

INSTALLATION INSTRUCTIONS

FOR (-)GFD UPFLOW, (-)GGD DOWNFLOW, & (-)GJD DEDICATED HORIZONTAL HIGH EFFICIENCY MODULATING CONDENSING GAS FURNACES

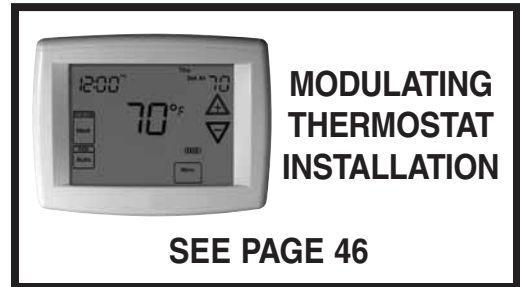
(-)GFD



(-)GJD



(-)GGD



RECOGNIZE THIS SYMBOL AS AN INDICATION OF IMPORTANT SAFETY INFORMATION!

▲ WARNING

IF THE INFORMATION IN THESE INSTRUCTIONS IS NOT FOLLOWED EXACTLY, A FIRE OR EXPLOSION MAY RESULT, CAUSING PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.

▲ WARNING

THESE INSTRUCTIONS ARE INTENDED AS AN AID TO QUALIFIED SERVICE PERSONNEL FOR PROPER INSTALLATION, ADJUSTMENT AND OPERATION OF THIS UNIT. READ THESE INSTRUCTIONS THOROUGHLY BEFORE ATTEMPTING INSTALLATION OR OPERATION. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN IMPROPER INSTALLATION, ADJUSTMENT, SERVICE OR MAINTENANCE, POSSIBLY RESULTING IN FIRE, ELECTRICAL SHOCK, CARBON MONOXIDE POISONING, EXPLOSION, PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.

▲ WARNING

PROPOSITION 65 WARNING: THIS PRODUCT CONTAINS CHEMICALS KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER, BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

▲ WARNING

- Do not store or use gasoline or other flammable vapors and liquids, or other combustible materials in the vicinity of this or any other appliance.
- WHAT TO DO IF YOU SMELL GAS
 - Do not try to light any appliance.
 - Do not touch any electrical switch; do not use any phone in your building.
 - Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
 - If you cannot reach your gas supplier, call the fire department.
 - Do not return to your home until authorized by the gas supplier or fire department.
- DO NOT RELY ON SMELL ALONE TO DETECT LEAKS. DUE TO VARIOUS FACTORS, YOU MAY NOT BE ABLE TO SMELL FUEL GASES.
 - U.L. recognized fuel gas and CO detectors are recommended in all applications, and their installation should be in accordance with the manufacturer's recommendations and/or local laws, rules, regulations, or customs.
- Improper installation, adjustment, alteration, service or maintenance can cause injury, property damage or death. Refer to this manual. Installation and service must be performed by a qualified installer, service agency or the gas supplier. In the commonwealth of Massachusetts, installation must be performed by a licensed plumber or gas fitter for appropriate fuel.



DO NOT DESTROY THIS MANUAL. PLEASE READ CAREFULLY AND KEEP IN A SAFE PLACE FOR FUTURE REFERENCE BY A SERVICEMAN.

IMPORTANT: All Rheem products meet current Federal OSHA Guidelines for safety. California Proposition 65 warnings are required for certain products, which are not covered by the OSHA standards.

California's Proposition 65 requires warnings for products sold in California that contain, or produce, any of over 600 listed chemicals known to the State of California to cause cancer or birth defects such as fiberglass insulation, lead in brass, and combustion products from natural gas.

All "new equipment" shipped for sale in California will have labels stating that the product contains and/or produces Proposition 65 chemicals. Although we have not changed our processes, having the same label on all our products facilitates manufacturing and shipping. We cannot always know "when, or if" products will be sold in the California market.

You may receive inquiries from customers about chemicals found in, or produced by, some of our heating and air-conditioning equipment, or found in natural gas used with some of our products. Listed below are those chemicals and substances commonly associated with similar equipment in our industry and other manufacturers.

- Glass Wool (Fiberglass) Insulation
- Carbon Monoxide (CO)
- Formaldehyde
- Benzene

More details are available at the Websites for OSHA (Occupational Safety and Health Administration), at www.osha.gov and the State of California's OEHHA (Office of Environmental Health Hazard Assessment), at www.oehha.org. Consumer education is important since the chemicals and substances on the list are found in our daily lives. Most consumers are aware that products present safety and health risks, when improperly used, handled and maintained.

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Installation Instructions are updated on a regular basis. This is done as product changes occur or if new information becomes available. In this publication, an arrow ► denotes changes from the previous edition or additional new material.

IMPORTANT: To insure proper installation and operation of this product, completely read all instructions prior to attempting to assemble, install, operate, maintain or repair this product. Upon unpacking of THE furnace, inspect all parts for damage prior to installation and start-up.

SAFETY INFORMATION

▲ WARNING

INSTALL THIS FURNACE ONLY IN A LOCATION AND POSITION AS SPECIFIED IN THE LOCATION REQUIREMENTS AND CONSIDERATIONS SECTION OF THESE INSTRUCTIONS. PROVIDE ADEQUATE COMBUSTION AND VENTILATION AIR TO THE FURNACE SPACE AS SPECIFIED IN THE VENTING SECTION OF THESE INSTRUCTIONS.

▲ WARNING

PROVIDE ADEQUATE COMBUSTION AND VENTILATION AIR TO THE FURNACE SPACE AS SPECIFIED IN THE COMBUSTION AND VENTILATION AIR SECTION OF THESE INSTRUCTIONS.

▲ WARNING

COMBUSTION PRODUCTS MUST BE DISCHARGED OUTDOORS. CONNECT THIS FURNACE TO AN APPROVED VENT SYSTEM ONLY, AS SPECIFIED IN VENT PIPE INSTALLATION SECTION OF THESE INSTRUCTIONS.

▲ WARNING

DO NOT INSTALL THIS FURNACE IN A MOBILE HOME!! THIS FURNACE IS NOT APPROVED FOR INSTALLATION IN A MOBILE HOME. DOING SO COULD CAUSE FIRE, PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.

▲ WARNING

NEVER TEST FOR GAS LEAKS WITH AN OPEN FLAME. USE A COMMERCIALY AVAILABLE SOAP SOLUTION MADE SPECIFICALLY FOR THE DETECTION OF LEAKS TO CHECK ALL CONNECTIONS, AS SPECIFIED IN GAS SUPPLY AND PIPING SECTION OF THESE TION INSTRUCTIONS.

▲ WARNING

THIS FURNACE IS NOT APPROVED OR RECOMMENDED FOR INSTALLATION ON ITS BACK, WITH ACCESS DOORS FACING UPWARDS, OR WITH SUPPLY AIR DISCHARGING TO THE RIGHT-HAND SIDE WHEN FACING THE FRONT OF THE FURNACE. SEE FIGURES 5 AND 6 FOR PROPER INSTALLATION OF HORIZONTAL MODELS.

▲ WARNING

USE ONLY WITH TYPE OF GAS APPROVED FOR THIS FURNACE. REFER TO THE FURNACE RATING PLATE.

▲ WARNING

ALWAYS INSTALL FURNACE TO OPERATE WITHIN THE FURNACE'S INTENDED TEMPERATURE-RISE RANGE WITH A DUCT SYSTEM WHICH HAS AN EXTERNAL STATIC PRESSURE WITHIN THE ALLOWABLE RANGE, AS SPECIFIED IN DUCTING SECTION OF THESE INSTRUCTIONS. SEE ALSO FURNACE RATING PLATE.

▲ WARNING

WHEN A FURNACE IS INSTALLED SO THAT SUPPLY DUCTS CARRY AIR CIRCULATED BY THE FURNACE TO AREAS OUTSIDE THE SPACE CONTAINING THE FURNACE, THE RETURN AIR SHALL ALSO BE HANDLED BY DUCT(S) SEALED TO THE FURNACE CASING AND TERMINATING OUTSIDE THE SPACE CONTAINING THE FURNACE.

▲ WARNING

DO NOT JUMPER OR OTHERWISE BYPASS OVERTEMPERATURE OR ANY OTHER LIMITS OR SWITCHES ON THE FURNACE. IF ONE OF THESE LIMITS OR SWITCHES SHOULD TRIP OR OPEN, THE USER IS TO BE INSTRUCTED TO CALL A QUALIFIED INSTALLER, SERVICE AGENCY OR THE GAS SUPPLIER. FOR MANUALLY RESETTABLE SWITCHES, THE USER IS FURTHER INSTRUCTED TO NEVER RESET THE SWITCH, BUT TO CALL A QUALIFIED TECHNICIAN. MANUAL RESET SWITCHES MAY REQUIRE FURTHER CORRECTIVE ACTIONS. FAILURE TO FOLLOW THIS WARNING COULD RESULT IN CARBON MONOXIDE POISONING, SERIOUS INJURY OR DEATH. IF THE UNIT IS INSTALLED IN A CLOSET, THE DOOR MUST BE CLOSED WHEN MAKING THIS CHECK. INSTALLERS AND TECHNICIANS ARE INSTRUCTED TO REPLACE ANY LIMIT OR SAFETY SWITCH/DEVICE ONLY WITH IDENTICAL REPLACEMENT PARTS.

▲ WARNING

WHEN THIS FURNACE IS INSTALLED IN A RESIDENTIAL GARAGE, IT MUST BE INSTALLED SO THE BURNERS AND IGNITION SOURCE ARE LOCATED NO LESS THAN 18 INCHES ABOVE THE FLOOR. THIS IS TO REDUCE THE RISK OF IGNITING FLAMMABLE VAPORS WHICH MAY BE PRESENT IN A GARAGE. ALSO, THE FURNACE MUST BE LOCATED OR PROTECTED TO AVOID PHYSICAL DAMAGE BY VEHICLES. FAILURE TO FOLLOW THESE WARNINGS CAN CAUSE A FIRE OR EXPLOSION, RESULTING IN PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.

▲ WARNING

USE OF THIS FURNACE IS ALLOWED DURING CONSTRUCTION IF THE FOLLOWING TEMPORARY INSTALLATION REQUIREMENTS ARE MET. INSTALLATION MUST COMPLY WITH ALL INSTALLATION INSTRUCTIONS INCLUDING:

- PROPER VENT INSTALLATION;
- FURNACE OPERATING UNDER THERMOSTATIC CONTROL;
- RETURN AIR DUCT SEALED TO THE FURNACE;
- AIR FILTERS IN PLACE;
- SET FURNACE INPUT RATE AND TEMPERATURE RISE PER RATING PLATE MARKING;
- MEANS FOR PROVIDING OUTDOOR AIR REQUIRED FOR COMBUSTION;
- RETURN AIR TEMPERATURE MAINTAINED BETWEEN 55°F (13°C) AND 80°F (27°C); AND;
- CLEAN FURNACE, DUCT WORK AND COMPONENTS UPON SUBSTANTIAL COMPLETION OF THE CONSTRUCTION PROCESS, AND VERIFY FURNACE OPERATING CONDITIONS INCLUDING IGNITION, INPUT RATE, TEMPERATURE RISE AND VENTING, ACCORDING TO THE INSTRUCTIONS.

▲ WARNING

DUCT LEAKS CAN CREATE AN UNBALANCED SYSTEM AND DRAW POLLUTANTS SUCH AS DIRT, DUST, FUMES AND ODORS INTO THE HOME CAUSING PROPERTY DAMAGE. FUMES AND ODORS FROM TOXIC, VOLATILE OR FLAMMABLE CHEMICALS, AS WELL AS AUTOMOBILE EXHAUST AND CARBON MONOXIDE (CO), CAN BE DRAWN INTO THE LIVING SPACE THROUGH LEAKING DUCTS AND UNBALANCED DUCT SYSTEMS CAUSING PERSONAL INJURY OR DEATH (SEE FIGURE 4).

- IF AIR-MOVING EQUIPMENT OR DUCTWORK IS LOCATED IN GARAGES OR OFF-GARAGE STORAGE AREAS - ALL JOINTS, SEAMS, AND OPENINGS IN THE EQUIPMENT AND DUCT MUST BE SEALED TO LIMIT THE MIGRATION OF TOXIC FUMES AND ODORS INCLUDING CARBON MONOXIDE FROM MIGRATING INTO THE LIVING SPACE.
- IF AIR-MOVING EQUIPMENT OR DUCTWORK IS LOCATED IN SPACES CONTAINING FUEL BURNING APPLIANCES SUCH AS WATER HEATERS OR BOILERS - ALL JOINTS, SEAMS, AND OPENINGS IN THE EQUIPMENT AND DUCT MUST ALSO BE SEALED TO PREVENT DEPRESSURIZATION OF THE SPACE AND POSSIBLE MIGRATION OF COMBUSTION BYPRODUCTS INCLUDING CARBON MONOXIDE INTO THE LIVING SPACE.

NOTICE

IMPROPER INSTALLATION, OR INSTALLATION NOT MADE IN ACCORDANCE WITH THE CSA INTERNATIONAL (CSA) CERTIFICATION OR THESE INSTRUCTIONS, CAN RESULT IN UNSATISFACTORY OPERATION AND/OR DANGEROUS CONDITIONS AND ARE NOT COVERED BY THE UNIT WARRANTY.

NOTICE

IN COMPLIANCE WITH RECOGNIZED CODES, IT IS RECOMMENDED THAT AN AUXILIARY DRAIN PAN BE INSTALLED UNDER ALL EVAPORATOR COILS OR UNITS CONTAINING EVAPORATOR COILS THAT ARE LOCATED IN ANY AREA OF A STRUCTURE WHERE DAMAGE TO THE BUILDING OR BUILDING CONTENTS MAY OCCUR AS A RESULT OF AN OVERFLOW OF THE COIL DRAIN PAN OR A STOPPAGE IN THE PRIMARY CONDENSATE DRAIN PIPING. SEE ACCESSORIES SECTION OF THESE INSTRUCTIONS FOR AUXILIARY HORIZONTAL OVERFLOW PAN INFORMATION (MODEL RXBM).

INSTALLATION CHECK LIST

REFER TO INSTALLATION INSTRUCTIONS

GAS SUPPLY

- _____ Adequate pipe size
- _____ Correct supply pressure (during furnace operation)
- _____ Manifold pressure
- _____ No gas leaks

ELECTRICAL

- _____ 115 V.A.C. supply (Single Circuit)
- _____ Polarity observed
- _____ Furnace properly grounded (Earth ground)
- _____ Adequate wire size

FURNACE INSTALLATION

- _____ Adequate clearance to combustibles
- _____ Adequate clearance for service (at front)

DUCT STATIC PRESSURE

- _____ in. w.c. on heating speed
- _____ in. w.c. on cooling speed
- _____ Air temperature rise

CONDENSATE LINE

- _____ Trap filled with water
- _____ Vented
- _____ Sloped toward drain
- _____ Condensate drain line hoses connected and clamped
- _____ Freeze protection (if necessary)
- _____ Neutralizer (if needed)

VENTING – DIRECT VENT

- _____ in. diameter – intake pipe
- _____ in. diameter – exhaust pipe
- _____ ft. of pipe – intake air
- _____ no. of elbows – intake air
- _____ ft. of pipe – exhaust pipe
- _____ no. of elbows – exhaust pipe

TERMINATIONS – DIRECT VENT

VERTICAL

- _____ Intake – 12" min. above roof/snow level
- _____ Correct relationship – exhaust to intake

VERTICAL – CONCENTRIC (RXGY-E03)

- _____ Intake – 12" min. above roof/snow level

HORIZONTAL – STANDARD (RXGY-D02, -D03)

- _____ Correct relationship – exhaust to intake
- _____ 12" min. above grade/snow level

HORIZONTAL – ALTERNATE (RXGY-D02, -D03 OR -D04)

- _____ Correct relationship – exhaust to intake
- _____ Above anticipated snow level

HORIZONTAL – CONCENTRIC (RXGY-E03)

- _____ 12" min. above grade/snow level

- _____ Intake “Y” rotated above center

- _____ Exhaust sloped toward furnace

VENTING – NON-DIRECT VENT (VERTICAL ONLY)

- _____ in. diameter – exhaust pipe
- _____ ft. of pipe – exhaust
- _____ no. of elbows

TERMINATION – NON-DIRECT VENT (VERTICAL ONLY)

- _____ 12" min. above roof/snow level
- _____ Model #
- _____ Serial #
- _____ Date of installation

GENERAL INFORMATION

The (-)GFD, (-)GGD and (-)GJD series furnaces are design-certified by CSA for use with natural and L.P. gases as follows:

- As direct vent, central forced air furnaces with all combustion air supplied directly to the furnace burners through a special air intake system outlined in these instructions.
- As non-direct, central forced air furnace taking combustion air from the installation area or using air ducted from the outside.
- **IMPORTANT:** Proper application, installation and maintenance of this

furnace are required if consumers are to receive the full benefits for which they have paid.

Install this furnace in accordance with the American National Standard Z223.1 – latest edition entitled “National Fuel Gas Code” (NFPA54, 90A and 90B) and requirements or codes of the local utilities or other authorities having jurisdiction. This is available from the following:

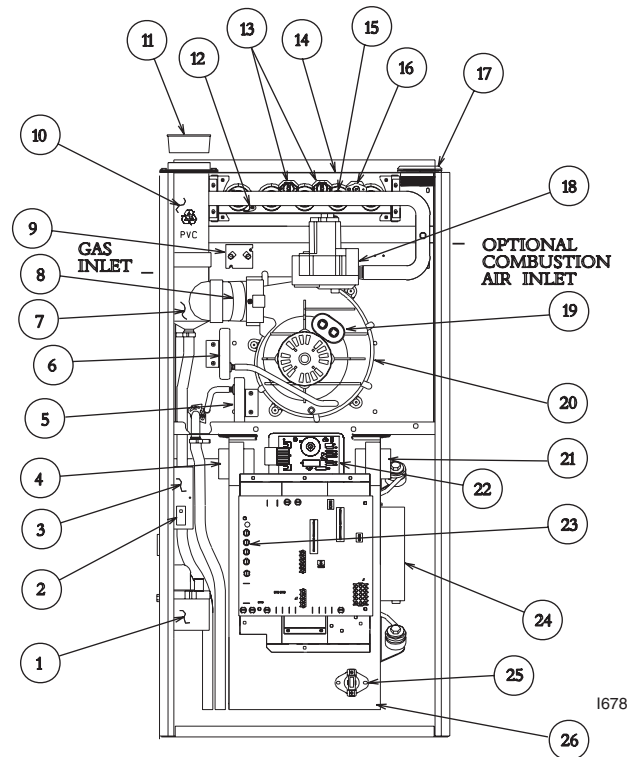
National Fire Protection Association, Inc.
Batterymarch Park
Quincy, MA 02269

CSA International - U.S.
8501 East Pleasant Valley Road
Cleveland, Ohio, 44131

Canadian installations must be installed in accordance with CSA, local installation codes and authorities having jurisdiction. CSA is available from:

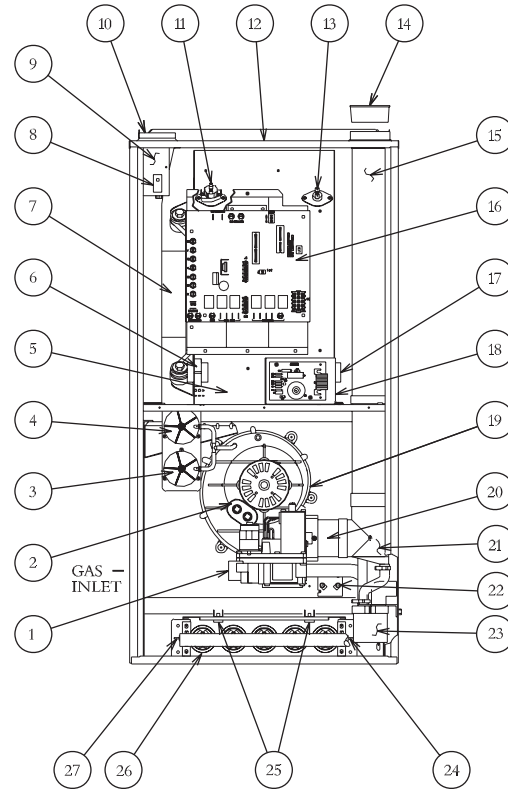
CSA International - Canada
178 Rexdale Blvd.
Etobicoke (Toronto), Ontario,
Canada M9W-1R3

FIGURE 1
UPFLOW FURNACE (-)GFD



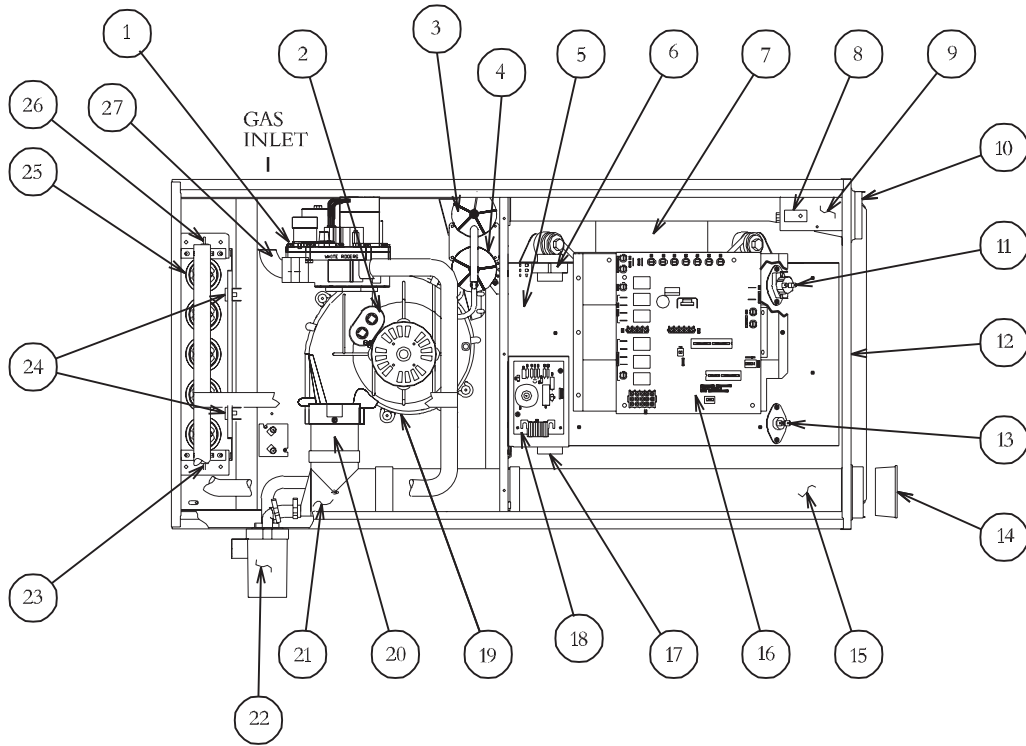
ITEM NO.	PART NAME	ITEM NO.	PART NAME
1	CONDENSATE TRAP	14	TOP PLATE
2	DOOR SWITCH	15	BURNER
3	JUNCTION BOX	16	IGNITER
4	TRANSFORMER	17	COMBUSTION AIR INLET
5	LOW PRESSURE SWITCH	18	GAS VALVE
6	HIGH PRESSURE SWITCH	19	CAPACITOR
7	EXHAUST TRANSITION	20	INDUCED DRAFT BLOWER
8	CONNECTOR	21	POWER FACTOR CHOKE
9	MAIN LIMIT	22	IGNITION CONTROL
10	EXHAUST AIR PIPE	23	INTEGRATED FURNACE CONTROL
11	VENT CAP PLUG	24	BLOWER MOTOR
12	FLAME SENSOR	25	R/A SENSOR
13	OVERTEMPERATURE SWITCH	26	BLOWER HOUSING

FIGURE 2
DOWNFLOW FURNACE (-)GGD



ITEM NO.	PART NAME	ITEM NO.	PART NAME
1	GAS VALVE	14	VENT CAP PLUG
2	CAPACITOR	15	EXHAUST AIR PIPE
3	LOW PRESSURE SWITCH	16	INTEGRATED FURNACE CONTROL
4	HIGH PRESSURE SWITCH	17	TRANSFORMER
5	BLOWER HOUSING	18	IGNITION CONTROL
6	POWER FACTOR CHOKE	19	INDUCED DRAFT BLOWER
7	BLOWER MOTOR	20	CONNECTOR
8	DOOR SWITCH	21	EXHAUST TRANSITION
9	JUNCTION BOX	22	MAIN LIMIT
10	COMBUSTION AIR INLET	23	CONDENSATE TRAP
11	HALC	24	IGNITER
12	TOP PLATE	25	OVERTEMPERATURE SWITCH
13	RETURN AIR SENSOR	26	BURNER
		27	FLAME SENSOR

► **FIGURE 3**
HORIZONTAL FURNACE (-)GJD



ITEM NO.	PART NAME	ITEM NO.	PART NAME
1	GAS VALVE	14	VENT CAP PLUG
2	CAPACITOR (FOR INDUCER)	15	OUTLET AIR PIPE
3	LOW PRESSURE SWITCH	16	INTEGRATED FURNACE CONTROL
4	HIGH PRESSURE SWITCH	17	TRANSFORMER
5	BLOWER HOUSING	18	IGNITION CONTROL
6	POWER FACTOR CHOKE	19	INDUCED DRAFT BLOWER
7	BLOWER MOTOR	20	CONNECTOR
8	DOOR SWITCH	21	EXHAUST TRANSITION
9	JUNCTION BOX	22	CONDENSATE TRAP
10	COMBUSTION AIR INLET	23	IGNITER
11	HALC	24	OVERTEMPERATURE SWITCH
12	TOP PLATE	25	BURNER
13	RETURN AIR SENSOR	26	FLAME SENSOR
		27	FACTORY-INSTALLED STREET ELBOW

IMPORTANT INFORMATION ABOUT EFFICIENCY AND INDOOR AIR QUALITY

Central cooling and heating equipment is only as efficient as the duct system that carries the cooled or heated air. To maintain efficiency, comfort and good indoor air quality, it is important to have the proper balance between the air being supplied to each room and the air returning to the cooling and heating equipment.

Proper balance and sealing of the duct system improves the efficiency of the heating and air conditioning system and improves the indoor air quality of the home by reducing the amount of airborne pollutants that enter homes from spaces where the ductwork and / or equipment is located. The manufacturer and the U.S. Environmental Protection Agency's Energy Star Program recommend that central duct systems be checked by a qualified contractor for proper balance and sealing.

▲ WARNING

DUCT LEAKS CAN CREATE AN UNBALANCED SYSTEM AND DRAW POLLUTANTS SUCH AS DIRT, DUST, FUMES AND ODORS INTO THE HOME CAUSING PROPERTY DAMAGE. FUMES AND ODORS FROM TOXIC, VOLATILE OR FLAMMABLE CHEMICALS, AS WELL AS AUTOMOBILE EXHAUST AND CARBON MONOXIDE (CO), CAN BE DRAWN INTO THE LIVING SPACE THROUGH LEAKING DUCTS AND UNBALANCED DUCT SYSTEMS CAUSING PERSONAL INJURY OR DEATH (SEE FIGURE 4).

- IF AIR-MOVING EQUIPMENT OR DUCTWORK IS LOCATED IN GARAGES OR OFF-GARAGE STORAGE AREAS - ALL JOINTS, SEAMS, AND OPENINGS IN THE EQUIPMENT AND DUCT MUST BE SEALED TO LIMIT THE MIGRATION OF TOXIC FUMES AND ODORS INCLUDING CARBON MONOXIDE FROM MIGRATING INTO THE LIVING SPACE.
- IF AIR-MOVING EQUIPMENT OR DUCTWORK IS LOCATED IN SPACES CONTAINING FUEL BURNING APPLIANCES SUCH AS WATER HEATERS OR BOILERS - ALL JOINTS, SEAMS, AND OPENINGS IN THE EQUIPMENT AND DUCT MUST ALSO BE SEALED TO PREVENT DEPRESSURIZATION OF THE SPACE AND POSSIBLE MIGRATION OF COMBUSTION BYPRODUCTS INCLUDING CARBON MONOXIDE INTO THE LIVING SPACE.

NOTICE

IMPROPER INSTALLATION, OR INSTALLATION NOT MADE IN ACCORDANCE WITH THE CSA INTERNATIONAL (CSA) CERTIFICATION OR THESE INSTRUCTIONS, CAN RESULT IN UNSATISFACTORY OPERATION AND/OR DANGEROUS CONDITIONS AND ARE NOT COVERED BY THE UNIT WARRANTY.

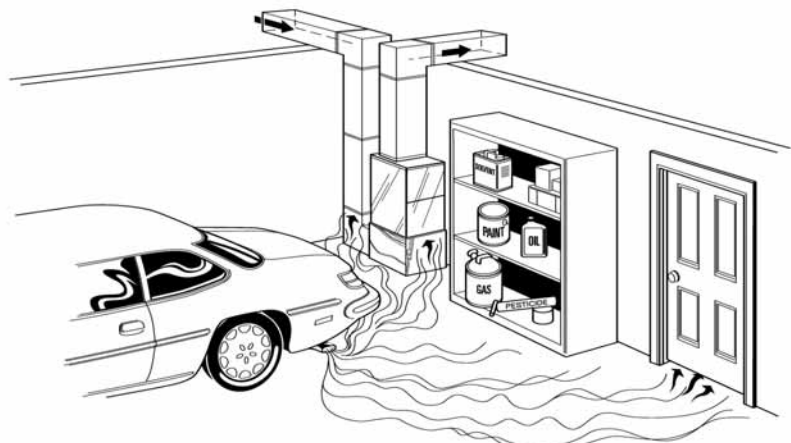
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matches what is required for the job specification.

- Read the entire instructions before starting the installation.
- Some building codes require extra cabinet insulation and gasketing when unit is installed in attic applications.
- If installed in an unconditioned space, apply caulking around the power wires, control wires, refrigerant tubing and condensate line where they enter the cabinet. Seal the power wires on the inside where they exit conduit opening. Caulking is required to prevent air leakage into and condensate from forming inside the unit, control box, and on electrical controls.
- Install the unit in such a way as to allow necessary access to the coil/filter rack and blower/control compartment.
- Install the unit in a level position to ensure proper condensate drainage. Make sure unit is level in both directions within 1/8".
- Install the unit in accordance with any local code which may apply and the national codes. Latest edi-

FIGURE 4
MIGRATION OF DANGEROUS SUBSTANCES, FUMES, AND ODORS INTO LIVING SPACES



Adapted from *Residential Duct Diagnostics and Repair*, with permission of Air Conditioning Contractors of America (ACCA).

RECEIVING

Immediately upon receipt, all cartons and contents should be inspected for transit damage. Units with damaged cartons should be opened immediately. If damage is found, it should be noted on the delivery papers, and a damage claim filed with the last carrier.

- After unit has been delivered to job site, remove carton taking care not to damage unit.
- Check the unit rating plate for unit size, electric heat, coil, voltage, phase, etc. to be sure equipment

are available from: "National Fire Protection Association, Inc., Batterymarch Park, Quincy, MA 02269." These publications are:

- ANSI/NFPA No. 70-(Latest Edition) National Electrical Code.
- NFPA90A Installation of Air Conditioning and Ventilating Systems.
- NFPA90B Installation of warm air heating and air conditioning systems.
- The equipment has been evaluated in accordance with the Code of Federal Regulations, Chapter XX, Part 3280.

LOCATION REQUIREMENTS AND CONSIDERATIONS

GENERAL INFORMATION

▲ CAUTION

DO NOT USE THIS FURNACE DURING CONSTRUCTION IF AIR LADEN CORROSIVE COMPOUNDS ARE PRESENT SUCH AS CHLORINE AND FLUORINE. OTHERWISE, PROVISIONS MUST BE TAKEN TO PROVIDE CLEAN, UNCONTAMINATED COMBUSTION AND VENTILATION AIR TO THE FURNACE. FURNACE COMBUSTION AND VENTILATION AIR CONTAMINATED WITH THESE COMPOUNDS FORMS ACIDS DURING COMBUSTION WHICH CORRODES THE HEAT EXCHANGER AND COMPONENT PARTS. SOME OF THESE CONTAMINANTS ARE FOUND IN, BUT NOT LIMITED TO, PANELING, DRY WALL, ADHESIVES, PAINTS, STAINS, VARNISHES, SEALERS, AND MASONRY CLEANING MATERIALS.

▲ WARNING

DO NOT INSTALL THIS FURNACE IN A MOBILE HOME!! THIS FURNACE IS NOT APPROVED FOR INSTALLATION IN A MOBILE HOME. DOING SO COULD CAUSE FIRE, PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.

▲ WARNING

WHEN THIS FURNACE IS INSTALLED IN A RESIDENTIAL GARAGE, IT MUST BE INSTALLED SO THE BURNERS AND IGNITION SOURCE ARE LOCATED NO LESS THAN 18 INCHES ABOVE THE FLOOR. THIS IS TO REDUCE THE RISK OF IGNITING FLAMMABLE VAPORS WHICH MAY BE PRESENT IN A GARAGE. ALSO, THE FURNACE MUST BE LOCATED OR PROTECTED TO AVOID PHYSICAL DAMAGE BY VEHICLES. FAILURE TO FOLLOW THESE WARNINGS CAN CAUSE A FIRE OR EXPLOSION, RESULTING IN PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.

1. **IMPORTANT:** If installing the unit over a finished ceiling or living area, be certain to install an auxiliary condensate drain pan under the entire unit. Extend this auxiliary drain pan under any evaporator coil installed with the furnace and the open portion of the con-

densate drain assembly. See "Condensate Drain/Neutralizer" section for more details.

2. **IMPORTANT:** If using a cooling evaporator coil with this furnace. Be sure the air passes over the heat exchanger before passing over the cooling coil. The cooled air passing over the warm ambient air inside the heat exchanger tubes can cause condensation inside the tubes resulting in corrosion and eventual failure.
3. **IMPORTANT:** Install the furnace level. If it is not level, condensate cannot drain properly, possibly causing furnace shut down.

NOTE: These furnaces are approved for installation in attics, as well as alcoves, utility rooms, closets and crawlspaces. Make provisions to prevent freezing of condensate.

4. **IMPORTANT:** If this furnace is installed in a garage, attic or any other unconditioned space, a self-regulating heat tape must be installed around the condensate trap and along the entire length of the condensate drain in the unconditioned space.

The heat tape should meet the following requirements:

- a. The heat tape must be UL listed.
- b. Install the heat tape per the manufacturer's instructions for the entire length of drain pipe in the unconditioned space.
- c. The heat tape should be rated at 3 or 5 watts per foot at 120V.

5. **IMPORTANT:** If installing in a utility room, be sure the door is wide enough to:
 - a. allow the largest part of the furnace to pass; or
 - b. allow any other appliance (such as a water heater) to pass.
6. Install the furnace level and plumb. If it is not level, condensate cannot drain properly, possibly causing furnace to shut down.

IMPORTANT: Do not attempt to twin the modulating furnace. The characteristics of the ECM blower motor preclude twinning applications.

FIGURE 4
HORIZONTAL FURNACE WITH HEAT TAPE ON CONDENSATE TRAP

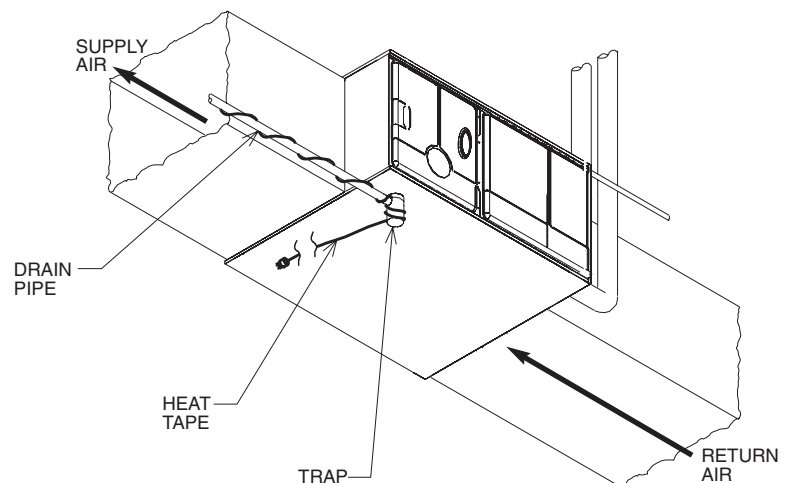
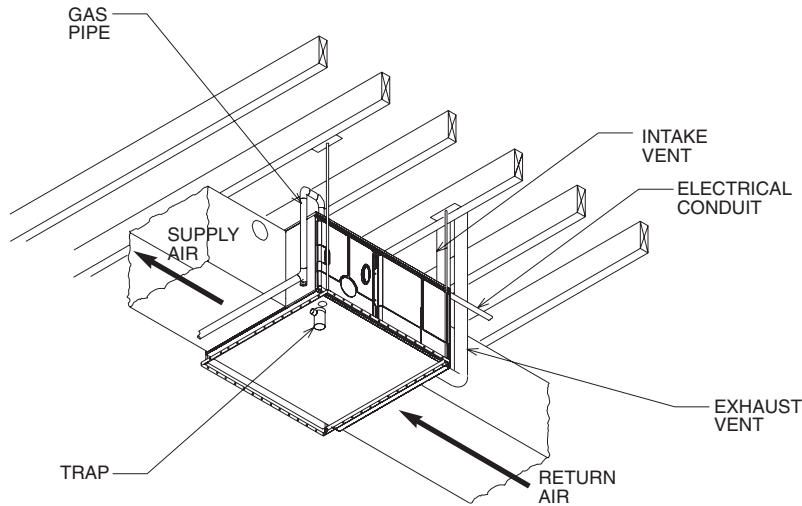


FIGURE 6
HORIZONTAL FURNACE INSTALLED W/SUPPORT BRACKETS

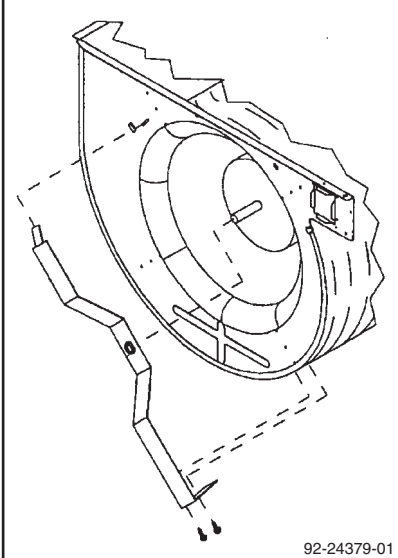


CAUTION

THIS FURNACE IS NOT APPROVED OR RECOMMENDED FOR INSTALLATION ON ITS BACK, WITH ACCESS DOORS FACING UPWARDS, OR WITH SUPPLY AIR DISCHARGING TO THE RIGHT HAND SIDE WHEN FACING THE FRONT OF THE FURNACE.

SEE FIGURES 5 AND 6 FOR PROPER INSTALLATION OF HORIZONTAL MODELS.

FIGURE 7
REMOVING SHIPPING BRACKET



CAUTION

SOME MODELS HAVE A SHIPPING BRACKET INSTALLED TO PROTECT THE BLOWER ASSEMBLY DURING SHIPPING.

LOCATE AND REMOVE THE SHIPPING BRACKET FROM THE SIDE OF THE BLOWER HOUSING BEFORE OPERATING UNIT. SEE

FIGURE 7.

THE FOLLOWING MODELS INCLUDE THE ADDITIONAL BRACKET (WHICH MUST BE REMOVED) ON THE BLOWER ASSEMBLY:

- (-)GFD/GGD/or GJD-09EZCMS
- (-)GFD/GGD/or GJD-10EZCMS
- (-)GFD/GGD/or GJD-12ERCMS

CLEARANCE - ACCESSIBILITY

The design of forced air furnaces with models as listed in the tables under Figures 9, 10 and 11 are certified by CSA Laboratories for the clearances to combustible materials shown in inches.

See name/rating plate and clearance label for specific model number and clearance information.

Service clearance of at least 24 inches is recommended in front of all furnaces.

FOR PURPOSES OF SERVICING THIS APPLIANCE, ACCESSIBILITY CLEARANCES, WHERE GREATER, SHOULD TAKE PRECEDENCE OVER FIRE PROTECTION CLEARANCES.

WARNING

FURNACES MUST NOT BE INSTALLED DIRECTLY ON CARPET, TILE OR OTHER COMBUSTIBLE MATERIAL. INSTALLATION ON A COMBUSTIBLE MATERIAL OTHER THAN WOOD FLOORING MAY RESULT IN FIRE CAUSING DAMAGE, PERSONAL INJURY OR DEATH.

-GGD FURNACES MAY NOT BE INSTALLED DIRECTLY TO A COMBUSTIBLE FLOOR. A SPECIAL FLOOR BASE IS REQUIRED.

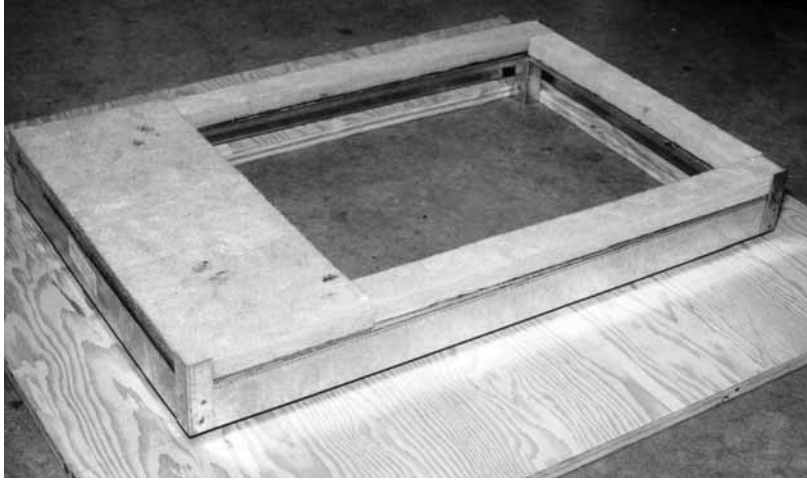
-GFD upflow furnaces and -GGD downflow furnaces are designed and certified for installation on combustible (wood only) floors.

-GGD downflow furnaces may be installed on a cased evaporator coil mounted on a combustible (wood only) floor or (for installations without an evaporator coil) installed on a special base for combustible floors mounted to a combustible (wood only) floor. The necessary floor base for installing a -GGD furnace in the downflow configuration to a combustible (wood only) floor is an accessory sold through finished goods. Following is a list of floor base models by furnace input size.

-GGD Furnace BTU's	Special Base For Combustible Floors
60, 75	RXGC-B17
90, 105	RXGC-B21
120	RXGC-B24

Upflow furnaces are shipped with a bottom closure panel installed. When bottom return air is used, remove the panel by removing the two screws attaching the panel to the front base angle. See filter section for details.

FIGURE 8
BASE FOR COMBUSTIBLE FLOORS



SITE SELECTION

1. Select a site in the building near the center of the proposed, or existing, duct system.
2. Give consideration to the vent system piping when selecting the furnace location. Vent from the furnace to the termination with minimal length and elbows.
3. Locate the furnace near the existing gas piping. If running a new gas line, locate the furnace to minimize the length and elbows in the gas piping.
4. Locate the furnace to maintain proper clearance to combustibles as shown in Figures 9, 10 & 11.

▲ WARNING

COMBUSTIBLE MATERIAL MUST NOT BE PLACED ON OR AGAINST THE FURNACE JACKET. THE AREA AROUND THE FURNACE MUST BE KEPT CLEAR AND FREE OF ALL COMBUSTIBLE MATERIALS INCLUDING GASOLINE AND OTHER FLAMMABLE VAPORS AND LIQUIDS. PLACEMENT OF COMBUSTIBLE MATERIALS ON, AGAINST OR AROUND THE FURNACE JACKET CAN CAUSE AN EXPLOSION OR FIRE RESULTING IN PROPERTY DAMAGE, PERSONAL INJURY OR DEATH. THE HOMEOWNER SHOULD BE CAUTIONED THAT THE FURNACE AREA MUST NOT BE USED AS A BROOM CLOSET OR FOR ANY OTHER STORAGE PURPOSES.

