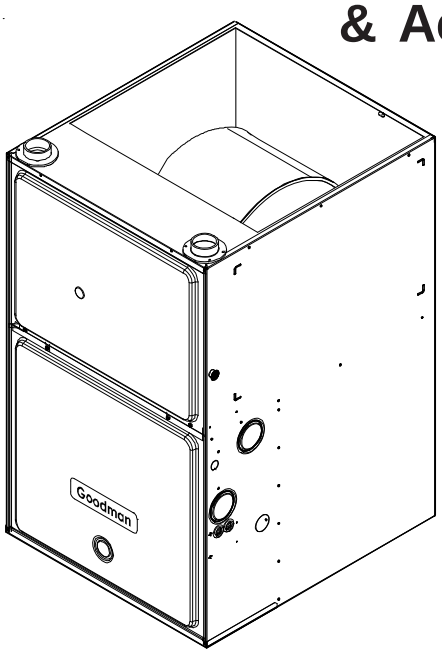
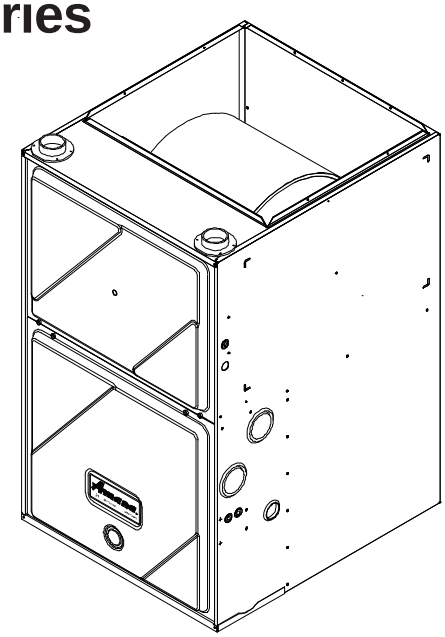
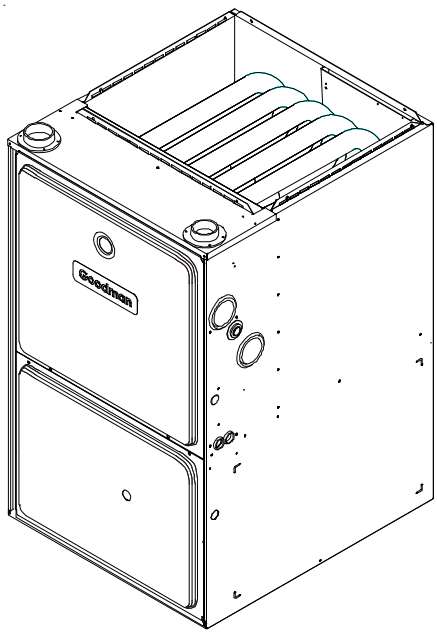
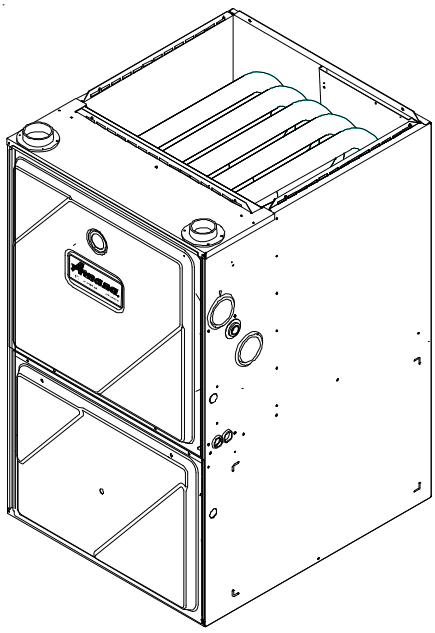
Service Instructions

96% Modulating Gas Furnaces
ACVM, AMVM, GCVM, GMVM
& Accessories









This manual is to be used by qualified, professionally trained HVAC technicians only. Goodman does not assume any responsibility for property damage or personal injury due to improper service procedures or services performed by an unqualified person.

