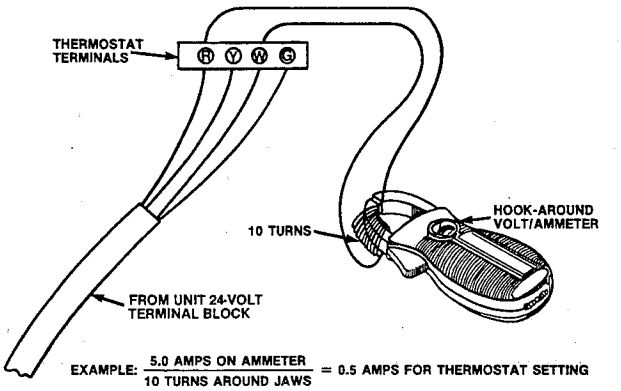


Fig. 15—Amp Draw Check With Ammeter

   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 pipe to furnace outlet collar.

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

3. Check flow-sensing switch.

   This control proves operation of draft inducer blower.

   a. Turn off 115-v power to furnace.

   b. Remove 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 the hot surface ignitor does not glow within several minutes and control flashes code 32, then the flow-sensing switch is functioning properly.

   e. Turn off 115-v power to furnace.

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

CHECK LIST

1. Put away tools, instruments, and clean up debris.
2. Check SW1 through SW4 after completing installation to ensure desired settings for thermostat type (SW1 and SW2) and blower off delay (SW3 and SW4).
3. Verify manual reset switches have continuity.
4. Ensure blower and 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.