FIGURE 9
PHYSICAL DIMENSIONS AND CLEARANCE TO COMBUSTIBLES, UPFLOW MODELS

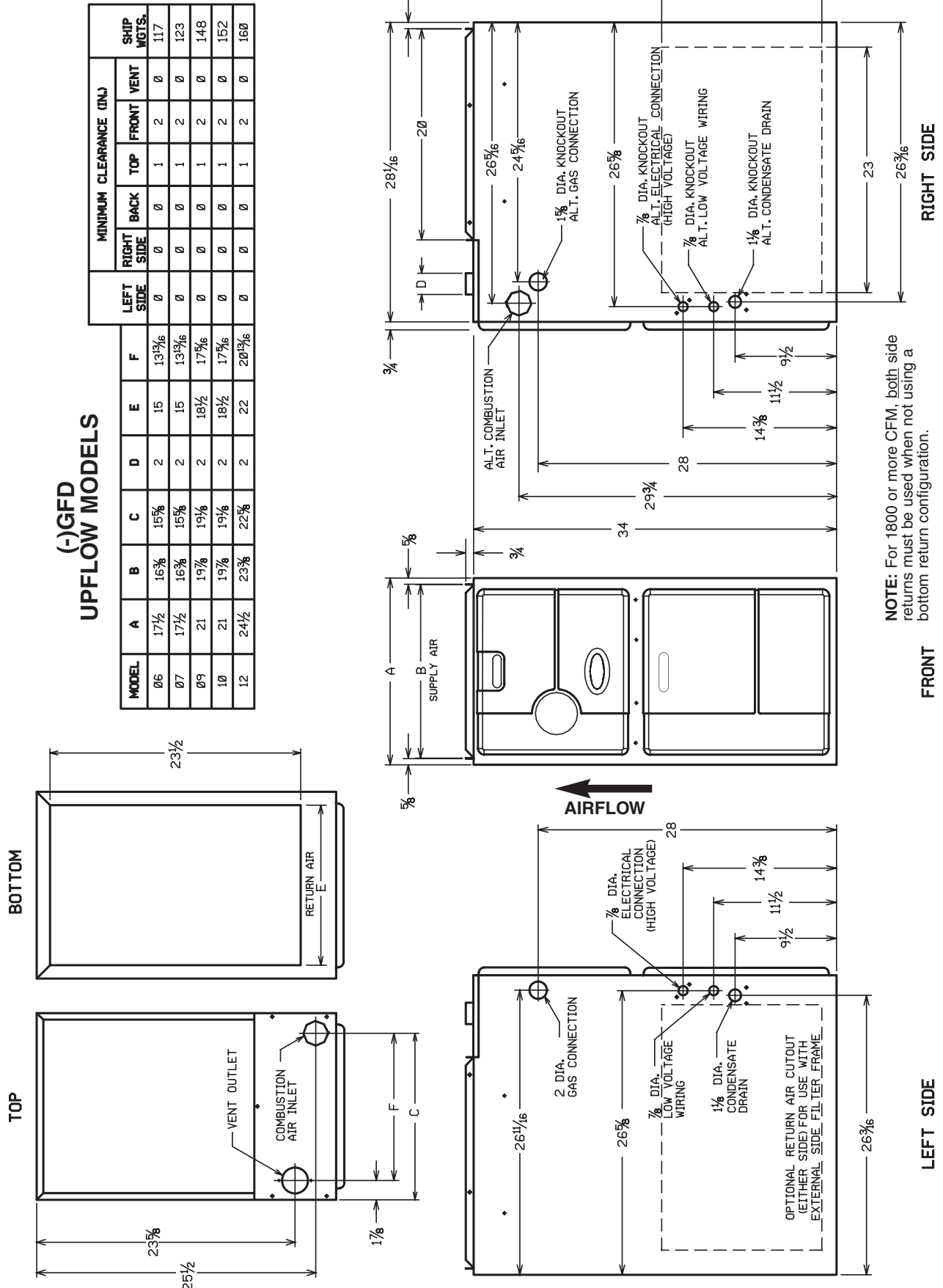
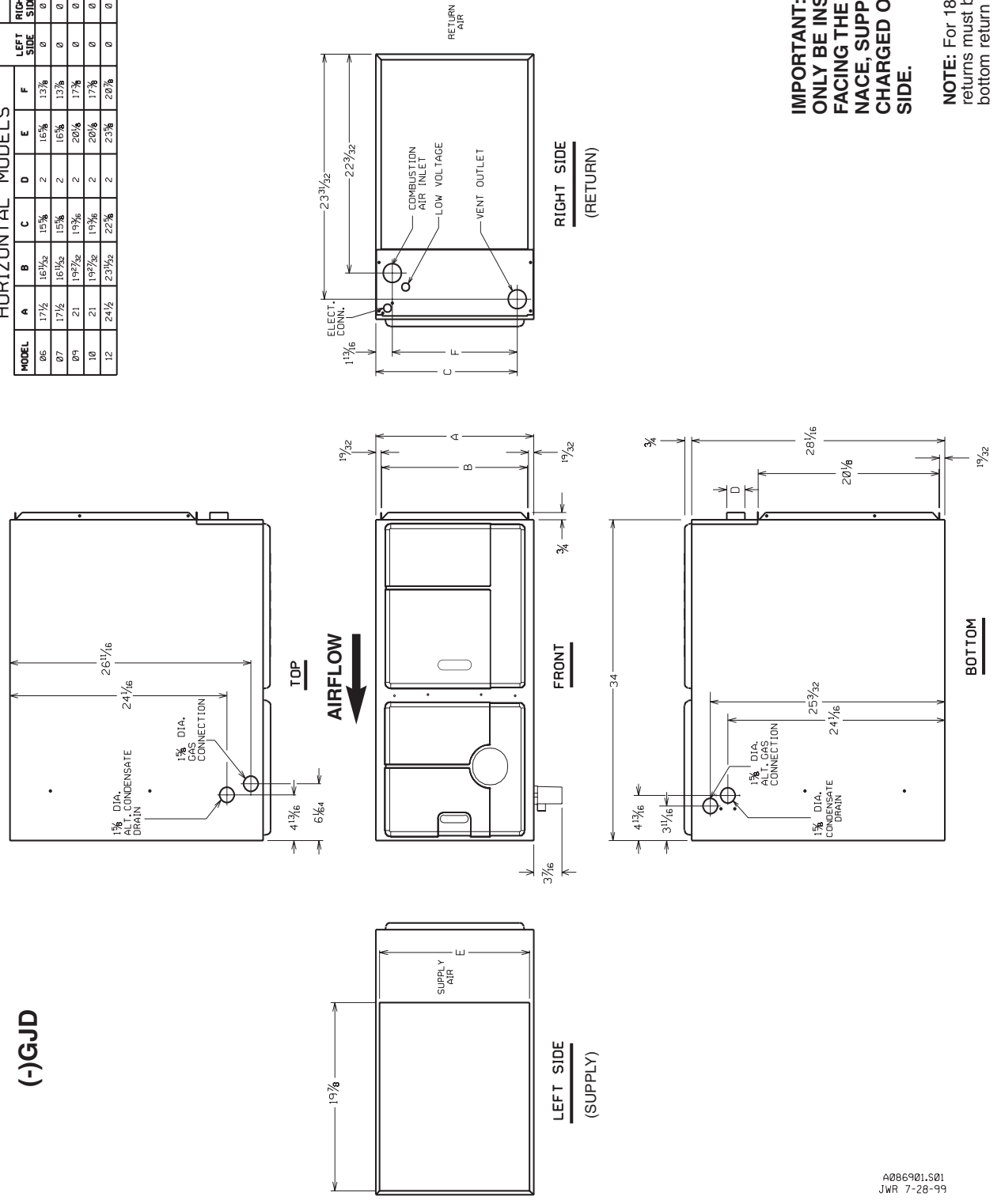


FIGURE 10
DIMENSIONS AND CLEARANCES TO COMBUSTIBLES, HORIZONTAL MODELS

MODEL	HORIZONTAL MODELS						MINIMUM CLEARANCE (IN)						SHIP WGT., LBS.
	A	B	C	D	E	F	LEFT SIDE	RIGHT SIDE	BACK	TOP	FRONT	VENT	
06	17½	16¾	15¾	2	15¾	13¾	0	0	0	1	2	0	117
07	17½	16¾	15¾	2	16¾	13¾	0	0	0	1	2	0	123
09	21	19¾	19¾	2	20¾	17¾	0	0	0	1	2	0	149
10	21	19¾	19¾	2	20¾	17¾	0	0	0	1	2	0	152
12	24½	23½	22¾	2	23¾	20¾	0	0	0	1	2	0	160

HORIZONTAL MODELS



IMPORTANT: THIS FURNACE MAY ONLY BE INSTALLED SO AS WHEN FACING THE FRONT OF THE FURNACE, SUPPLY AIR IS DISCHARGED ON THE LEFT HAND SIDE.

NOTE: For 1800 or more CFM, both side returns must be used when not using a bottom return configuration.

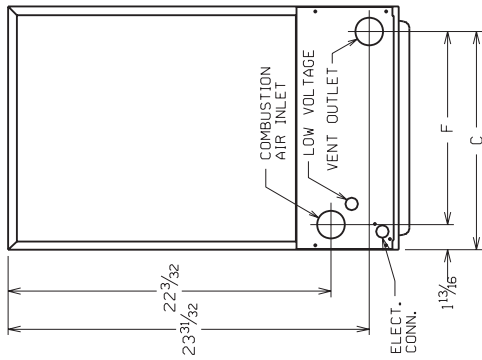
FIGURE 11
DIMENSIONS AND CLEARANCES TO COMBUSTIBLES, DOWNFLOW MODELS

(-)GGD

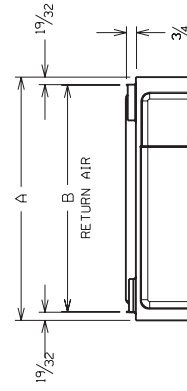
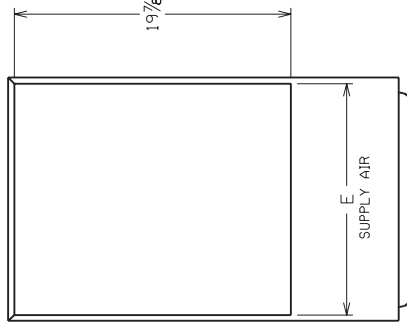
DOWNFLOW MODELS
(Downflow Configuration)

MODEL	A	B	C	D	E	F	MINIMUM CLEARANCE (IN.)				SHIP WCTS.	
							LEFT SIDE	RIGHT SIDE	BACK	TOP		FRONT
06	17½	16⅞	15½	2	16⅝	13⅞	0	0	1	2	0	117
07	17½	16⅞	15½	2	16⅝	13⅞	0	0	1	2	0	123
09	21	19⅞	19⅞	2	20⅞	17⅞	0	0	1	2	0	148
10	21	19⅞	19⅞	2	20⅞	17⅞	0	0	1	2	0	152
12	24½	23⅞	22⅝	2	23⅝	20⅞	0	0	1	2	0	160

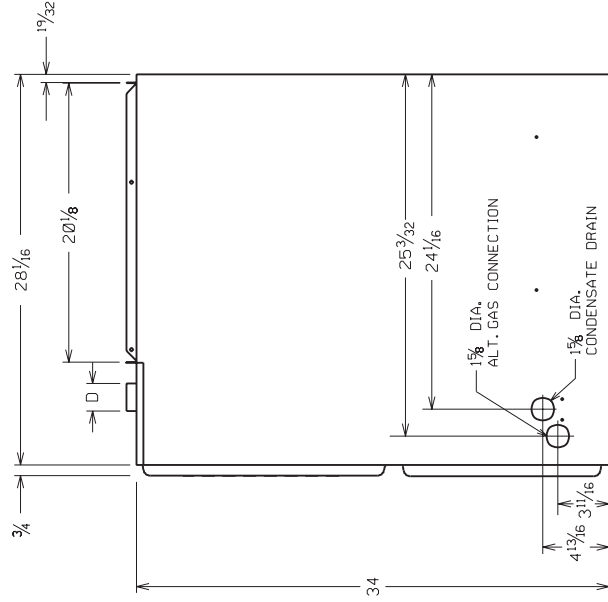
TOP



BOTTOM

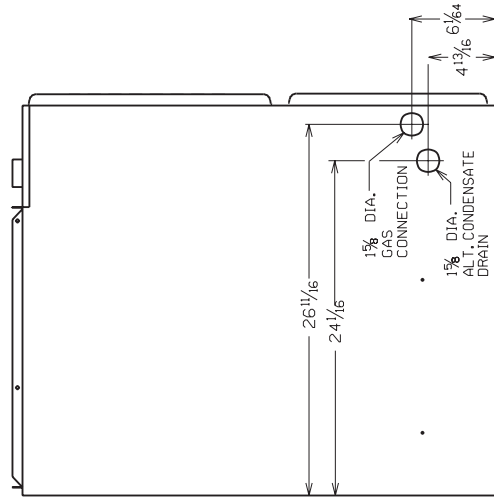


AIRFLOW



RIGHT SIDE

FRONT



LEFT SIDE

A084901.S01
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DUCTING

Proper airflow is required for the correct operation of this furnace.

Too little airflow can cause erratic operation and can damage the heat exchanger. The supply and return duct must carry the correct amount of air for heating and cooling if summer air conditioning is used.

Size the ducts according to acceptable industry standards and methods. The total static pressure drop of the supply and return duct should not exceed 0.2" w.c.

▲ WARNING

NEVER ALLOW THE PRODUCTS OF COMBUSTION FROM THE FLUE TO ENTER THE RETURN AIR DUCTWORK OR THE CIRCULATED AIR SUPPLY. ALL RETURN DUCTWORK MUST BE ADEQUATELY SEALED AND SECURED TO THE FURNACE WITH SHEET METAL SCREWS; AND JOINTS, TAPED. SECURE ALL OTHER DUCT JOINTS WITH APPROVED CONNECTIONS AND SEAL AIRTIGHT. WHEN A FURNACE IS MOUNTED ON A PLATFORM WITH RETURN THROUGH THE BOTTOM, IT MUST BE SEALED AIRTIGHT BETWEEN THE FURNACE AND THE RETURN AIR PLENUM. THE FLOOR OR PLATFORM MUST PROVIDE PHYSICAL SUPPORT OF THE FURNACE WITHOUT SAGGING, CRACKS, OR GAPS AROUND THE BASE, PROVIDING A SEAL BETWEEN THE SUPPORT AND THE BASE.

FAILURE TO PREVENT PRODUCTS OF COMBUSTION FROM BEING CIRCULATED INTO THE LIVING SPACE CAN CREATE POTENTIALLY HAZARDOUS CONDITIONS, INCLUDING CARBON MONOXIDE POISONING THAT COULD RESULT IN PERSONAL INJURY OR DEATH.

DO NOT, UNDER ANY CIRCUMSTANCES, CONNECT RETURN OR SUPPLY DUCTWORK TO OR FROM ANY OTHER HEAT PRODUCING DEVICE SUCH AS A FIREPLACE INSERT, STOVE, ETC. DOING SO MAY RESULT IN FIRE, CARBON MONOXIDE POISONING, EXPLOSION, PERSONAL INJURY OR PROPERTY DAMAGE.

IMPORTANT: Some high efficiency filters have a greater than normal resistance to airflow. This can adversely affect furnace operation. Be sure to check airflow if using any filter other than the factory-provided filter.

UPFLOW UNITS

1. Position the unit to minimize long runs of duct or runs of duct with many turns and elbows.

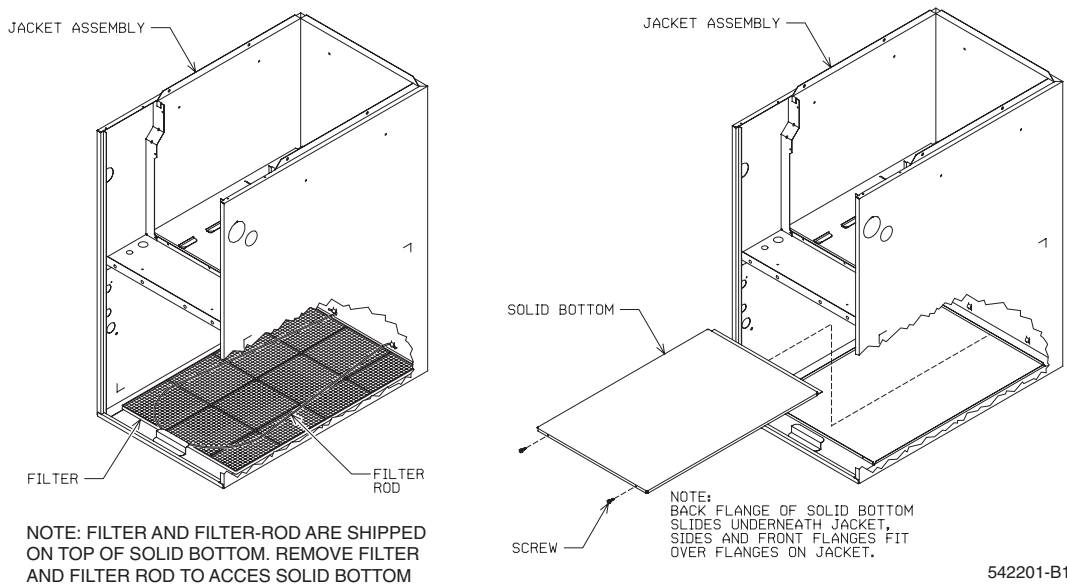
▲ WARNING

UPFLOW FURNACE: A SOLID METAL BASE PLATE MUST BE INSTALLED IN THE FURNACE BOTTOM WHEN USING SIDE AIR RETURN. FAILURE TO INSTALL A BASE PLATE COULD CAUSE THE PRODUCTS OF COMBUSTION TO CIRCULATE INTO THE LIVING SPACE AND CREATE POTENTIALLY HAZARDOUS CONDITIONS, INCLUDING CARBON MONOXIDE POISONING OR DEATH.

2. Open the return air compartment.
 - a. If using side return air, **do not remove the bottom base.**
 - b. Cut an opening in the side . The opening should be cut the full width of the knockouts on the unit.
NOTE: When using side return, return air plenums, RXGR-C17B, C21B and C24B are available from the factory.
 - c. Remove the bottom base, if using bottom return air. Remove the panel by removing the two screws attaching the base to the front base angle. See Figure 12.
NOTE: Where the maximum airflow is 1800 CFM or more, both sides or the bottom must be used for return air.
3. Connect the return duct or return air cabinet to the unit. Make the connection air tight to prevent entraining combustion gases from an adjacent fuel-burning appliance.
4. **Be sure to have adequate space for the unit filter.**
NOTE: DO NOT take return air from bathrooms, kitchens, furnace rooms, garages, utility or laundry rooms, or cold areas. DO NOT use a rear air return.
5. If summer air conditioning is desired, position the indoor coil on the supply air side of the unit. Insure that no air can bypass this coil.
6. Connect the supply air plenum to the furnace plenum opening.

IMPORTANT: If a flexible duct connector must be used, it **MUST** be rated for a minimum temperature of 250°F. continuous.

**FIGURE 12
BOTTOM PANEL REMOVAL**



DOWNFLOW UNITS

1. Position the unit to minimize long runs of duct or runs of duct with many turns and elbows.
2. If summer air conditioning is desired, position the indoor coil on the supply air side of the unit. Insure that no air can bypass this coil.
3. If installing on a combustible floor **and not using an air conditioning plenum**, install the special base for combustible floors. See Figure 8.

▲ WARNING

THE DOWNFLOW FURNACE DESIGN IS CERTIFIED FOR INSTALLATION ON A NON-COMBUSTIBLE FLOOR. USE THE SPECIAL BASE SPECIFIED ON THE FURNACE CLEARANCE LABEL. FAILURE TO INSTALL THE SPECIAL BASE MAY RESULT IN FIRE, PROPERTY DAMAGE, PERSONAL INJURY OR DEATH. THIS SPECIAL BASE IS SHIPPED FROM THE FACTORY AS AN ACCESSORY.

4. Connect the furnace to the supply air plenum.
5. Connect the return air ducting to the return air opening at the top of the unit. Make the connection air tight to prevent entraining combustion gases from an adjacent fuel-burning appliance.
6. **Be sure to have adequate space for the unit filter.**

NOTE: DO NOT take return air from bathrooms, kitchens, furnace rooms, garages, utility or laundry rooms, or cold areas.

HORIZONTAL UNITS (-GJD MODELS)

IMPORTANT: This furnace may only be installed so as when facing the front of the furnace, supply air is discharged on the left hand side.

1. Position the unit to minimize long runs or runs with many turns and elbows.
2. If summer air conditioning is desired, position the indoor coil on the supply air side of the unit. Insure that no air can bypass this coil.
3. Connect the furnace to the supply air plenum.

4. Connect the return air ducting to the return air opening at the right end of the unit. Make the connection air tight to prevent entraining combustion gases from an adjacent fuel-burning appliance.
5. **Be sure to have adequate space for the unit filter.**

NOTE: DO NOT take return air from bathrooms, kitchens, furnace rooms, garages, utility or laundry rooms, or cold areas.

► Return air can come from : (1) outside the building, (2) from return air

ducting from several inside rooms, or (3) a combination of the two. When using outside air, design and adjust the system to maintain a return air temperature **above 55°F** during the heating season. If return air comes from both inside and outside the building, design the ducting system with a diverting damper so that the volume of return air entering the furnace equals that which would normally enter through the return air intake of the furnace. Any duct opening pulling return air from the outside must not be any higher nor closer than 10 feet to the furnace exhaust vent.

SUPPLY AIR SENSOR

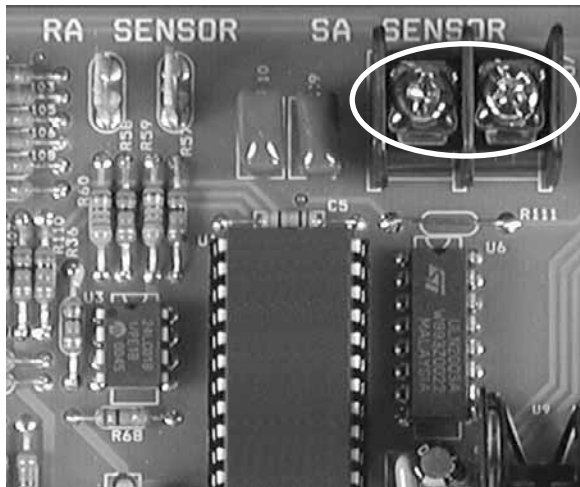
Each furnace comes shipped from the factory with a supply air sensor. Install the sensor, in the supply air plenum trunk, with two, field supplied, #8 sheet metal screws, using the following guidelines:

1. 12" downstream of the evaporator coil, if installed.
2. If no evaporator coil is used, locate the sensor out of direct line-of-site of the heat exchanger and not closer than 18" downstream of the furnace outlet.
3. Attach the supply air sensor wires onto the terminals marked "SA Sensor" on the integrated furnace control board (See Figure 13).
4. Do not extend the supply-air sensor wire.

NOTE: Improper placement of the supply air sensor can adversely affect furnace temperature rise.

NOTE: In downflow circumstances where building construction does not allow for the placement of the sensor to fall within these parameters, the supply air sensor should not be connected. This means that the furnace will run under default parameters. When running under default parameters, the "82" code will appear for 90 seconds. After that, the fault code will be stored in the control board's memory and will show only upon power cycling. Default airflow parameters can be manually adjusted. See section discussing Integrated Furnace Control (IFC) board in this manual.

FIGURE 13
SUPPLY AIR SENSOR TERMINALS



VENTING AND COMBUSTION AIR PIPING

GENERAL INFORMATION

▲ WARNING

READ AND FOLLOW ALL INSTRUCTIONS IN THIS SECTION. FAILURE TO PROPERLY VENT THIS FURNACE OR PROTECT IT FROM INADEQUATE COMBUSTION AIR CAN CAUSE CARBON MONOXIDE POISONING, AN EXPLOSION OR FIRE, RESULTING IN PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.

OVER TEMPERATURE SAFETY SWITCHES

Furnaces are equipped with safety switches in the burner compartment to protect against over temperature conditions. If a switch is tripped, it must be manually reset.

▲ WARNING

DO NOT JUMPER OVERTEMPERATURE OR ANY OTHER SAFETY SWITCHES! IF ONE OF THESE OVER TEMPERATURE SWITCHES SHOULD TRIP, CALL A QUALIFIED INSTALLER, SERVICE AGENCY OR THE GAS SUPPLIER. DO NOT RESET THE SWITCHES WITHOUT TAKING CORRECTIVE ACTION. FAILURE TO DO SO CAN RESULT IN CARBON MONOXIDE POISONING OR DEATH. IF THIS UNIT IS INSTALLED IN A CLOSET, THE DOOR MUST BE CLOSED WHEN MAKING THIS CHECK.

REPLACE THE OVER TEMPERATURE SAFETY SWITCHES ONLY WITH THE IDENTICAL REPLACEMENT PART.

▲ WARNING

IN CANADA, PRODUCTS CERTIFIED FOR INSTALLATION AND INTENDED TO BE VENTED WITH PLASTIC VENT SYSTEMS (PVC, CPVC) MUST USE VENT SYSTEMS THAT ARE CERTIFIED TO THE STANDARD FOR TYPE BH GAS VENTING SYSTEMS, ULC S636.

THE COMPONENTS OF THE CERTIFIED MATERIAL MUST NOT BE INTERCHANGED WITH OTHER VENT SYSTEMS OR UNLISTED PIPE/FITTINGS.

PLASTIC COMPONENTS AND SPECIFIED PRIMERS AND GLUES OF THE CERTIFIED SYSTEM MUST BE FROM A SINGLE SYSTEM MANUFACTURER AND NOT INTERMIXED WITH OTHER SYSTEM MANUFACTURER'S PARTS.

INSTALLATION WITH PRE-EXISTING VENT SYSTEMS

When the installation of this furnace replaces an existing furnace that is removed from a vent system serving other appliances (such as a water heater), the existing vent system is likely to be too large to properly vent the remaining attached appliances.

Follow the steps below with each appliance remaining connected to the original common vent system. Place the appliance to be tested in operation, while the other appliances remaining connected to the common vent system are not in operation. Test the operation of each appliance individually by the following method.

1. Permanently seal any unused openings in the common venting system.
2. Visually inspect the venting system for proper size and horizontal pitch and determine that there is no blockage, restriction, leakage, corrosion or other deficiencies which could cause an unsafe condition.
3. If practical, close all building doors, windows and all doors between the space where the appliances remaining connected to the common venting system are located. Turn on clothes dryers and any appliance not connected to the

common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.

4. Follow the lighting instructions. Place the appliance being inspected into operation. Adjust the thermostat so the appliance will operate continuously.
5. Test for spillage at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, cigar or pipe.
6. After it has been determined that each appliance that remains connected to the common venting system properly vents (when tested as outlined above), return doors, windows, exhaust fans, fireplace dampers and any other gas-burning appliance to their previous conditions of use.
7. If improper venting is observed during any of the above tests, resize the common venting system. Refer to latest edition of the National Fuel Gas Code ANSI Z223.1, or the CSA-GAMA venting tables for Category I furnaces.

NOTE: Schedule 40 ABS-DWV pipe and fittings may be used as an alternate to PVC pipe for the combustion air inlet and vent pipes.

NOTE: Cellular core PVC is also approved for use. It must be schedule 40 PVC-DWV cellular pipe manufactured under ASTM F-891.

JOINING PIPE AND FITTINGS

▲ WARNING

PVC SOLVENT CEMENTS AND PRIMERS ARE HIGHLY FLAMMABLE. PROVIDE ADEQUATE VENTILATION AND DO NOT ASSEMBLE COMPONENTS NEAR HEAT SOURCE OR AN OPEN FLAME. DO NOT SMOKE. AVOID SKIN OR EYE CONTACT. OBSERVE ALL CAUTIONS AND WARNINGS PRINTED ON MATERIAL CONTAINERS. FAILURE TO FOLLOW THESE GUIDELINES MAY RESULT IN FIRE, EXPLOSION OR ASPHYXIATION CAUSING PERSONAL INJURY OR DEATH.

All pipe, fittings, solvent cement, primers and procedures must conform to American National Standard Institute and American Society for Testing and Materials (ANSI/ASTM) standards as shown below:

IMPORTANT: The plastic combustion air and venting components are MADE of PVC. If using ABS piping, ensure that the solvent cement is compatible for joining PVC to ABS components or use a mechanical connection that can withstand the vent temperatures and is corrosion resistant.

CEMENTING JOINTS

Properly seal all joints in the PVC vent using the following materials and procedures:

PVC CLEANER-PRIMER AND
PVC MEDIUM-BODY SOLVENT
CEMENT

IMPORTANT: After cutting pipe, remove all ragged edges and burrs. This is important to prevent increase in pressure drop throughout the system.

1. Cut pipe end square. Chamfer edge of pipe. Clean fitting socket and pipe joint area of all dirt, grease and moisture.
2. After checking pipe and socket for proper fit, wipe socket and pipe with cleaner-primer. Apply a liberal coat of primer to inside surface of socket and outside of pipe. **READ INSTRUCTIONS INCLUDED WITH THE PRIMER FOR PROPER INSTALLATION.**

3. Apply a thin coat of cement evenly in the socket. Quickly apply a heavy coat of cement to the pipe end and insert pipe into fitting with a slight twisting movement until it bottoms out.

NOTE: Cement must be fluid; if not, recoat.

4. Hold the pipe in the fitting for 30 seconds to prevent the tapered socket from pushing the pipe out of the fitting.
5. Wipe all excess cement from the joint with a rag. Allow 15 minutes before handling. Cure time varies according to fit, temperature and humidity.

NOTE: Stir the solvent cement frequently while using. Use a natural bristle, one inch wide brush or the applicator supplied with the can.

IMPORTANT: For Proper Installation DO NOT use solvent cement that has become curdled, lumpy or thickened. DO NOT thin. Observe shelf precautions printed on containers. For application below 32°F, use only low-temperature-type solvent cement.

For correct installation of the vent pipe, follow the instructions provided by the manufacturers of the pipe, primer and solvent.

PIPE & FITTING MATERIAL	ASTM SPECIFICATION
Schedule 40 PVC (Pipe)	D1785
Schedule 40 PVC (Cellular Core Pipe)	F891
Schedule 40 PVC (Fittings)	D2466
SDR-21PVC (Pipe)	D2241
SDR-26 PVC (Pipe)	D2241
Schedule 40 ABS Cellular Core DWV (Pipe)	F628
Schedule 40 ABS (Pipe)	D1527
Schedule 40 ABS (Fittings)	D2468
ABS-DWV (Drain Waste & Vent) (Pipe & Fittings)	D2661
PVC-DWV (Drain Waste & Vent) (Pipe & Fittings)	D2665

NON-DIRECT VENT PIPE INSTALLATION (FOR VERTICAL TERMINATIONS ONLY)

COMBUSTION AIR

▲ WARNING

ALWAYS PROVIDE THIS FURNACE AND ANY OTHER FUEL BURNING APPLIANCE WITH ENOUGH FRESH AIR FOR PROPER COMBUSTION AND VENTILATION OF THE FLUE GASES. MOST BUILDING CODES REQUIRE THAT OUTSIDE AIR BE SUPPLIED INTO THE FURNACE AREA. FAILURE TO DO SO CAN CAUSE DEATH FROM CARBON MONOXIDE POISONING.

Provide adequate facilities for combustion and ventilation air in accordance with section 5.3, Air for Combustion and Ventilation of the National Fuel Gas Code, ANSI Z223.1 - latest edition; CAN/CGA B149.1 and .2, or applicable provisions of the local building codes. These combustion and ventilation facilities must not be obstructed.

IMPORTANT: Air for combustion and ventilation must not come from a corrosive atmosphere. Any furnace failure due to corrosive elements in the atmosphere is excluded from warranty coverage.

The following types of installation (but not limited to the following) REQUIRE OUTDOOR AIR for combustion, due to chemical exposures:

- Commercial buildings
- Buildings with indoor pools
- Furnaces installed in laundry rooms
- Furnaces in hobby or craft rooms
- Furnaces installed near chemical storage areas.

Exposure to the following substances in the combustion air supply (but not limited to the following) also REQUIRE OUTDOOR AIR for combustion:

- Permanent wave solutions
- Chlorinated waxes and cleaners
- Chlorine-based swimming pool chemicals
- Water softening chemicals
- De-icing salts or chemicals
- Carbon Tetrachloride
- Halogen type refrigerants
- Cleaning solvents (such as perchloroethylene)
- Printing inks, paint removers, varnishes, etc.
- Hydrochloric acid
- Cements and glues
- Anti-static fabric softeners for clothes dryers
- Masonry acid washing materials

Combustion air must be free of acid forming chemicals such as sulphur, fluorine, and chlorine. These elements are found in aerosol sprays, detergents, bleaches, cleaning solvents, air fresheners, paint and varnish removers, refrigerants and many other commercial and household products. Vapors from these products when burned in a gas flame form acid compounds. The acid compounds increase the dew point temperature of the flue products and produce highly corrosive condensate.

▲ WARNING

ALL FURNACE INSTALLATIONS MUST COMPLY WITH THE NATIONAL FUEL GAS CODE AND LOCAL CODES TO PROVIDE ADEQUATE COMBUSTION AND VENTILATION AIR FOR THE FURNACE. FAILURE TO DO SO CAN RESULT IN EXPLOSION, FIRE, PROPERTY DAMAGE, CARBON MONOXIDE POISONING, PERSONAL INJURY OR DEATH.

Combustion air requirements are determined by whether the furnace is in an open (unconfined) area or in a confined space such as a closet or small room.

FURNACE LOCATED IN AN UNCONFINED SPACE

Using indoor air for combustion.

An unconfined space must have at least 50 cubic feet for each 1,000 BTUH of the **total input for all appliances** in the space. Here are a few examples of the room sizes required for different inputs. The sizes are based on 8 foot ceilings. See Table 1.

**TABLE 1
UNCONFINED SPACE DIMENSIONS**

BTUH Input	Minimum Sq. Feet With 8 foot Ceiling	Typical Room Size
60,000	375	15' x 25' OR 19' x 20'
75,000	469	15' x 32' OR 20' x 24'
90,000	563	20' x 28' OR 24' x 24'
105,000	657	20' x 33' OR 26' x 25'
120,000	750	25' x 30' OR 24' x 32'

If the open space containing the furnace is in a building constructed to severely limit outside air infiltration (contemporary energy efficient construction methods), outside air may still be required for the furnace to operate and vent properly. Outside air openings should be sized the same as for a confined space.

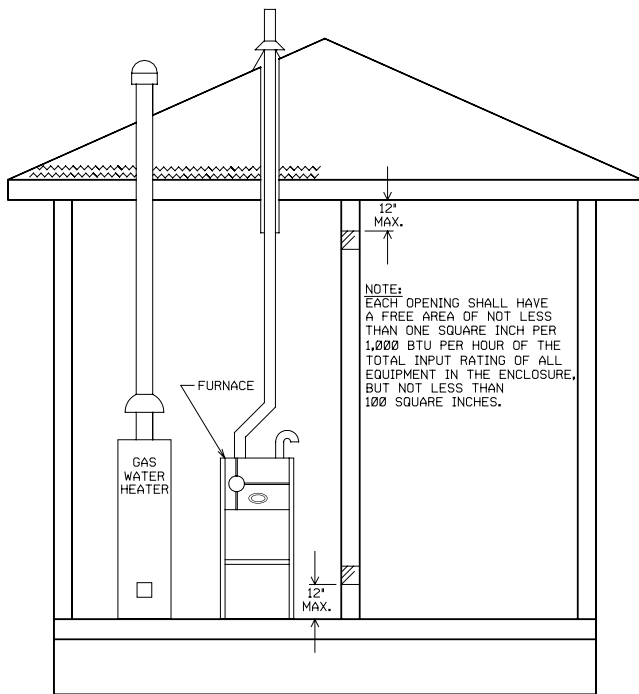
FURNACE LOCATED IN A CONFINED SPACE.

A confined space (any space smaller than shown before as “unconfined”) must have **openings into the space, which are located in accordance with the requirements set forth in the following subsections A and B.** The openings must be sized by how they connect to the heated area or to the outside, and by the input of all appliances in the space.

If the confined space is within a building with tight construction, combustion air must be taken from outdoors or areas freely communicating with the outdoors.

BTUH Input	Free Area Each Opening
60,000	100 square inches
75,000	100 square inches
90,000	100 square inches
105,000	105 square inches
120,000	120 square inches

**FIGURE 14
AIR FROM HEATED SPACE**



A. USING INDOOR AIR FOR COMBUSTION

IMPORTANT: DO NOT take air from a heated space with a fireplace, exhaust fan or other device that may produce a negative pressure.

If combustion air is taken from the heated area (see Figure 14), the openings must **each** have at least **100 square inches of free area.** Each opening must have at least **one square inch of free area for each 1,000 BTUH of total input** in the space. See Table 2.

B. USING OUTDOOR AIR FOR COMBUSTION

IMPORTANT: Do not take air from an attic space that is equipped with power ventilation.

The confined space must communicate with the outdoors in accordance with Methods 1 or 2. The minimum dimension of air openings shall not be less than 3 inches. Where ducts are used, they shall be of the same cross-sectional area as the free area of the openings to which they connect.

Method 1

Two permanent openings, one located within 12 inches of the top and one located within 12 inches of the bottom of the enclosure, shall be provided. The openings shall communicate directly, or by ducts, with the outdoors or spaces (crawl or attic) that freely communicate with the outdoors.

- a. Where directly communicating with the outdoors or where communicating to the outdoors through vertical ducts as shown in Figure 15, each opening shall have a minimum free area of 1 square inch for each 4000 BTUH of total appliance input rating in the enclosure. See Table 3.

BTUH Input	Free Area Each Opening	Round Pipe Size
60,000	15.00 square inches	5"
75,000	18.75 square inches	5"
90,000	22.50 square inches	6"
105,000	26.25 square inches	6"
120,000	30.00 square inches	7"

- b. Where communicating with outdoors through horizontal ducts, each opening shall have a minimum free area of 1 square inch for each 2000 BTUH of total input rating of all equipment in the enclosure. See Table 4 and Figure 16.

BTUH Input	Free Area Each Opening	Round Pipe Size
60,000	30.00 square inches	7"
75,000	37.50 square inches	7"
90,000	45.00 square inches	8"
105,000	52.50 square inches	9"
120,000	60.00 square inches	9"

Method 2

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

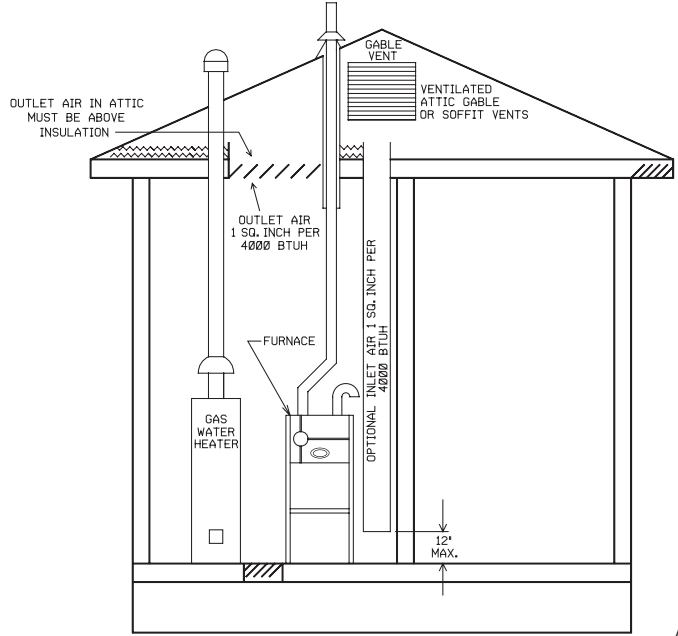
- a. One square inch for each 3000 BTUH of the total input rating of all equipment located in the enclosure (see Table 5), and
- b. Not less than the sum of the areas of all vent connectors in the confined space.

If the unit is installed where there is an exhaust fan, sufficient ventilation must be provided to prevent the exhaust fan from creating a negative pressure.

BTUH Input	Free Area Each Opening	Round Pipe Size
60,000	20.00 square inches	6"
75,000	25.00 square inches	6"
90,000	30.00 square inches	7"
105,000	35.00 square inches	7"
120,000	40.00 square inches	8"

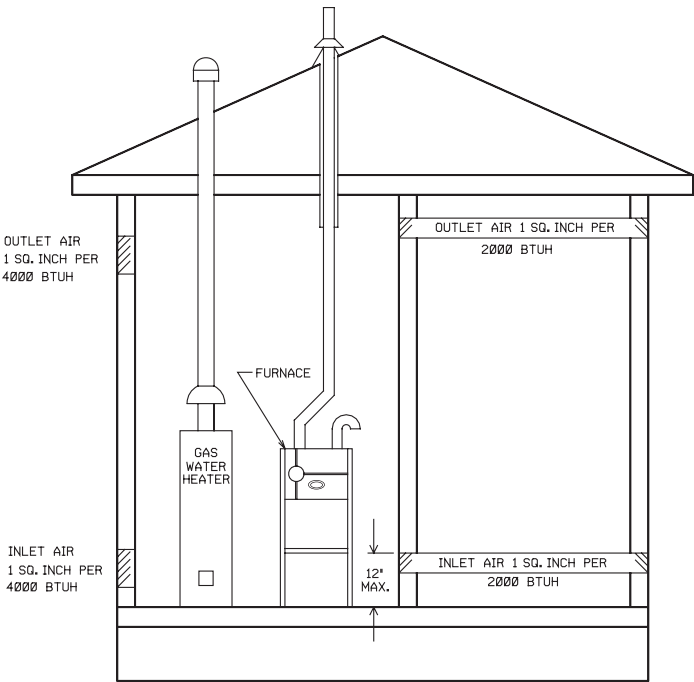
Combustion air openings must not be restricted in any manner.
CONSULT LOCAL CODES FOR SPECIAL REQUIREMENTS.

**FIGURE 15
AIR FROM ATTIC/CRAWL SPACE**



A077601

**FIGURE 16
OUTSIDE AIR USING A HORIZONTAL INLET & OUTLET**



MINIMUM 1 INLET & 1 OUTLET AIR SUPPLY
 REQUIRED IN ANY COMBINATION SHOWN

A077701

INSTALLATION GUIDELINES

IMPORTANT: When installed as a non-direct furnace, only vertical terminations are allowed. Do not use horizontal terminations when the furnace is installed with a non-direct vent.

All exhaust vent piping must be installed in compliance with Part 7, Venting of Equipment, of the latest edition of the National Fuel Gas Code NFPA 54/ANSI A223.1, or CAN/CGA-B149.1 and .2, local codes or ordinances and these instructions.

VENTING GUIDELINES - Non-Direct Vent

- IMPORTANT:** Do not common vent with any other appliance. Do not install in the same chase or chimney with a metal or high temperature plastic pipe from another gas or fuel-burning appliance unless the required minimum clearances to combustibles are maintained between the PVC pipe and other pipes.
- Use only medium or long radius sweep elbows, such as PVC-DWV elbows.**
NOTE: For upflow and downflow installations, extend the exhaust pipe a minimum of 18" vertically above the furnace cabinet before turning the vent.
- Vertical vent piping is preferred.**
- Install all horizontal piping as follows:
 - Slope horizontal vent piping upward a minimum of 1/4" per foot of run so that condensate drains toward the furnace.
 - Support horizontal vent piping at least every four feet. No sags or dips are permitted.
- Insulate all vent runs through unconditioned spaces where below-freezing temperatures are expected, with 1" thick medium density, foil faced fiber glass or equivalent Rubatex/Armaflex insulation. For horizontal runs where water may collect and freeze, wrap the vent pipe with self-regulating, 3 or 5 Watt heat tape. The heat tape must be U.L. listed and installed per the manufacturer's instructions.

- All piping between the furnace and the roof penetration is 2" or 3" as specified in Table 6. Table 6 lists the maximum allowable exhaust vent pipe length for the number of elbows used, based on the furnace size.

IMPORTANT: Use Only standard vertical terminations when installing the modulating furnace as a non-direct vent appliance.

- The minimum vent length is **5 feet**.
- All piping through the roof is 2".
When using 3" pipe, reduce to 2" within 18" of the inside of the roof.
- Vertical through-the-roof installations do not require any special vent termination. **Use 2" PVC pipe extending a minimum of 12**

inches above the anticipated level of snow accumulation.

- Elbows must be a minimum of 15" apart.
- No screens may be used to cover combustion air or exhaust.

**► TABLE 6
NON-DIRECT VENT APPLICATIONS
MAXIMUM ALLOWABLE LENGTH IN FEET OF EXHAUST PIPE**

UPFLOW FURNACES (-)GFD					
FURNACE INPUT	PIPE SIZE	TERMINATION (VERTICAL VENT TERMINATIONS ONLY)	NUMBER OF ELBOWS 22°, 45° OR 90° MEDIUM / LONG RADIUS ONLY		
			1 - 2	3 - 4	5 - 6
60,000	2"	STANDARD	40'	35'	30'
	3"	STANDARD	120'	120'	120'
75,000	2"	STANDARD	20'	15'	10'
	3"	STANDARD	120'	120'	120'
90,000	3"	STANDARD	110'	105'	95'
105,000	3"	STANDARD	110'	105'	95'
120,000	3"	STANDARD	45'	35'	30'
DOWNFLOW AND HORIZONTAL FURNACES (-)GGD & (-)GJD					
FURNACE INPUT	PIPE SIZE	TERMINATION (VERTICAL VENT TERMINATIONS ONLY)	NUMBER OF ELBOWS 22°, 45° OR 90° MEDIUM / LONG RADIUS ONLY		
			1 - 2	3 - 4	5 - 6
60,000	2"	STANDARD	30'	25'	20'
	3"	STANDARD	120'	120'	120'
75,000	2"	STANDARD	20'	15'	10'
	3"	STANDARD	120'	120'	120'
90,000	3"	STANDARD	90'	80'	75'
105,000	3"	STANDARD	45'	40'	35'
120,000	3"	STANDARD	40'	35'	30'

NOTES:

- N.R. - NOT RECOMMENDED.
 - MAXIMUM OF 6 ELBOWS MAY BE USED. DO NOT COUNT ELBOWS IN ALTERNATE TERMINATION KIT. MEDIUM OR LONG SWEEP ELBOWS MAY BE USED.
 - A 45 OR 22.5 DEGREE ELBOW IS CONSIDERED ONE ELBOW.
 - CONCENTRIC TERMINATION NO. RXGY-E03 IS FOR THRU-THE-ROOF OR THRU-THE-WALL VENTING.
 - USE KITS RXGY-DO2 (2") OR RXGY-D03 (3") FOR STANDARD OR ALTERNATE THRU-THE-WALL VENTING.
 - USE KITS RXGY-D04 FOR ALTERNATE VENTING OF 120,000 BTUH UNITS WITH LONG RUNS.
 - NO SCREENS MAY BE USED TO COVER COMBUSTION AIR AND EXHAUST.
- * A = 17½" CABINET WIDTH
B = 21" CABINET WIDTH

DIRECT VENT PIPE INSTALLATION

▲ WARNING

READ AND FOLLOW ALL INSTRUCTIONS IN THIS SECTION. FAILURE TO PROPERLY VENT THIS FURNACE CAN CAUSE CARBON MONOXIDE POISONING OR AN EXPLOSION OR FIRE, RESULTING IN PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.

Direct vent installations require a dedicated combustion air and venting system. All air for combustion is taken from outside and all combustion products are discharged to the outdoors. **Therefore, no ventilation or combustion air openings are required.**

INSTALLATION GUIDELINES

All exhaust piping must be installed in compliance with Part 7, "Venting of Equipment," of the latest edition of the National Fuel Gas Code NPFA 54, 90A and 90B ANSI Z223.1-, local codes or ordinances and these instructions.

- IMPORTANT:** Do not common vent with any other appliance. Do not install in the same chase or chimney with a metal or high temperature plastic pipe from another gas or fuel-burning appliance unless the required minimum clearances to combustibles are maintained between the approved PVC pipe and other pipes.

- Use only medium or long radius sweep elbows.

NOTE: For all installations. Extend the combustion air exhaust pipe a minimum of 18" vertically above the furnace cabinet before turning the vent.

- Vertical piping is preferred.
- Install all horizontal piping as follows:
 - Slope horizontal vent piping upward a minimum of 1/4" per foot of run so that condensate drains toward the furnace.
 - Support horizontal vent piping at least every four feet. No sags or dips are permitted.

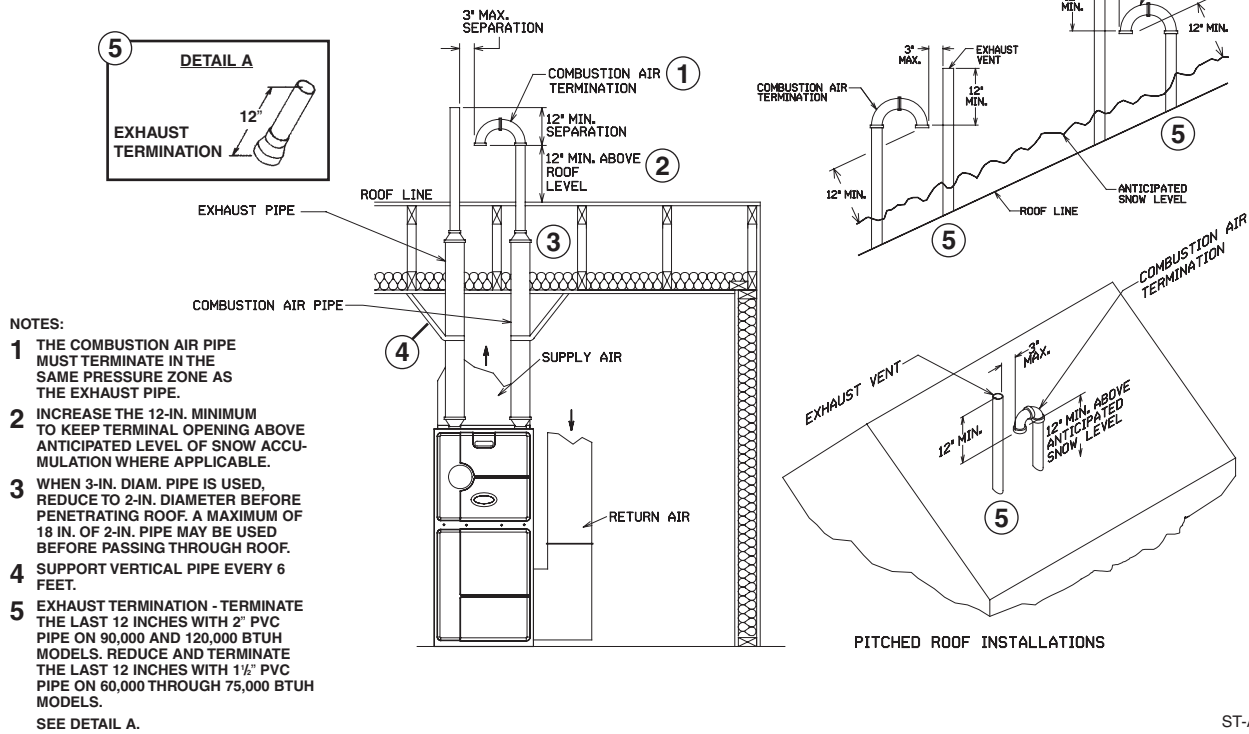
**► TABLE 7
DIRECT VENT APPLICATIONS
MAXIMUM ALLOWABLE LENGTH IN FEET OF EACH EXHAUST PIPE AND INTAKE PIPE**

UPFLOW (-)GFD FURNACES						
FURNACE INPUT	PIPE SIZE	TERMINATION	VENT TERMINATION KIT RECOMMENDED	NUMBER OF ELBOWS 22½°, 45° OR 90° MEDIUM / LONG RADIUS ONLY		
				1 - 2	3 - 4	5 - 6
60,000	2"	STANDARD	RXGY-D02/G02	40'	35'	30'
		CONCENTRIC	RXGY-E03/G02			
		ALTERNATE	RXGY-D02	30'	25'	20'
	3"	STANDARD	RXGY-D03/G02	120'	120'	120'
		CONCENTRIC	RXGY-E03/G02			
		ALTERNATE	RXGY-D03	110'	105'	100'
75,000	2"	STANDARD	RXGY-D02/G02	20'	15'	10'
		STANDARD	RXGY-D03/G02	120'	120'	120'
	3"	CONCENTRIC	RXGY-E03/G02			
		ALTERNATE	RXGY-D03	100'	95'	85'
90,000	3"	STANDARD	RXGY-D03/G02	110'	105'	95'
		CONCENTRIC	RXGY-E03/G02			
		ALTERNATE	RXGY-D03	50'	40'	35'
105,000	3"	STANDARD	RXGY-D03/G02	110'	105'	95'
		CONCENTRIC	RXGY-E03/G02			
		ALTERNATE	RXGY-D03	50'	40'	35'
	120,000	3"	STANDARD	RXGY-D03/G02	45'	35'
CONCENTRIC			RXGY-E03/G02			
ALTERNATE			RXGY-D03	45'	35'	30'
ALTERNATE		RXGY-D04	105'	95'	90'	
DOWNFLOW (-)GGD AND HORIZONTAL (-)GJD FURNACES**						
FURNACE INPUT	PIPE SIZE	TERMINATION	VENT TERMINATION KIT RECOMMENDED	NUMBER OF ELBOWS 22½°, 45° OR 90° MEDIUM / LONG RADIUS ONLY		
				1 - 2	3 - 4	5 - 6
60,000	2"	STANDARD	RXGY-D02/G02	30'	25'	20'
		CONCENTRIC	RXGY-E03/G02	30'	25'	20'
	3"	STANDARD	RXGY-D03/G02	120'	120'	120'
		CONCENTRIC	RXGY-E03/G02	120'	120'	120'
75,000	2"	STANDARD	RXGY-D02/G02	20'	15'	10'
		CONCENTRIC	RXGY-E03/G02	20'	15'	10'
	3"	STANDARD	RXGY-D03/G02	120'	120'	120'
		CONCENTRIC	RXGY-E03/G02	120'	120'	120'
90,000	3"	STANDARD	RXGY-D03/G02	70'	60'	55'
		CONCENTRIC	RXGY-E03/G02	70'	60'	55'
105,000	3"	STANDARD	RXGY-D03/G02	45'	40'	35'
		CONCENTRIC	RXGY-E03/G02	45'	40'	35'
120,000	3"	STANDARD	RXGY-D03/G02	40'	35'	30'
		CONCENTRIC	RXGY-E03/G02	40'	35'	30'

NOTES:

- N.R. - NOT RECOMMENDED.
 - MAXIMUM OF 6 ELBOWS MAY BE USED. DO NOT COUNT ELBOWS IN ALTERNATE TERMINATION KIT. MEDIUM OR LONG SWEEP ELBOWS MAY BE USED.
 - A 45 OR 22.5 DEGREE ELBOW IS CONSIDERED ONE ELBOW.
 - CONCENTRIC TERMINATION NO. RXGY-E03 IS FOR THRU-THE-ROOF OR THRU-THE-WALL VENTING.
 - USE KITS RXGY-D02 (2") OR RXGY-D03 (3") FOR STANDARD OR ALTERNATE THRU-THE-WALL VENTING.
 - USE KITS RXGY-D04 FOR ALTERNATE VENTING OF 120,000 BTUH UNITS WITH LONG RUNS.
 - NO SCREENS MAY BE USED TO COVER COMBUSTION AIR AND EXHAUST.
- * A = 17½" CABINET WIDTH
B = 21" CABINET WIDTH
** ALTERNATE VENT NOT PERMITTED ON DOWNFLOW/HORIZONTAL MODELS.

FIGURE 17
STANDARD VERTICAL DIRECT VENTING
UPFLOW MODEL SHOWN (TYPICAL FOR DOWNFLOW/HORIZONTAL MODELS)



5. Insulate all vent runs through unconditioned spaces where below-freezing temperatures are expected with 1" thick medium density, foil faced fiber glass or equivalent Rubatex/Armaflex insulation. For horizontal runs where water may collect, wrap the vent pipe with self-regulating, 3 or 5 Watt heat tape. The heat tape must be U.L. listed and installed per the manufacturer's instructions.
6. All piping between the furnace and the roof or outside wall penetration is 2" or 3" as specified in Table 7. Table 7 lists the maximum allowable length for the exhaust vent pipe and intake air pipe for the number of elbows used, based on the type of termination and furnace size.
7. The minimum vent length is 5 feet.
8. All piping through the roof or outside wall is 2". **When using 3" pipe, reduce to 2" within 18" of the inside of the roof or outside wall (except 120,000 BTUH model using the RXGY-D04 Horizontal Vent Kit).**
9. Terminate the vent using one of the following termination options.

10. Elbows must be a minimum of 15" apart.
11. No screens may be used to cover combustion air or exhaust.

VERTICAL TERMINATIONS

STANDARD VERTICAL TERMINATIONS (See Figure 16)

Combustion Air Piping: Use two medium-radius sweep elbows to keep the inlet downward and prevent the entry of rain. **The inlet opening of the combustion air termination must be a minimum of 12" above the anticipated level of snow accumulation.**

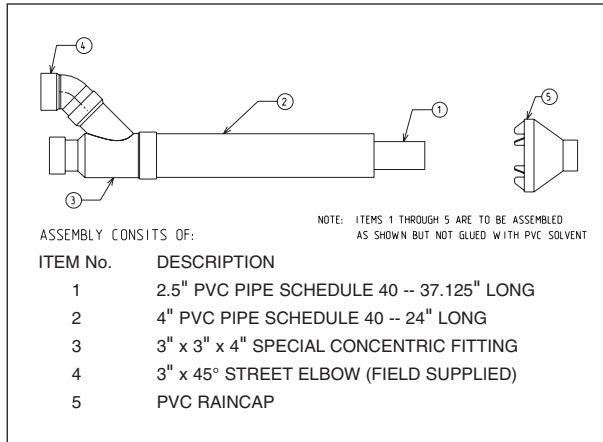
Exhaust Vent Piping: The exhaust vent must terminate at least 12 inches above the combustion air termination inlet. The 2" vent pipe used to penetrate the roof must be reduced to 1 1/2" PVC for the last 12" for the 60,000 and 75,000 BTUH furnace models. No reduction of the 2" pipe is necessary for the 90,000 through 120,000 BTUH models. The maximum length of the exposed vent pipe above the roof is 30".

CONCENTRIC TERMINATIONS

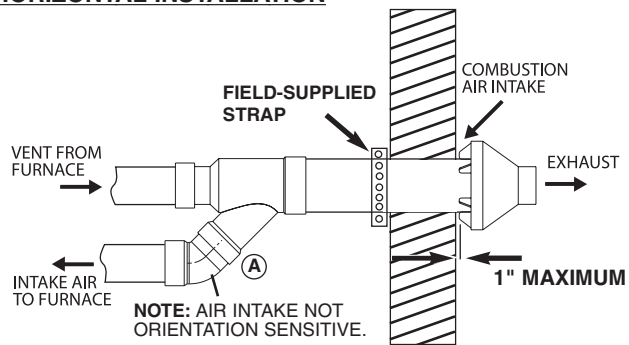
CONCENTRIC VENT KIT NO. RXGY-E03 (SEE FIGURE 18)

This kit is for vertical and horizontal intake air/vent runs. One 5-in. diameter hole is required for installation. See Figure 18 for the general layout. Complete installation instructions are included with the kit.

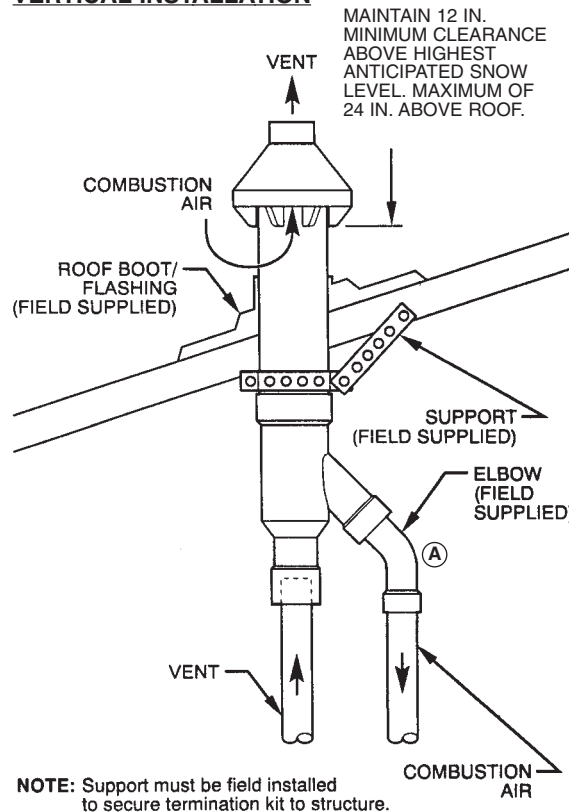
FIGURE 18
CONCENTRIC VENT KIT NO. RXGY-E03
(DIRECT VENT INSTALLATIONS)



HORIZONTAL INSTALLATION



VERTICAL INSTALLATION



INSTALLATION - RXGY-G02 Side Wall Vent

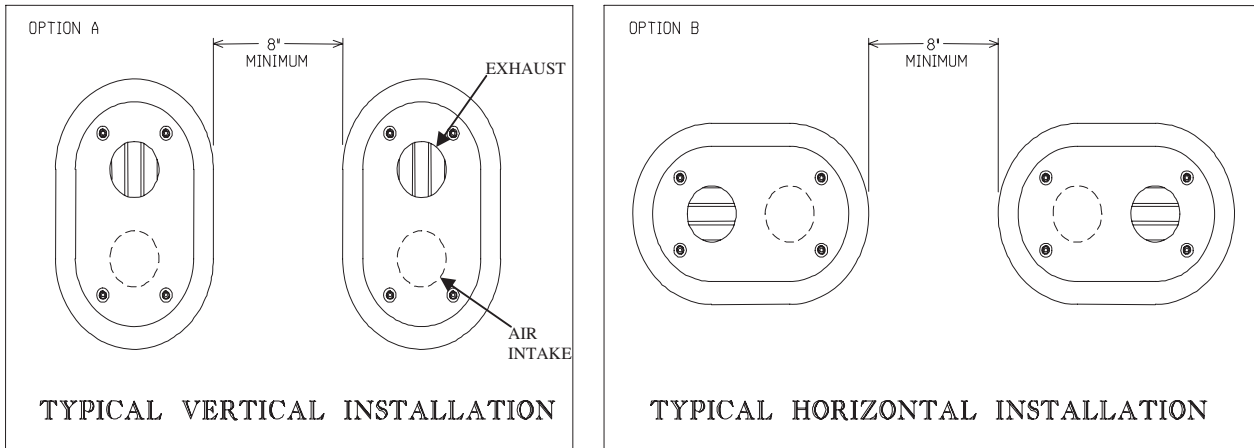
This termination for horizontal venting only.

This termination for direct vent application only.

Important: Do not install on the prevailing winter wind side of the structure

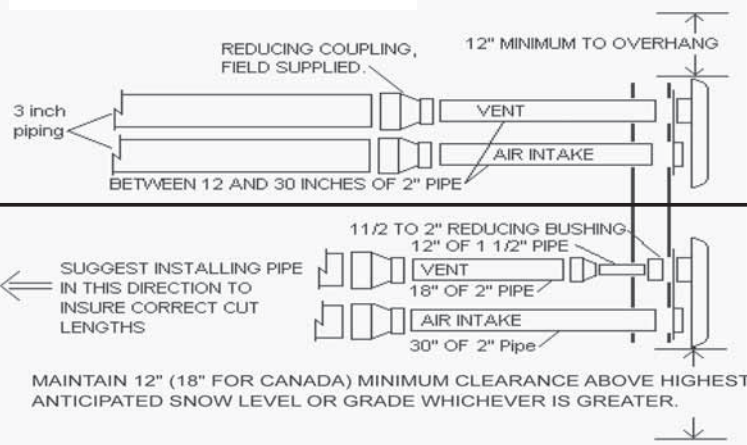
Note: Multi-venting-No common venting.

FIGURE 19
VENT KIT INSTALLATION OPTIONS



NOTE: Install the vent and air intake piping into the vent plate openings. Seal all gaps between the pipes and wall. **Be Sure To Use Silicone Sealant** to seal the vent pipe to the vent cap to permit field disassembly for annual inspection and cleaning. Also seal all pipe penetrations in wall. To prevent possibility of condensate freeze-up or recirculation, **do not install vent kits one above the other.**

FIGURE 20
TYPICAL INSTALLATION



For 90000 thru 120000 BTUH models- reduce to a length between 12 inches and 30 inches of 2 inch pipe.

For 60000 thru 75000 BTUH models- when 3 inch pipe is used: reduce last 30 inches to 18 inches of 2 inch pipe and 12 inches of 1-1/2 inch pipe to maintain velocity.

Note: Vent should protrude a maximum of 2-1/4" beyond vent plate. Air intake should protrude a maximum of 1 inch beyond vent plate.

Seal all wall cavities

HORIZONTAL TERMINATIONS

STANDARD HORIZONTAL TERMINATIONS (SEE FIGURE 21)

NOTE: All furnaces with horizontal air intakes (except those using horizontal concentric vent kit RXGY-E03) must have a drain tee assembly and trap installed in the combustion air pipe as close to the furnace as possible. This is to drain any water that may enter the combustion air pipe to prevent it from entering the furnace vestibule area. These parts are included in horizontal vent kits RXGY-D02, RXGY-D03 and RXGY-D04.

NOTE: The combustion air and exhaust terminations must be at least 12 inches above grade or anticipated snow levels. Use alternate horizontal terminations when termination locations are limited and higher snow levels are anticipated.

NOTE: Ensure the location of the combustion air inlet with respect to the exhaust vent terminal complies with Figure 21, detail C.

Combustion Air Piping: Use a 2" PVC coupling with a wind deflector vane (provided) installed as follows:

1. Install a 2" coupling to the combustion air pipe at the outside wall to prevent the termination from being pushed inward.
2. Cut a 2 1/4" length of 2" PVC pipe and connect this to the coupling.
3. Connect another 2" coupling to the end of the 2 1/4" length of pipe. Terminate this outer coupling 4 inches from the wall.
4. Attach the vane in the final 2" coupling in the vertical position with PVC cement.

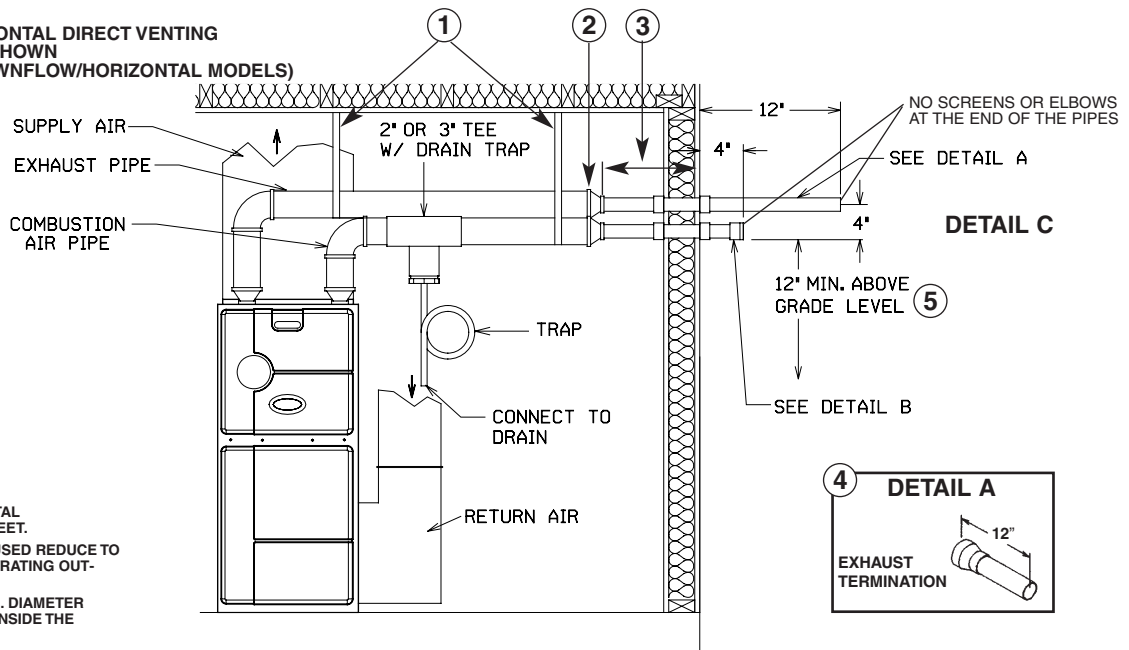
IMPORTANT: To insure proper furnace operation, install the vane in the vertical position as shown in Figure 21, Detail B. Failure to install the vane properly can result in nuisance tripping of the pressure switch.

Exhaust Vent Piping:

60,000 and 75,000 BTUH models: Install a 2" to 1 1/2" reducer coupling at the outside wall to prevent the termination from being pushed inward. Reduce the 2" vent pipe used to penetrate the wall to 1 1/2" PVC for the last 12" of the run. Terminate the 1 1/2" PVC exhaust vent at least 12 inches from the outside wall.

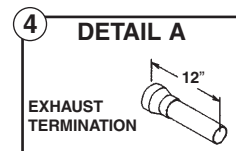
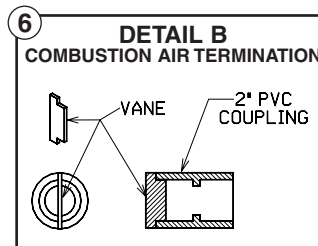
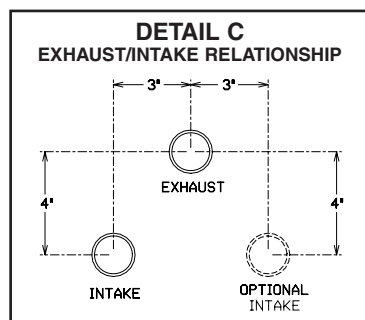
90,000 through 120,000 BTUH models: Install a 2" coupling at the outside wall to prevent the termination from being pushed inward. No reduction of the 2" pipe used to penetrate the wall is necessary. Terminate the 2" PVC exhaust vent at least 12 inches from the outside wall.

FIGURE 21
STANDARD HORIZONTAL DIRECT VENTING
UPFLOW MODEL SHOWN
(TYPICAL FOR DOWNFLOW/HORIZONTAL MODELS)



NOTES:

- 1 SUPPORT HORIZONTAL PIPE EVERY FOUR FEET.
- 2 WHEN 3 IN. PIPE IS USED REDUCE TO 2 IN. BEFORE PENETRATING OUTSIDE WALL.
- 3 18 IN. MAXIMUM. 2 IN. DIAMETER PIPE MAY BE USED INSIDE THE WALL.
- 4 DETAIL "A" - EXHAUST TERMINATION TERMINATE THE LAST 12 INCHES WITH 2" PVC PIPE ON 90,000 AND 120,000 BTUH MODELS. REDUCE AND TERMINATE THE LAST 12 INCHES WITH 1 1/2" PVC PIPE ON 60,000 THROUGH 75,000 BTUH MODELS.
- 5 INCREASE THE 12 IN. MINIMUM ABOVE GRADE TO KEEP TERMINAL OPENINGS ABOVE ANTICIPATED LEVEL OF SNOW ACCUMULATION WHERE APPLICABLE.
- 6 DETAIL "B". INSTALL WIND DEFLECTOR VANE IN 2 IN. PVC COUPLING IN VERTICAL POSITION USING PVC SOLVENT. THE COMBUSTION AIR TERMINATION MUST BE IN THE SAME PRESSURE ZONE AS THE EXHAUST TERMINATION.



ALTERNATE HORIZONTAL TERMINATIONS (See Figure 22)

NOTE: This method is not permitted on modulation downflow ((-) GGD) or horizontal ((-)GJD) furnace models.

NOTE: The combustion air and exhaust terminations must be at least 12 inches above grade or anticipated snow levels. Alternate horizontal terminations allow the combustion air and exhaust terminations to be raised a maximum of 60 inches above the wall penetrations to maintain the required clearance.

NOTE: If combustion air vent pipe is extended more than 24 inches, insulate the vent pipe between the two outside 90° elbows with closed cell insulation such as rubatex, armaflex or equivalent.

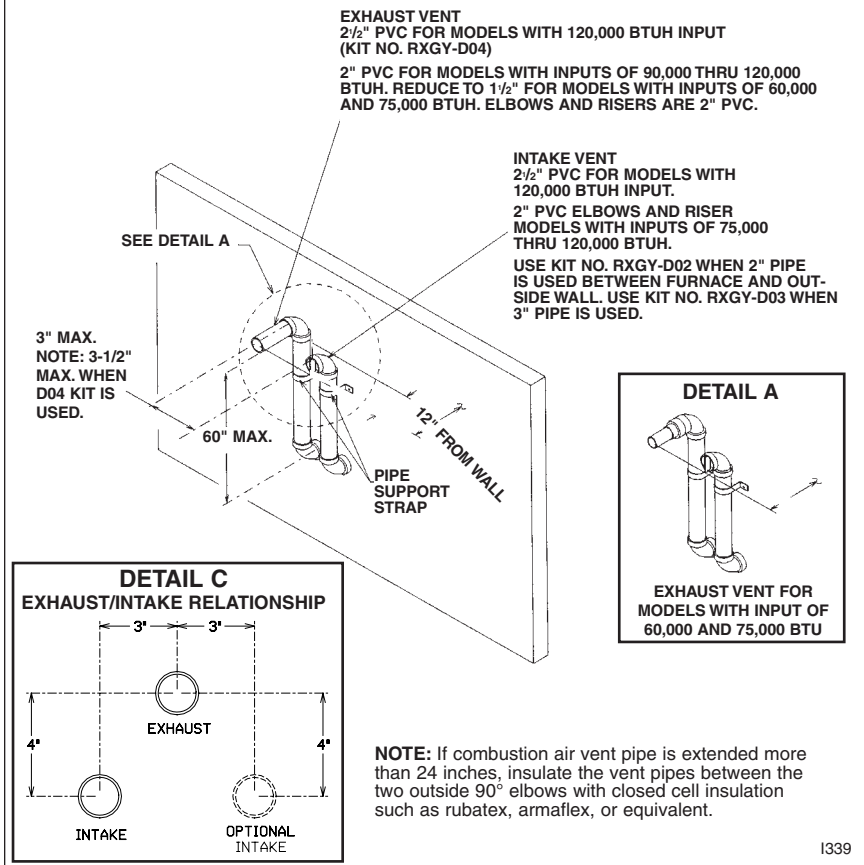
NOTE: Ensure the location of the combustion air inlet with respect to the exhaust vent terminal complies with Figure 22.

Combustion Air Piping: Use a 2" PVC elbow with a wind deflector vane (provided) installed as follows:

1. Install a 2" elbow to the combustion air pipe at the outside wall to prevent the termination from being pushed inward.
2. Cut an adequate length of 2" PVC pipe as needed to clear the anticipated snow level and connect this to the elbow.
3. Connect another 2" elbow to the end of the pipe such that the inlet is facing away from the wall. This outer coupling must terminate 4 inches from the wall.
4. Attach the vane in the final 2" elbow in the vertical position with PVC solvent.

IMPORTANT: To insure proper furnace operation, the supplied vane must be installed in the vertical position as shown in Figure 21, Detail B.

FIGURE 22
ALTERNATE HORIZONTAL DIRECT VENT TERMINATION



Exhaust Vent Piping:

1. Install a 2" elbow to the exhaust vent pipe at the outside wall to prevent the termination from being pushed inward.
2. Cut an adequate length of 2" PVC pipe as needed to insure proper location of the exhaust vent termination with respect to the combustion air inlet and connect this to the elbow.
3. Connect another 2" elbow to the end of the pipe such that the inlet is facing away from the wall.

Exhaust Vent Termination:

60,000 and 75,000 BTUH models: Reduce the 2" vent pipe used to penetrate the wall and extend the terminations to 1 1/2" PVC for the last 12" of the run. Install a 2" to 1 1/2" reducer bushing in the last 2" elbow. Connect a length of 1 1/2" PVC pipe such that the exhaust vent terminates at least 12 inches from the outside wall. See Figure 22, Detail A.

90,000 through 120,000 BTUH models: No reduction of the 2" pipe used to penetrate the wall is necessary. Terminate the 2" PVC exhaust vent at least 12 inches from the outside wall.

120,000 BTUH model with the RXGY-D04 Horizontal Vent Kit: Venting and terminations install the same as above except the 2" pipe and connectors are replaced with 2 1/2" pipe and connectors.

LOCATION REQUIREMENTS HORIZONTAL DIRECT VENTS

▲ CAUTION

THE COMBUSTION PRODUCTS AND MOISTURE IN THE FLUE GASES WILL CONDENSE AS THEY LEAVE THE TERMINATION. THE CONDENSATE CAN FREEZE ON THE EXTERIOR WALL, UNDER THE EAVES AND ON SURROUNDING OBJECTS. SOME DISCOLORATION TO THE EXTERIOR OF THE BUILDING IS TO BE EXPECTED. HOWEVER, IMPROPER LOCATION OR INSTALLATION CAN RESULT IN STRUCTURAL OR EXTERIOR FINISH DAMAGE TO THE BUILDING AND MAY RECIRCULATE PRODUCTS OF COMBUSTION INTO THE COMBUSTION AIR TERMINAL AND FREEZE.

NOTE: In Canada vent terminations must be in accordance with the current CSA-B149 Gas Installation Code and/or local codes.

The vent must be installed with the following minimum clearances. See Figures 23 and 24.

1. Locate the bottom of the vent terminal and the air inlet at least 12 inches above grade. Increase the 12-in. minimum to keep the terminal openings above the level of snow accumulation, where applicable.
2. Do not terminate the vent over public walkways or over an area where condensate or vapor could create a nuisance or hazard.
3. Locate the vent terminal at least one foot from any opening through which flue gases could enter a building.
4. Locate the vent terminal at least 3 feet above any forced air inlet located within 10 feet, except the combustion air inlet of a direct vent appliance.
5. Allow the vent terminal minimum horizontal clearance of 4 feet from electric meters, gas meters, regulators and relief equipment.
6. Locate the furnace combustion air inlet a sufficient distance from the vent of any other gas or fuel burning appliance or electric clothes dryer to prevent recirculation of the flue gases into the furnace combustion air inlet. The only exception to this requirement is the case of multiventing two or more furnaces, which is covered in the section on multiventing in these instructions.

In addition to the minimum clearances listed above, the vent location should be governed by the following guidelines.

1. Do not terminate under any kind of patio or deck. If running the vent under a deck, insulate it to insure no condensate freezes and blocks the pipe. The insulation must be waterproof.
For vent considerations, the edge of the deck must be considered the outside wall.
2. Do not terminate behind any area that may allow the flue products to become stagnant and recirculate.
3. Do not locate on the side of a building with prevailing winter winds. This will help prevent moisture from freezing on walls and overhangs (under eaves).

4. Do not extend vent directly through brick or masonry surfaces. Use a rust-resistant sheet metal or plastic backing plate behind vent. See Figure 17.
5. Do not locate too close to shrubs as condensate may stunt or kill them.
6. Minimum vertical clearances of 1 foot are recommended for overhangs up to 1 foot horizontal. The vertical clearance should be increased equally for each additional increase in horizontal overhang to a maximum vertical clearance of 6 feet.
7. Caulk all cracks, seams and joints within 6 feet horizontally as well as 6 feet above and below vent. See Figure 23.

**FIGURE 23
MOISTURE ZONES**

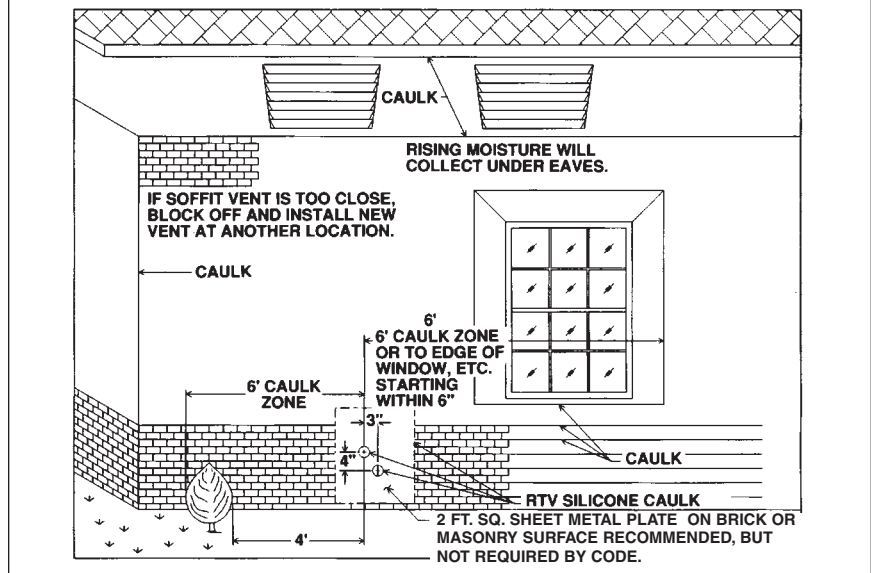
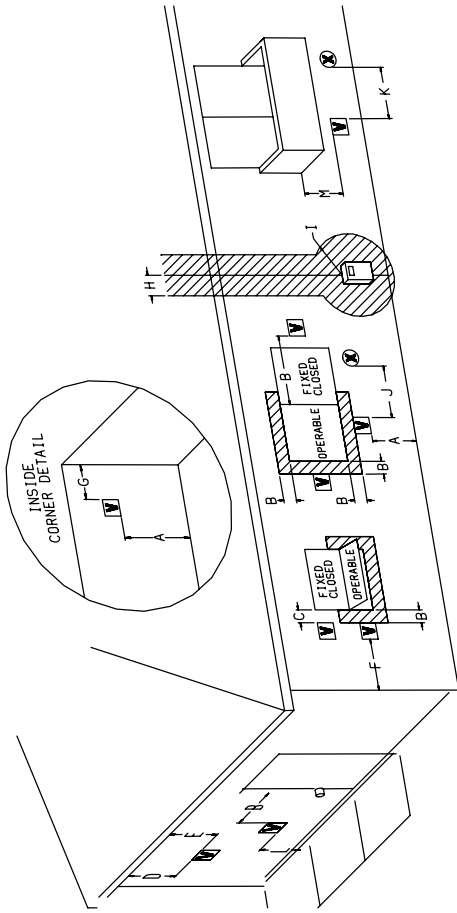


FIGURE 24
DIRECT VENT TERMINAL CLEARANCES



	Canadian Installations ¹	US Installations ²	Canadian Installations ¹	US Installations ²
A=	Clearance above grade, veranda, porch, deck, or balcony	12 inches (30 cm)	6 inches (15 cm) for appliances ≤10,000 BTUH (3 kW), 9 inches (23 cm) for appliances >10,000 BTUH (3 kW) and ≤50,000 BTUH (15 kW), 36 inches (91 cm) for appliances >50,000 BTUH (15 kW)	6 inches (15 cm) for appliances ≤10,000 BTUH (3 kW), 9 inches (23 cm) for appliances >10,000 BTUH (3 kW) and ≤50,000 BTUH (15 kW), 12 inches (30 cm) for appliances >50,000 BTUH (15 kW)
B=	Clearance to window or door that may be opened	6 inches (15 cm) for appliances ≤10,000 BTUH (3 kW), 9 inches (23 cm) for appliances >10,000 BTUH (3 kW) and ≤50,000 BTUH (15 kW), 36 inches (91 cm) for appliances >50,000 BTUH (15 kW)	6 inches (15 cm) for appliances ≤10,000 BTUH (3 kW), 9 inches (23 cm) for appliances >10,000 BTUH (3 kW) and ≤50,000 BTUH (15 kW), 36 inches (91 cm) for appliances >50,000 BTUH (15 kW)	6 inches (15 cm) for appliances ≤10,000 BTUH (3 kW), 9 inches (23 cm) for appliances >10,000 BTUH (3 kW) and ≤50,000 BTUH (15 kW), 36 inches (91 cm) for appliances >50,000 BTUH (15 kW)
C=	Clearance to permanently closed window	*	*	*
D=	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 feet (61 cm) from the center line of the terminal	*	*	*
E=	Clearance to unventilated soffit	*	*	*
F=	Clearance to outside corner	*	*	*
G=	Clearance to inside corner	*	*	*
H=	Clearance to each side of center line extended above meter/regulator assembly	3 feet (91 cm) within a height 15 feet above the meter/regulator assembly	*	*
I=	Clearance to service regulator vent outlet	3 feet (1.83 m)	*	*
J=	Clearance to nonmechanical air supply inlet to building or the combustion air inlet to any other appliance	6 inches (15 cm) for appliances ≤10,000 BTUH (3 kW), 12 inches (30 cm) for appliances >10,000 BTUH (3 kW) and ≤100.00 BTUH (30 kW), 36 inches (91 cm) for appliances >100.00 BTUH (30 kW)	6 inches (15 cm) for appliances ≤10,000 BTUH (3 kW), 12 inches (30 cm) for appliances >10,000 BTUH (3 kW) and ≤100.00 BTUH (30 kW), 36 inches (91 cm) for appliances >100.00 BTUH (30 kW)	6 inches (15 cm) for appliances ≤10,000 BTUH (3 kW), 9 inches (23 cm) for appliances >10,000 BTUH (3 kW) and ≤50,000 BTUH (15 kW), 12 inches (30 cm) for appliances >50,000 BTUH (15 kW)
K=	Clearance to a mechanical air supply inlet	6 feet (1.83 m)	6 feet (1.83 m)	3 feet (91 cm) above if within 10 feet (3 m) horizontally
L=	Clearance above paved sidewalk or paved driveway located on public property	7 feet (2.13 m) †	7 feet (2.13 m) †	*
M=	Clearance under veranda, porch, deck, or balcony	12 inches (30 cm) ‡	12 inches (30 cm) ‡	*

¹ In accordance with the current CSA B149.1 *Natural Gas and Propane Installation Code*
² In accordance with the current ANSI Z223.1 / NFPA 54 *National Fuel Gas Code*
 † A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.
 ‡ Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor.
 * For clearances not specified in ANSI Z223.1 / NFPA 54 or CAN/CGA-B149, one of the following shall be indicated:
 a) A reference to the following footnote:
 "Clearance in accordance with local installation codes, the requirements of the gas supplier and the manufacturer's installation instructions."

FIGURE 25
TWO FURNACE VENTING THROUGH ROOF

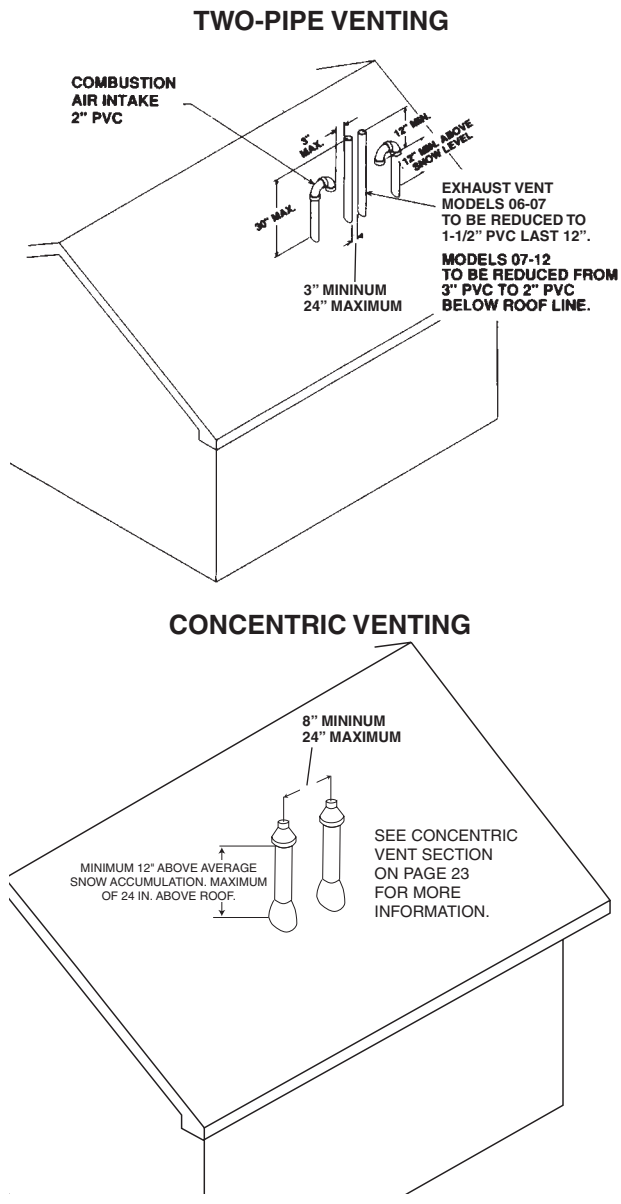
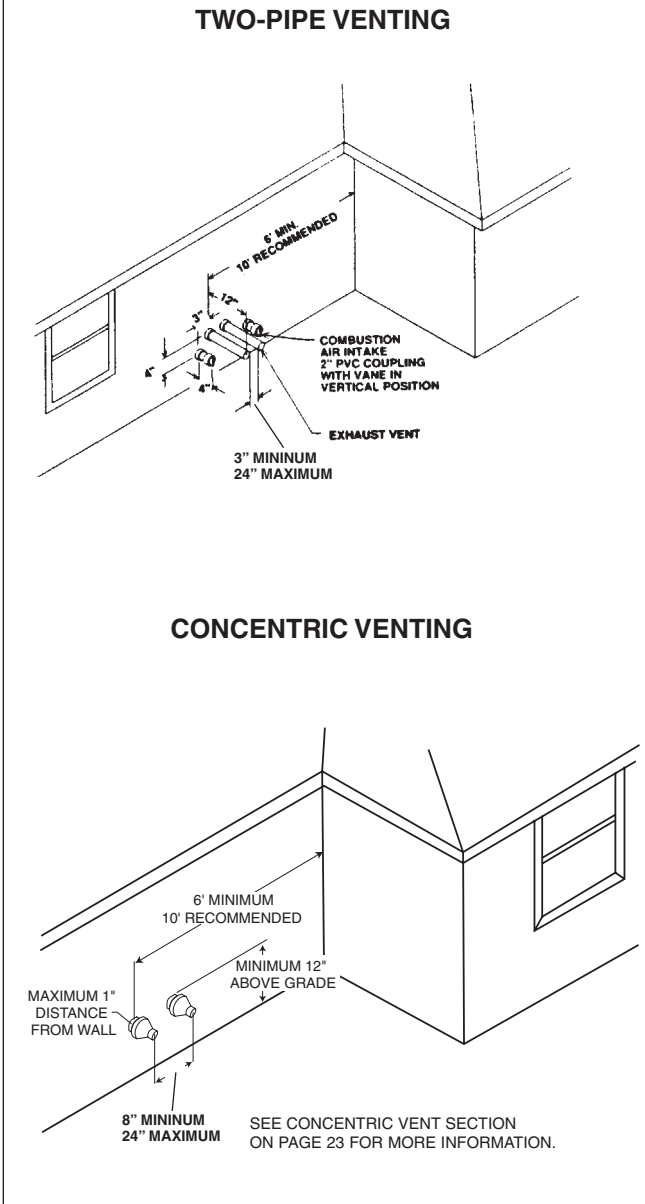


FIGURE 26
TWO FURNACE VENTING THROUGH WALL



8. Painted surfaces must be sound and in good condition with no cracking, peeling, etc. Painted surfaces will require maintenance.
9. Do not expose 3" x 2" reducer/bushing to outdoor ambient temperatures.

MULTIVENTING
IF VENTING TWO OR MORE FURNACES NEAR EACH OTHER IS REQUIRED, EACH FURNACE MUST BE INDIVIDUALLY VENTED – NO COMMON VENTING IS PERMITTED. See Figures 25 and 26 for positioning of the terminations. When more than two furnaces are to be vented, there must be at least 4 feet between the first two furnaces and the third, etc.

CONNECTING TO FURNACE
IMPORTANT: Clean and deburr all pipe cuts. The shavings must not be allowed to block the exhaust, inlet or condensate drain pipes.
IMPORTANT: When indoor combustion air is used, the inlet air opening at the furnace must be protected from accidental blockage. On down-flow models, install a double elbow in the top inlet air opening. See Figure 29.

UPFLOW MODELS

The exhaust air pipe connection is a 2-in. female PVC pipe fitting extending through the left side of the furnace top plate. See Figure 27. This opening has a protective cap which should be removed just prior to installing the exhaust pipe. When 2-in. pipe is used, connect it directly to this fitting. When 3-in. pipe is used, connect a 2 to 3-in. coupling to this fitting with a short piece of 2-in. PVC pipe.

The inlet combustion air connection is at the right side of the top plate. An alternate combustion inlet air connection may be made on the right side of the jacket. The alternate connection opening has a plastic cap. A combustion inlet air connection fitting is supplied with the furnace and it must be installed in the furnace by screwing it into the opening. Make sure the rubber "O-ring" supplied with the furnace is used with this fitting. See Figure 27.

IMPORTANT: When using indoor combustion air, the furnace air opening must be protected from accidental blockage. Install a 2-inch 90° elbow pointing downward on the side or a double elbow pointing downward in the top opening. See Figure 28.

► DOWNFLOW & HORIZONTAL MODELS

NOTE: Combustion air inlet and exhaust outlet air pipes are reversed for downflow and horizontal models from that of upflow.

The exhaust pipe connection is a 2-in. PVC pipe fitting extending through the right side of the furnace top cover. This opening has a protective cap which should be removed just prior to installing the exhaust pipe. When 2-in. pipe is used, connect it directly to this fitting. When 3-in. pipe is used, connect with a 2- to 3-in. coupling directly to the 2-in. pipe.

The combustion inlet air connection is a 2-in. extruded hole on the left side of the top plate. When a 2-in. pipe is used, attach a 2-in. PVC coupling over this hole with RTV sealant and also add two sheet metal screws to secure it in place, and add the required piping. When 3-in. pipe is required, use a 2- to 3-in. coupling and add the required piping. See Figure 29.

IMPORTANT: Always pre-drill holes before securing with screws. Using self-tapping screws without first pre-drilling causes the PVC fitting to crack.

FIGURE 27
UPFLOW MODELS -- COMBUSTION AIR AND VENT PIPE CONNECTION

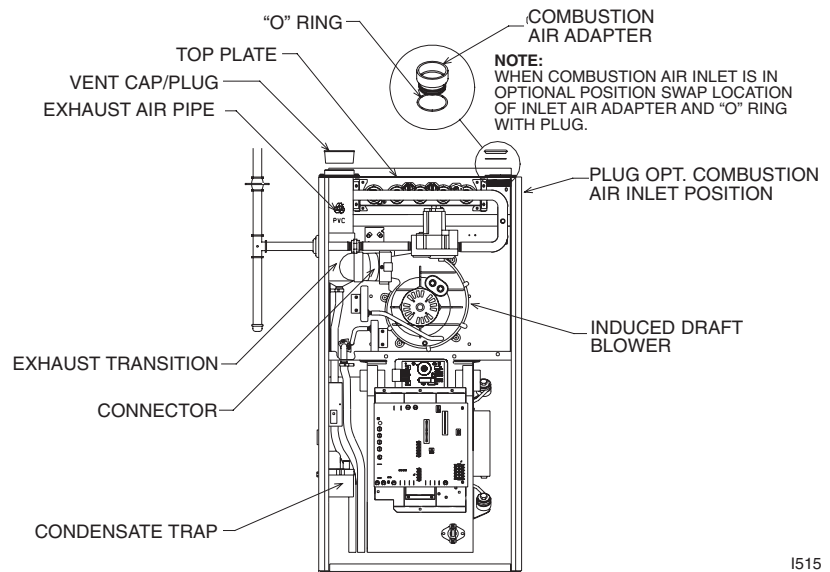
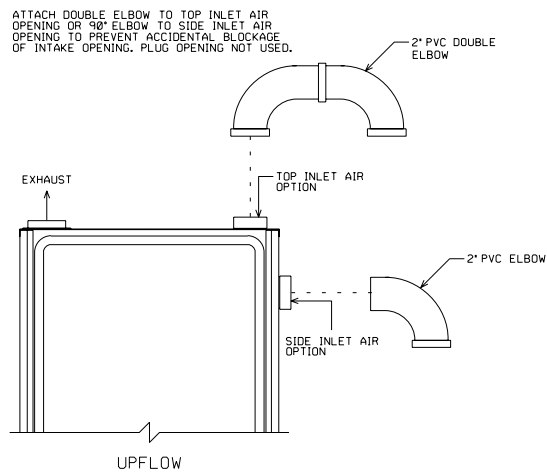
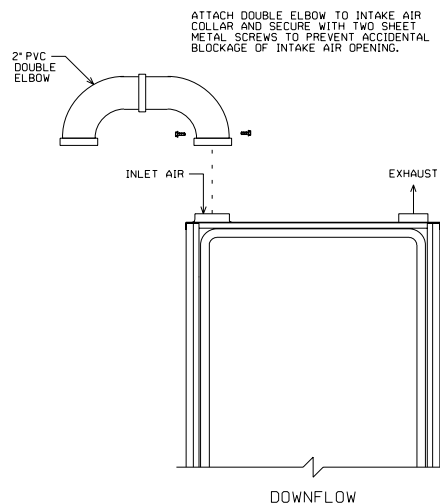


FIGURE 28
UPFLOW MODELS -- COMBUSTION AIR FITTING



► FIGURE 29
DOWNFLOW AND HORIZONTAL MODELS -- COMBUSTION AIR AND VENT PIPE CONNECTION



CONDENSATE DRAIN/OPTIONAL NEUTRALIZER

GENERAL INFORMATION

▲ CAUTION

DO NOT RUN DRAIN OUTDOORS. FREEZING OF CONDENSATE CAN CAUSE PROPERTY DAMAGE.

IMPORTANT: Do not connect into a common drain line with an air conditioner evaporator coil drain located below the furnace. A blocked or restricted drain line can result in overflow of the coil pan and negate the furnace blocked-drain shutoff control.

► **IMPORTANT:** If installing the unit over a finished ceiling or living area, be certain to install an auxiliary condensate drain pan under the entire unit extending out under the condensate tee. With the minimum 5½" riser for upflow models or 1¾" for downflow models installed above the tee, a blocked drain will result in overflow from the riser. If the furnace is installed in an attic, crawlspace or other area where freezing temperatures may occur, the furnace drain can freeze while shut off for long periods of time.

If required by local codes, install a condensate neutralizer cartridge in the drain line. Install cartridge in horizontal position only. Also install an overflow line if routing to a floor drain (see Figures 30 & 31). If available, install a condensate pump that is resistant to acidic water. Pumps are available from your local distributor. If pump used is not resistant to acidic water, a condensate neutralizer must be used ahead of the pump. The condensate pump must have an auxiliary safety switch to prevent operation of the furnace and resulting overflow of condensate in the event of pump failure. The safety switch must be wired through the "R" circuit only (low voltage) to provide operation in either heating or cooling modes.

When selecting neutralizer cartridges and condensate pumps, use the following data:

CONDENSATE PRODUCTION:

MAX (ALL MODELS) = 1-2 gallons per hr.

pH LEVEL:

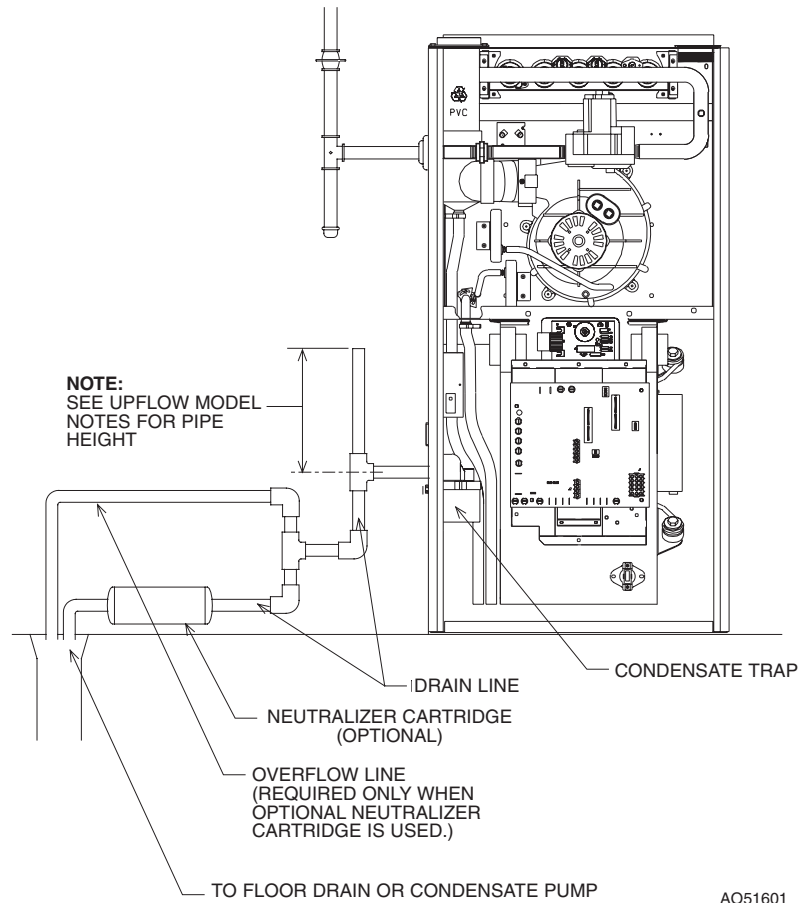
3.2 - 4.5 using OUTDOOR air
2.2 - 4.5 using INDOOR air
(neutral pH = 7.0)

UPFLOW MODELS

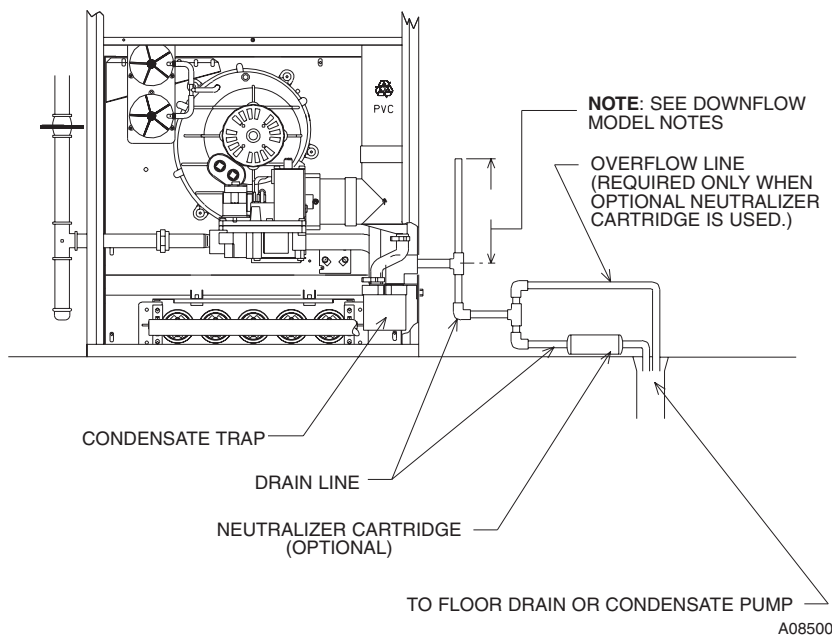
The condensate drain trap is located in the blower compartment on the left-hand side of the jacket. A short piece of ½-in. PVC pipe and a ½-in. tee are provided. Connect the ½-in. pipe to the elbow on the trap and the tee to this pipe so that the open end is upward. Run a drain tube from the bottom of the tee to a floor drain or condensate pump.

IMPORTANT: If installing the unit over a finished ceiling or living area, be certain to install an auxiliary condensate drain pan under the entire unit extending out under the condensate tee.

FIGURE 30
UPFLOW CONDENSATE DRAIN



► **FIGURE 31**
DOWNFLOW CONNECTION



IMPORTANT: There are two options when choosing a height for the condensate riser:

CONDENSATE OVERFLOW: With a 5½ inch riser installed above the tee, a blocked drain will result in overflow from the riser.

FURNACE SHUTDOWN: To cause the furnace to shut down when a blocked drain is present, install a riser which is a minimum of 10¹³/₁₆". If the furnace is installed in an attic, crawl-space or other area where freezing temperatures may occur, the furnace drain can freeze while shut off for long periods of time.

Use a solvent cement that is compatible with PVC material. Cut the drain hoses to the appropriate length and connect to the trap with hose clamps. Tighten the clamps with pliers and check for leaks after attaching.

DOWNFLOW MODELS

IMPORTANT: There are two options when choosing a height for the condensate riser:

CONDENSATE OVERFLOW: With a 1¾ inch riser installed above the tee, a blocked drain will result in overflow from the riser.

FURNACE SHUTDOWN: To cause the furnace to shut down when a blocked drain is present, install a riser which is a minimum of 5½". If the furnace is installed in an attic, crawl-space or other area where freezing temperatures may occur, the furnace drain can freeze while shut off for long periods of time.

Use a solvent cement that is compatible with PVC material.

REVERSING THE TRAP UPFLOW MODELS

The trap may be moved to the right side for right-side drainage. Open the knockout for the drain on the right side of the cabinet. Remove the bracket holding the trap from the left side. Seal the left side drain hole with a plug provided in the cloth bag with the furnace. Position the mounting bracket and trap so that the drain elbow is centered in the hole on the right. See Figure 32.

Drill two holes in the cabinet to mount the bracket. Mount the trap and bracket to the right side with the drain elbow pointing through the knockout. Connect the ½" pipe and tee as noted above. Route the drain hoses behind the top of the electric box, cut to the appropriate length, and connect to the trap with hose clamps.

IMPORTANT: Do not connect into a common drain line with an air conditioner evaporator coil drain located above the furnace. A blocked or restricted drain line can result in overflow of the coil pan and negate the furnace blocked drain shutoff control.

RXGY-H01 CONVERTING TO LEFT DRAIN FOR DOWNFLOW MODELS

As of September 2, 2006, to convert downflow models to left-hand drain, a kit (RXGY-H01) must be ordered from the distributor. The kit includes a 24" piece of ½" black PVC pipe, a 2" rubber grommet, a 1-5/8" plug and instructions. Note the location of the alternate drain hole as shown in Figure 33.

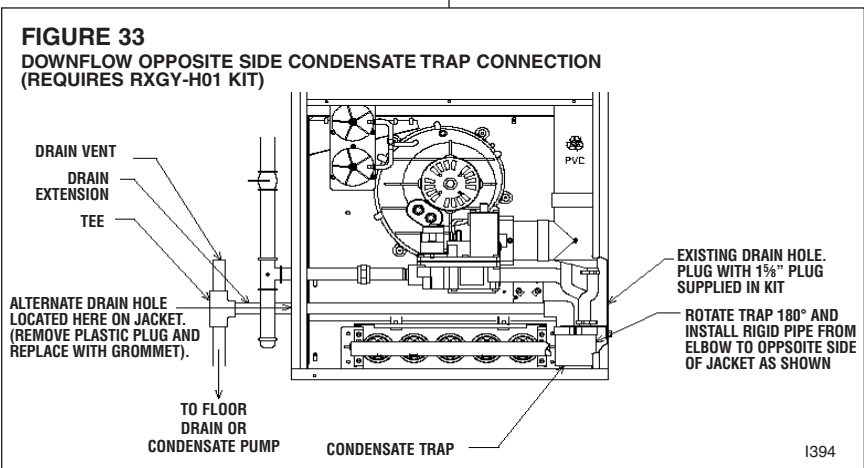
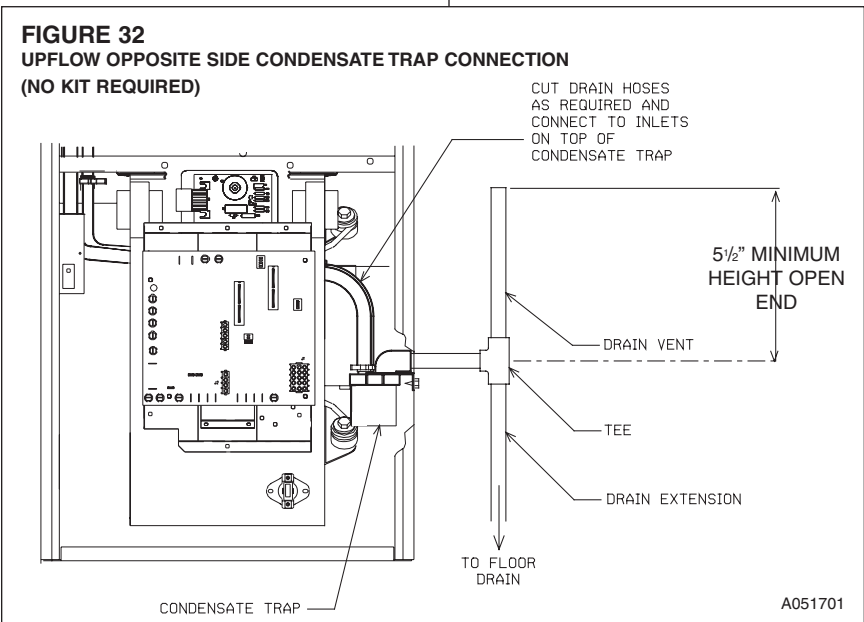
To convert to left side drainage, first remove the drainage hoses from the trap. Remove the trap from its mounting bracket, rotate it 180 degrees and mount in place with the drainage elbow pointing to the left. Reattach the drain hoses.

Remove the plug from the 2" alternate drain hole (see Figure 33) and replace it with the 2" rubber grommet supplied in the RXGY-H01 downflow alternate drain kit. Also, remove the 1-5/8" grommet supplied in the primary drain

hole and replace it with the 1-5/8" diameter plug that is also supplied in the RXGY-H01 downflow alternate drain kit. Both the hole-plug and grommet must be in place to insure a good seal in the burner compartment.

A length of ½" black PVC pipe is also provided in the RXGY-H01 downflow alternate drain kit. Glue one end of the pipe to the elbow in the trap. Cut the pipe so that it extends through the alternate drain hole in the left side of the cabinet one inch (see Figure 33). Connect the ½" PVC tee (supplied with the furnace) to the pipe with a 1-3/4" riser. Use the 1-5/8" plug supplied in the RXGY-H01 downflow alternate drain kit to seal the right side drainage hole.

IMPORTANT: Do not connect into a common drain line with an air conditioner evaporator coil drain located above the furnace. A blocked or restricted drain line can result in overflow of the coil pan and negate the furnace blocked-drain shutoff control.



CONDENSATE DRAIN FOR HORIZONTAL (-GJD) INSTALLATION

⚠ WARNING

HORIZONTAL (-GJD) MODELS ARE SHIPPED WITHOUT A DRAIN TRAP ATTACHED. IT MUST BE ATTACHED (AS DESCRIBED BELOW) IN THE FIELD. FAILURE TO INSTALL THE DRAIN TRAP AS DESCRIBED CAN CAUSE THE FURNACE TO SHUT DOWN UNEXPECTEDLY.

NOTE: The following steps should take place with the furnace in the horizontal position.

Refer to Figure 36 for Steps 1-8.

1. Locate the parts bag in the burner compartment.
2. Remove the red vinyl covers that cover the vent drain and heat exchanger drain (see Figure 34).
3. Fill the trap assembly (G) with a cup of water.
4. Attach the gasket (H) onto the trap assembly so that the gasket holes on the gasket line up with the holes on the trap assembly.
5. Insert the trap assembly with gasket up through the existing hole in the jacket and secure from inside the jacket. Use two screws provided. Screw down into the two "ears" molded into either side of the trap. Snug the trap assembly against the furnace jacket compressing the gasket slightly to eliminate any air leaks. Do not overtighten!
6. Attach the black molded rubber 90° elbow (I) to the straight spout on the trap top using a black nylon clamp (J). Attach the other end of the rubber elbow to the spout (K) located on the exhaust transition (E) using a black nylon clamp.
7. Attach one end of the horizontal ribbed tube (L) to the collector box. Clamp the hose tight with black nylon clamp. Then attach the other end of the ribbed tube to the 45° elbow molded into the top of the trap assembly. Clamp the hose tight with black nylon clamp. The horizontal ribbed tube is 6.7" in length.

IMPORTANT: Tighten all clamp connections with a pair of pliers and check for leaks after conversion is complete.

8. **IMPORTANT:** There are two options when choosing a height for the condensate riser:

CONDENSATE OVERFLOW: With a 1¾ inch riser installed above the tee, a blocked drain will result in overflow from the riser.

FURNACE SHUTDOWN: To cause the furnace to shut down

when a blocked drain is present, install a riser which is a minimum of 5½". If the furnace is installed in an attic, crawlspace or other area where freezing temperatures may occur, the furnace drain can freeze while shut off for long periods of time. Provisions must be made to prevent freezing of condensate.

Use a solvent cement that is compatible with PVC material.

NOTE: See location requirements and combustion section for additional recommendations.

FILLING THE TRAP

FILL THE TRAP ASSEMBLY WITH WATER BEFORE OPERATING THE FURNACE. Do this by removing the drain hose from the trap or from the connection to the secondary coil. Pour about a cup of water into the vent trap. Any excess water flows into the house drain when the trap is full.

FIGURE 34
REMOVE VINYL CAPS BEFORE INSTALLING THE DRAIN SYSTEM.

REMOVE THESE RED VINYL COVERS TO INSTALL THE DRAIN SYSTEM

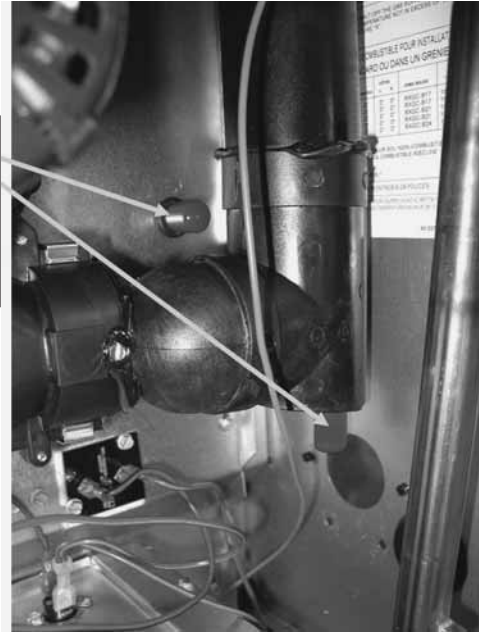
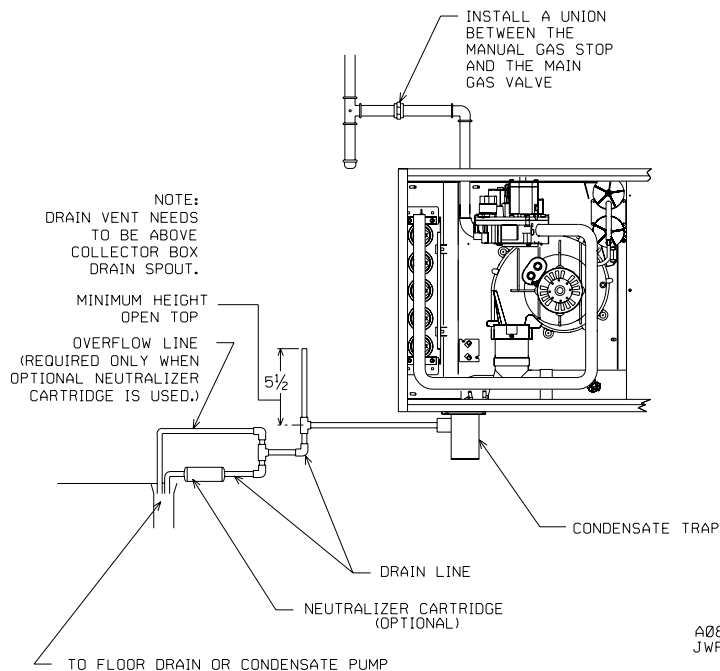


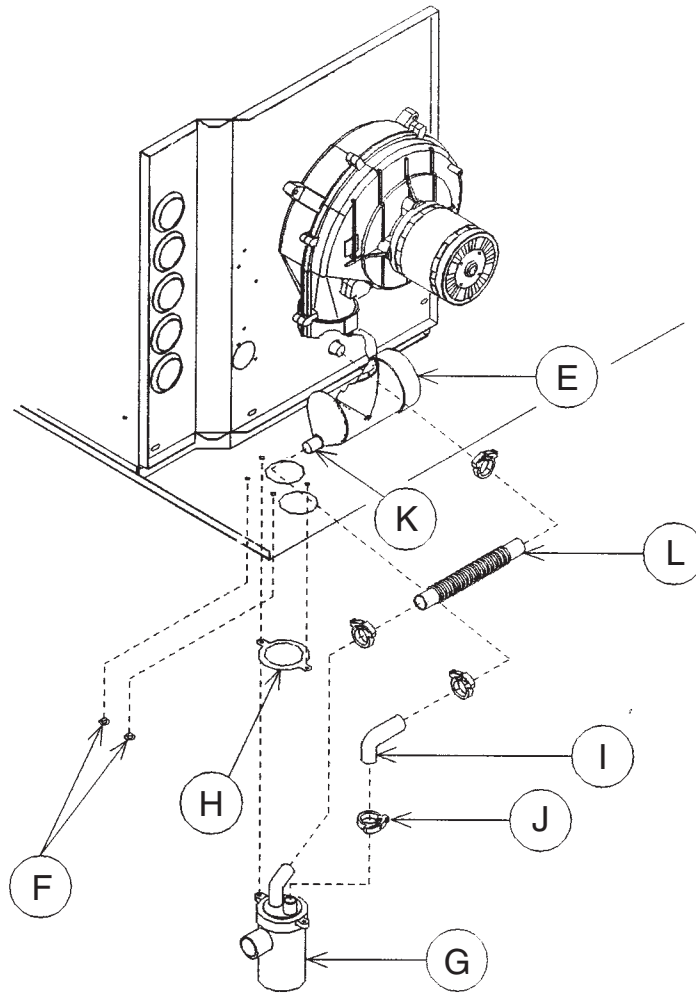
FIGURE 35
HORIZONTAL CONDENSATE DRAIN



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CONDENSATE TRAP CONVERSION FROM DOWNFLOW TO HORIZONTAL INSTALLATION

FIGURE 36
HORIZONTAL POSITION: CONDENSATE TRAP INSTALLATION
FOR HORIZONTAL OPERATION



1534

GAS SUPPLY AND PIPING

GAS SUPPLY

⚠ WARNING

THIS FURNACE IS EQUIPPED AT THE FACTORY FOR USE ON NATURAL GAS ONLY. CONVERSION TO LP GAS REQUIRES A SPECIAL KIT AVAILABLE FROM THE DISTRIBUTOR. FAILURE TO USE THE PROPER CONVERSION KIT CAN CAUSE FIRE, CARBON MONOXIDE POISONING, EXPLOSION, PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.

See the conversion kit index supplied with the furnace. This index identifies the proper LP Gas Conversion Kit required for each particular furnace.

IMPORTANT: Any additions, changes or conversions required for the furnace to satisfactorily meet the application should be made by a qualified installer, service agency or the gas supplier, using factory-specified or approved parts.

IMPORTANT: Connect this furnace only to gas supplied by a commercial utility.

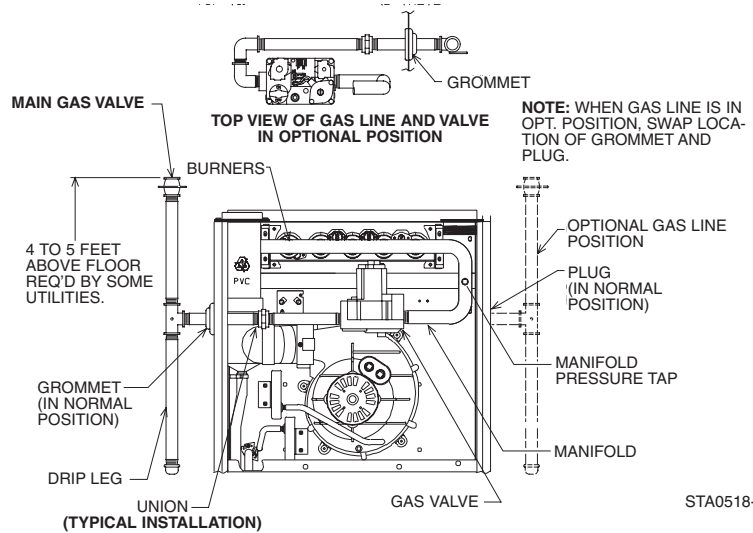
IMPORTANT: A U.L. recognized fuel gas and CO detector(s) are recommended in all applications, and their installation should be in accordance with the manufacturer's recommendations and/or local laws, rules, regulations or customs.

GAS PIPING

Install the gas piping according to all local codes and regulations of the utility company.

If possible, run a separate gas supply line directly from the meter to the furnace. Consult the local gas company for the location of the manual main shut-off valve. **The gas line and manual gas valve must be adequate in size to prevent undue pressure drop and never smaller than the pipe size**

FIGURE 37
GAS PIPING -- UPFLOW INSTALLATION



IMPORTANT: Do not run a flexible gas connector inside the unit.

FIGURE 38
GAS PIPING -- HORIZONTAL INSTALLATION

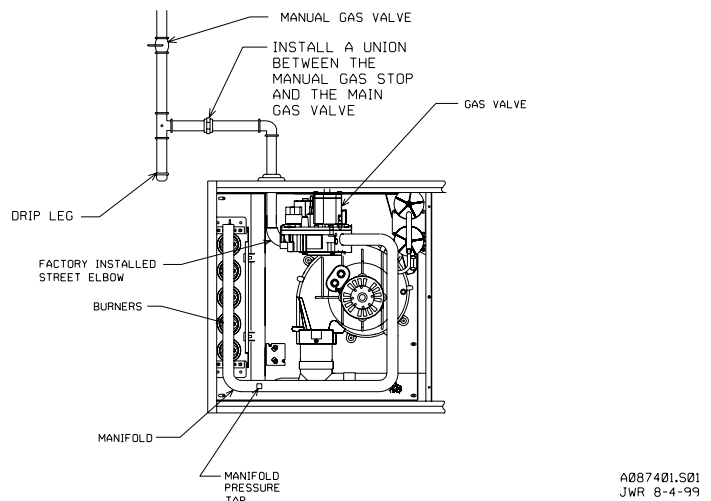
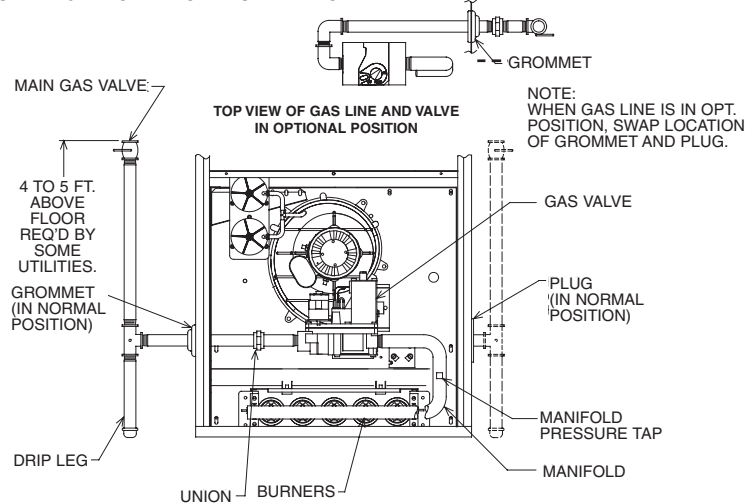


FIGURE 39
GAS PIPING -- DOWNFLOW INSTALLATION



to the combination gas valve on the furnace. Refer to Table 8 for the recommended gas pipe size for natural gas and Table 9 for L.P. See Figures 37, 38 & 39 for typical gas pipe connections.

Install a ground joint union between the manual gas stop and the main gas valve to easily remove the control valve assembly. Install a manual gas stop in the gas line outside the furnace cabinet. The gas stop should be readily accessible to turn the gas supply on or off. Install a drip leg in the gas supply line as close to the furnace as possible. Always use a pipe compound resistant to the action of liquefied petroleum gases on all threaded connections.

IMPORTANT: When making gas pipe connections, use a back-up wrench to prevent any twisting of the control assembly and gas valve.

Any strains on the gas valve can change the position of the gas orifices in the burners. This can cause erratic furnace operation.

IMPORTANT: Do not run a flexible gas connector inside the unit. If local codes allow the use of a flexible gas appliance connector, always use a new listed connector. Do not use a connector which has previously serviced another gas appliance. Massachusetts law requires that all flexible gas connectors be less than 36".

The gas pipe grommet in the cabinet does not seal around a flexible gas connector. **It is important to have all openings in the cabinet burner compartment sealed for proper furnace operation.**

IMPORTANT: To insure a good seal, the gas pipe that runs through the grommet must be 1/2" schedule 40 black pipe.

IMPORTANT: Ensure that the furnace gas control valve is not subjected to high gas line supply pressures (13.5" w.c. or above).

DISCONNECT the furnace and its individual shut-off valve from the gas supply piping during **any pressure testing that exceeds 1/2 PSIG (3.23 kPa or 13" w.c.).**

GAS PRESSURE

Natural gas supply pressure should be 5" to 10.5" w.c. LP gas supply pressure should be 11" to 13" w.c. This pressure must be maintained with all other gas-fired appliances in operation.

▲ WARNING

NEVER PURGE A GAS LINE INTO THE COMBUSTION CHAMBER. NEVER USE MATCHES, FLAME OR ANY IGNITION SOURCE FOR CHECKING LEAKAGE. FAILURE TO ADHERE TO THIS WARNING CAN CAUSE A FIRE OR EXPLOSION RESULTING IN PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.

To check for gas leakage, use an approved chloride-free soap and water solution, an electronic combustible gas detector, or other approved method.

GAS VALVE

This furnace has a 24-volt operated valve. It has ports for measuring supply pressure and manifold pressure. A manual control is on the valve body. It can be set to only the "ON" or "OFF" positions. See Figure 40.

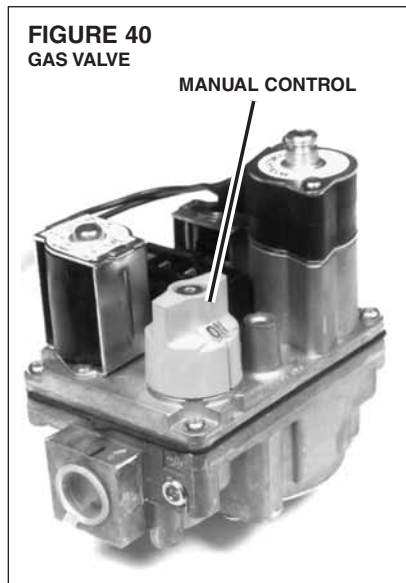


TABLE 8**NATURAL GAS PIPE CAPACITY TABLE (CU. FT./HR.)**

Capacity of gas pipe of different diameters and lengths in cu. ft. per hr. with pressure drop of 0.3 in. and specific gravity of 0.60 (natural gas).

Nominal Iron Pipe Size, Inches	Length of Pipe, Feet							
	10	20	30	40	50	60	70	80
1/2	132	92	73	63	56	50	46	43
3/4	278	190	152	130	115	105	96	90
1	520	350	285	245	215	195	180	170
1-1/4	1,050	730	590	500	440	400	370	350
1-1/2	1,600	1,100	890	760	670	610	560	530

After the length of pipe has been determined, select the pipe size which will provide the minimum cubic feet per hour required for the gas input rating of the furnace. By formula:

$$\text{Cu. Ft. Per Hr. Required} = \frac{\text{Gas Input of Furnace (BTU/HR)}}{\text{Heating Value of Gas (BTU/FT}^3\text{)}}$$

The gas input of the furnace is marked on the furnace rating plate. The heating value of the gas (BTU/FT³) may be determined by consulting the local natural gas utility or the LP gas supplier.

TABLE 9**LP GAS PIPE CAPACITY TABLE (CU. FT./HR.)**

Maximum capacity of pipe in thousands of BTU per hour of undiluted liquefied petroleum gases (at 11 inches water column inlet pressure).

(Based on a Pressure Drop of 0.5 Inch Water Column)

Nominal Iron Pipe Size, Inches	Length of Pipe, Feet											
	10	20	30	40	50	60	70	80	90	100	125	150
1/2	275	189	152	129	114	103	96	89	83	78	69	63
3/4	567	393	315	267	237	217	196	182	173	162	146	132
1	1,071	732	590	504	448	409	378	346	322	307	275	252
1-1/4	2,205	1,496	1,212	1,039	913	834	771	724	677	630	567	511
1-1/2	3,307	2,299	1,858	1,559	1,417	1,275	1,181	1,086	1,023	976	866	787
2	6,221	4,331	3,465	2,992	2,646	2,394	2,205	2,047	1,921	1,811	1,606	1,496

Example (LP): Input BTU requirement of unit, 150,000
Equivalent length of pipe, 60 ft. = 3/4" IPS required.

LP COPPER TUBE SIZING TABLE

Sizing between single or second stage (low pressure) regulator and appliance. Maximum capacity of pipe in thousands of BTU per hour of undiluted propane gases (at 11" w.c. setting).

Outside Diameter Copper Tubing, Type L	Length of Pipe, Feet										
	10	20	30	40	50	60	80	100	125	150	
3/8"	49	34	27	23	20	19	16	14	11	10	
1/2"	110	76	61	52	46	42	36	32	28	26	
5/8"	206	141	114	97	86	78	67	59	52	48	
3/4"	348	239	192	164	146	132	113	100	89	80	
7/8"	536	368	296	253	224	203	174	154	137	124	

LP CONVERSION

IMPORTANT: LP gas from trucks used to transport liquid-based fertilizers can contain chemicals that will damage the furnace. Verify that your gas supplier does not use the same truck to transport materials other than LP.

This furnace is shipped from the factory for use on natural gas only. For use on LP gas, a proper conversion is required.

Conversion of this furnace for use on LP gas requires conversion kit **RXGJ-FP07 for U.S. and RXGJ-FP08 for Canada**. This kit includes an LP gas valve.

▲ CAUTION

ELEVATIONS ABOVE 2000 FT REQUIRE THAT THE FURNACE INPUT RATING BE ADJUSTED AND THAT THE SIZE OF THE BURNER ORIFICES BE RE-CALCULATED BASED ON ELEVATION AND GAS HEATING VALUE. THE BURNER ORIFICES MAY (OR MAY NOT) NEED TO BE CHANGED. SEE THE SECTION TITLED “HIGH ALTITUDE INSTALLATIONS” OF THIS BOOK FOR INSTRUCTIONS.

NOTE: Order the correct LP conversion kit available from the local distributor. *Furnace conversion to LP gas must be performed by a qualified installer, service agency, or the gas supplier.*

To change orifice spuds for either conversion to LP or for elevation:

1. Shut off the manual gas valve and disconnect the gas line at the union ahead of the unit gas valve.

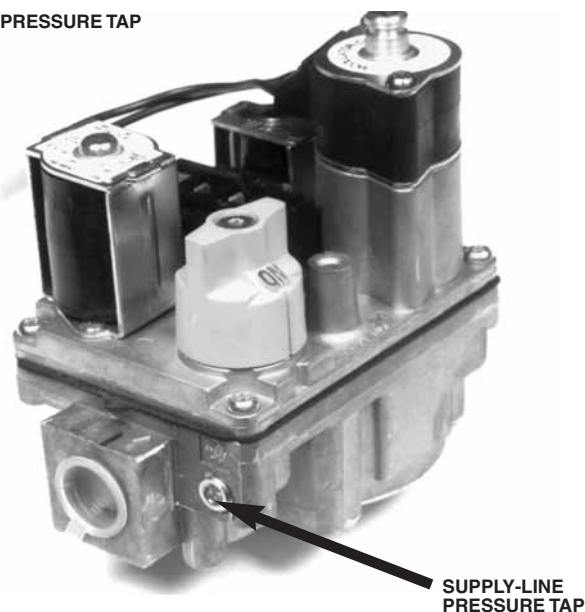
2. Remove the gas valve and manifold assembly.
3. Replace the orifice spuds.
4. Remove the natural gas valve from the manifold assembly and replace with the LP valve included in the kit.
5. Re-attach the manifold assembly to the unit and connect the gas line to the gas valve.
6. Place the conversion label, included in the kit, adjacent to the CSA rating plate.

7. Check unit for leaks.
8. Follow lighting instructions to put the furnace into operation.
9. Check manifold pressure.

Consult Table 11, if there is any question concerning orifice sizing.

NOTE: No LP orifices are included in the kit. LP orifices must be selected based on the altitude of the installation. See orifice chart.

FIGURE 41
SUPPLY-LINE PRESSURE TAP



SETTING GAS PRESSURE

A properly calibrated pressure gauge or U-Tube manometer is required for accurate gas pressure measurements.

▲ CAUTION

ELEVATIONS ABOVE 2000 FT REQUIRE THAT THE FURNACE INPUT RATING BE ADJUSTED AND THAT THE SIZE OF THE BURNER ORIFICES BE RE-CALCULATED BASED ON ELEVATION AND GAS HEATING VALUE. THE BURNER ORIFICES MAY (OR MAY NOT) NEED TO BE CHANGED. SEE THE SECTION TITLED "HIGH ALTITUDE INSTALLATIONS" OF THIS BOOK FOR INSTRUCTIONS.

Supply Gas Pressure Measurement.

1. With gas shut off to the furnace at the manual gas valve outside the unit, remove the line pressure tap plug on the gas valve. See Figure 41.
2. Connect a U-Tube manometer to the pressure tap.

3. Turn on the gas supply and operate the furnace at 100% and all other gas-fired units on the same gas line as the furnace.
4. Note or adjust the supply-line pressure to give:
 - A. 5" - 10.5" w.c. for natural gas.
 - B. 11" - 13" w.c. for LP gas.
5. Shut off the gas at the manual gas valve and remove the U-Tube manometer.
6. Replace the supply-line pressure tap plug before turning on the gas.
7. Check unit for leaks.

If the supply-line pressure is above these ranges, install an in-line gas regulator to the furnace for natural gas units. With LP gas, have the LP supplier reduce the supply-line pressure at the regulator.

If supply-line pressure is below these ranges, either remove any restrictions in the gas supply piping or enlarge the gas pipe. See Tables 8 and 9.

With LP gas, have the LP supplier adjust the supply-line pressure at the regulator.

▲ CAUTION

ELEVATIONS ABOVE 2000 FT REQUIRE THAT THE FURNACE INPUT RATING BE ADJUSTED AND THAT THE SIZE OF THE BURNER ORIFICES BE RE-CALCULATED BASED ON ELEVATION AND GAS HEATING VALUE. THE BURNER ORIFICES MAY (OR MAY NOT) NEED TO BE CHANGED. SEE THE SECTION TITLED "HIGH ALTITUDE INSTALLATIONS" OF THIS BOOK FOR INSTRUCTIONS.

► MANIFOLD GAS PRESSURE MEASUREMENT.

1. With the gas to the unit shut off at the manual gas valve, remove the outlet pressure tap plug in the gas valve. See Figure 42.
2. Connect the positive pressure hose to the pressure tap.
3. Note the manifold gas pressure to be:
 - A. 3.5" w.c. (± 0.3) for natural gas.
 - B. 10.0" w.c. (± 0.5) for LP gas.
4. To adjust the pressure regulator, remove the regulator cap.

NOTE: Only small variations in gas pressure should be made by adjusting the pressure regulator.

5. Turn the adjustment screw, using a $\frac{3}{32}$ " allen wrench, clockwise to increase pressure, or counter-clockwise to decrease pressure. See Figure 43.
6. Check manifold gas pressure.
7. Repeat step 5 & 6 if needed.
8. Securely replace the regulator cap.

NOTE: Shut off gas at the manual gas valve and remove the U-Tube manometer.

9. Replace the manifold pressure tap plug before turning on the gas.
10. Check unit for leaks.

NOTE: Do not use gas valve pressure adjustment as a means to adjust temperature rise. The blower motor will change speed to maintain a reasonably constant temperature rise.

FIGURE 42
MANIFOLD PRESSURE TAP LOCATION

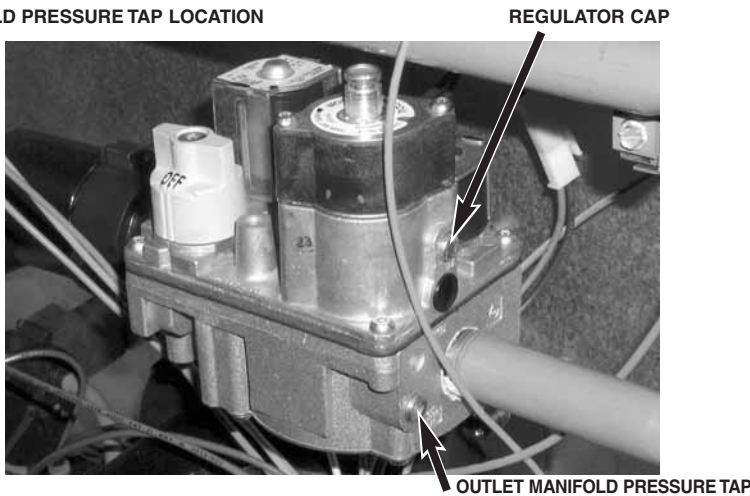
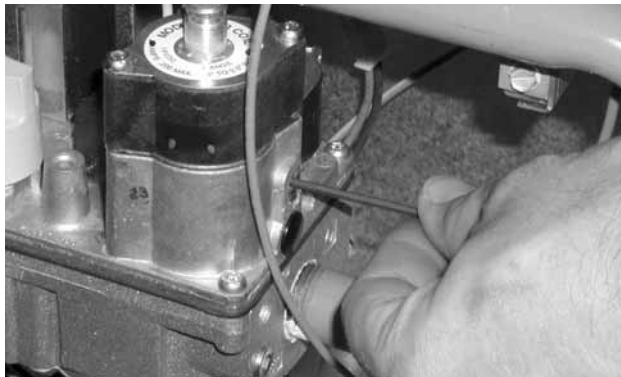


FIGURE 43
GAS VALVE PRESSURE ADJUSTMENT ($\frac{3}{32}$ " ALLEN WRENCH)



ELECTRICAL WIRING

▲ WARNING

TURN OFF ELECTRIC POWER AT FUSE BOX OR SERVICE PANEL BEFORE MAKING ANY ELECTRICAL CONNECTIONS. FAILURE TO DO SO CAN CAUSE ELECTRICAL SHOCK RESULTING IN PERSONAL INJURY OR DEATH.

▲ WARNING

THE CABINET MUST HAVE AN UNINTERRUPTED GROUND ACCORDING TO THE LATEST EDITION OF THE NATIONAL ELECTRICAL CODE, ANSI/NFPA70-, OR IN CANADA, THE CANADIAN ELECTRICAL CODE, CSA-C22.1 OR LOCAL CODES THAT APPLY. A GROUND SCREW IS PROVIDED IN THE JUNCTION BOX. FAILURE TO PROPERLY CONNECT THE GROUND WIRE CAN CAUSE ELECTRICAL SHOCK RESULTING IN PERSONAL INJURY OR DEATH.

▲ WARNING

THIS FURNACE IS EQUIPPED WITH A BLOWER DOOR SAFETY SWITCH. DO NOT DISABLE THIS SWITCH. FAILURE TO FOLLOW THIS WARNING CAN RESULT IN ELECTRICAL SHOCK, PERSONAL INJURY OR DEATH.

IMPORTANT: The furnace must be installed so that the electrical components are protected from water.

A grounding wire is provided to connect to the incoming grounding wire from line power. The furnace must be permanently grounded in accordance with all national and local codes.

Before proceeding with the electrical connections, be certain that the service panel voltage, frequency and phase corresponds to that specified on the furnace rating plate. Maximum over-current protection is 15 amperes.

Use a separate, fused branch electrical circuit containing a properly sized fuse or circuit breaker. Run this circuit directly from the main switch box to an electrical disconnect that is readily accessible and located near the furnace. Connect from

the electrical disconnect to the junction box on the left side of the furnace, inside the blower compartment. See Figure 44. For the proper connection, refer to the appropriate wiring diagram located on the inside cover of the furnace control box and in these instructions.

NOTE: The electrical junction box may be moved to the right side if necessary. A knockout is provided. Seal the opposite hole with plug provided.

IMPORTANT: L1 terminal and neutral terminal polarity must be observed when making field connections to the furnace. The ignition control will **NOT** sense flame if 120 vac and neutral terminals reversed.

Make all electrical connections in accordance with the latest edition of the National Electrical Code ANSI/NFPA70 – or in Canada, the Canadian Electrical Code Part 1- CSA Standard C22.1 and local codes having jurisdiction.

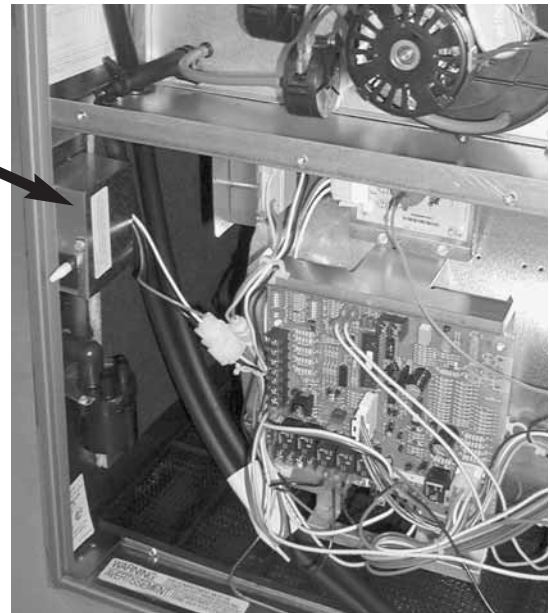
These may be obtained from:

National Fire Protection
Association, Inc.
Batterymarch Park
Quincy, MA 02269

Canadian Standards Association
178 Rexdale Boulevard
Rexdale, Ontario, Canada M9W 1R3

FIGURE 44
JUNCTION BOX LOCATION

UPFLOW
MODELS



➤ DOWNFLOW/
HORIZONTAL
MODELS



ELECTRICAL CHECKS

Line Power Check

The furnace must have a nominal 115 volt power supply for proper operation. If there is not a consistent power supply, contact a licensed electrician to correct the problem.

1. With the blower compartment door off, manually hold the push button door switch in.
2. Call for heat at the thermostat.
3. With the unit operating, use a voltmeter to measure the voltage from any 120 VAC terminal to any neutral connection.
4. The voltage should be a nominal 115 volts (acceptable 105-120VAC).

This test should be made with the unit in full operation.

Polarity Check

Proper line voltage polarity, or phasing, is a must for this furnace to operate. Use a volt meter to make this check.

1. With the blower compartment door off, manually hold the push button door switch in.
2. Use a voltmeter to measure the voltage from any 120 VAC terminal to any bare metal ground on the furnace.
3. The voltage should be a nominal 115 volts (acceptable 105-120VAC).
4. Use a voltmeter to measure the voltage from any neutral terminal to the bare metal ground on the furnace.
5. The voltage should be less than 1.0 VAC.
6. If the voltage from any 120 VAC terminal to ground is less than 1.0 VAC volts and the voltage from a neutral to ground is a nominal 115 volts, the polarity is reversed.
7. To correct the problem, either reverse the hot and neutral wires to the furnace or have a licensed electrician check the building wiring.

Control Voltage Check

1. With the blower compartment door off, manually hold the push button door switch in.
2. Call for heat at the thermostat.
3. With the unit operating, use a voltmeter to measure the voltage from control voltage terminal "W" to terminal "C" on the furnace control board.
4. The voltage should be a nominal 24 volts (Acceptable 18-30 VAC).

This test should be made with the unit in full operation.

THERMOSTATS

THERMOSTAT WIRING

NOTE: For fully modulating function, the furnace must be installed with the (-)HC-TST401MDMS Modulating Touch-Screen Thermostat.

NOTE: Do not use 24 volt control wire smaller than No. 18 AWG.

Wire all thermostats to the 24V connections on the integrated furnace control. See Figures 46, 47, 48, 49, and 50.

NOTE: A larger wire gage may be required for longer lengths of thermostat wire.

For proper installation of the Variable Output Thermostat, follow the “Thermostat Installation, Programming and Troubleshooting Manual” included as section II of this manual. For proper installation of a Single-Stage or Two-Stage Thermostat, see the Installation Instructions included with the thermostat.

► FURNACE OPERATION USING MODULATING, SINGLE-STAGE, AND TWO-STAGE THERMOSTATS

The modulating furnace with the UT Electronic Controls IFC is also capable of operating with a single-stage or a two-stage thermostat as well as the modulating thermostat. Furnaces equipped with part # 62-24174-01 (rev -02 or newer) or 62-24174-02 (all revisions) will operate with either single-stage or two-stage thermostats as a modulating system using an algorithm that utilizes three distinct firing rates; 40%, 65% and 100% of the furnace heating capacity (See below for operation of each).

Figures 46, 47, 48, 49 and 50 detail how to wire the modulating furnace for operation with a modulating thermostat, a single-stage thermostat or a two-stage thermostat.

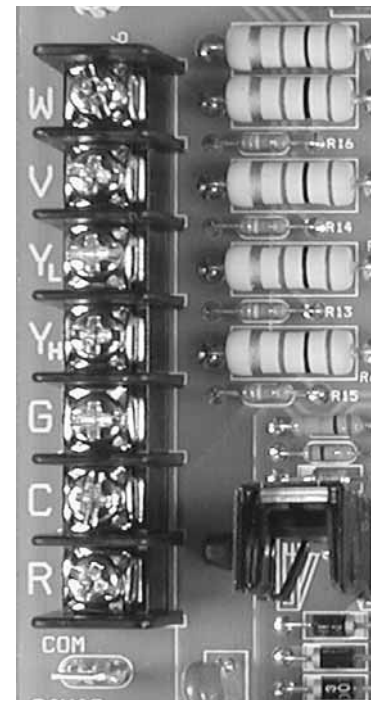
► FURNACE OPERATION WITH A MODULATING THERMOSTAT

As described previously in this manual, operation with a modulating thermostat when installed as shown in Figure 46 is fully modulating between 40% and 100% of furnace capacity. The firing rate is first determined by the thermostat and then sent to the furnace. This is the optimum mode of operation and will give the best temperature control with minimal temperature variation from the desired set point.

► FURNACE OPERATION WITH A SINGLE STAGE THERMOSTAT

To operate the furnace with a single-stage thermostat, set switches 1 & 2 of SW2 (See Figure 56) to the “OFF” position. Note that these switches

FIGURE 45
24-VOLT TERMINALS



should be in the “OFF” position from the factory. The lack of the modulating “V” signal will automatically be sensed as a single-stage thermostat and the furnace will operate accordingly.

With a single-stage thermostat (installed as shown in Figure 49), during a call for heat, the furnace will operate as follows:

Phase 1: 0 to 5 minutes = 40% of furnace capacity

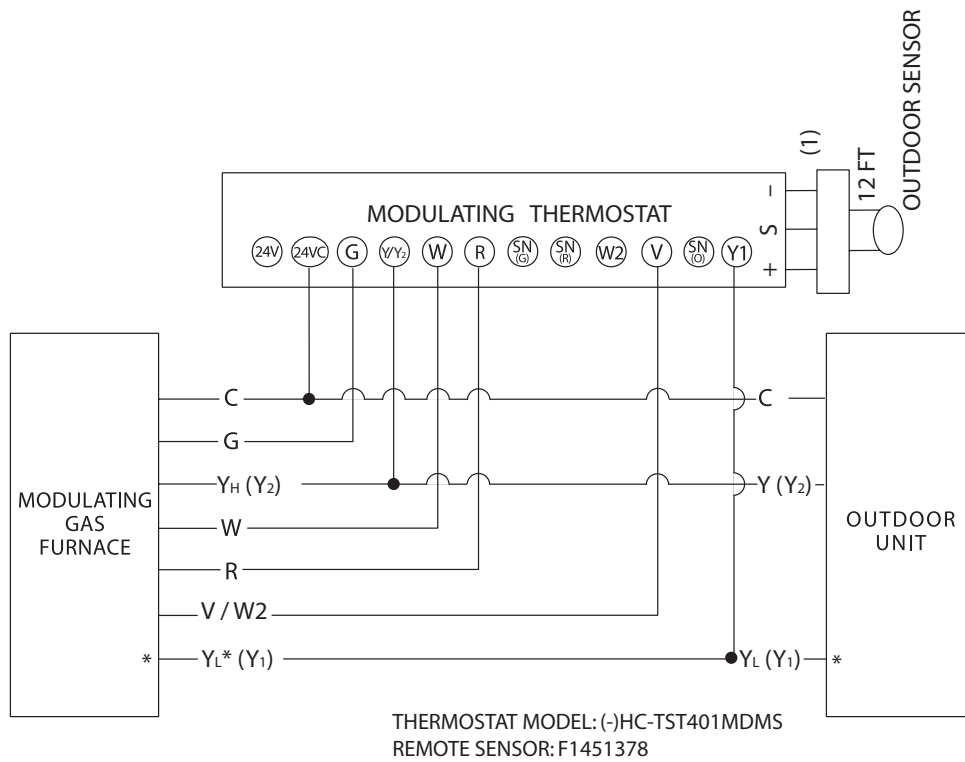
Phase 2: 5 to 12 minutes = 65% of furnace capacity

Phase 3: After 12 minutes = 100% of furnace capacity

NOTE: If the call for heat ends during any phase, the furnace will terminate immediately at the firing rate of that phase.

If switches 1 & 2 of SW2 are in the “ON” position (See Figure 56), the furnace will always operate at 40% with a single-stage thermostat installed as shown in Figure 40. **THIS CONFIGURATION IS NEITHER RECOMMENDED NOR APPROVED.**

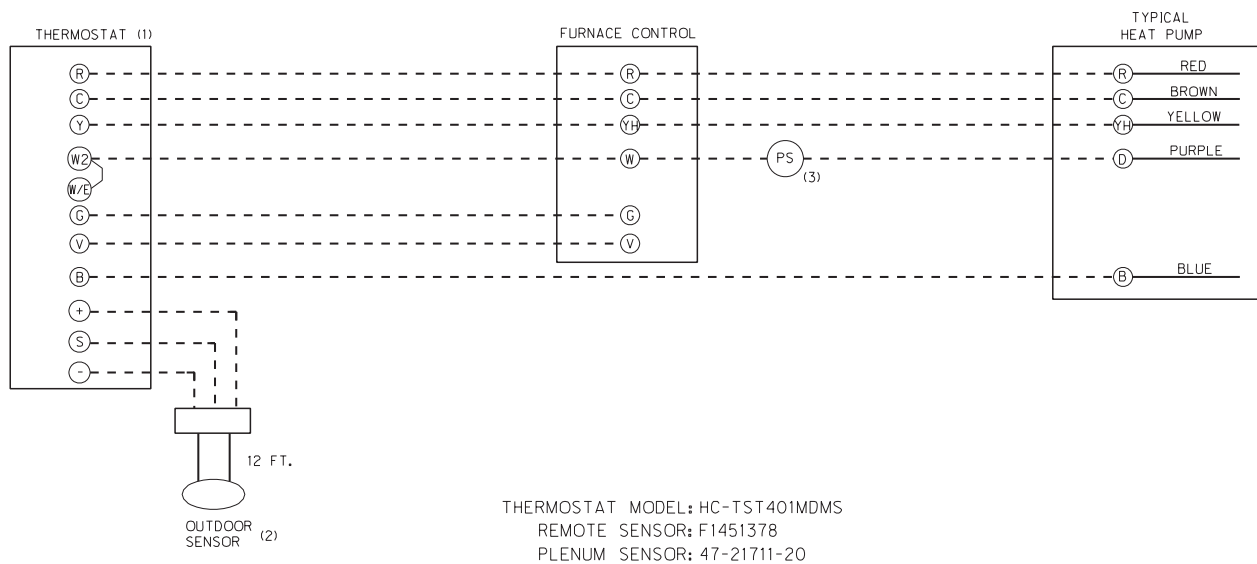
FIGURE 46
WIRING DIAGRAM FOR MODULATING HEAT (NO DUAL FUEL)



*2 STAGE COOLING ONLY

(1) FOR REMOTE SENSOR INSTALLATION
 SEE THERMOSTAT INSTALLATION INSTRUCTIONS

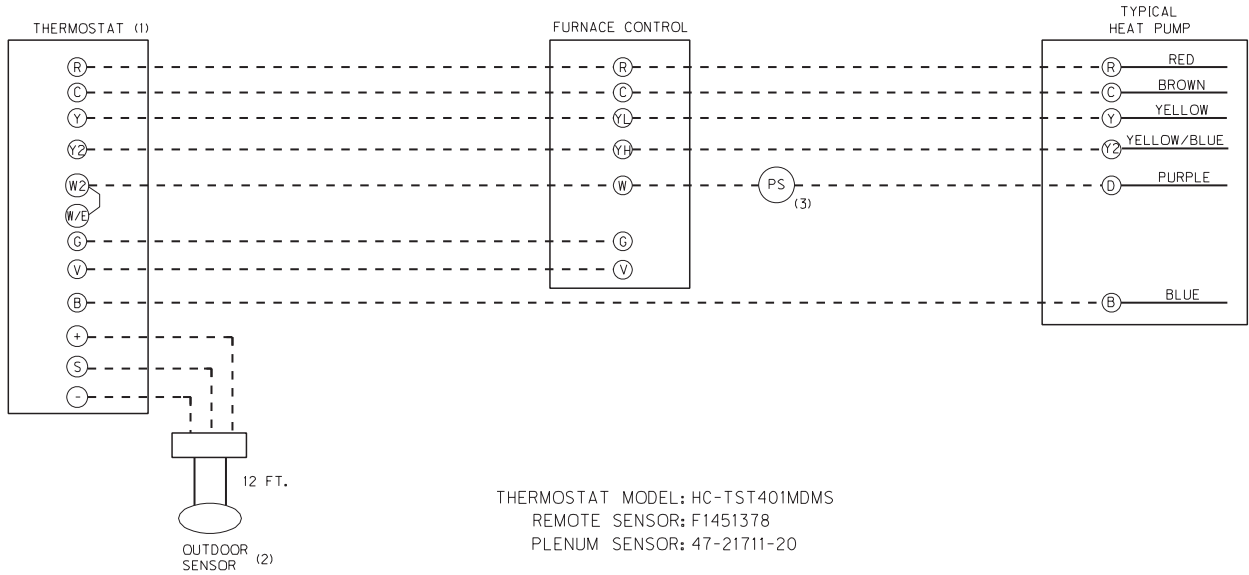
FIGURE 47
FULLY MODULATING – TYPICAL DUAL FUEL APPLICATION – SINGLE STAGE HEAT PUMP



NOTES:

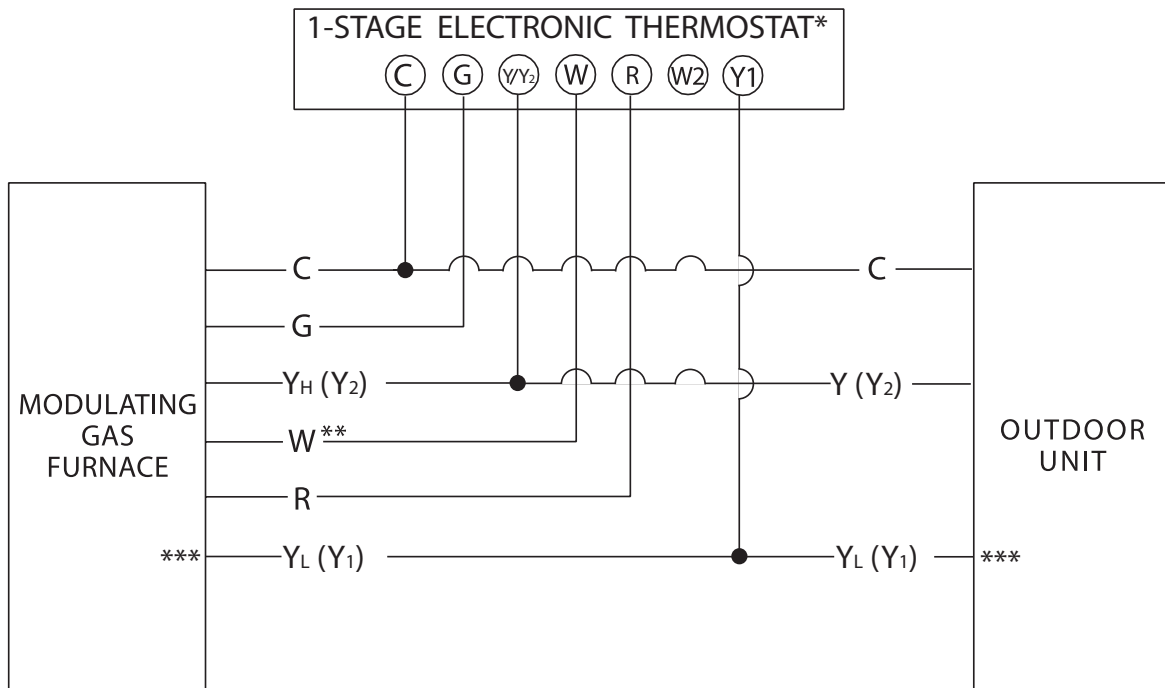
- (1) FOR PROGRAMMING THERMOSTAT IN DUAL FUEL APPLICATION SEE THERMOSTAT INSTALLATION INFORMATION.
- (2) FOR REMOTE SENSOR INSTALLATION SEE THERMOSTAT INSTALLATION INFORMATION.
- (3) OPTIONAL PLENUM SENSOR (47-21711-20).

FIGURE 48
FULLY MODULATING – TYPICAL DUAL FUEL APPLICATION - TWO STAGE HEAT PUMP



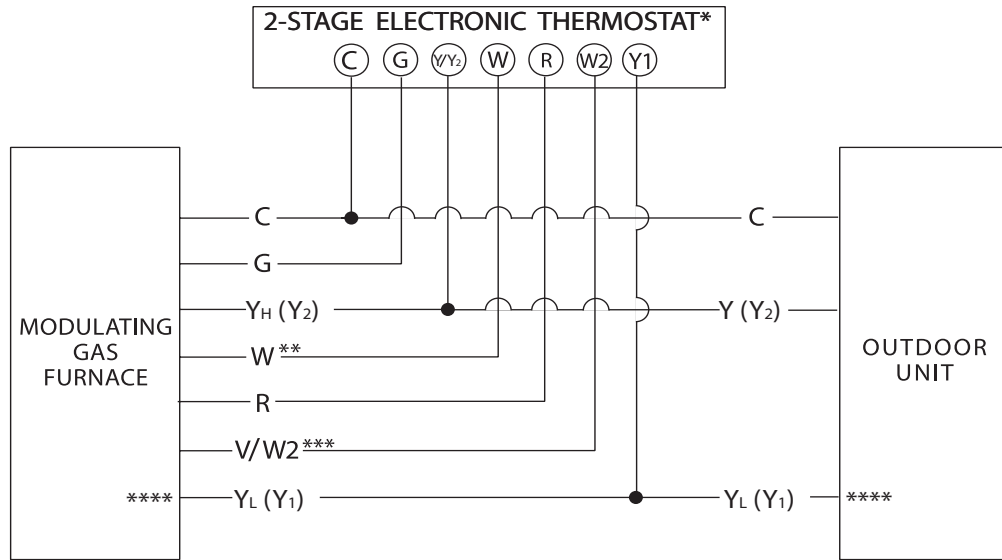
- NOTES:**
- (1) FOR PROGRAMMING THERMOSTAT IN DUAL FUEL APPLICATION SEE THERMOSTAT INSTALLATION INFORMATION.
 - (2) FOR REMOTE SENSOR INSTALLATION SEE THERMOSTAT INSTALLATION INFORMATION.
 - (3) OPTIONAL PLENUM SENSOR (47-21711-20).

FIGURE 49
WIRING DIAGRAM FOR SINGLE-STAGE HEAT



- * NO MECHANICAL THERMOSTATS.
- ** 40%, 65%, and 100% FIRING RATE IN SINGLE-STAGE OPERATION. 40% FIRING RATE IN TWO-STAGE OPERATION (DIP SWITCH SET SW2 — SWITCHES 1 & 2 OFF).
- *** 2 STG. COOLING ONLY.

FIGURE 50
WIRING DIAGRAM FROM TWO-STAGE HEAT



* NO MECHANICAL THERMOSTATS.
 ** 40% FIRING RATE IN TWO-STAGE OPERATION (DIP SWITCH SET SW2 — SWITCHES 1 & 2 ON).
 *** 65% and 100% FIRING RATE IN TWO-STAGE OPERATION (W & W₂ ENERGIZED).
 **** 2 STAGE COOLING ONLY.

FURNACE OPERATION WITH A TWO-STAGE THERMOSTAT

To set the furnace for operation with two-stage thermostats, set switches 1 & 2 of SW2 to the “ON” position (See Figure 56). Note that these switches should be in the “OFF” position from the factory. With both switches in the “ON” position, the furnace can still recognize a “V” signal present and will still operate with a modulating thermostat. However, with both switches of SW2 in the “ON” position, the furnace is set to operate with a two-stage thermostat as well.

With a two-stage thermostat (installed as shown in Figure 50) and switch settings configured as described above, during a call for heat, the furnace will operate as follows:

First Stage

(“W”=ON and “W₂”=OFF)

40% of furnace capacity always

Second Stage

(“W”=ON and “W₂”=ON)

Phase 1: 0 to 5 minutes = 65% of furnace capacity

Phase 2: After 5 minutes = 100% of furnace capacity

NOTE: If the call for heat ends during any phase and/or stage, the furnace will terminate immediately at the firing rate of that phase and/or stage.

APPLICATIONS
MODULATING TOUCH-SCREEN THERMOSTAT

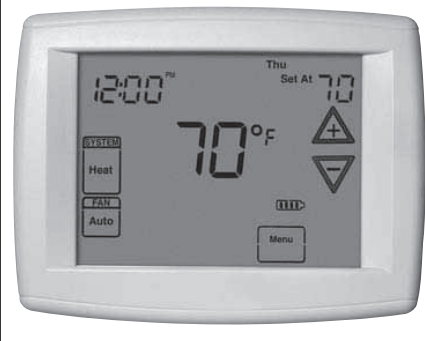
Model	Programming Choices		
(-)HC-TST401MDMS	Non-Programmable	5/1/1 Day	7 Day

THERMOSTAT APPLICATION GUIDE

Description	
Modulating P'W'M output, gas furnace	Yes
Heat Pump (with Aux. or Emergency Heat), 2 Stage	Yes
Systems with up to 3 Stages Heat, 2 Stages Cool	Yes
Heat Only Systems	Yes
Wired Remote Temperature Sensor (Indoor/Outdoor)	Yes
Dual Fuel Feature (Heat Pump Mode)	Yes

For complete product specifications, see the Installation Instructions supplied with thermostat.

FIGURE 51
(-)HC-TST401MDMS
MODULATING TOUCHSCREEN THERMOSTAT



INSTALLATION

▲ WARNING

THERMOSTAT INSTALLATION AND ALL COMPONENTS OF THE CONTROL SYSTEM SHALL CONFORM TO CLASS II CIRCUITS PER THE NEC CODE.

REMOVE OLD THERMOSTAT

A standard heat/cool thermostat consists of three basic parts:

1. The cover, which may be either a snap-on or hinge type.
2. The base, which is removed by loosening all captive screws.

3. The switching subbase, which is removed by unscrewing the mounting screws that hold it on the wall or adapter plate. **Before removing wires from old thermostat, label each wire with the terminal designation from which it was attached.** Disconnect the wires from the old thermostat one at a time. **Do not let wires fall back into the wall.**

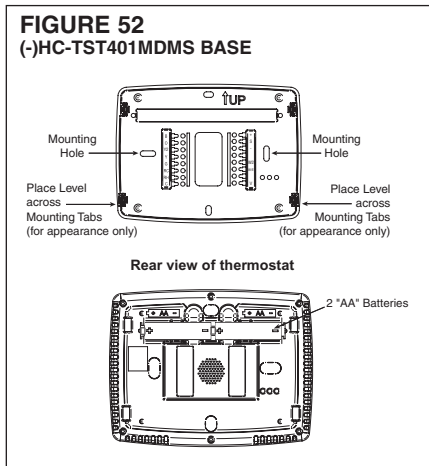
INSTALLING NEW THERMOSTAT

1. Pull the thermostat body off the thermostat base. Forcing or prying on the thermostat will cause damage to the unit. Rear view of thermostat
2. Place base over hole in wall and mark mounting hole locations on wall using base as a template.

3. Move base out of the way. Drill mounting holes. If you are using existing mounting holes and the holes drilled are too large and do not allow you to tighten base snugly, use plastic screw anchors to secure the base.
4. Fasten base snugly to wall using mounting holes shown in Figure 52 and two mounting screws. Leveling is for appearance only and will not affect thermostat operation.
5. Connect wires to terminal block on base using appropriate wiring schematic (see Figures 46, 47 & 48).
6. Push excess wire into wall and plug hole with a fire resistant material (such as fiberglass insulation) to prevent drafts from affecting thermostat operation.
7. Carefully line the thermostat up with the base and snap into place.

BATTERY LOCATION

2 "AA" alkaline batteries are included in the thermostat at the factory with a battery tag to prevent power drainage. Remove the battery tag to engage the batteries. To replace batteries, set system to **OFF**, remove thermostat from wall and install the batteries in the rear along the top of the thermostat (see Figure 52).



WIRING CONNECTIONS

Refer to equipment manufacturers' instructions for specific system wiring information. After wiring, see CONFIGURATION section for proper thermostat configuration. For wiring diagrams, see Figures 46, 47 & 48.

Wiring diagrams shown are for typical systems and describe the thermostat terminal functions.

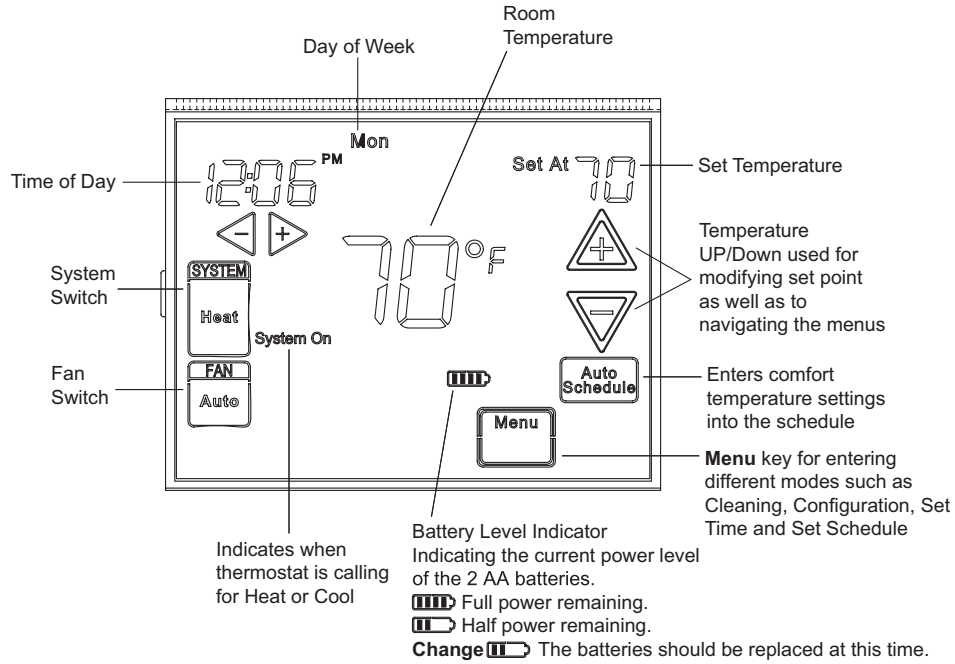
TERMINAL DESIGNATION DESCRIPTIONS

Terminal Designation	Description
B	Changeover valve for heat pump energized constantly in heating
O	Changeover valve for heat pump energized constantly in cooling
Y2	2nd Stage Compressor
Y	Compressor Relay
G	Fan Relay
RC	Power for Cooling
RH	Power for Heating
C	Common wire from secondary side of cooling
V	PWM Output
W/E	Heat Relay/Emergency Heat Relay (Stage 1)
W2	2nd Stage Heat (3rd Stage Heat in HP2)
-	Common (DC) for wired remote temperature sensor
S	Frequency signal from remote temperature sensor
+	Power (DC) to remote temperature sensor

THERMOSTAT QUICK REFERENCE

Home Screen Description

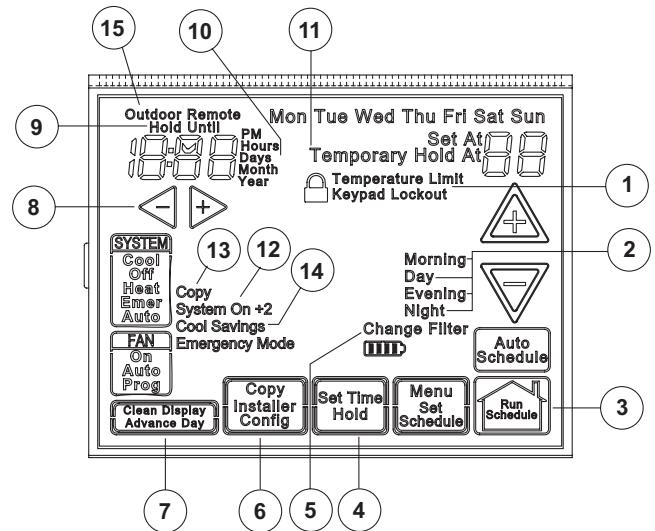
Figure 53 – Home Screen Display



Programming and Configuration Items





- ① Displays and "Keypad Lockout" when in keypad lockout mode. Displays and "Temperature Limit" and "Keypad Lockout" when limited range is activated and locked. Displays only "Temperature Limit" when limited range is activated.
- ② Indicates period of day being programmed.
- ③ RUN SCHEDULE (run program) button.
- ④ SET TIME button or HOLD temperature button.
- ⑤ Displays "Change Filter" when the system has run for the programmed filter time period as a reminder to change or clean your filter.
- ⑥ COPY button or INSTALLER CONFIG button.
- ⑦ CLEAN DISPLAY button allows 30 seconds to wipe off the display or ADVANCE DAY button for programming.
- ⑧ Used in programming to set time and in configuration menu to change selections.
- ⑨ "Hold Until" indicates the time when a temporary hold period will end.
- ⑩ "Hours" and "Days" displays during steps in installer configuration.
- ⑪ The words "Hold At" are displayed when the thermostat is in the HOLD mode. "Temporary Hold At" is displayed when the thermostat is in a temporary HOLD mode.
- ⑫ "System On" indicates when heating or cooling stage is energized. "+2" also indicates when a second stage is energized.




Figure 54 – Programming & Configuration Items



- ⑬ "Copy" indicates the copy program feature is being used during programming.
- ⑭ A steady "Cool Savings" display indicates the feature is enabled in the installer menu. A flashing "Cool Savings" display indicates the feature is active.
- ⑮ "Remote" indicates that the indoor remote temperature sensor, is being accessed. "Outdoor Remote" indicates the outdoor remote temperature sensor is being accessed.

INSTALLER/CONFIGURATION MENU

To enter the menu: Press the **Menu** touch key. Press and hold for 5 seconds the **Installer Config** touch key. This displays menu item #1 in the table below. Press  to advance to the next menu item or  to return to a previous menu item. Press  or  to change a menu item.

CONFIGURATION MENU						
Menu Reference Number	Programmable	Non-Programmable	Press Button	Displayed (Factory Default)	Press  or  to select from listed options	Comments
1	1	1		MS 2	HP 1, HP 2, SS 1	Selects Multi-Stage (MS 2, No Heat Pump), Heat Pump 1 (HP 1, 1 compressor), Heat Pump 2 (HP 2, 2 compressor or 2 speed compressor), or Single Stage.
2	2	2		(GAS)	ELE	GAS setting: furnace controls blower. ELE setting: thermostat controls blower.
3	3	3		Days, (7) P	5-1-1 or 0	Programs per week. (0 = non-programmable)
4	4	NA		PS (4) Morning, Day, Evening, Night	2 Day, Night	Program periods per day. 4 = Morning, Day, Evening, Night 2 = Day, Night
5	5	4		Cool-Off-Heat-Auto	Cool-Off-Heat, Off-Heat, Cool-Off	System switch configuration in non heat pump mode.
				Cool-Off-Heat-Emer-Auto	Cool-Off-Heat-Emer, Off-Heat-Emer, Cool-Off	System switch configuration, heat pump mode.
6	6	NA		E (On)	OFF	Selects Energy Management Recovery, E (with programming option on)
7	7	5		Cr, Heat (FA)	SL	Selects Adjustable Anticipation, cycle rate, Heat
8	8	6		Cr, Cool (FA)	SL	Selects Adjustable Anticipation, cycle rate, Cool
9	9	7		Cr/AU, Emer (FA)	SL	Selects Adjustable Anticipation, cycle rate auxiliary, (This item is only to appear if HP 1 or HP 2 is selected above).
10	10	8		CL (OFF)	On	Selects Compressor Lockout.
11	11	9		dL (On)	OFF	Selects Continuous Display backlight & intensity.
12	12	10		dL (LO)	HI	Selects Backlight Intensity.
13	13	11		0	4, LO to 4, HI	Selects Adjustable Ambient Temperature Display [range -4 (LO) to +4 (HI)].
14	14	12		F	C	Selects F/ C Display (temperature units in Fahrenheit or Celsius).
15	15	13		b (On)	OFF	Selects audible Beeper On/Off.
16	16	14		dS (On)	OFF	Selects Daylight Saving Time calculation.
17	17	15		AS, Heat (OFF)	On	Selects Automatic Schedule for comfort temperature Programming, heat mode.
18	18	16		AS, Cool (OFF)	On	Selects Automatic Schedule for comfort temperature Programming, cool mode.
19	19	17		CS, (OFF) Cool Savings	1-2-3-4-5-6	Selects Cool Saving Feature & amount.
20	20	18		HL, Heat (99)	62-98	TEMPERATURE LIMIT, HEAT (max. heat set point).
21	21	19		LL, Cool (45)	46-82	TEMPERATURE LIMIT, COOL (min. cool set point).
22	22	20		OFF,  Keypad Lockout	L (total), P (partial), Temperature Limit (limited temperature range)	Selects Keypad Lockout.
				000	001-999	Selects Keypad Lockout Combination (active only if keypad Lockout is selected).
23	23	21		FS, Heat (On)	OFF	Fast second stage of heat (not available if SS1 is selected above).
24	24	22		FS, Cool (On)	OFF	Fast second stage of cool (not available if SS1 or HP1 is selected above).
25	25	23		Remote (OFF)	On	Remote temperature sensor, enable/disable.
				In, Remote	Outdoor Remote	Remote temperature sensor (Indoor/Outdoor).
				LS (On)	OFF	Local temp. Sensor enable/disable (only when Indoor Remote is selected On).
26	26	24		dF (5)	5-50	Selects Dual Fuel Feature & setpoint (in Fahrenheit) (applicable only when HP1 or HP2 is selected).
				Cd (15)	0-99	Selects Compressor delay in seconds (only when dF is selected >5).
27	27	25		AO (80)	35 to 80	Selects Auxiliary Off setpoint (applicable only when HP1 or HP2 is selected).
28	28	26		Change Filter (OFF)	On	Selects Change filter feature
				200 Hours	25-1975 (in increments of 25 hours)	Change filter, duration hours.

INSTALLER/CONFIGURATION MENU

- 1) This control can be configured for:
 MS2 Multi-Stage System (2 heat/2 cool)
 HP1 Heat Pump with one stage of compressor (2 heat/1 cool)
 HP2 Heat Pump with two stage compressor or two compressor system, Gas or Electric backup; (Dual Fuel see menu item 35) (3 heat/2 cool)
 SS1 Single Stage System (3 wire zone see wiring diagram 37-6808A)
- 2) GAS or Electric (ELE) fan operation. If the heating system requires the thermostat to energize the fan, select ELE. Select GAS if the heating system energizes the fan on a call for heat. **Note: Resetting the thermostat switches the option to ELE.**
- 3) **Programs per week** This control can be configured for 7 independent day or 5/1/1 day programming or non-programmable modes. Default is 7-day mode. The display indicates "7 Days" as default. Other options "5 Days" or "0 Days" can be selected by pressing touch keys, \triangleright or \triangleleft . If "0 Days" is selected for non-programmable mode, the step for EMR will be skipped, as this feature will not be available in this mode.
- 4) **Program Steps per day** This control can be configured for 4 or 2 program steps per day. Default is "4 PS" and can be toggled between 4 PS and 2 PS by pressing the \triangleright or \triangleleft touch keys.
- 5) **System Switch Configuration (MS2/SS1)** This thermostat is configured for Heat and Cool with Auto changeover default (Cool-Off-Heat-Auto). Can be configured as Heat & Cool (Cool-Off-Heat), or Heat Only (Off-Heat), or Cool Only (Cool-Off).
 When the control is in heat pump configuration (HP1/HP2), the system switch configuration will have an additional mode available namely, Emer for **Emergency Mode**.
- 6) **Energy Management Recovery (EMR)** (this step is skipped if configured as non-programmable).
 When set to "On" causes the thermostat to start heating or cooling early to make the building temperature reach the program setpoint at the time you specify.
Example: Let us say, the heating program is 65 F at night and 70 at 7 AM. If the building temperature is 65 F, the difference is 5 F. Allowing 5 minutes per F rise, the thermostat setpoint will change to 70 at 6:35 AM.
 Cooling allows more time per F, because it takes longer to reach temperature.
- 7, 8 & 9) **Cycle Rate Selection** The factory default setting is fast cycle (FA Cr) in all modes (Heat, Cool, Emer). To slow cycling (SL, Cr), press touch keys \triangleright or \triangleleft toggle between FA & SL. The cycle rates are as below different selections:

Mode	Fast rate	Slow rate
Heat	0.6 F	1.2 F
Cool	1.2 F	1.7 F
Emer	1.2 F	1.7 F
- 10) **Select Compressor Lockout (CL)** Selecting CL On will cause the thermostat to wait 5 minutes between cooling cycles. This is intended to help protect the compressor from short cycling. Some of the newer compressors have already got a time delay built in and do not require this feature to be activated in the thermostat. Your compressor manufacturer can tell you if this lockout feature is already present in their system. When the thermostat compressor time delay is activated, it will flash the set point for up to five minutes.
- 11) **Select Continuous Backlight** In low lighting conditions, display backlight improves the display contrast. When C terminal is connected, selecting dL On will turn the backlight on continuously. Selecting dL Off will turn the backlight on momentarily after any key is pressed. When C terminal is not powered (battery only), dL On enables the momentary backlight whenever a key is pressed.
- 12) **Select Backlight Intensity** This thermostat has the ability to provide two selectable intensities of the backlight: HI and LO. Using \triangleright or \triangleleft touch keys you can toggle the selection between HI and LO.
- 13) **Select Temperature Display Adjustment 4 LO to 4 HI** This allows you to adjust the room temperature display by an amount in the range of -4 F to +4 F in 1 steps by using the \triangleright or \triangleleft touch keys. Your thermostat was accurately calibrated at the factory, however you have the option to change the display temperature value to match your previous thermostat, if you so prefer.
- 14) **Select °F or °C Readout** Select the desired temperature unit by pressing \triangleright or \triangleleft . Factory default is F.
- 15) **Select Audio Prompting (Beeper) On or Off** Factory default setting is on (b, On). If you wish to turn off the beeper select OFF.
- 16) **Select Daylight Saving Time Calculation** This feature will allow the thermostat to calculate the DST automatically and apply it to the Real Time Clock display. Default On. Use \triangleright or \triangleleft touch keys to select the feature, OFF.
- 17 & 18) **Select Automatic Schedule** With just one touch of the **Auto Schedule** key this feature allows you to program a desired comfort temperature into all the program periods along with a 6 set back for night periods of both Heat and Cool programs. Factory default is "On" for both. When **Heat AS On** and **Cool AS On** are activated while in Heat or Cool mode, select desired setpoint temperature and press **Auto Schedule. Auto Schedule** will flash, press it again to copy. This value will be copied into all the morning, day and evening program periods. The night program periods will be with a 6 F set back.
- 19) **Select Cool Savings™:** With Cool Savings enabled, the thermostat will make small adjustments to the sensed temperature during periods of high demand to reduce AC system running time and save energy. When the cooling system has been running for more than 20 minutes, humidity in the home will be lower and a higher temperature will feel comfortable. After 20 minutes of run time, the thermostat will start decreasing the sensed temperature in steps of less than one degree as the system continues to run. These adjustments will eventually cause the system to satisfy the thermostat to turn the system off and reduce the energy consumption. When the Cool Savings feature is active and making adjustments, the display will flash **CoolSavings™**. The amount of the adjustments to the sensed temperature is dependent on the Cool Savings value that is set, 1 being the least adjustment and 6 being the most adjustment. With this feature set to OFF, no change will occur when the AC system is continuously running during the periods of high demand. Periods of high demand will normally occur during the late afternoon and early evening on the hottest days of the summer. As demand lessens the adjustments to sensed temperature are reversed until sensed temperature returns to normal and **"CoolSavings™"** no longer flashes.

INSTALLER/CONFIGURATION MENU

- 20) **Heat Temperature Limit Range** This feature adjusts the highest setpoint temperature for heat. The default setting is 99 F. It can be changed between 62 F and 98 F by pressing the \triangleright or \triangleleft key. The "temperature limit" icon will be displayed to the left of your setpoint temperature when using this feature. The "temperature limit" icon will flash if an attempt is made to adjust the temperature beyond the range selected.
- 21) **Cool Temperature Limit Range** This feature adjusts the lowest setpoint temperature for cool. The default setting is 45 F. It can be changed between 46 F and 82 F by pressing the \triangleright or \triangleleft key. The "temperature limit" icon will be displayed to the left of your setpoint temperature when using this feature. The "temperature limit" icon will flash if an attempt is made to adjust the temperature beyond the range selected.
- 22) **Keypad Lockout** This step allows you to select the type of lockout or limited range security required. If no lockout or limited range security is required, press \triangle to advance the menu.
Three security settings are available in this menu item. Use the \triangleright or \triangleleft keys to select the lockout desired. Lockout selections are:
"Keypad Lockout and L" = Total Lockout. Total Lockout locks all keys.
"Keypad Lockout and P" = Partial Lockout. Partial Lockout allows only the \triangle or ∇ keys to operate within your set temperature limits.
"Temperature Limit/Keypad Lockout" prevents changing the temperature limits in the Configuration Menu.
Keypad Lockout Combination Number Selection
Display will read "OFF" "Keypad Lockout".
Skip this step and continue through the configuration menu items 19 thru 22 if you require an Air Filter Change out indicator or Humidifier Pad Change out indicator by pressing the \triangle button to advance.
Return to this point when you are ready to start your selected lock-out and continue by:
Pressing \triangleright or \triangleleft keys to select ON.
Press \triangle . Display will read "000".
Pressing \triangleright or \triangleleft keys to select your keypad lockout combination number. Note: "000" is not a valid combination choice.
Record the number you select for future use.
Press \triangle to exit the menu. The security feature you select will start in 10 seconds. The system button will remain active for 10 seconds to allow setting Heat, Off, Cool or Auto.
- 23 & 24) **Select Fast Second Stage ON or OFF** In the run mode, with the fast Heat feature enabled (FA Heat On), if the Heat setpoint temperature is manually raised by 3 F (2 C) or more above the actual temperature using \triangle the second stage will energize immediately. With FA OFF, second stage will not energize until the setpoint temperature is 1 F or more above actual temperature for more than ten minutes. The Fast Cool feature (FA Cool) provides the same controls when the setpoint temperature is lowered.
- 25) **Select Remote Temperature Sensor** This control allows one wired remote temperature sensor (indoor or outdoor) be connected to it and indicates the measured temperature in clock digits. This menu enables you to select the remote sensor and also configure it as indoor or outdoor temperature sensor. Factory default is off. Select **Remote On** and **Remote in** (for indoor) or **Outdoor Remote**.
Local Temperature Sensor disable This is applicable only when indoor remote temperature sensor is enabled. Factory default is **On LS**. You can make it **Off LS** if you desire by using \triangleright or \triangleleft touch keys. Then, only the indoor remote temperature reading will be used for control.
- 26) **Select Dual Fuel Feature and Setpoint** This feature is applicable only in heat pump modes. When the feature is selected, the thermostat will switch to gas heat and inhibit the compressor when the outside temperature (monitored by the outside remote sensor), falls below the DF setpoint. By using \triangleright or \triangleleft touch keys, select **x, DF** where x=5 to 50; factory default is 5 which disables the feature. This feature requires an outdoor remote temperature sensor (WR# F145-1378), however does not need a fossil fuel kit.
Select Compressor Delay When the DF feature is enabled, the shut down of the compressor stage(s) are delayed by a programmable time after the auxiliary stage is energized to minimize the duration during which the system may blow cooler air. Default delay is 60 seconds (60, Cd). By using \triangleright or \triangleleft touch keys any value between 0 and 99 can be selected.
- 27) **Select Auxiliary Offset Point** This feature is applicable only in heat pump modes. When the outdoor temperature is above the Auxiliary Off (**AO**) setpoint, the auxiliary stages will be inhibited so the temperature will be maintained by only the heat pump. Factory default is 80, which disables the feature. AO setpoint cannot be set at or below Dual Fuel (DF) setpoint. By using \triangleright or \triangleleft touch keys, select **x, AO** where x=35 to 80.
- 28) **Select Change Filter Run Time** The thermostat will display "Change Filter" after a set time of blower operation. This is a reminder to change or clean your air filter. This time can be set from 25 to 1975 hours in 25 hour increments. A selection of OFF will cancel this feature. When "Change Filter" is displayed, you can clear it by pressing Clean Display. In a typical application, 200 hours of run time is approximately 30 days.

OPERATING YOUR THERMOSTAT ————— IMPORTANT! —————

Choose the Fan Setting (Auto or On or Prog)

Fan **Auto** is the most commonly selected setting and runs the fan only when the heating or cooling system is on.
Fan **On** selection runs the fan continuously for increased air circulation or to allow additional air cleaning.
Fan **Prog** will cycle the fan for -10 minutes on and 20 minutes off if the thermostat has not called for heat or cool during the past 60 minutes.

Choose the System Setting (Cool, Off, Heat, Emer, Auto)

Press the SYSTEM button to select:

Heat: Thermostat controls only the heating system.

Off: Heating and Cooling systems are off.

Cool: Thermostat controls only the cooling system.

Auto: Auto Changeover is used in areas where both heating and cooling may be required on the same day. **AUTO** allows the thermostat to automatically select heating or cooling depending on the indoor temperature and the selected heat and cool temperatures. When using **AUTO**, be sure to set the Cooling temperatures more than 1 Fahrenheit higher than the heating temperature.

Emer: Setting is available only when the thermostat is configured in HP1 or HP2 mode.

Manual Operation for Non-Programmable Mode Thermostats

Press the SYSTEM button to select Heat or Cool and use the Δ or ∇ buttons to adjust the temperature to your desired setting. After selecting your desired settings you can also press the SYSTEM button to select **AUTO** to allow the thermostat to automatically change between Heat and Cool.

Manual Operation (Bypassing the Program) Programmable Thermostats

Press Δ or ∇ and the HOLD button and adjust the temperature wherever you like. This will override the program. The **HOLD** feature bypasses the program and allows you to adjust the temperature manually, as needed. Whatever temperature you set in **HOLD** will be maintained 24 hours a day, until you manually change the temperature or press **Run Schedule** to cancel **HOLD** and resume the programmed schedule.

Program Override (Temporary Override)

Press Δ or ∇ buttons to adjust the temperature. This will override the temperature setting for a (default) four hour override period. The override period can be shortened by pressing \leftarrow or lengthened by pressing \rightarrow . Program Override period can range from 15 minutes to 7 days.

Example: If you turn up the heat during the morning program, it will be automatically lowered later, when the temporary hold period ends. To cancel the temporary setting at any time and return to the program, press **Run Schedule**. If the SYSTEM button is pressed to select **AUTO** the thermostat will change to Heat or Cool, whichever ran last. If it switches to heat but you want cool, or it changes to cool but you want heat, press both Δ or ∇ buttons simultaneously to change to the other mode.

Special Test Mode for PWM (V) output (Installer function only)

The PWM (V) output controls the modulating gas valve. Amplitude of this signal is about 10 VDC, frequency is 1 HZ and the pulse width is variable 350 to 950 in steps of 50 msec.

To activate the modulating test mode, press and hold the **Installer Config** touch key until the display changes to show **dC** (in actual temperature digits) and **05** (default) in clock digits (at least 10 seconds). If the touch key is released before the display changes the test mode will not be activated and the installer menu mode will be active. On entering the modulating test mode, the display (**05**) will indicate the duty cycle of 5% (pulse width of 50 msec) corresponding to no call for heat.

Press \rightarrow key to change the display to **35** (duty cycle 35%). The **W** output will energize and within one second the pulse width modulated **V** output will also be activated with a pulse width of 350 msec.

Use \rightarrow or \leftarrow touch keys to increase or decrease the pulse width in steps of 50 milliseconds (5% change in duty cycle). The maximum duty cycle is 95% (maximum pulse width of 950 milliseconds).

This special test mode will be exited by pressing **Run Schedule** touch key or when there is no keypad activity for over 60 minutes.

PROGRAMMING

Set Current Time and Day

- 1) Press Menu key to enter installer menu. Then press Set Time once to indicate hour & A or P designation in clock display.
- 2) Press and hold either the \rightarrow or \leftarrow touch key until you reach the correct hour and A or P designation.
- 3) Press Set Time again to display minutes only in clock display.
- 4) Press and hold either the \rightarrow or \leftarrow touch keys until you reach the correct minutes.
- 5) Press Set Time once again to display year.
- 6) Press and hold either the \rightarrow or \leftarrow touch key until you reach the correct year.
- 7) Press Set Time once again to display month.
- 8) Press and hold either the \rightarrow or \leftarrow touch key until you reach the correct month.
- 9) Press Set Time once again to display date of the month along with day of the week at top row (which is automatic).
- 10) Press and hold either the \rightarrow or \leftarrow touch key until you reach the correct day of the month. The correct day of the week is displayed at the top row.
- 11) Press Run Schedule once; now the display will show the correct time and room temperature.

PROGRAMMING

Automatic Daylight Saving Calculation

The Real Time Clock will adjust automatically for daylight savings time, in the following manner until 2007: Increment one hour at 2 AM on the first Sunday of April and decrement one hour at 2 AM of the last Sunday of October every year.

From March 2007, the adjustment will occur every year as follows: Increment one hour at 2 AM on the second Sunday of March and decrement one hour at 2 AM on the first Sunday of November.

The daylight saving feature can be enabled or disabled in installer configuration mode.

After entering installer configuration mode, momentarily press Δ or ∇ touch key until the display indicates dS (in actual temperature digits) and on (default in c lock digits). \triangleright and \triangleleft keys will toggle display and operation from On to OFF.

Programming Tip: Copy Button

You may copy any daily program to another day or group of days by pressing the Copy button. In 7 day programming mode when the Copy button is pressed, the other 6 days of the week will flash. To copy the current program into the remaining six days, simply press the Copy button again. To copy the current program to another day of the week, press Advance Day to select the day and press Copy to paste the program. In 5/1/1 day programming mode the copy function is similar. The weekday (Mon-Fri) program can be copied to Sat and Sun (both flashing) or use Advance Day to choose Sat or Sun and press the Copy button to paste the program.

Fill in the blank schedule on the next page then:

Enter the Heating Program

- 1) Press the Menu button and then press Set Schedule. Press SYSTEM button to select either "Heat" or "Cool" in the system switch area indicating the active mode being programmed. You can switch to the other mode by pressing the system switch at any time.
- 2) The top of the display will show the day(s) being programmed. The time and set at temperature are also displayed. "Morning" will also be displayed to indicate the period.
- 3) Press Δ or ∇ key to change the temperature to your selected temperature for the 1st heating period (Morning).
- 4) Press \triangleright or \triangleleft key to adjust the start time for period. The time will change in 15 minute increments.
- 5) Press FAN to select Auto or Prog.
- 6) After you have set the time and the temperature for the period to begin, press Set Schedule to advance to the next program period.
- 7) Repeat steps 2 through 6 until all of the program times and temperatures are set for all program periods on that day.
- 8) Press "Advance Day" to change to the next day and repeat steps 2 through 8.
- 9) When programming is complete and all of the times and temperatures match your desired heating schedule, press Run Schedule. The thermostat will now run your program.

Enter the Cooling Program

- 1) Press the SYSTEM button until the Cool icon appears.
- 2) Follow Enter Heating Program instructions for entering cooling times and temperatures.

Automatic Schedule

This feature provides a method to program every day with the most popular time and temperature profile using one key press. For this feature to be available, the Auto schedule options (AS Cool or AS Heat) should be set on in the installer configuration.

Select the desired Comfort Temperature in the setpoint. When the Auto Schedule touch key is pressed, it will start flashing indicating that it is now ready to insert the displayed temperature setpoint as the Comfort Temperature for the selected system mode currently in (Heat/Cool). A second press of the Auto Schedule touch key will complete the process. A 6° F setback temperature will also be inserted for the night step. Once it is done, the touch key display Auto Schedule will disappear disabling any further operation of Auto Schedule touch key. If desired it can be enabled again in the installer configuration menu.

Entering Fan Program

The FAN touch key is used to select FAN Auto operation (fan energized with a call for cool but not on with a call for heat) to FAN On (fan on continuous) or FAN PROG (fan programmed to cycle fixed time automatically). Each press of the FAN touch key will change the mode from Auto to On to Prog. FAN Auto or FAN On or FAN On Prog will display in the run mode for as long as the fan is in that position. When FAN Prog position is selected and the system is in the Cool, Heat or Auto mode, the circulator blower (fan) will cycle ON for 10 minutes, OFF for 20 minutes when the thermostat has not called for cooling or heating for the past 60 minutes.

To improve indoor air quality, the system circulator can be programmed to run during any program time period by touching the FAN touch key in the appropriate program time period when in the Menu mode for that particular day. The display shall indicate Prog (under the FAN icon) when in Menu mode and the fan is programmed to come on during that time.

In the menu mode, each time the fan key is pressed, the fan operation and display will change from FAN Auto to FAN Prog. The display shall indicate FAN On Prog when in run mode and the fan is programmed to run for that particular time period.

When in Run Schedule mode and the FAN touch key is pressed, it will override the schedule, and the display and fan operation shall change to FAN Auto and the fan is stopped. Further key depression will change it to FAN On (continuous blower on) and to FAN Prog (cycling 10 minutes on and 20 minutes off if there is no call for heat or cool for 60 minutes). The Run Schedule touch key will also be indicated, meaning that it is an override on the scheduled program. The override will last until next schedule comes up or the Run Schedule touch key is depressed.

PROGRAMMING

Energy Saving Factory Pre-Program

The (-)HC-TST401MDMS thermostats are programmed with the energy saving settings shown in the table below for all days of the week. If this program suits your needs, simply set the thermostat clock and press the RUN button. The table below shows the factory set heating and cooling schedule for all days of the week.

	* Wake Up (Morning)		Leave For Work (Day)		* Return Home (Evening)		Go To Bed (Night)	
Heating Program	6:00 AM	70 F	8:00 AM	62 F	5:00 PM	70 F	10:00 PM	62 F
Cooling Program	6:00 AM	78 F	8:00 AM	85 F	5:00 PM	78 F	10:00 PM	82 F

* You can eliminate these two program periods in the configuration menu (reference #3) if the building is occupied all day. Day will change to 6:00 am and can be programmed as required.

Planning Your Program – Important

The Heating and Cooling Program schedules below allow you to pencil in your own program times and temperatures. The (-)HC-TST401MDMS comes configured for 7 day programming and can also be configured for 5+1+1 programming (see configuration section). Factory settings are listed on Monday, Saturday and Sunday. If you are re-programming a 5+1+1 day schedule, pencil in your own times and temperatures directly below the factory times and temperatures.

If you are re-programming a 7 day fill in all lines with the times and temperatures you want.

Keep the following guidelines in mind when planning your program.

In Heating, lower temperatures will save energy.

In Cooling, higher temperatures will save energy.

If you plan on using Auto Changeover, do not program the heating higher than the cooling.

Worksheet for Re-Programming 5+1+1 and 7 Day Program

Heating Program	Wake Up (Morning)			Leave For Work (Day)			Return Home (Evening)			Go To Bed (Night)		
	Time	Temp	Fan	Time	Temp	Fan	Time	Temp	Fan	Time	Temp	Fan
MON	6:00 AM	70 F	Auto	8:00 AM	62 F	Auto	5:00 PM	70 F	Auto	10:00 PM	62 F	Auto
TUE												
WED												
THU												
FRI												
SAT	6:00 AM	70 F	Auto	8:00 AM	62 F	Auto	5:00 PM	70 F	Auto	10:00 PM	62 F	Auto
SUN	6:00 AM	70 F	Auto	8:00 AM	62 F	Auto	5:00 PM	70 F	Auto	10:00 PM	62 F	Auto

Cooling Program	Wake Up (Morning)			Leave For Work (Day)			Return Home (Evening)			Go To Bed (Night)		
	Time	Temp	Fan	Time	Temp	Fan	Time	Temp	Fan	Time	Temp	Fan
MON	6:00 AM	78 F	Auto	8:00 AM	85 F	Auto	5:00 PM	78 F	Auto	10:00 PM	82 F	Auto
TUE												
WED												
THU												
FRI												
SAT	6:00 AM	78 F	Auto	8:00 AM	85 F	Auto	5:00 PM	78 F	Auto	10:00 PM	82 F	Auto
SUN	6:00 AM	78 F	Auto	8:00 AM	85 F	Auto	5:00 PM	78 F	Auto	10:00 PM	82 F	Auto

PROGRAMMING

Wired Remote Temperature Sensing

One remote temperature sensor can be installed indoor or outdoor and connected to the thermostat by a maximum cable length of 100 meters (300 ft). Three terminals, +, S & - are provided on the terminal block to connect to the White-Rodgers standard wired remote sensor. This sensor will be read by the thermostat only when 24VAC is present.

When used as indoor sensor, the readings can be weighted with the local sensor for specific program periods. User can enable or disable the remote sensor in the installer configuration mode and also the outdoor temperature can be selected to show on the display.

Once in the installer configuration mode, momentarily press the \blacktriangle or \blacktriangledown touch key until display indicates **Remote** (at the top left of the LCD) and OFF (default in clock digits).

Pressing \blacktriangleright or \blacktriangleleft touch key will toggle the operation and display from **Remote OFF** to **Remote On**.

When **Remote On** is selected, press \blacktriangle key for the display to indicate **Remote In** (for indoor remote).

The \blacktriangle or \blacktriangledown keys will toggle the operation and display from **Remote In** to **Outdoor Remote**.

When any remote is selected the temperature will display in the clock digits for one second alternating with the current time for three seconds when in **Run Schedule** mode.

Outdoor Remote will indicate at the top left of display for outdoor remote reading.

Only **Remote** will show at top left for indoor remote reading. ($^{\circ}$ F or $^{\circ}$ C will not indicate with remote temperature readings).

Sensing Range:

Outdoor temperature range is -40 to 140° F

Indoor temperature range is 32° F to 99° F

Weight of Remote Reading:

When in view schedule mode the weight of the indoor remote sensor will be shown in the left actual temperature digits designated as A2 (default for average weight), H4 (high weight) or L1 (low weight). The period (Morning, Day, Evening, Night) will also be shown to the right of the weight value in the actual temperature digits.

When in view schedule mode, press \blacktriangleright and \blacktriangleleft keys at the same time to sequence the indoor remote temperature sensor weight from A2 to H4 to L1 and back to A2 for each of the program period times for each day. (The H4 weight is twice the weight of A2 and A2 is twice the weight of L1).

When **Remote In** is selected (with **Remote** selected to **On**), press \blacktriangle key for the display to indicate the status of the local sensor **LS On** (default for thermostat local sensor operational). The \blacktriangle and \blacktriangledown keys will toggle the function and display from **LS** (shown in actual temperature digits) and **On** (shown in clock digits) to **LS OFF** to designate the local sensor is disabled.

The local sensor may be disabled only if the indoor remote sensor is enabled and functional.

If the indoor remote sensor is disabled or not functional, the local sensor will automatically enable and display in the run schedule mode.

The actual temperature displayed in the run mode is the mathematical weighted sum of the two temperature sensors local and indoor remote.

(Outdoor remote sensor is not used for this computation).

If the remote sensor is absent or not enabled then the actual temperature will be as measured by the local sensor.

Dual Fuel Temperature Set Point

The Thermostat can monitor outside temperature through an outdoor remote sensor if installed and switch to gas heat and inhibit the compressor when in heat pump mode and outside temperature is below a user selectable value. This temperature is called the dual fuel temperature set point. This eliminates the need for a fossil fuel kit.

For this feature to be functional the following conditions are to be met:

1. The thermostat must be in heat pump mode;
2. The outdoor temperature sensor must be enabled and operational.

Once in the installer configuration mode, step through the menu items until the display indicates **dF** (for dual fuel) in the actual temperature digits and 5 (default) in clock digits.

Pressing the \blacktriangleright or \blacktriangleleft touch keys will increment the dual fuel temperature setpoint from 5 to 50 (default unit is Fahrenheit).

When the dual fuel temperature setpoint is any value above 5° F this feature is enabled. If the actual outdoor temperature is lower than this temperature setpoint the heat pump will be inhibited. If the balance point temperature setpoint is 5° F the feature is disabled.

When the dual fuel feature is enabled, the shut down of the compressor stage(s) are delayed a programmable time with a default of 60 seconds after the auxiliary stage is energized to minimize the time that the system may blow cooler air.

Only when the dual fuel feature is enabled and the \blacktriangle is pressed after the dual fuel feature dF is selected, the display will indicate Cd (for compressor delay) in actual temperature digits and 60 (default) in clock digits.

Pressing the \blacktriangleright or \blacktriangleleft touch keys will increment the compressor delay time to 99 seconds or decrement down to 0 second.

If the \blacktriangleright or \blacktriangleleft touch keys are held depressed, the setpoint will increment or decrement one degree at the rate of one degree every one half second for the first three seconds and thereafter at double the speed.



TROUBLESHOOTING

Reset Operation

Note: When thermostat is reset, installer configuration menu settings and programming will reset to factory settings.

If a voltage spike or static discharge blanks out the display or causes erratic thermostat operation, you can reset the thermostat by removing the wires from terminals **R** and **C** (do not short them together) and removing batteries for 2 minutes. After resetting the thermostat, replace the wires and batteries. If the thermostat has been reset and still does not function correctly contact your heating/cooling service person or place of purchase.

Note: Be sure to review the installer configuration menu settings.

To reset the programming, clock and configuration settings, press  and  and the SYSTEM button simultaneously. The thermostat should go blank and then all segments will be displayed momentarily.

Symptom	Possible Cause	Corrective Action
No Heat/No Cool/No Fan (common problems)	<ol style="list-style-type: none"> Blown fuse or tripped circuit breaker. Furnace power switch to OFF. Furnace blower compartment door or panel loose or not properly installed. Loose connection to thermostat or system. 	Replace fuse or reset breaker. Turn switch to ON. Replace door panel in proper position to engage safety interlock or door switch. Tighten connections.
No Heat	<ol style="list-style-type: none"> Pilot light not lit. Furnace Lock-Out Condition. Heat may also be intermittent. Heating system requires service or thermostat requires replacement. 	Re-light pilot. Many furnaces have safety devices that shut down when a lock-out condition occurs. If the heat works intermittently contact the furnace manufacturer or local HVAC service person for assistance. Diagnostic: Set SYSTEM Switch to HEAT and raise the setpoint above room temperature. Within a few seconds the thermostat should make a soft click sound. This sound usually indicates the thermostat is operating properly. If the thermostat does not click, try the reset operation listed above. If the thermostat does not click after being reset contact your heating and cooling service person or place of purchase for a replacement. If the thermostat clicks, contact the furnace manufacturer or a HVAC service person to verify the heating is operating correctly.
No Cool	<ol style="list-style-type: none"> Cooling system requires service or thermostat requires replacement. 	Same as diagnostic for No Heat condition except set the thermostat to COOL and lower the setpoint below the room temperature. There may be up to a five minute delay before the thermostat clicks in Cooling.
Heat, Cool or Fan Runs Constantly	<ol style="list-style-type: none"> Possible short in wiring. Possible short in thermostat. Possible short in heat/cool/fan system. FAN Switch set to Fan ON. 	Check each wire connection to verify they are not shorted or touching together. No bare wire should stick out from under terminal block. Try resetting the thermostat as described above. If the condition persists the manufacturer of your system or service person can instruct you on how to test the Heat/Cool system for correct operation. If the system operates correctly, replace the thermostat.
Thermostat Setting & Thermostat Thermometer Disagree	<ol style="list-style-type: none"> Thermostat thermometer setting requires adjustment. 	The thermometer can be adjusted +/- 4 degrees. See Temperature Display Adjustment in the Configuration Menu section.
Furnace (Air Conditioner) Cycles Too Fast or Too Slow (narrow or wide temperature swing)	<ol style="list-style-type: none"> The location of the thermostat and/or the size of the Heating System may be influencing the cycle rate. 	Digital thermostats provide precise control and cycle faster than older mechanical models. The system turns on and off more frequently but runs for a shorter time so there is no increase in energy use. If you would like an increased cycle time, choose SL for slow cycle in the Configuration menu, step 6 (heat) or 7 (cool). If an acceptable cycle rate is not achieved, contact a local HVAC service person for additional suggestions.
Forgot Keypad Lockout Code		Press the menu button (button will disappear) and hold in for 20 seconds. This unlocks the thermostat.

ACCESSORIES

FIELD-INSTALLED OPTION ACCESSORIES

TWINNING: Twinning is **NOT** permitted on any modulating (-GFD, -GGD or -GJD) furnace model.

ELECTRONIC AIR CLEANER

Line voltage power can be supplied from the screw terminal “EAC”, see Figure 55, and a line voltage neutral screw terminal on the control board. This will power the electronic air cleaner whenever the ECM2+ blower is operating and delivering the recommended minimum CFM. The 60 and 75 KBTU models, which are capable of a maximum delivery of 1200 CFM, will operate the electronic air cleaner at 500 CFM and above. The 90, 105 and 120 KBTU models, which are capable of a maximum delivery of 2000 CFM, will operate the electronic air cleaner at 800 CFM and above. These limits are set to prevent excessive production of ozone at the lower airflows of the modulating furnace and are based on average requirements of commercially available electronic air cleaners. The continuous fan speeds are set to always provide adequate airflow for electronic air cleaner operation.

FIGURE 55
EAC TERMINAL

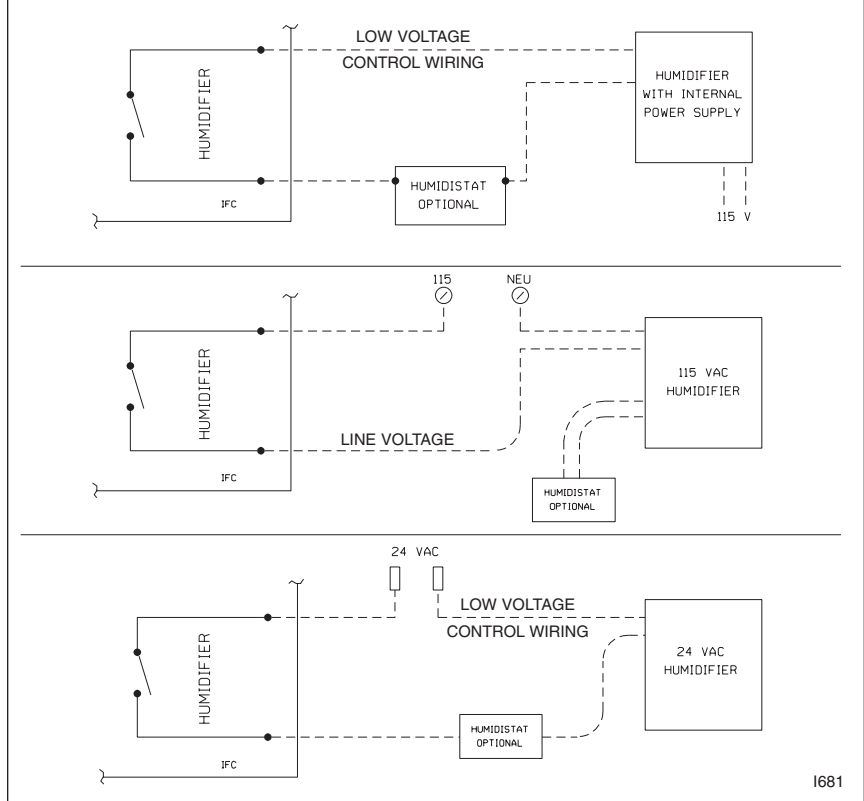


HUMIDIFIER

The humidifier contacts (labeled HUMIDIFIER on the IFC) are “dry” contacts on the IFC. This means that the terminals are connected directly to the contacts of a board-mounted relay. The coil of the relay is controlled by the microprocessor of the IFC. The coil is engaged roughly any time the heat speed blower is engaged so that humidification is active any time the heat blower is running. In addition to this control, on 24 VAC humidifiers or

humidifiers controlled by a 24 VAC control circuit, an optional 24 VAC humidistat can be installed (see Figure 56). With the optional humidistat, two separate conditions must be met before humidification of the conditioned space can begin: 1) There must be a heat call and the heat speed blower must be running and 2) The humidistat must determine that there is a need for humidification.

FIGURE 56
WIRING FOR OPTIONAL HUMIDIFIER



I681

DEHUMIDIFICATION IN COOLING OPERATION

Dehumidification in the cooling mode can be accomplished by two different methods. Both methods will reduce the amount of airflow in cooling by 15%. This reduced airflow will cause more water to condense on the evaporator coil thus reducing the humidity in the conditioned space.

IMPORTANT: The manufacturer requires that all cooling systems installed with either dehumidification feature enabled **MUST** have a coil of the type with an expansion valve. In addition to these requirements, evaporator coils must have a freeze-stat (part #RXXR-AM01) installed to prevent possible coil freeze-up. Note that the RCBA coils must have **BOTH** an expansion valve kit and a freeze-stat installed per manufacturer's instructions.

Method A: THERMOSTAT DEMAND DE-HUMIDIFICATION

This method for dehumidification relies on an algorithm in the modulating thermostat (part #41-24312-04) to calculate a need for dehumidification based on the number and frequency of cooling calls over a specified period of time. The feature is enabled on the thermostat interface panel. Please read and follow the instructions for the modulating thermostat to enable this feature.

Please note that the thermostat can only estimate when there is a need for dehumidification by looking at the recent history of cooling calls. This is not a true measurement of humidity. For true humidity measurement, a humidistat must be installed per the instructions in method B below.

Method B: ON-DEMAND DE-HUMIDIFICATION—REFERENCE FIGURES 57 THRU 59

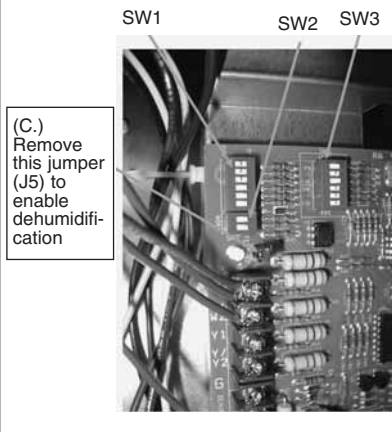
On UTECH IFC Revision –03 (62-24174-01 rev 03) or newer (After May 12, 2004) or all revisions of 62-24174-02, an additional method for dehumidification was added to the function of the IFC. This method is not available on units constructed before this date.

The following methods for dehumidification utilize the most accurate means for sensing humidity. A humidistat should be installed to the control board “YL” or “R” terminals.

ON DEMAND DEHUMIDIFICATION ON UTECH IFC #62-24174-01 REVISION 03 (62-24174-01 Rev -03)

A humidistat should be installed to the control board “YL” and “R” terminals. PLEASE NOTE THAT TWO-STAGE COOLING AND ON-DEMAND DE-HUMIDIFICATION CANNOT BE USED AT THE SAME TIME (IFC REV. 03 ONLY). The dip switch position #6 of bank SW-1 is used to select between either two-stage cooling or on-demand de-humidification, both features can not be used at the same time because there is only one input used for both. Also, if neither feature is to be used, it does not matter if the dip switch is in the “ON” or “OFF” position. Any humidistat can be used provided it is of the type that can handle 24 volts and opens the contacts when there is a need for de-humidification.

FIGURE 57
UT Electronic Controls IFC. 62-24174-02
Shown with Nec. Jumper location for activation of dehumidification control.



For proper installation of On-Demand De-Humidification, ensure the following:

- Install one wire from one humidistat contact terminal to the IFC “YL” terminal and another wire from the remaining humidistat contact terminal to the IFC “R” terminal.
- When installing, be sure to use a humidistat and **NOT** a de-humidistat.
- Position dip switch #6 of bank SW-1 to the “ON” position.
- It is not possible to use two-stage cooling and de-humidification feature at the same time.

NOTE: When the dip switch position #6 of bank SW-1 is in the on position, a 24 volt signal from the humidistat must be supplied at all times to keep the blower running at the correct cooling speed. When the 24 VAC signal is absent, the IFC assumes there is a need for de-humidification and operates the blower at the reduced rate. This is what is known as “reverse-logic”. In other words, when a 24 VAC signal is present, normal operation occurs (100% cooling CFM), however, when there is no signal present, the IFC goes into the dehumidification mode and reduces the airflow by 15%. This could be confusing and will cause the cooling speed to be reduced by 15% if the dip-switch is in the “on” position but no humidistat is connected.

FIGURE 58
WIRING FOR OPTIONAL DEHUMIDIFIER

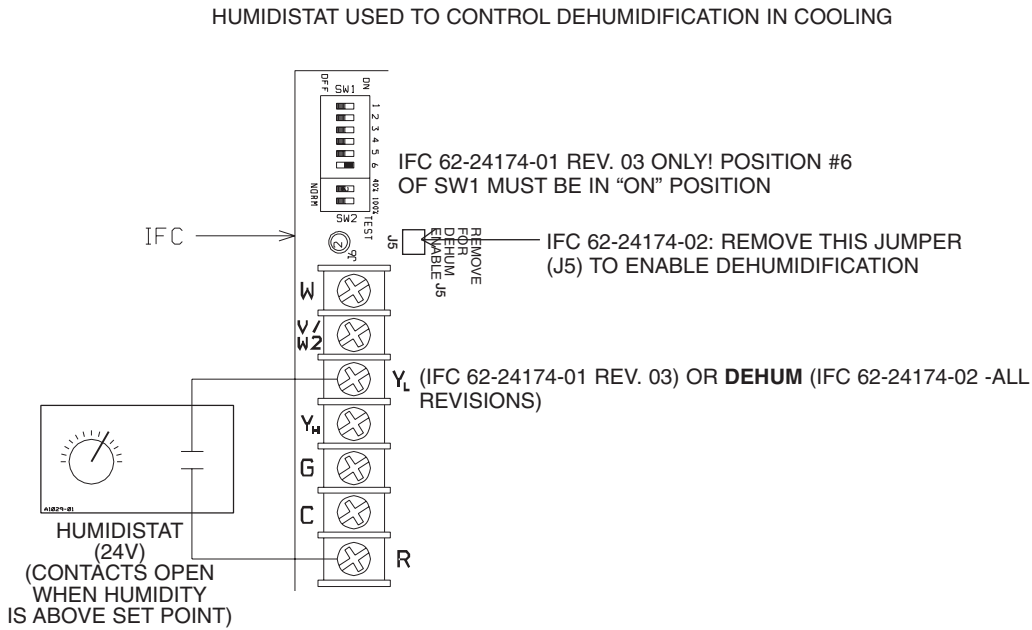
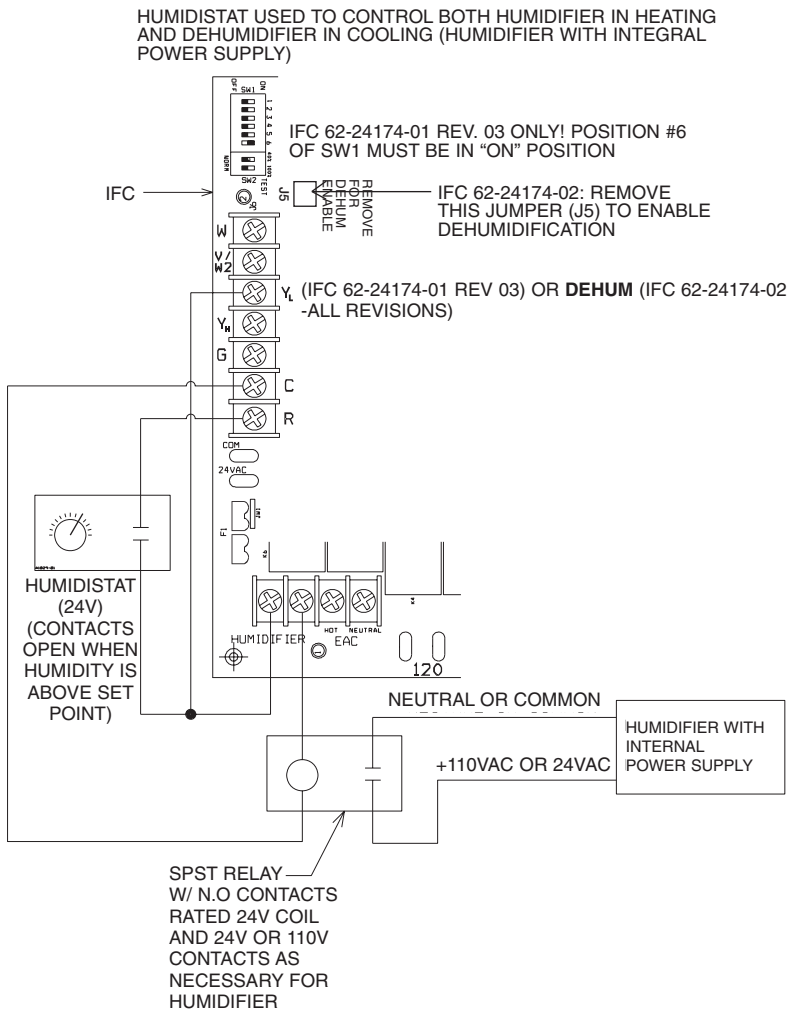


FIGURE 59
WIRING FOR OPTIONAL DEHUMIDIFIER WITH HUMIDIFIER

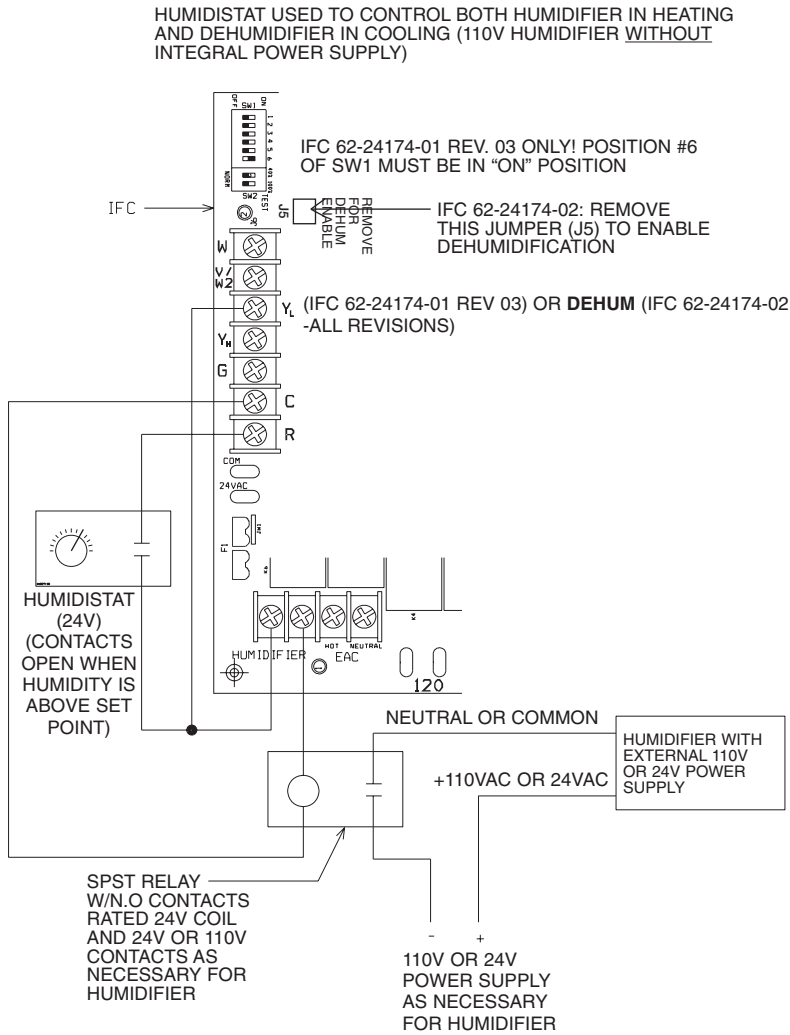


**ON DEMAND DEHUMIDIFICATION
IFC #62-24174-02**

IMPORTANT: Do not remove the jumper at J5 unless a humidistat is installed to the "DEHUM" terminal of the IFC. In addition, the control allows the use of two-stage cooling and dehumidification at the same time and separate cooling airflows for high efficiency (up to 16 SEER) cooling. (see section labeled "FURNACE INSTALLATION WITH HIGH EFFICIENCY PREMIUM COOLING SYSTEMS").

For IFC Revision #62-24174-02 (AVAILABLE 2ND QUARTER 2005) or later, a new dehumidification terminal has been added to the thermostat terminal block. This terminal will permit the user to install dehumidification without the need to manipulate any dip-switches. However, to activate the ODD feature, a jumper located at position J5 (between the thermostat terminal block and dip switch bank SW-2 on the IFC – see Figure 57) must be removed and discarded. This jumper applies 24 volts to the "dehum" terminal at all times in order to prevent the control from reverting to the lower (dehumidification) speed when no voltage is applied.

FIGURE 60
WIRING FOR OPTIONAL DEHUMIDIFICATION WITH HUMIDIFIER AND SEPARATE POWER SUPPLY.



For proper installation of On-Demand De-Humidification, ensure the following:

- Install one wire from one humidistat contact terminal to the IFC "DEHUM" terminal and another wire from the remaining humidistat contact terminal to the IFC "R" terminal.
- When installing, be sure to use a humidistat and NOT a de-humidistat.
- The jumper at position J5 on the control (see Figure 57) has been removed.

OTHER ACCESSORIES AVAILABLE

These kits are available through the finished goods department.

CONCENTRIC VENT TERMINATION KIT = RXGY-E03

HORIZONTAL, TWO-PIPE TERMINATION KIT = RXGY-D02, RXGY-D03, OR RXGY-D04

VENT TERMINATION KIT: RXGY-G02

CONDENSATE PUMP KIT: RXGY-B01

NEUTRALIZER KIT: RXGY-A01

EXTERNAL BOTTOM FILTER RACK: RXGF-CB

EXTERNAL SIDE FILTER RACK: RXGF-CA

These parts are available through ProStock parts department.

ALTERNATE (LEFT-SIDE) DRAIN KIT (DOWNFLOW MODELS ONLY): RXGY-H01

THERMOSTAT AND ACCESSORIES FOR THERMOSTAT

Programmable Modulating Thermostat:
 (-)HC-TST401MDMS

Remote Sensor:
 (For Mod Thermostat Above Only)
 F1451378

Thermostat Wall Plate For Mod Thermostat Above Only:
 F61-2600

HIGH ALTITUDE INSTALLATIONS

-GFD/-GGD/-GJD -HIGH ALTITUDE OPTION #278

▲ WARNING

FOR -GGD-06 AND -GJD-06 MODELS, A PRESSURE SWITCH CHANGE IS NOT NECESSARY AT ANY ELEVATION. FOR -GGD-07 AND -GJD-07 MODELS, A PRESSURE SWITCH CHANGE IS REQUIRED AT ELEVATIONS ABOVE 8,000 FT. FOR ALL OTHER -GFD/-GGD/-GJD FURNACES, A PRESSURE SWITCH CHANGE IS REQUIRED AT ELEVATIONS ABOVE 5,000 FT. OPTION CODE -278 OR THE APPROPRIATE HIGH-ELEVATION KIT WILL CONVERT THE FURNACE FOR USE ABOVE THE APPROPRIATE ELEVATION STATED HERE. DO NOT INSTALL THE -278 OPTION FURNACE OR THE HIGH ALTITUDE KIT BELOW THE STATED ELEVATION. DOING SO CAN CAUSE SERIOUS PERSONAL INJURY OR DEATH OR EQUIPMENT FAILURE.

Furnaces can be ordered from the factory already converted for high altitude elevations. The factory option for high altitude elevations would be ordered as a 278 option (example: a 105k BTU upflow furnace which is factory converted for high altitude elevations would have the model number -GFD-10EZCMS278). These factory converted furnaces come with pressure switches for high-altitude elevations already attached. Also, different burner orifices are installed at the factory which are one drill size smaller (#51 DMS) than standard -GFD/GGD/GJD gas furnaces (#50 DMS). The smaller orifice is installed to accommodate for average heating values expected in most high altitude areas and a required 4% per thousand feet reduction in input as specified by the *National Fuel Gas Code* (NFGC). Specific orifices should always be recalculated for all high altitude installations as outlined below. Orifices should be changed, if necessary, based on gas heating value and elevation.

HIGH ALTITUDE CONVERSION KITS AND OPTIONS

▲ WARNING

FOR -GGD-06 & -GJD-06 MODELS, A PRESSURE SWITCH CHANGE IS NOT NECESSARY AT ANY ELEVATION. FOR -GGD-07 & -GJD-07 MODELS, A PRESSURE SWITCH CHANGE IS REQUIRED AT ELEVATIONS ABOVE 8,000 FT. FOR ALL OTHER -GFD/-GGD/-GJD FURNACES, A PRESSURE SWITCH CHANGE IS REQUIRED AT ELEVATIONS ABOVE 5,000 FT. OPTION CODE -278 OR THE APPROPRIATE HIGH-ELEVATION KIT WILL CONVERT THE FURNACE FOR USE ABOVE THE APPROPRIATE ELEVATION STATED HERE. DO NOT INSTALL THE -278 OPTION FURNACE OR THE HIGH ALTITUDE KIT BELOW THE STATED ELEVATION. DOING SO

CAN CAUSE SERIOUS PERSONAL INJURY OR DEATH OR EQUIPMENT FAILURE.

HIGH ALTITUDE FIELD CONVERSION KITS (GFD MODELS)

MODEL	INPUT(BTU)	KIT NO.
-GFD-06XXXXX	60,000	RXGY-F06
-GFD-07XXXXX	75,000	RXGY-F07
-GFD-09XXXXX	90,000	RXGY-F06
-GFD-10XXXXX	105,000	RXGY-F05
-GFD-12XXXXX	120,000	RXGY-F05

HIGH ALTITUDE FIELD CONVERSION KITS (GGD & GJD MODELS)

MODEL	INPUT(BTU)	KIT NO.
-GGD/-GJD-06XXXXX	60,000	No Kit Required RXGY-F23 (8000 ft and above only)
-GGD/-GJD-07XXXXX	75,000	
-GGD/-GJD-09XXXXX	90,000	RXGY-F24
-GGD/-GJD-10XXXXX	105,000	RXGY-F25
-GGD/-GJD-12XXXXX	120,000	RXGY-F26

Orifice Selection for High Altitude Applications Natural Gas

▲ CAUTION

INSTALLATION OF THIS FURNACE AT ALTITUDES ABOVE 2000 FT (610 m) SHALL BE IN ACCORDANCE WITH LOCAL CODES, OR IN THE ABSENCE OF LOCAL CODES, THE NATIONAL FUEL GAS CODE, ANSI Z223.1/NFPA 54 OR NATIONAL STANDARD OF CANADA, NATURAL GAS AND PROPANE INSTALLATION CODE, CAN B149.1.

INSTALLATION OF THIS APPLIANCE AT OR ABOVE 5000 FT (1525 m) SHALL BE MADE IN ACCORDANCE WITH THE LISTED HIGH ALTITUDE CONVERSION KIT AVAILABLE WITH THIS FURNACE.

34" 90 Plus furnaces (except for opt -278 models) installed at high elevations require the installation of a high altitude kit for proper operation. The high altitude kit consists of a high altitude pressure switch that replaces the pressure switch attached to the induced draft blower.

The pressure switch must be installed at elevations above those listed. Elevations above 2000 ft. require the

furnace to be de-rated 4% per thousand feet. **NOTE:** Factory installed orifices are calculated and sized based on a sea level Natural Gas heating value of 1075 BTU per cubic ft. Regional reduced heating values may nullify the need to change orifices except at extreme altitudes. Table 10 shows some quick conversions based on elevation and gas heating value. This table is combined and simplified from Tables F1 and F4 of the NFGC.

EXAMPLES

The following are examples of orifice sizing using the National Fuel Gas Code Appendix F. For a simplified estimation of orifice size based on heating value and elevation use Tables 10 and 11. However, calculations are the best method.

Example: 900 BTU/ft³ Regional Natural Gas Heating Value

$$I / H = Q$$

$$15000 / 900 = 16.68 \text{ ft}^3/\text{hr}$$

I = Sea Level input (per burner):

$$15000$$

H = Sea Level Heating Value: 900

$$Q = 16.68 \text{ ft}^3 \text{ Natural Gas per hour.}$$

From Table F.1 of *National Fuel Gas Code Handbook, 2002* (3.5" w.c. column)

Orifice required at Sea Level: # 48

From Table F.4 of *National fuel Gas Code Handbook, 2002*

Orifice required at 5000 ft. elevation (4% de-rate per thousand ft): # 50

Orifice required at 8000 ft. elevation (4% de-rate per thousand ft): # 51

(4% de-rate per thousand ft): # 51

Example: 1050 BTU/ft³ Regional Natural Gas Heating Value

$$I / H = Q$$

$$15000 / 1050 = 14.63 \text{ ft}^3/\text{hr}$$

I = Sea Level input (per burner):

$$15000$$

H = Sea Level Heating Value: 1050

$$Q = 14.28 \text{ ft}^3 \text{ Natural Gas.}$$

From Table F.1 of *National Fuel Gas code Handbook, 2002* (3.5" w.c. column)

Orifice required at Sea Level: # 50

From Table F.4 of *National Fuel Gas code Handbook, 2002*

Orifice required at 5000 ft. elevation (4% de-rate per thousand ft): # 51

Orifice required at 8000 ft. elevation (4% de-rate per thousand ft): # 52

TABLE 10

Natural Gas Orifice Drill Size (4% per 1000 ft. De-Rate)

IMPORTANT: For 90+ Furnaces only. Do not use this chart for any 80+ Furnace.

Burner Input (per burner) 15,000 BTU @ Sea Level

Annual Avg. Heat Value (btu per ft ³)	Sea level to 1999 ft	2000 to 2999 ft	3000 to 3999 ft	4000 to 4999 ft	5000 to 5999 ft	6000 to 6999 ft	7000 to 7999 ft	8000 to 8999 ft
850	47	48	48	49	49	49	50	50
900	48	49	49	49	50	50	50	51
1000	49	50	50	50	51	51	51	52
1075	50	51	51	51	51	52	52	52
1170	51	51	52	52	52	53	53	53

TABLE 11**90 Plus ONLY models with 15,000 Btu's per Burner. DO NOT USE THIS CHART FOR ANY 80 PLUS MODEL.**

NATURAL GAS QUICK REFERENCE CHART FOR ORIFICE SELECTION, AT 3.5" W.C. AND APPROXIMATE FINAL FIRING RATES

Sea Level Orifice Size	Sea Level Cubic Foot at 3.5" W.C.	90 Plus Heat Value at 15,000 Btu's per Burner	ELEVATION CHART (NFG recommended orifice based on 4% derate for each 1000 foot of elevation, based on the intersection of the orifice required at Sea Level and the elevation required below)													
			0-999	1000-1999	2000-2999	3000-3999	4000-4999	5000-5999	6000-6999	7000-7999	8000-8999	9000-9999				
46	18.57	808	46	46	47	47	47	48	48	48	48	49	49	49	49	50
47	17.52	856	47	47	48	48	48	49	49	49	49	49	50	50	50	51
48	16.36	917	48	48	49	49	49	49	50	50	50	50	50	51	51	51
49	15.2	987	49	49	50	50	50	50	51	51	51	51	51	51	52	52
50	13.92	1078	50	50	51	51	51	51	51	51	51	52	52	52	52	53
51	12.77	1175	51	51	51	52	52	52	52	52	52	52	53	53	53	53
Final Firing Rate per Burner			15,000	14,400	13,800	13,200	12,600	12,000	11,400	10,800	10,200	9,600				

All calculations are performed by using the first three columns of information only. Before beginning any calculations, determine the individual burner Btu size and heating value at Sea Level for the installation site. Each value shown in the Heat Value column is per burner at 3.5" W.C.

NOTE:

Heat Value at Sea Level, for the location of the installation, is available from the Natural Gas Supplier to that site. Orifices for all altitudes are based on Sea Level values.

Divide the individual burner capacity (15,000 for 90 plus) by the Heat Value for the site to determine the Cubic Foot value at Sea Level, or divide burner capacity by the Cubic Foot value for the Heat Value. Once you have either the Cubic Foot Value or the Heat Value you can estimate the Sea Level orifice for the site. To select the corresponding high altitude orifice, locate the site elevation on the chart above and the orifice required at Sea Level from your calculation in the first column. The correct high altitude orifice that must be installed in each individual burner is the intersection of these two points on the chart above.

LP GAS AT HIGH ALTITUDE ELEVATIONS

LP Gas is a manufactured gas that has consistent heating value across most regions.

The NFGC guidelines are used with the following exception:

The recommended LP Gas high altitude orifice selections differ slightly in that the NFGC LP orifice chart, as they are not accurate for the (-)GFD or (-)GGD gas furnace. The National Fuel Gas Code LP orifices are based on an 11" of water column pressure at the orifice, which differs from products that use 10" of water column at the orifice. This difference requires a deviation from the NFGC orifice size recommendations. The Sea Level input should still be reduced by 4% per thousand ft. and the orifice size must be selected based on the reduced input selection shown in Table 12.

Orifice Ordering Information

Orifice sizes are selected by adding the 2-digit drill size required in the orifice part number. Drill sizes available are 39 through 64; metric sizes available 1.10mm (-90) and 1.15mm (-91):

Orifice Part Number 62-22175-(drill size)

Example 1:

#60 drill size orifice required

Part #62-22175-60

Example 2:

1.15mm drill size orifice required

Part #62-22175-91

TABLE 12

LP Gas Orifice Drill Size and per burner de-rate by elevation based on 15,000 btu 90+ burners.

IMPORTANT: For 90+ Furnaces only. Do not use this chart for any 80+ Furnace.

Altitude	Input (per burner) 15000	Orifice Size
0 to 2000 ft.	15000	1.15 mm (factory)
2001' to 3000'	13200	1.15 mm
3001' to 4000'	12600	1.10 mm
4001' to 5000'	12000	#58
5001' to 6000'	11400	#59
6001' to 7000'	1080	#60
7001' to 8000'	10200	#62
8001' to 9000'	9600	#63
9001' to 10000'	9000	#64

ZONING SYSTEMS

The manufacturer does not currently provide or support zoning with modulating furnace. However, zoning systems can be installed with the system as long as the zoning equipment manufacturers specifications and installation instructions are met and followed.

The preferred zoning method is to use a “bypass” system which is properly installed for maximum efficiency. In these systems, excess air is routed back through the system to be used again – this is opposed to a “dump” system in which excess air is routed to a zone where it is expected that the extra heat or cooling would be least noticed.

If installed as a “bypass” system, the installation must have an optional freeze stat installed to prevent the coil from icing with excess bypass cooling. Also, if the zoning equipment manufacturer provides a limit switch (usually provided by the zoning manufacturer), this limit must be installed in the system to prevent the furnace from overheating.

FURNACE INSTALLATION WITH HIGH-EFFICIENCY PREMIUM COOLING SYSTEMS

Furnace installation with Rheem/Ruud -ARA or -ARL outdoor condensing units can provide high efficiency (up to 16 SEER) cooling operation when combined with proper evaporator coil. For listed cooling equipment combinations, see the -ARA or -ARL specification sheets and Figure 62 of this document. Using Tables 13 and 14 and literature provided with the cooling equipment, the installer needs to make sure that the proper evaporator coil, condensing coil and airflow is configured to achieve rated efficiency.

In accordance with Rheem/Ruud cooling equipment installation instructions, do not install an evaporator coil or coil casing to the furnace which is smaller in width than the furnace cabinet.

UP TO 16 SEER COOLING OPERATION

Check the revision number of the integrated furnace control (IFC) to determine how best to configure your furnace for high SEER operation.

IFC #62-24174-02

To achieve high SEER operation, turn dip switch #6 of bank SW1 to the “on” position. This will enable the furnace operation for 16 SEER. Actual SEER values will vary and depend on the equipment combination. Consult the specifications sheets and installation instructions of the cooling equipment purchased for a listing of the SEER ratings for a specific combination.

ALL OTHER INTEGRATED FURNACE CONTROLS

High SEER operation with IFC's other than 62-24174-02 may not achieve rated performance or desired comfort levels. For these older models, there are no additional adjustments necessary to the furnace. For optimum performance, replace with IFC #62-24174-02.

A NOTE ABOUT DEHUMIDIFICATION:

High SEER systems may require the use of the onboard dehumidification feature of this system. Be sure to consult the section titled “ON DEMAND DEHUMIDIFICATION” on page 45 of this document.

TABLE 13
AIRFLOW AND CONDENSER SELECTION – PREMIUM COOLING SYSTEMS (1 STAGE COOL ONLY)

TONS	FURNACE		APPROX. AIRFLOW (CFM)	CONDENSING UNIT	MOD. FURNACE IFC DIP-SWITCH SETTINGS			
	MODEL	WIDTH			SW-1,#1	SW-1,#2	SW-1,#3	SW-1,#4
2	-GFD/GGD/GJD-06 & -07	17.5"	800	-ARA-24	OFF	ON	OFF	OFF
2-1/2	-GFD/GGD/GJD-06 & -07*	17.5"	1000	-ARA-30	ON	OFF	OFF	OFF
3	-GFD/GGD/GJD-09 & -10*	21"	1200	-ARA-36	ON	ON	OFF	OFF
3-1/2	-GFD/GGD/GJD-09 & -10*	21"	1400	-ARA-42	ON	ON	OFF	OFF
3	-GFD/GGD/GJD-12	24.5"	1200	-ARA-36	ON	ON	OFF	OFF
3-1/2	-GFD/GGD/GJD-12	24.5"	1400	-ARA-42	ON	ON	OFF	OFF

Evaporator coil must be the same width as the furnace OR one size larger in width than the gas furnace. (See condenser spec. sheet, I&O and other literature for evaporator selection)

TABLE 14
AIRFLOW AND CONDENSER SELECTION – PREMIUM COOLING SYSTEMS (2 STAGE COOL ONLY)

TONS	FURNACE		APPROX. AIRFLOW (CFM)	CONDENSING UNIT	MOD. FURNACE IFC DIP-SWITCH SETTINGS			
	MODEL	WIDTH			SW-1,#1	SW-1,#2	SW-1,#3	SW-1,#4
2	-GFD/GGD/GJD-06 & -07	17.5"	800	-ARL/ASL-24	OFF	ON	OFF	OFF
3	-GFD/GGD/GJD-06 & -07	17.5"	1200	-ARL/ASL-36	OFF	OFF	OFF	OFF
3	-GFD/GGD/GJD-09 & -10	21"	1200	-ARL/ASL-36	ON	ON	OFF	OFF
3	-GFD/GGD/GJD-12	24.5"	1200	-ARL/ASL-36	ON	ON	OFF	OFF
4	-GFD/GGD/GJD-09 & -10	21"	1600	-ARL/ASL-48	ON	OFF	OFF	OFF
4	-GFD/GGD/GJD-12	24.5"	1600	-ARL/ASL-48	ON	OFF	OFF	OFF
5	-GFD/GGD/GJD-12	24.5"	1800	-ARL/ASL-60	OFF	OFF	OFF	OFF

Evaporator coil must be the same width as the furnace OR one size larger in width than the gas furnace. (See condenser spec. sheet, I&O and other literature for evaporator selection)

INTEGRATED FURNACE CONTROL

GENERAL

The UT Electronic Controls IFC board (see Figure 61) is a recent addition to the furnace and will be a direct replacement for all Johnson Controls IFC boards. New features have been added to the IFC board to improve airflow performance in the heating mode. The new board also adds two-stage capability in addition to the existing modulating and single-stage operation. Also, the locations of the original dip switches (SW1 & SW2), and the location of the seven segment display are different than the previous Johnson Controls IFC board. The function of these components has not changed.

► **IMPORTANT:** The dip switches on SW2 (used for test mode and for operation with two-stage thermostats) must be in the “OFF” position for modulating or single-stage operation. If both switches are in the “ON” position, a missing “V” signal with a call on “W” will cause the furnace to run only at 40%. However, with both switches in the “ON” position, the furnace will function with a two-stage thermostat when connected as shown in Figure 55.

DIP SWITCH SET SW1

For proper setting of the airflow switches to meet requirements, see Figure 62.

► DIP SWITCH SET SW2

The UT Electronic Controls IFC board has added two-stage capabilities. This feature is activated by changing the switches 1 & 2 of SW2 to the “ON” position and installing a two-stage thermostat as shown in Figure 55. This feature allows the furnace to be used with a standard two-stage thermostat. With switches 1 & 2 of SW2 set to the “ON” position, the furnace will go to 40% of capacity when “W” is energized alone. In this configuration, when “W” and “W2” are energized, the furnace runs at 65% for five minutes and then changes to 100%. If the call for heat ends at any time the furnace terminates immediately at the present firing rate.

TABLE 15
SW2 MODE SELECTION SETTINGS

Mode	Switch 1 Position	Switch 2 Position
Modulating/Single-Stage	OFF	OFF
Test 40%	ON	OFF
Test 100%	OFF	ON
Two-Stage	ON	ON

DIP SWITCH SET SW3

The UT Electronic Controls IFC board has an added set of dip switches labeled SW3 (see Figure 61). The function of these dip switches is to fine-tune airflow in the heating mode. The dip switches will be set to either the 40% or 100% (or both) firing rate, and will adjust every point in between accordingly.

SW3 will allow for airflow adjustments at high altitude, improper temperature probe locations, or no temperature probe applications. If temperature rise range is a problem, the technician must use temperature probes to determine the rise range and adjust the airflow using SW3's dip switches until the temperature rise is within the specified range.

ADJUSTING AIRFLOW

All airflow adjustments on SW3 should be made with the main power OFF. Dip switches 1 through 3 will adjust airflow at the 100% firing rate and dip switches 4 through 6 will adjust the airflow at the 40% firing rate.

100% Firing Rate

To use SW3 to change the airflow at the 100% rate:

- 1) Dip switch 1 must be “ON” (or “ADJ”). This instructs the IFC that the high firing rate airflow will be overridden.
- 2) Dip switch 2 in the “OFF” position will decrease airflow at 100% fire, and in the “ON” position will increase airflow at 100% fire.
- 3) If dip switch 3 is “OFF” the amount airflow will be adjusted by 7.5%. If it is “ON” amount of airflow will be adjusted by 15%.

40% FIRING RATE

To use SW3 to change the airflow at the 40% rate:

- 1) Dip switch 4 must be “ON” (or “ADJ”). This instructs the IFC that the high firing rate airflow will be overridden.
- 2) Dip switch 5 in the “OFF” position will decrease airflow at 40% fire, and in the “ON” position will increase airflow at 40% fire.
- 3) If dip switch 6 is “OFF” the amount airflow will be adjusted by 7.5%. If it is “ON” amount of airflow will be adjusted by 15%.

FIGURE 61
UT ELECTRONIC CONTROLS IFC BOARD

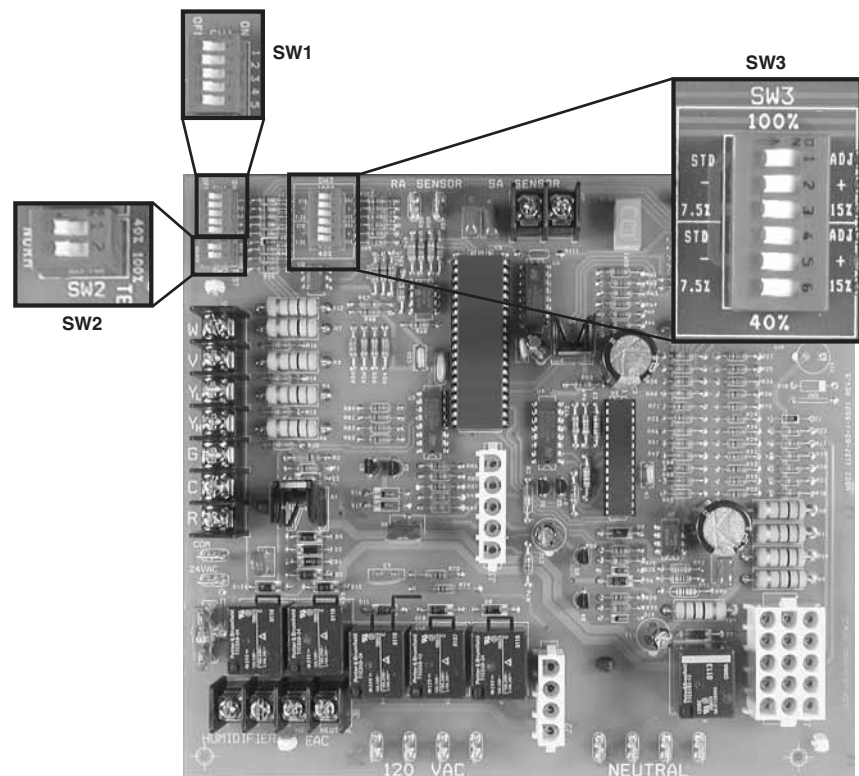
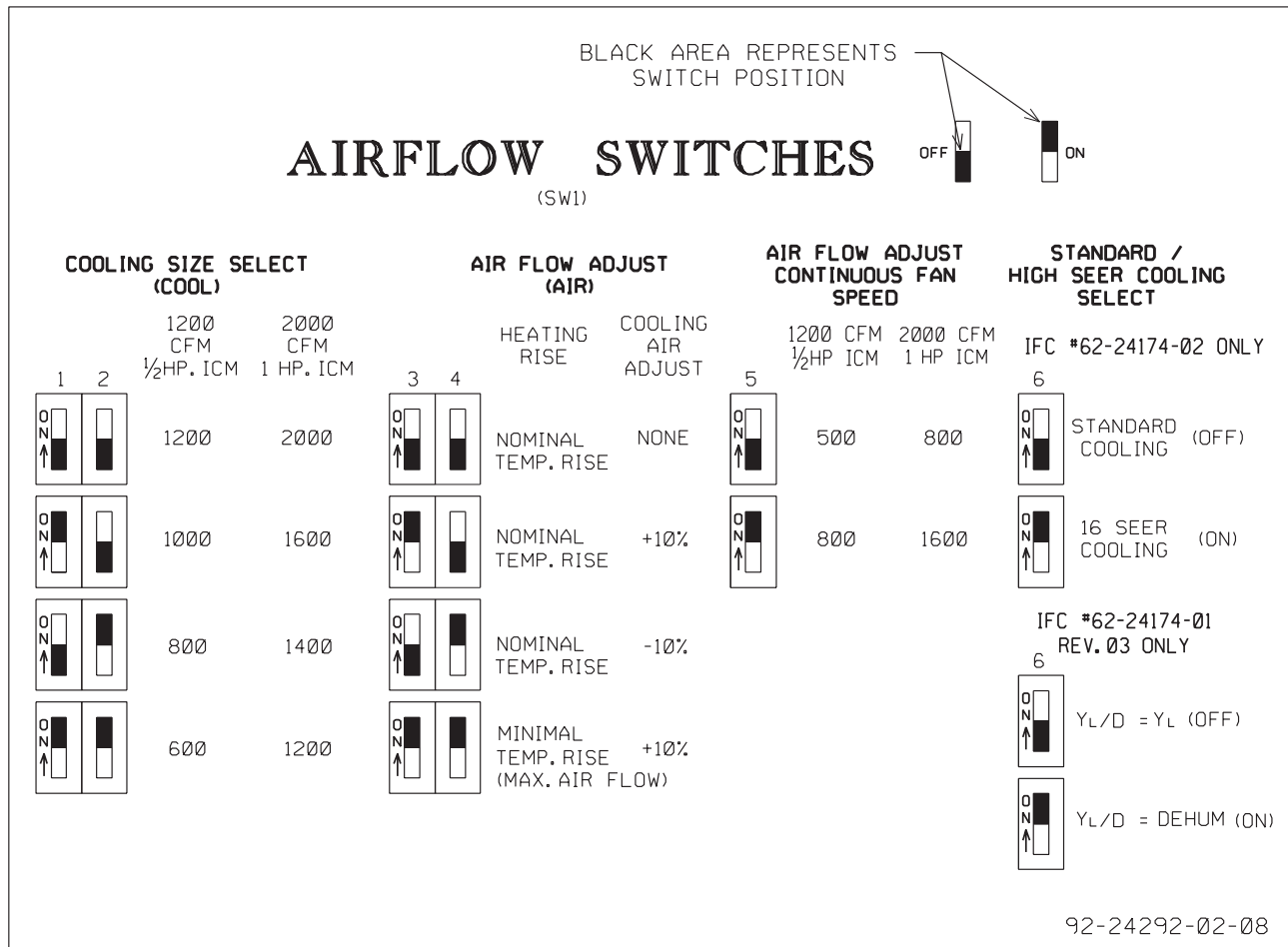


FIGURE 62
AIRFLOW SWITCHES (SW1)



MODULATING FURNACE COOLING AIRFLOW RATES, 1/2 HP (1200 CFM) motor settings						
SW1, Pos 6 (16 SEER)	SW1, Pos. 2	SW1, Pos. 1	YH Single stage	YL Low 2 stage	YL+YH High 2 stage	Notes
OFF	OFF	OFF	1200 CFM	600 CFM	1200 CFM	Standard Cooling (approx. 50% of High-Stage Cooling on Low Stage) This matches cooling airflow of the original IFC.
OFF	OFF	ON	1000 CFM	500 CFM	1000 CFM	
OFF	ON	OFF	800 CFM	400 CFM	800 CFM	
OFF	ON	ON	600 CFM	300 CFM	600 CFM	
ON	OFF	OFF	1200 CFM	900 CFM	1200 CFM	HIGH SEER (16+) Premium Cooling airflow (SW1, Position 6 is ON)
ON	OFF	ON	1000 CFM	750 CFM	1000 CFM	
ON	ON	OFF	800 CFM	600 CFM	800 CFM	
ON	ON	ON	600 CFM	450 CFM	600 CFM	

MODULATING FURNACE COOLING AIRFLOW RATES, 1 HP (2000 CFM) motor settings						
SW1, Pos 6 (16 SEER)	SW1, Pos. 2	SW1, Pos. 1	YH Single stage	YL Low 2 stage	YL+YH High 2 stage	Notes
OFF	OFF	OFF	2000 CFM	1000 CFM	2000 CFM	Standard Cooling (approx. 50% of High-Stage Cooling on Low Stage) This matches cooling airflow of the original IFC.
OFF	OFF	ON	1600 CFM	800 CFM	1600 CFM	
OFF	ON	OFF	1400 CFM	700 CFM	1400 CFM	
OFF	ON	ON	1200 CFM	600 CFM	1200 CFM	
ON	OFF	OFF	2000 CFM	1400 CFM	1800 CFM	HIGH SEER (16+) Premium Cooling airflow (SW1, Position 6 is ON)
ON	OFF	ON	1600 CFM	1200 CFM	1600 CFM	
ON	ON	OFF	1275 CFM	1050 CFM	1400 CFM	
ON	ON	ON	1200 CFM	900 CFM	1200 CFM	

AIRFLOW ADJUSTMENT EXAMPLES

Three examples of airflow adjustment are shown below.

NOTE: All dip switches on SW3 will be shipped in the "OFF" position.

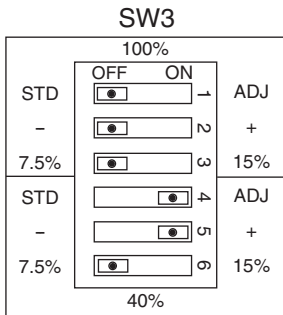
Example 1 (see Figure 63)

PROBLEM: Temperature rise is too high at 40% firing rate although it is within the published range at 100% firing rate.

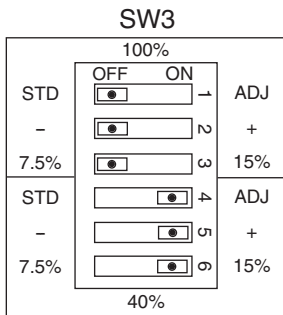
SOLUTION: More airflow is needed to lower the temperature rise at 40%.

- 1) Set dip switches 4 and 5 of SW3 to the "ON" position. This will produce a 7.5% increase in blower output.
- 2) Allow furnace to run for several minutes at 40% firing rate until temperature probes reach equilibrium.
- 3) If the temperature rise is still above the published range, set switch 6 of SW3 to the "ON" position. This will increase the airflow rate from +7.5% to +15% above the standard value.

FIGURE 63
EXAMPLE 1



A. Set switches 4 & 5 to "ON" position to increase airflow by 7.5% at the 40% fire rate.



B. If +7.5% is not enough, increase airflow by setting switch 6 to "ON" position to give +15%.

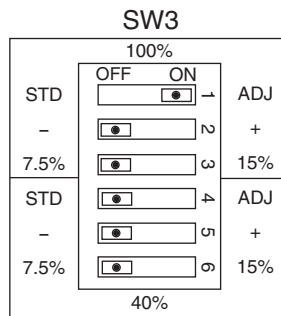
EXAMPLE 2 (see Figure 64)

PROBLEM: Temperature rise is too low at 100% firing rate although it is within the published range at 40% firing rate.

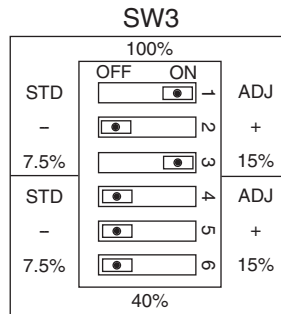
SOLUTION: Less airflow is needed to increase temperature rise at 100%.

- 1) Set dip switch 1 of SW3 to the "ON" position, which overrides standard airflow.
- 2) Leave switches 2 and 3 in the "OFF" position to decrease airflow by 7.5%.
- 3) Allow furnace to run for several minutes at 100% rate until temperature probes reach equilibrium.
- 4) If the temperature rise is still below the published range, set switch 3 to the "ON" position. This will decrease the airflow rate from -7.5% to -15% below the standard value.

FIGURE 64
EXAMPLE 2



A. Set switch #1 to "ON" position and leave #2 and #3 in the "OFF" position to decrease airflow by 7.5% at the 100% fire rate.



B. If -7.5% is not enough, decrease airflow by setting switch 3 to "ON" position to give -15%.

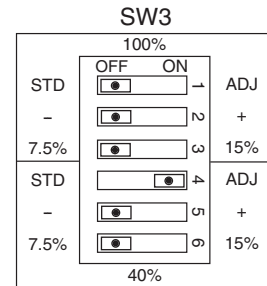
EXAMPLE 3 (see Figure 65)

PROBLEM: Temperature rise is too low at 40% firing rate and is too high at 100%.

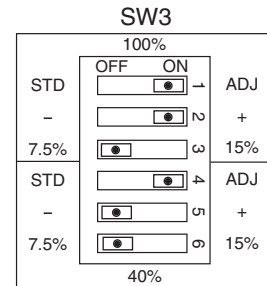
SOLUTION: Less airflow is needed to increase temperature rise at 40% firing rate and more is needed to decrease temperature rise at 100%.

- 1) Set dip switch 4 of SW3 to the "ON" position to override standard airflow at 40% firing rate. Leave switches 5 and 6 in "OFF" position to decrease airflow by 7.5%.
- 2) Allow furnace to run for several minutes at 40% rate until temperature probes reach equilibrium.
- 3) If temperature rise is still lower than the published range, set switch 6 to the "ON" position to decrease the airflow rate from -7.5% to -15% below the standard value.
- 4) Set dip switches 1 to the "ON" position to override standard airflow at 100% firing rate. Set switch 2 to the "ON" position to increase airflow by 7.5%.
- 5) Allow furnace to run for several minutes at 100% rate until temperature probes reach equilibrium.
- 6) If temperature rise is still higher than the published range, set switch 3 to "ON" position to increase the airflow rate from 7.5% to 15% above the standard value.

FIGURE 65
EXAMPLE 3



A. Set switch #4 to "ON" and leave #5 and #6 set to "OFF" to decrease airflow by 7.5% at the 40% fire rate. If necessary, set switch #6 to "ON" to decrease airflow by 15%.



B. Set switches #1 and #2 to "ON" and leave #3 set to "OFF" to increase airflow by 7.5% at the 100% fire rate. If necessary, set switch #3 to "ON" to increase airflow by 15%.

START-UP PROCEDURES

TO START THE FURNACE DIRECT SPARK IGNITION LIGHTING INSTRUCTIONS

This appliance is equipped with a direct-spark ignition device. This device lights the main burners each time the room thermostat calls for heat (connects R to W). See the lighting instructions on the furnace.

During initial start-up, it is not unusual for odor or smoke to come out of any room registers. To ensure proper ventilation, it is recommended to open windows and doors, before initial firing.

The furnace has a negative pressure switch that is a safety during a call for heat. The induced draft blower must pull a negative pressure on the heat exchanger to close the negative pressure switch. The induced draft blower must maintain at least the negative pressure switch set point for the furnace to operate. If the induced draft blower fails to close or maintain the closing of the negative pressure switch, a "no heat call" would result.

1. Remove the burner compartment control access door.
2. **IMPORTANT:** Be sure that the manual gas control has been in the "OFF" position for at least five minutes. Do not attempt to manually light the main burners.
3. Set the room thermostat to its lowest setting and turn off the furnace electrical power.
4. Turn the gas control knob to the "ON" position.
5. Replace the burner compartment control access door.

WARNING

FAILURE TO REPLACE THE BURNER DOOR CAN CAUSE PRODUCTS OF COMBUSTION TO BE RELEASED INTO THE CONDITIONED AREA RESULTING IN PERSONAL INJURY OR DEATH.

6. Turn on the manual gas stop.
7. Turn on the furnace electrical power.
8. Turn thermostat to "Heat" mode and set the room thermostat at least 4° F above room temperature to light the main burners.
9. After the burners are lit, set the room thermostat to a desired temperature.

FURNACE TEST MODE FURNACE TEST SWITCHES

NOTE: The integrated furnace control does not recognize switch setting changes while energized. To change settings, remove power to the board, make changes, then return power.

The Integrated Furnace Control is equipped with three sets of field selectable switches. The set with five switches (SW1) (See Figure 60) is for selecting airflow operation options (Airflow Switches). The set with two switches (SW2) is for placing the furnace into test mode for initial set-up and troubleshooting and for choosing between modulating, single-stage and two-stage functions. (see Figure 61).

The Test Switches (SW2) will place the IFC into a test mode, operating the furnace at continuous input rates of either 100% of full rate (maximum fire) or 40% of full rate (minimum fire and 2-stage operation). This is accomplished by setting the Test Switches as indicated in Table 16.

TABLE 16
SW2 MODE SELECTION SETTINGS

Mode	Switch 1 Position	Switch 2 Position
Modulating/ Single-Stage	OFF	OFF
Test 40%	ON	OFF
Test 100%	OFF	ON
Two-Stage	ON	ON

To enter the Furnace Test Mode, proceed as follows:

1. Switch the 115 volt power to the furnace OFF. **Do not change settings with control energized.**
2. Position Test Switches 1 and 2 for the desired test mode.
3. Switch the 115 volt power to the furnace ON.
4. Set the thermostat mode to HEAT, adjust the setpoint at least 4°F above room temperature to demand a call for heating.

When the furnace is powered with the test switches in a position other than modulating/single-stage or in 2-stage mode, the first call for heat within the first hour after power-up will instruct the furnace to perform as follows:

1. Normal ignition sequence
2. A calibration cycle will be performed unless the Test Switches are set for Test 40%. The LED status indicator will flash "H" or "h" during the calibration cycle (see Table 18).

NOTE: The return air sensor (factory installed) and the supply air sensor (field installed) are required for the furnace calibration cycle. If the air sensors are faulty, or not properly connected, the furnace will not attempt a calibration cycle and will operate on factory default parameters pre-programmed into the microprocessor.

3. After calibration, the furnace will then adjust to the desired Test capacity. This allows time for the technician to check steady-state operation and evaluate furnace performance.

NOTE: Refer to Figure 70 (Furnace Test Mode Sequence of Operation/ Troubleshooting), and Furnace Performance Data Table 17.

4. The furnace will operate at the fixed Test capacity until one of the following conditions:
 - a. The thermostat is satisfied and the call for heat is removed.
 - b. The furnace has been in test mode continuously for sixty minutes, at which time the controller will go into modulating/single-stage operation.

NOTE: The IFC will only check the test mode switches on power up. Terminating the test mode by either 4a or 4b will place the furnace into modulating or single-stage operation regardless of the test mode switch positions.

To set the furnace for normal operation:

1. Set the thermostat mode to OFF. Always allow furnace to complete the cool down cycle.
2. Switch the 115 volt power to the furnace OFF. **Do not change settings with control energized.**
3. Position Test Switches 1 and 2 for modulating/single-stage mode or 2-stage mode.
4. Switch the 115 volt power to the furnace ON.
5. Set the thermostat as desired.

THERMOSTAT TEST MODE

SEE THERMOSTAT SECTION OF THESE INSTRUCTIONS FOR TEST-MODE DIRECTIONS.

TABLE 17
FURNACE PERFORMANCE DATA

Operating Level	Inducer Speed	Servo Valve Current	Manifold Pressure	Temperature Rise
100%	High	~180 milliamps	Natural - 3.5" w.c. (± 0.3 "	40°-70° F
			LP - 10.0" w.c. (± 0.5 "	
90%	High	~162 milliamps	Natural - 2.8" w.c. (± 0.3 "	40°-70° F
			LP - 8.1" w.c. (± 0.5 "	
80%	High	~144 milliamps	Natural - 2.2" w.c. (± 0.3 "	40°-70°F
			LP - 6.4" w.c. (± 0.5 "	
70%	High	~126 milliamps	Natural - 1.7" w.c. (± 0.3 "	40°-70°F
			LP - 4.9" w.c. (± 0.5 "	
60%	High	~108 milliamps	Natural - 1.3" w.c. (± 0.3 "	40°-70°F
			LP - 3.6" w.c. (± 0.5 "	
50%	High	~90 milliamps	Natural - 0.9" w.c. (± 0.3 "	40°-70°F
			LP - 2.5" w.c. (± 0.5 "	
40%	Low	~72 milliamps	Natural - 0.6" w.c. (± 0.3 "	40°-70°F
			LP - 1.6" w.c. (± 0.5 "	
Calibration	High	~135 milliamps	Natural - 2.0" w.c. (± 0.3 "	40°-70°F
			LP - 5.6" w.c. (± 0.5 "	

NOTE: Gas valve milliamp readings may vary $\pm 05\%$.

TABLE 18
NORMAL OPERATION INDICATORS - DIAGNOSTIC LED

LED SYMBOL	DESCRIPTION	COMMENTS All symbols indicate furnace control board is properly powered.
O	System OFF	There is no demand from the thermostat. There are no active faults.
F	System FAN ONLY	The IFC is receiving 24V on the "G" terminal ONLY. There are no active faults.
C	System COOL	The IFC is receiving 24 V on the "YL" and/or "YH" terminals. There are no active faults.
H	System HEAT	The IFC is receiving 24 V on the "W" terminal. The modulating signal is present on the "V" terminal. There are no active faults.
h	System HEAT	The IFC is receiving 24 V on the "W" terminal. The modulating signal is NOT present on the "V" terminal. There are no active faults.
"H" Flashing	Calibration Cycle	The IFC is receiving 24 V on the "W" terminal. The modulating signal is present on the "V" terminal. The furnace is in calibration mode. There are no active faults.
"h" Flashing	Calibration Cycle	The IFC is receiving 24 V on the "W" terminal. The modulating signal is NOT present on the "V" terminal. The furnace is in calibration mode. There are no active faults.

TO SHUT DOWN THE FURNACE

1. Set the room thermostat to its lowest setting and turn to "OFF" position.
2. Turn off the manual gas stop and turn off the electrical power to the furnace.
3. Remove the burner compartment control access door.
4. Shut off the gas to the main burners by turning the gas control knob to the "OFF" position.
5. Replace the burner compartment control access door.

▲ WARNING

SHOULD OVERHEATING OCCUR OR THE GAS SUPPLY FAIL TO SHUT OFF, CLOSE THE MANUAL GAS VALVE FOR THE APPLIANCE BEFORE SHUTTING OFF THE ELECTRICAL SUPPLY. FAILURE TO DO SO CAN CAUSE AN EXPLOSION OR FIRE RESULTING IN PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.

SEQUENCE OF OPERATION

Heating Cycle Initiation

The heating cycle is always initiated by a 24 volt signal on W of the thermostat. When the controller senses 24 volts on W, the following sequence occurs:

- High and low pressure switches are checked to insure contacts are open.
- Inducer is powered on high speed for a thirty (30) second prepurge.
- Pressure switches are monitored as the inducer creates the vacuum to close the contacts.
- The servo valve on the gas valve is energized with ~180 milliamps current. (No flow yet.)
- The controller sends 120 volts to the ignition control, which sparks across the electrodes.
- The main solenoids on the gas valve are energized allowing gas to flow to the burners.
- When flame is proven, the ignition control is de-energized - 8 second maximum trial time.
- The gas valve maintains 100% rate through the warm-up period - 20 seconds.

Heating Cycle Response

The heating cycle is always initiated by a 24 volt signal on W1. When the controller senses 24 volts on W1, the following sequence occurs:

MODULATING FUNCTION:

("W" and "V" signal inputs, refer to dip switch set SW2 on IFC)

After the warm-up period, the furnace will respond to the thermostat demand by adjusting the gas valve pressure

TABLE 19
METER TIME

METER TIME IN MINUTES AND SECONDS FOR NORMAL INPUT RATING OF FURNACES EQUIPPED FOR NATURAL OR LP GAS											
INPUT BTU/HR	METER SIZE CU. FT.	HEATING VALUE OF GAS BTU PER CU. FT.									
		900		1000		1040		1100		2500 (LP)	
		MIN.	SEC.	MIN.	SEC.	MIN.	SEC.	MIN.	SEC.	MIN.	SEC.
60,000	ONE	0	54	1	0	1	3	1	6	2	30
	TEN	9	0	10	0	10	24	11	0	25	0
75,000	ONE	0	44	0	48	0	50	0	53	2	0
	TEN	7	12	8	0	8	19	8	48	20	0
90,000	ONE	0	36	0	40	0	42	0	44	1	40
	TEN	6	0	6	40	7	0	7	20	16	40
105,000	ONE	0	31	0	34	0	36	0	38	1	26
	TEN	5	10	5	40	6	0	6	20	14	20
120,000	ONE	0	27	0	30	0	31	0	33	1	15
	TEN	4	30	5	0	5	10	5	30	12	30

$$\text{Formula: Input BTU/HR} = \frac{\text{DRY Heating Value of Gas (BTU/FT}^3) \times 3600}{\text{Time in Seconds (for 1 cu. ft.) of Gas}} \times C \cdot F$$

$$\text{Where } C \cdot F = \frac{\text{Gas Pressure (inch} \cdot \text{Hg)} \times 520 (^{\circ}\text{F)}}{\text{Gas Temperature } (^{\circ}\text{F}) \times 30 (\text{inches} \cdot \text{Hg})}$$

and blower speed anywhere between 40% to 100% heating capacity.

► TWO-STAGE FUNCTION:

(Two-stage function only applies when both switches of SW2 are in the "ON" position and a two-stage thermostat is installed as shown in Figure 50.)

After the warm-up period, the furnace will respond to the thermostat demand by adjusting the gas valve pressure and blower heating speeds to the "W" signal values. "W" only = 40% gas valve pressure and blower heating speed. "W2" = 65% gas valve pressure and blower heating speed for first five minutes and 100% thereafter. Also, if the call for heat ends, the furnace terminates at the present rate.

► SINGLE-STAGE FUNCTION:

("W" signal only)

After the warm-up period, the furnace will respond to the thermostat demand by altering the gas valve pressure and blower speed as follows:

Phase 1: 0 to 5 minutes = 40% of furnace capacity (gas valve output and blower speed)

Phase 2: 5 to 12 minutes = 65% of furnace capacity (gas valve output and blower speed)

Phase 3: After 12 minutes = 100% of furnace capacity (gas valve output and blower speed)

NOTE: If the call for heat ends during any phase, the furnace will terminate immediately at the firing rate of that phase.

Heating Cycle Termination

("W" signal only, refer to dip switch set SW2 on IFC)

When the 24 volt signal is removed from W1, the heating cycle will end and the furnace will shut down and return to the proper off cycle operation.

SETTING INPUT RATE

Checking furnace input is important to prevent over firing beyond its design-rated input. NEVER SET INPUT ABOVE THAT SHOWN ON THE RATING PLATE. Use the following table or formula to determine input rate. Prior to checking the furnace input, make certain that all other gas appliances are shut off, with the exception of pilot burners. Time the meter with only the furnace in operation. Start the furnace, in Furnace Test Mode, 100% rate, and measure the time required to burn one cubic foot of gas.

The furnace is shipped from the factory with #50 orifices. They are sized for natural gas having a heating value of 1075 BTU/cu. ft. and a specific gravity of .60. For high-altitude models (option 278) the furnace comes equipped with #51 orifices installed for elevations 5,000 to 5,999 ft. These orifices may still need to be changed based on both elevation and gas heating value. Consult the section of this book titled "High Altitude Installation" for details.

Since heating values vary geographically, the manifold pressure and/or gas orifice size may need to be changed to adjust the furnace to its nameplate input. The rate will also vary with altitude. Consult the local gas utility to obtain the yearly average heating value and orifice size required to fire each individual burner at 15,000 BTUH. For high altitude installations, also consult the section of this manual titled "High Altitude Installations" for details on how to calculate the correct orifice size.

MAINTENANCE

⚠ WARNING

DISCONNECT MAIN ELECTRICAL POWER TO THE UNIT BEFORE ATTEMPTING ANY MAINTENANCE. FAILURE TO DO SO CAN CAUSE ELECTRICAL SHOCK RESULTING IN PERSONAL INJURY OR DEATH.

FILTERS

Keep the filters clean at all times. Remove the filter. Vacuum dirt from filter, wash with detergent and water, air dry thoroughly and reinstall.

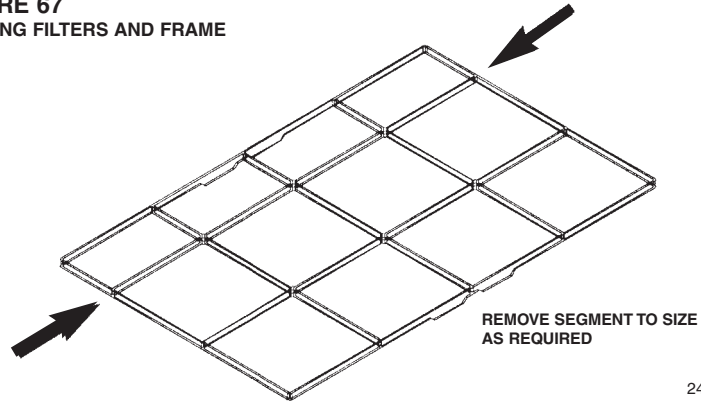
NOTE: Some filters must be resized to fit certain units and applications. See Table 20 and Figures 66, 67, 68, 69 & 70.

1. 21" - 90,000 & 105,000 BTUH units require removal of a 3½-in. segment of filter and frame to get the proper width for a side filter.
2. 24½" - 120,000 BTUH unit requires removal of a 7" segment of filter and frame to get the proper width for a side filter.

**TABLE 20
FILTER SIZES**

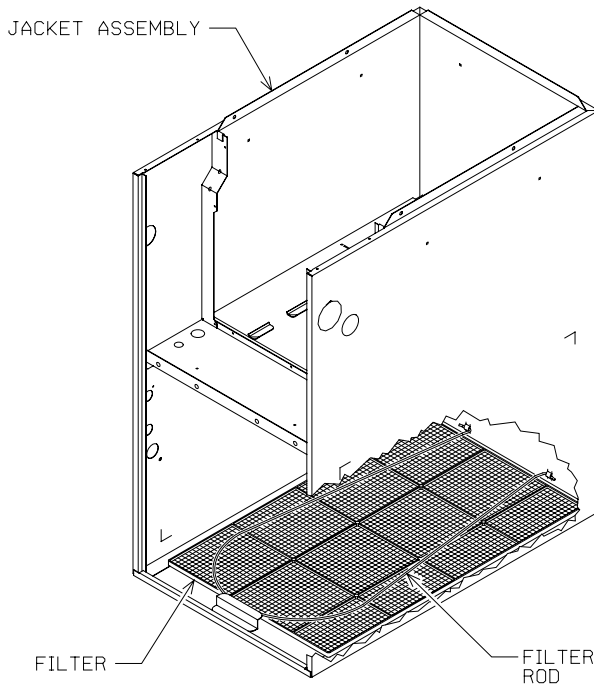
UPFLOW FILTER SIZES				
FURNACE WIDTH	INPUT KBTUH	BOTTOM SIZE	SIDE SIZE	QUANTITY
17½"	60 AND 75	15¾" X 25"	15¾" X 25"	1
21"	90 AND 105	19¼" X 25"	15¾" X 25"	1
24½"	120	22¾" X 25"	15¾" X 25"	1

**FIGURE 67
RESIZING FILTERS AND FRAME**



2409401

**FIGURE 66
UPFLOW — FILTER REPLACEMENT**



FILTER & ROD LOCATION

542201

FILTER MAINTENANCE

Instruct the user or homeowner on how to access the filters for regular maintenance.

Filter application and maintenance are critical to airflow, which may affect the heating and cooling system performance. Reduced airflow can shorten the life of the system's major components, such as motor, limits, heat exchanger, evaporator coil or compressor. Consequently, it is recommended that the return air duct system have only one filter location. The most common location will be inside the furnace or a filter base. Systems with a return-air filter grille or multiple filter grilles, can have a filter installed at each of the return-air openings. Installers are instructed to show the homeowner or end user where the filter has been installed.

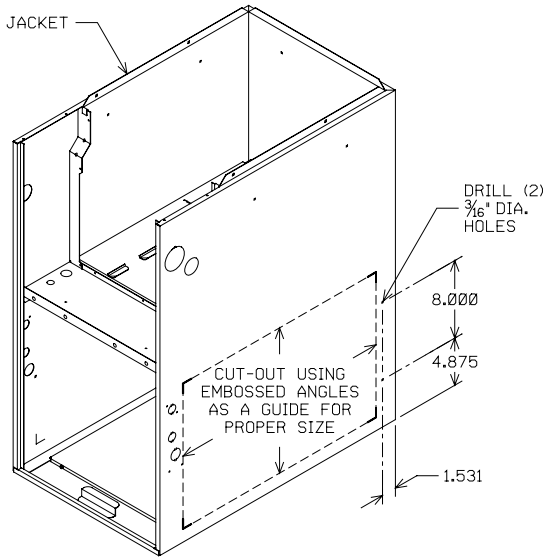
If high efficiency filters or electronic air cleaners are used in the system, it is important that the airflow is not reduced in order to maximize system performance and life. Always verify that the system's airflow is not impaired by the filtering system that has been installed. This can be done by performing a temperature rise and temperature drop test.

Instruct the homeowner or end-user to keep the filter(s) clean at all times. Instruct them to vacuum dirt from the filter, wash with detergent and water, air dry thoroughly and reinstall.

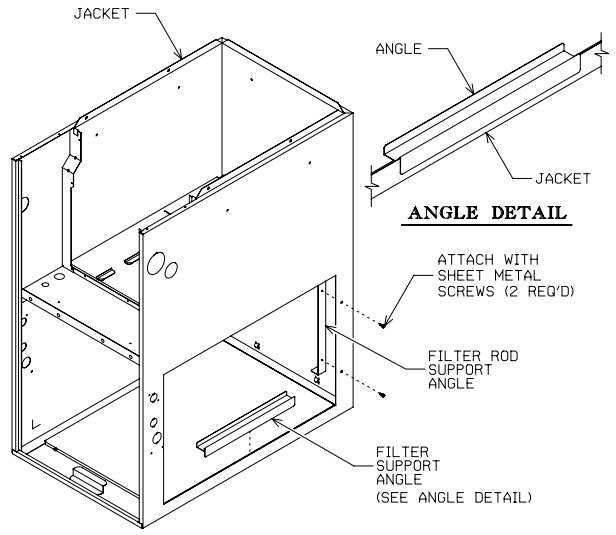
The installer may install a return-air filter in place of the furnace filter.

DO NOT DOUBLE-FILTER THE RETURN-AIR DUCT SYSTEM. DO NOT FILTER THE SUPPLY AIR DUCT SYSTEM.

FIGURE 68
UPFLOW -- SIDE FILTER LOCATIONS



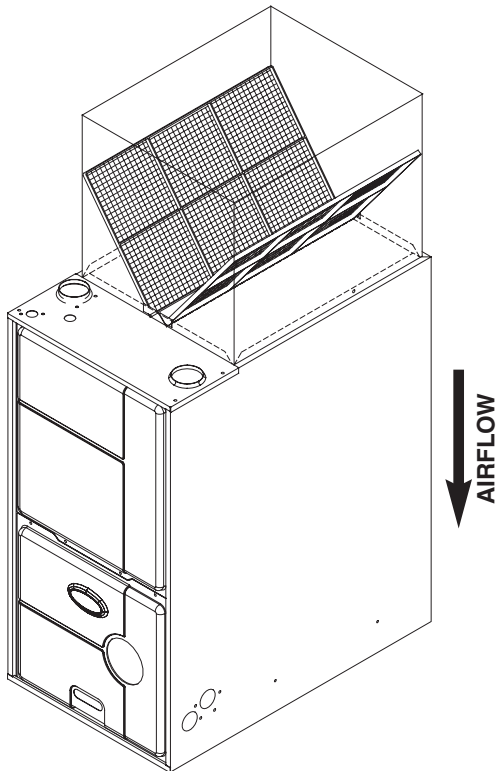
CUT-OUT AND DRILL DETAIL



ROD & FILTER SUPPORT ANGLE ASSEMBLY

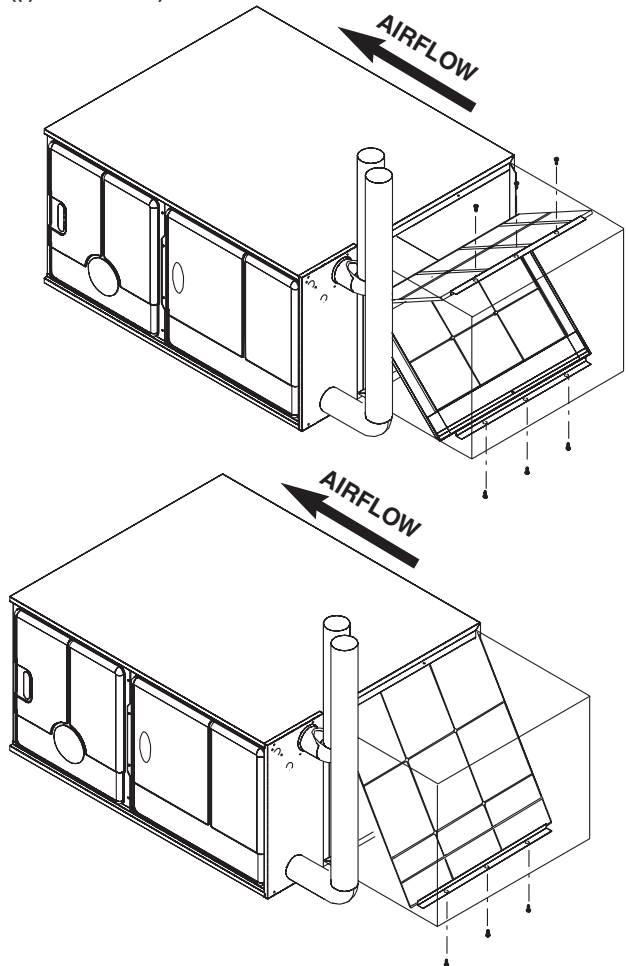
1332

FIGURE 69
DOWNFLOW -- FILTER INSTALLATION
((-)GGD MODELS)



A087001.S01

FIGURE 70
HORIZONTAL -- FILTER INSTALLATION
((-)GJD MODELS)



A087101.S01

▲ CAUTION

DO NOT OPERATE THE SYSTEM WITHOUT FILTERS. A PORTION OF THE DUST ENTRAINED IN THE AIR MAY TEMPORARILY LODGE IN THE AIR DUCT RUNS AND AT THE SUPPLY REGISTERS. ANY RECIRCULATED DUST PARTICLES WILL BE HEATED AND CHARRED BY CONTACT WITH THE FURNACE HEAT EXCHANGER. THIS RESIDUE WILL SOIL CEILINGS, WALLS, DRAPES, CARPETS AND OTHER HOUSEHOLD ARTICLES.

LUBRICATION

IMPORTANT: Do Not attempt to lubricate the bearings on the blower motor or the induced draft blower motor. Addition of lubricants can reduce the motor life and void the warranty.

The blower motor and induced draft blower motor bearings are prelubricated by the manufacturer and do not require further attention.

The blower motor and induced draft blower motor must be cleaned periodically by a qualified installer, service agency, or the gas supplier to prevent the possibility of overheating due to an accumulation of dust and dirt on the windings or on the motor exterior. The air filters should be kept clean. As dirty filters can restrict airflow. The motor depends upon sufficient airflowing across and through it to keep from overheating.

SYSTEM OPERATION INFORMATION

Advise The Customer

IMPORTANT: Replace all blower doors and compartment covers after servicing the furnace. Do not operate the unit without all panels and doors securely in place.

1. Keep the air filters clean. The heating system will operate more efficiently and more economically.
2. Arrange the furniture and drapes so that the supply air registers and the return air grilles are unobstructed.
3. Close doors and windows. This will reduce the heating load on the system.

4. Avoid excessive use of kitchen exhaust fans.
5. Do not permit the heat generated by television, lamps or radios to influence the thermostat operation.
6. Explain proper operation of the system with constant air circulation.

ANNUAL INSPECTION

The furnace should operate for many years without excessive scale build-up in the flue passageways. However, it is recommended that a qualified installer, service agency, or the gas supplier annually inspect the flue passageways, the vent system and the main burners for continued safe operation. Pay particular attention to deterioration from corrosion or other sources.

During the annual inspection, all electrical power to the furnace should be turned off and then restored. This will put the furnace into a calibration cycle on the initial call for heat. This is a five minute (or until the heat call is satisfied) cycle which allows the furnace to evaluate conditions. It should be noted, that a calibration cycle will occur on the initial call for heat each time after line voltage has been interrupted to the unit.

IMPORTANT: It is recommended that at the beginning and at approximately half way through the heating season, a visual inspection be made of the main burner flames for the desired flame appearance by a qualified installer, service agency or the gas supplier. If the flames are distorted and/or there is evidence of back pressure, check the vent and inlet air system for blockage. If there is carbon and scale in the heat exchanger tubes, the heat exchanger assembly should be replaced.

▲ WARNING

HOLES IN THE VENT PIPE OR HEAT EXCHANGER CAN CAUSE TOXIC FUMES TO ENTER THE HOME, RESULTING IN CARBON MONOXIDE POISONING OR DEATH. THE VENT PIPE OR HEAT EXCHANGER MUST BE REPLACED IF THEY LEAK.

IMPORTANT: It is recommended that at the beginning of the heating season, the flame sensor be cleaned with steel wool by a qualified installer, service agency or the gas supplier.

IMPORTANT: It is recommended that at the beginning of the heating season, the condensate trap be inspected for debris or blockage. A blocked condensate trap can cause water to back up into the primary heat exchanger and lead to nuisance tripping of the over temperature switches and/or pressure switches.

IMPORTANT: It is recommended that at the beginning of the heating season, the condensate neutralizer (if used) be replaced by a qualified installer, service agency or the gas supplier.

IMPORTANT: Drain traps will often dry out over a summer. During annual inspection the service person must verify that the trap still has water. If there is not enough water (or no water) in the trap, the service person must fill it to the appropriate level.

IMPORTANT: It is recommended that an annual inspection and cleaning of all furnace markings be made to assure legibility. Attach a replacement marking, which can be obtained through the distributor, if any are found to be illegible or missing.

REPLACEMENT PARTS

Contact your local distributor for a complete parts list.

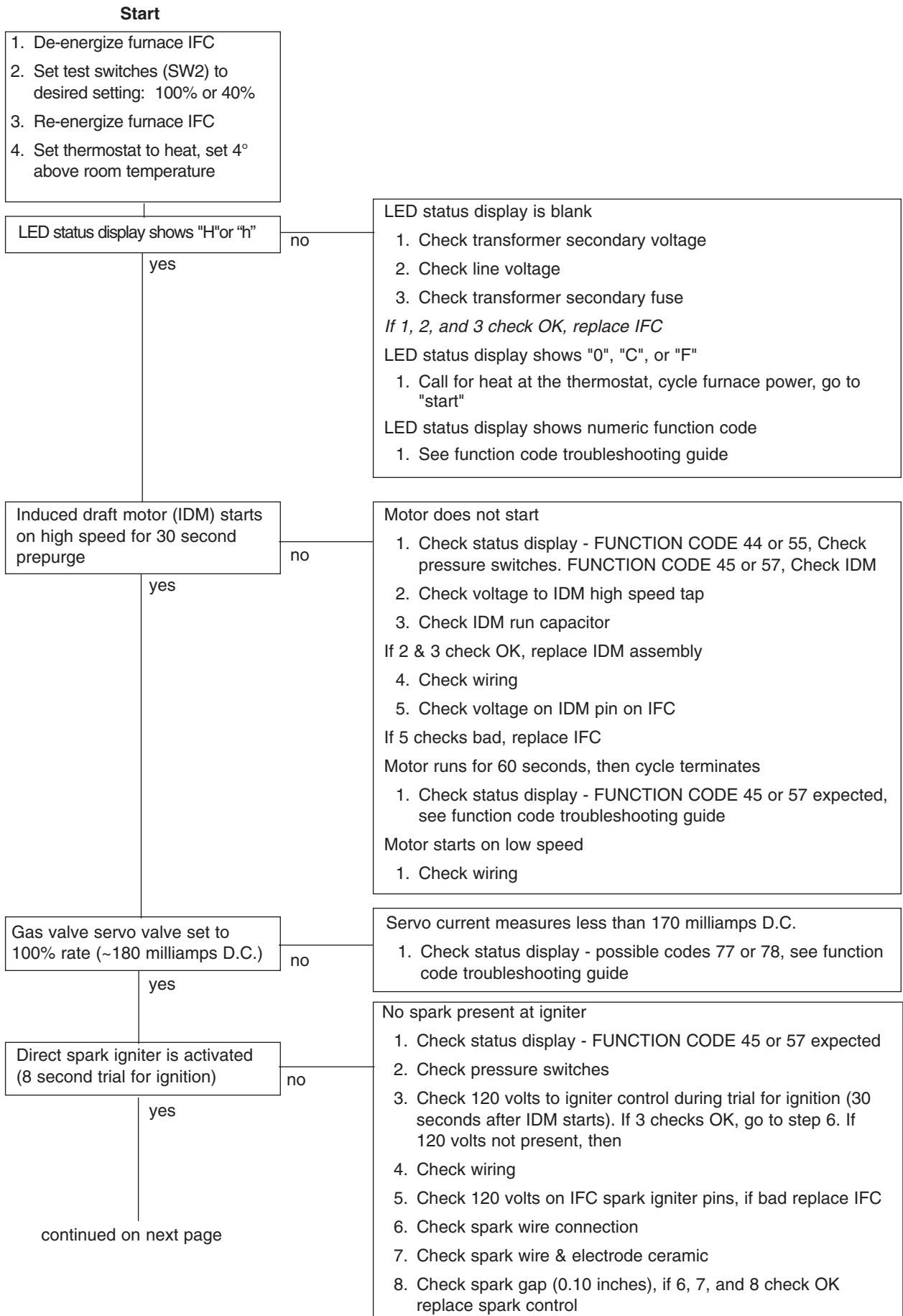
TROUBLESHOOTING

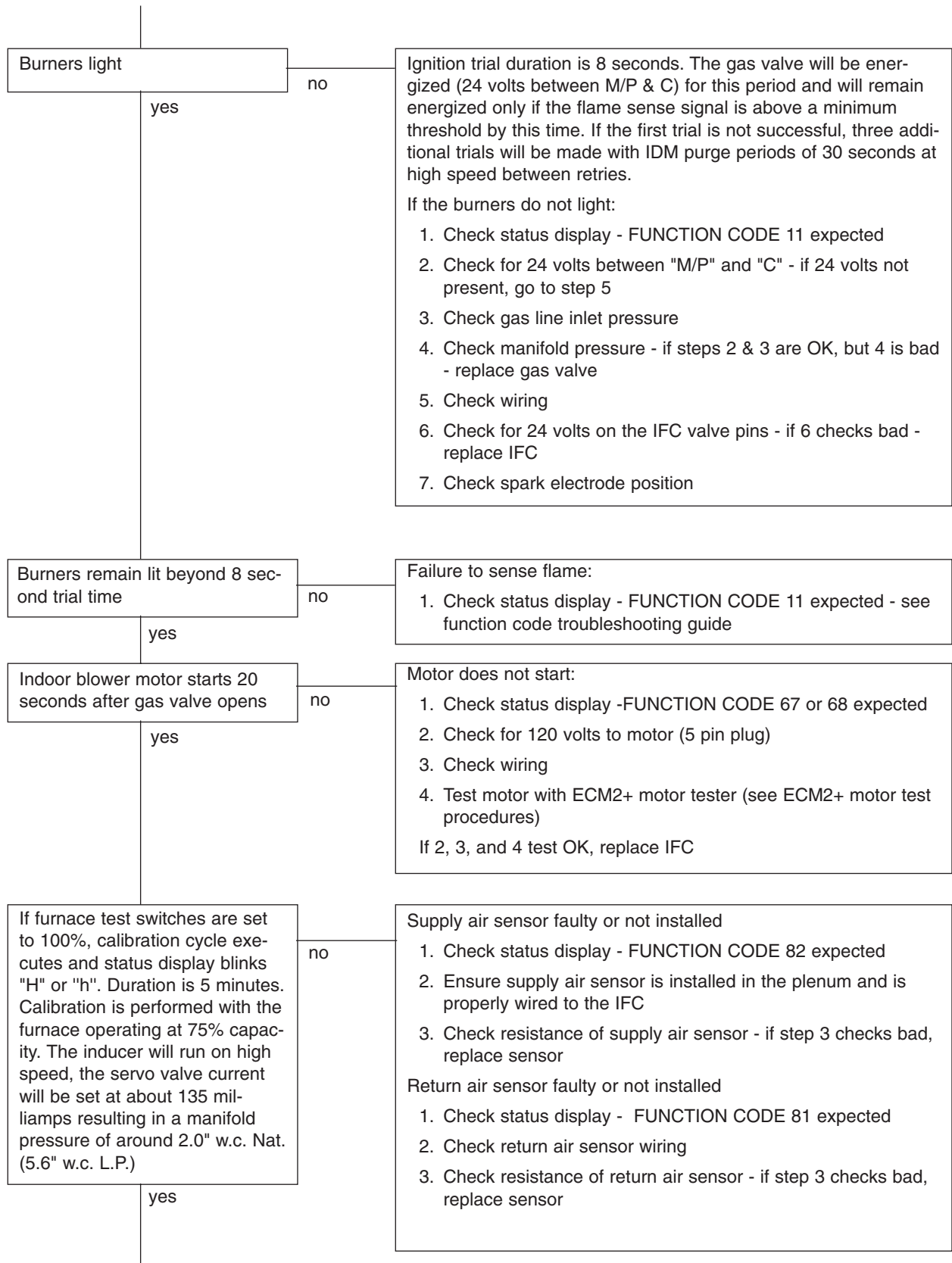
Figure 71 is a troubleshooting flow-charts for the sequence of operation. Table 21 is for fault-code descriptions.

WIRING DIAGRAM

Figure 72 is a complete wiring diagram for the furnace and power sources.

FIGURE 71
SEQUENCE OF OPERATION TROUBLESHOOTING FLOWCHART





continued on next page

FURNACE TEST SWITCHES SET AT 100 %

Furnace runs at 100% rate, status display shows "H" or "h", inducer on high speed, servo current is ~180 milliamps, manifold pressure is ~3.5 " w.c. and temperature rise is 40 - 70 °F

no

Monitor status display for abnormal indications, see function code troubleshooting guide

FURNACE TEST SWITCHES SET AT 40 %

Furnace runs at 40% rate, status display shows "H" or "h", inducer on low speed, servo current is ~ 72 milliamps, manifold pressure is ~0.6 " w.c. and temperature rise is 40 - 70°F

no

Monitor status display for abnormal indications, see function code troubleshooting guide

Terminate test mode

1. Test mode times out in 60 minutes.
2. Remove the call for heat from the W terminal

yes

yes

LED status display shows "O" gas valve off, flames off

no

Status display shows "C", "F", or "H"

1. Ensure thermostat is off
2. Check thermostat wiring

Flames remain on

1. Check 24 volts to gas valve solenoids (M/P) - if present, go to step 2, if 24 volts is not present, shut off gas and replace the gas valve
2. Check wiring
3. Check 24 volts on IFC valve pins (MV) - if status display shows "O" and 24 volts is present in step 3, replace IFC

yes

Induced draft motor stops after 20 seconds

no

Induced draft motor doesn't stop

1. Check status display - FUNCTION CODE 22 or 33 expected
2. Check over-temperature switch(es)
3. Check wiring

If steps 2 & 3 check OK, replace IFC

yes

ECM2+ indoor blower motor stops after 90 seconds

no

ECM2+ indoor blower motor does not stop running

1. Check status display - FUNCTION CODE 22, 23 or 33 expected
2. Check main limit and over temperature switch(es)
3. Test motor with ECM2+ motor tester (see ECM2+ motor test procedures)

If steps 2 & 3 check OK, replace IFC

yes

Troubleshooting ends

To return system to modulating/single-stage operation (SW2):

1. De-energize IFC
2. Set furnace test switches (SW2) for desired operation
3. Re-energize IFC
4. Set thermostat for desired operation

REPEAT PROCEDURE UNTIL TROUBLE-FREE OPERATION IS OBTAINED IN 100% AND 40% TEST MODES

TABLE 21
FAULT CODE TROUBLESHOOTING CHART

Function Code	Description	Response Comments	Probable Causes	Solutions
I	One-Hour Retry	A furnace fault has caused the controller to execute a one-hour retry mode.	A. Failed ignition trial four times (code 11) B. Lost flame sense four times (code 13)	1. Check for function code 11 in buffer. See solutions for function code 11. 2. Check for function code 13 in buffer. See solutions for function code 13.
—	Internal fault	Failed microprocessor self test or main gas valve safety circuit fault. Hard lockout	A. Voltage sensed on the MV output B. Software Self-test output	1. Check for mis-wiring in furnace 2. Replace IFC
11	Failed Ignition Trial	No flame sense during ignition trial. Remains displayed until successful ignition, one hour retry is started or heat demand is removed Fault is stored in buffer after four consecutive failed ignition trials in a single heat call	A. Insufficient line gas pressure	1. Insure gas supply is connected to furnace and check for proper line pressure
			B. Gas valve control turned "OFF"	1. Turn gas valve to the "ON" position
			C. Insufficient manifold pressure, gas valve "ON"	1. Check 24 VAC to gas valve. 2. Check for 170 - 190 mAmps to servo valve. 3. Adjust valve for proper manifold pressure at 100% rate 4. If gas valve will not adjust, replace gas valve.
			D. No spark at electrodes	1. Check 120 VAC at igniter control during ignition trial. 2. Check spark wire connection at igniter control transformer and electrode. 3. Check for short to ground of electrode (cracked ceramic, touching burners, etc.) 4. Check igniter wire for damage. 5. If all checks OK, replace igniter control
			E. Burners don't light	1. Check for proper mounting and placement spark electrode assembly. 2. Check for proper mounting of burner assembly.
12	Low Flame Sense	Flame sense level is below predetermined threshold but above minimum operating threshold. Remains displayed until flame sense level rises above threshold level or heat demand is removed.	F. Burners light, but extinguish after 8 seconds or less	1. Check for proper polarity of line voltage. 2. Check flame sensor wiring and connections. 3. Check for improperly mounted flame sensor (positioned out of flame, grounded). 4. Check flame sense current. 5. Clean flame sensor rod.
			A. Flame sensor contaminated	1. Clean flame sensor rod
			B. Flame Sensor improperly mounted or grounded	1. Re-install / replace flame sensor, check wiring and connections.

TABLE 21
FAULT CODE TROUBLESHOOTING CHART, CONT.

Function Code	Description	Response Comments	Probable Causes	Solutions
13	Lost Flame Sense	<p>Flame sense is below minimum operating threshold during a heating cycle. Remains until a successful ignition sequence, one hour retry is started or the heat demand is removed.</p> <p>Fault is stored in buffer after four ignition retries in a single heat call.</p>	A. Flame sensor contaminated	1. Clean flame sensor rod
			B. Flame sensor improperly mounted or grounded	1. Re-install / replace flame sensor, check wiring and connections.
			C. Unstable flame pattern	<ol style="list-style-type: none"> 1. Check that all burner assembly components are properly installed. 2. Check that all seals between the vestibule area and the heat exchanger area are tight 3. Insure that the combustion door gasket is in place and the door is properly installed.
14	Improper Flame Sense	<p>Flame sensed when gas valve is off. Remains displayed until flame sense signal is gone.</p>	A. Flame remains lit in "OFF" cycle	<ol style="list-style-type: none"> 1. Repair mis-wiring to remove continuous 24V to valve. 2. Gas valve stuck open - remove and replace.
			B. Flame goes out in "OFF" cycle	1. Replace IFC board
22	High Limit	<p>High limit circuit is open. Remains displayed until circuit is sensed closed.</p>	A. No airflow	<ol style="list-style-type: none"> 1. Check Fault Buffer for ECM motor fault history 2. Check ECM motor wiring to the control board. 3. Test ECM motor and replace if faulty.
			B. Insufficient airflow	<ol style="list-style-type: none"> 1. Check Fault Buffer for ECM motor fault history 2. Check filters and duct work for restrictions 3. Check rate and outlet air temperature at 100%, and 40%, compare to maximum on nameplate 4. Run furnace calibration and re-check outlet air temperature
			C. Faulty limit control	1. Replace limit control
23	Auxiliary Limit (HALC)	<p>Auxiliary limit circuit is open. Remains displayed until circuit is sensed closed.</p>	D. Input rate too high.	<ol style="list-style-type: none"> 1. Insure properly sized orifices installed. 2. Check manifold pressure and adjust as needed.
			A. On upflow furnaces jumper loose, broken or missing	1. Repair jumper between pins 5 & 11 on J1.
			B. On downflow furnace, faulty HALC.	1. Replace Limit.
			C. On downflow furnaces, no airflow	<ol style="list-style-type: none"> 1. Check Fault Buffer for ECM motor fault history 2. Check ECM motor wiring to the control board. 3. Test ECM motor and replace if faulty.

TABLE 21
FAULT CODE TROUBLESHOOTING CHART, CONT.

Function Code	Description	Response Comments	Probable Causes	Solutions
33	Over-Temperature Limit	Over-temperature limit circuit is open. Remains displayed until circuit is sensed closed.	A. Faulty limit control	1. Replace limit control.
			B. Insufficient combustion air	1. Check that inducer is operating at proper speed and RPM. 2. Insure venting does not exceed the maximum lengths specified in the venting instructions. 3. Check that all gaskets between the inducer and the center panel / heat exchanger are properly installed and no leaks exist
			C. Unstable flame pattern	1. Check that all burner assembly components are properly installed. 2. Check that all seals between the burner compartment and the heat exchanger area are tight. 3. Insure that the door seals are in place and the door is properly installed. 4. Check that the heat exchanger has not been damaged; i.e. crushed tubes, breached collector boxes
44	LPS –Contacts Closed	Low pressure switch circuit is closed when no call for heat. Remains displayed until circuit opens or heat demand is removed.	A. Faulty wiring	1. Check for shorted wires to the low pressure switch
			B. Faulty switch	1. Replace low pressure switch
			C. Abnormally high negative pressure present on vent system	1. Check for proper venting and termination as defined in the furnace installation instructions
45	LPS – Open – IDM=HI	Low pressure switch circuit is open during high speed IDM operation. Remains displayed until a successful ignition sequence or the heat demand is removed	A. Insufficient combustion airflow	1. Check for leaking hoses or leaking gasket at the induced draft blower
			B. Insufficient combustion air	
			C. Improper pressure switch setting	1. Replace Low Pressure Switch

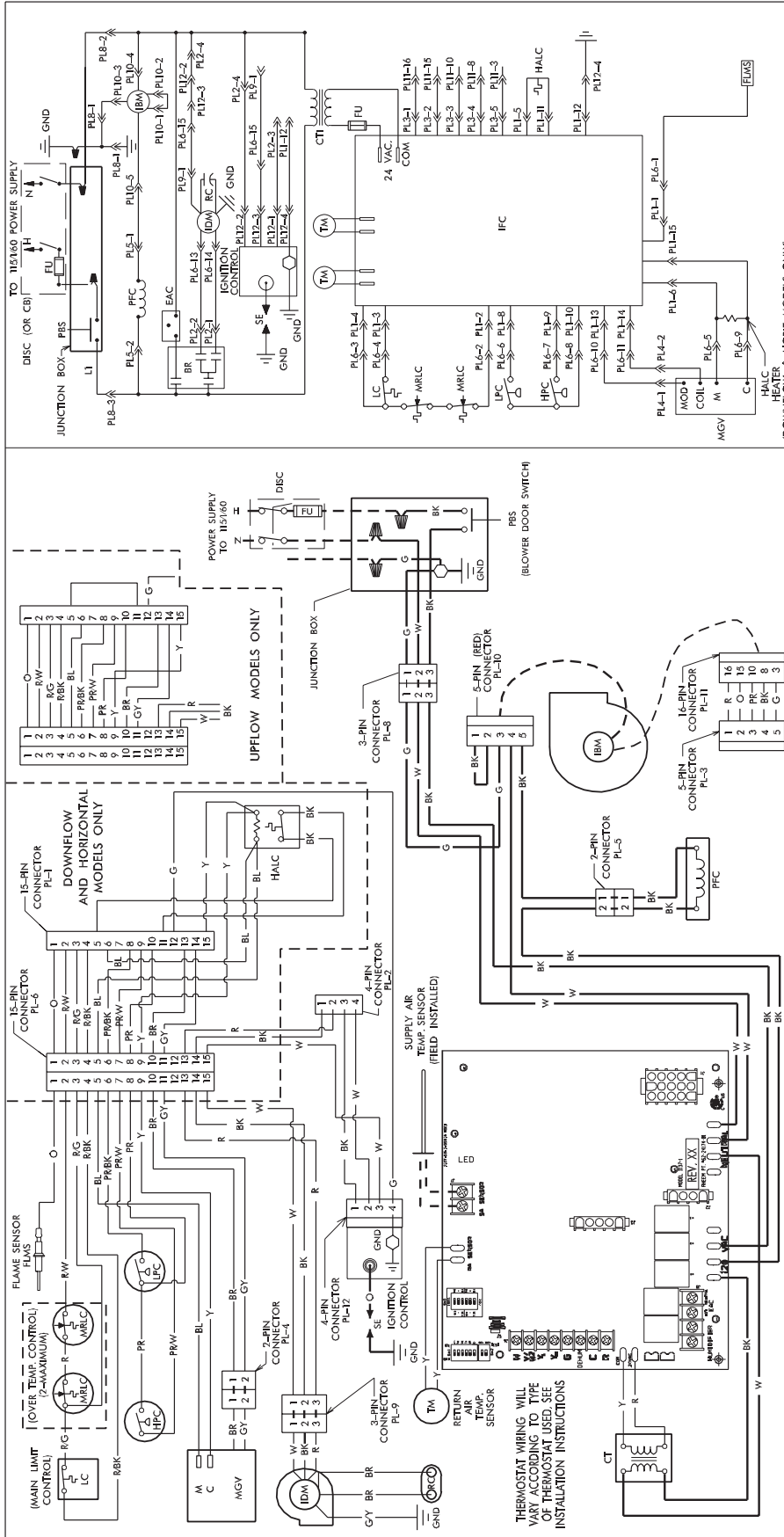
TABLE 21
FAULT CODE TROUBLESHOOTING CHART, CONT.

Function Code	Description	Response Comments	Probable Causes	Solutions
46	Auxiliary Limit LPS - Open - IDM = LO	Low pressure switch circuit is open during low speed IDM operation. Remains displayed until a successful ignition sequence or the heat demand is removed	A. Insufficient combustion airflow	1. Check that the maximum vent length for the application has not been exceeded and that the vent is properly terminated 2. Check that the combustion air inlet and vent pipes are not restricted 3. Check that the induced draft motor is operating at the proper speed.
			B. Condensate not draining from heat exchanger	1. Check drain lines for blockage, kinks or double traps 2. Insure drain trap has been filled with water before operation
			C. Insufficient pressure sensed at switch	1. Check for leaking hoses or leaking gasket at the induced draft blower
			D. Improper pressure switch setting	1. Replace Low Pressure Switch
			E. Faulty switch	1. Replace Low Pressure Switch
55	HPS – Contacts Closed	High pressure switch circuit is closed with no call for heat. Remains displayed until circuit opens or heat demand is removed.	A. Faulty wiring	1. Check that the wires to the high pressure switch have not been shorted together
			B. Faulty switch	1. Replace high pressure switch
56	HPS - Closed - IDM = LO	High pressure switch circuit is closed during low speed IDM operation. Remains displayed until heat demand is removed	A. Minimum vent requirements not followed	1. Insure vent system has minimum recommended vent lengths. 2. Insure vent system is properly terminated. 3. Insure combustion compartment door is properly installed.
			B. Improper switch setting	1. If high altitude pressure switch is installed and installation site elevation is near 5,000 feet, check cold pressures on high speed inducer to insure pressure switch change was necessary. 2. Replace high pressure switch as needed.
57	HPS – Open – IDM=HI	High pressure switch circuit is open during high speed IDM operation. Remains displayed until a successful ignition sequence or the heat demand is removed.	A. Insufficient combustion airflow	1. Check that the maximum vent length for the application has not been exceeded and that the vent is properly terminated 2. Check that the combustion air inlet and vent pipes are not restricted 3. Check that the induced draft motor is operating at the proper speed.
			B. Condensate not draining from heat exchanger	1. Check drain lines for blockage, kinks or double traps 2. Insure drain trap has been filled with water before operation
			C. Insufficient pressure sensed at switch	1. Check for leaking hoses or leaking gasket at the induced draft blower
			D. Improper pressure switch setting	1. Replace High Pressure Switch
			E. Faulty switch	1. Replace High Pressure Switch

TABLE 21
FAULT CODE TROUBLESHOOTING CHART, CONT.

Function Code	Description	Response Comments	Probable Causes	Solutions
66	ECM – RPM Range	ECM feedback signal indicated the indoor blower motor RPM is above 1200. Remains displayed until RPM returns to normal operating range or blower operation requirement is removed.	A. ECM motor operating at RPM limit. B. Unit installed in a “normal extreme” installation (see solution #5)	1. Check for dirty filter 2. Check for inadequate return air supply 3. Check for under-sized duct work 4. Check for loose blower wheel 5. Unit installation is at environmental limits of: altitude, system static pressures, high efficiency air filters, etc. Blower demand requires operation at RPM limit.
				1. Check motor part number, replace motor if needed.
67	ECM – Improper Signal	ECM Feedback signal does not follow defined protocol – RPM / CFM blink. Remains displayed until feedback is corrected or blower operation requirement is removed.	A. Wrong ECM motor installed	2. Test motor feedback signal, replace if faulty
			A. Faulty wiring	1. Ensure the ECM wiring harness is complete and connected
			B. Faulty ECM motor	1. Test motor for feedback signal, replace motor if faulty.
68	ECM – No Signal	ECM feedback signal missing. Remains displayed until feedback is corrected or blower operation requirement is removed.	C. Faulty control board	1. Replace control board if necessary
			A. Faulty wiring	1. Ensure continuity from board connector to gas valve and to ground, check all connections.
			B. Faulty gas valve	1. Check resistance of servo–valve coil. Replace valve if out of tolerance.
77	GV Servo – Open	Gas valve servo circuit is sensed open. Remains displayed until circuit is closed or heat demand is removed.	C. Faulty control board	1. Replace control board if faulty.
			A. Faulty wiring	1. Conduct the following test: a. Turn the gas valve control knob to the off position. b. Disconnect servo valve connector and place a 100-Ohm, 10-Watt resistor across the two wires from the furnace wiring harness (not the wires from the gas valve). c. Set the furnace to attempt another ignition cycle. d. If Function code 78 appears, replace the IFC. e. If Function code 11 appears, replace the gas valve
			B. Faulty gas valve	1. Check resistance of servo–valve coil. Replace valve if out of tolerance.
78	GV Servo – Control Fault	Gas valve current sensing circuit tests out of range. Remains displayed until circuit tests OK or heat demand is removed.	A. Gas valve servo coil out of specification	1. Ensure continuity from board connector to gas valve and to ground, check all connections
			A. Faulty wiring	1. Check resistance of thermistor. Replace sensor if out of tolerance
			C. Sensor Not Connected or not used	2. Reconnect sensor if used. If not used, then furnace is operating normally.
81/82	RAS / SAS – Out of Range	Return / Supply air sensor out of range. Remains displayed for 1.5 minutes after power on. After that time codes remain in memory but are not displayed. Recycling the power will redisplay codes.	A. Faulty wiring	1. Ensure continuity from board connector to gas valve and to ground, check all connections
			B. Faulty Thermistor Assembly	1. Check resistance of thermistor. Replace sensor if out of tolerance
			C. Sensor Not Connected or not used	2. Reconnect sensor if used. If not used, then furnace is operating normally.

FIGURE 72
WIRING DIAGRAM



COMPONENT CODE

C	COMMON	W	LOW PRESSURE CONTROL
CT	CONTROL TRANSFORMER	M	MAIN GAS VALVE
DISC	DISCONNECT SWITCH	AMRLC	MAIN RESET LIMIT CONTROL
FLMS	FLAME SENSOR	PBS	PUSH BUTTON SWITCH
FUSE	FUSE	PFC	POWER FACTOR CHOKE
GROUND	GROUND	PLUG	PLUG
HALC	HEAT ASSISTED LIMIT CONTROL	RC	RUN CAPACITOR
HPC	HIGH PRESSURE CONTROL	IBM	INDOOR BLOWER MOTOR
IBM	INDUCED DRAFT MOTOR	SE	SPARK ELECTRODE
IDM	INDUCED DRAFT MOTOR	TM	THERMISTOR
IFC	INTEGRATED FURNACE CONTROL	▲	WIRE NUT
LC	LIMIT CONTROL		

WIRING INFORMATION

- LINE VOLTAGE
 - FACTORY STANDARD
 - FACTORY OPTION
 - FIELD INSTALLED
- LOW VOLTAGE
 - FACTORY STANDARD
 - FACTORY OPTION
 - FIELD INSTALLED
- REPLACEMENT WIRE
 - MUST BE THE SAME SIZE AND TYPE OF INSULATION AS ORIGINAL (1095 C° MIN.)
- WARNING
 - CABINET MUST BE PERMANENTLY GROUNDED AND CONFORM TO I.E.C., N.E.C., C.E.C. AND LOCAL CODES AS APPLICABLE.

NOTES:

COMPONENT CODE

LOW	PRESSURE CONTROL
M	MAIN GAS VALVE
AMRLC	MAIN RESET LIMIT CONTROL
PBS	PUSH BUTTON SWITCH
PFC	POWER FACTOR CHOKE
PLUG	PLUG
RC	RUN CAPACITOR
IBM	INDOOR BLOWER MOTOR
SE	SPARK ELECTRODE
TM	THERMISTOR
▲	WIRE NUT

WIRE COLOR CODE

BK	BLACK	GY	GRAY	R	RED
BR	BROWN	O	ORANGE	W	WHITE
BL	BLUE	PK	PINK	Y	YELLOW
G	GREEN	PR	PURPLE		

ELECTRICAL WIRING DIAGRAM
UPFLOW / DOWNFLOW / HORIZONTAL
BLOWER INDUCED / HORIZONTAL
MODULATING
GAS FIRED / FORCED
AIR FURNACE
WHITE-RODGERS GAS VALVE
DIRECT SPARK IGNITION

DR. BY JIM
APP. BY JIM
DATE 10-3-00
IDMC. NO. 90-24216-04
REV 06