RS6612001r9
November 2013

TABLE OF CONTENTS

IMPORTANT INFORMATION

Pride and workmanship go into every product to provide our customers with quality products. It is possible, however, that during its lifetime a product may require service. Products should be serviced only by a qualified service technician who is familiar with the safety procedures required in the repair and who is equipped with the proper tools, parts, testing instruments and the appropriate service manual. **REVIEW ALL SERVICE INFORMATION IN THE APPROPRIATE SERVICE MANUAL BEFORE BEGINNING REPAIRS.**

IMPORTANT NOTICES FOR CONSUMERS AND SERVICERS

⚠ RECOGNIZE SAFETY SYMBOLS, WORDS AND LABELS

⚠ WARNING

THIS UNIT SHOULD NOT BE CONNECTED TO, OR USED IN CONJUNCTION WITH, ANY DEVICES THAT ARE NOT DESIGN CERTIFIED FOR USE WITH THIS UNIT OR HAVE NOT BEEN TESTED AND APPROVED BY GOODMAN. SERIOUS PROPERTY DAMAGE OR PERSONAL INJURY, REDUCED UNIT PERFORMANCE AND/OR HAZARDOUS CONDITIONS MAY RESULT FROM THE USE OF DEVICES THAT HAVE NOT BEEN APPROVED OR CERTIFED BY GOODMAN.

⚠ WARNING

INSTALLATION AND REPAIR OF THIS UNIT SHOULD BE PERFORMED ONLY BY INDIVIDUALS MEETING THE REQUIREMENTS OF AN ENTRY LEVEL TECHNICIAN, AT A MINIMUM, AS SPECIFIED BY THE AIR CONDITIONING, HEATING, AND REFRIGERATION INSTITUTE (AHRI). ATTEMPTING TO INSTALL OR REPAIR THIS UNIT WITHOUT SUCH BACKGROUND MAY RESULT IN PRODUCT DAMAGE, PERSONAL INJURY, OR DEATH.

⚠ WARNING

TO PREVENT THE RISK OF PROPERTY DAMAGE, PERSONAL INJURY, OR DEATH, DO NOT STORE COMBUSTIBLE MATERIALS OR USE GASOLINE OR OTHER FLAMMABLE LIQUIDS OR VAPORS IN THE VICINITY OF THIS APPLIANCE.

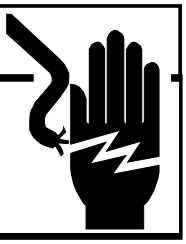
⚠ WARNING

GOODMAN WILL NOT BE RESPONSIBLE FOR ANY INJURY OR PROPERTY DAMAGE ARISING FROM IMPROPER SERVICE OR SERVICE PROCEDURES. IF YOU INSTALL OR PERFORM SERVICE ON THIS UNIT, YOU ASSUME RESPONSIBILITY FOR ANY PERSONAL INJURY OR PROPERTY DAMAGE WHICH MAY RESULT. MANY JURISDICTIONS REQUIRE A LICENSE TO INSTALL OR SERVICE HEATING AND AIR CONDITIONING EQUIPMENT.

⚠ WARNING

HIGH VOLTAGE

DISCONNECT ALL POWER BEFORE SERVICING OR INSTALLING THIS UNIT. MULTIPLE POWER SOURCES MAY BE PRESENT. FAILURE TO DO SO MAY CAUSE PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.



IMPORTANT INFORMATION

⚠ WARNING

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

– DO NOT STORE OR USE GASOLINE OR OTHER FLAMMABLE VAPORS AND LIQUIDS 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.

– INSTALLATION AND SERVICE MUST BE PERFORMED BY A QUALIFIED INSTALLER, SERVICE AGENCY OR THE GAS SUPPLIER.

⚠ WARNING

SHOULD OVERHEATING OCCUR OR THE GAS SUPPLY FAIL TO SHUT OFF, TURN OFF THE MANUAL GAS SHUTOFF VALVE EXTERNAL TO THE FURNACE BEFORE TURNING OFF THE ELECTRICAL SUPPLY.

DANGER
PELIGRO

CARBON MONOXIDE POISONING HAZARD

Special Warning for Installation of Furnace or Air Handling Units in Enclosed Areas such as Garages, Utility Rooms or Parking Areas

Carbon monoxide producing devices (such as an automobile, space heater, gas water heater, etc.) should not be operated in enclosed areas such as unventilated garages, utility rooms or parking areas because of the danger of carbon monoxide (CO) poisoning resulting from the exhaust emissions. If a furnace or air handler is installed in an enclosed area such as a garage, utility room or parking area and a carbon monoxide producing device is operated therein, there must be adequate, direct outside ventilation.

This ventilation is necessary to avoid the danger of CO poisoning which can occur if a carbon monoxide producing device continues to operate in the enclosed area. Carbon monoxide emissions can be (re)circulated throughout the structure if the furnace or air handler is operating in any mode.

CO can cause serious illness including permanent brain damage or death.

B10259-216

To locate an authorized servicer, please consult your telephone book or the dealer from whom you purchased this product. For further assistance, please contact:

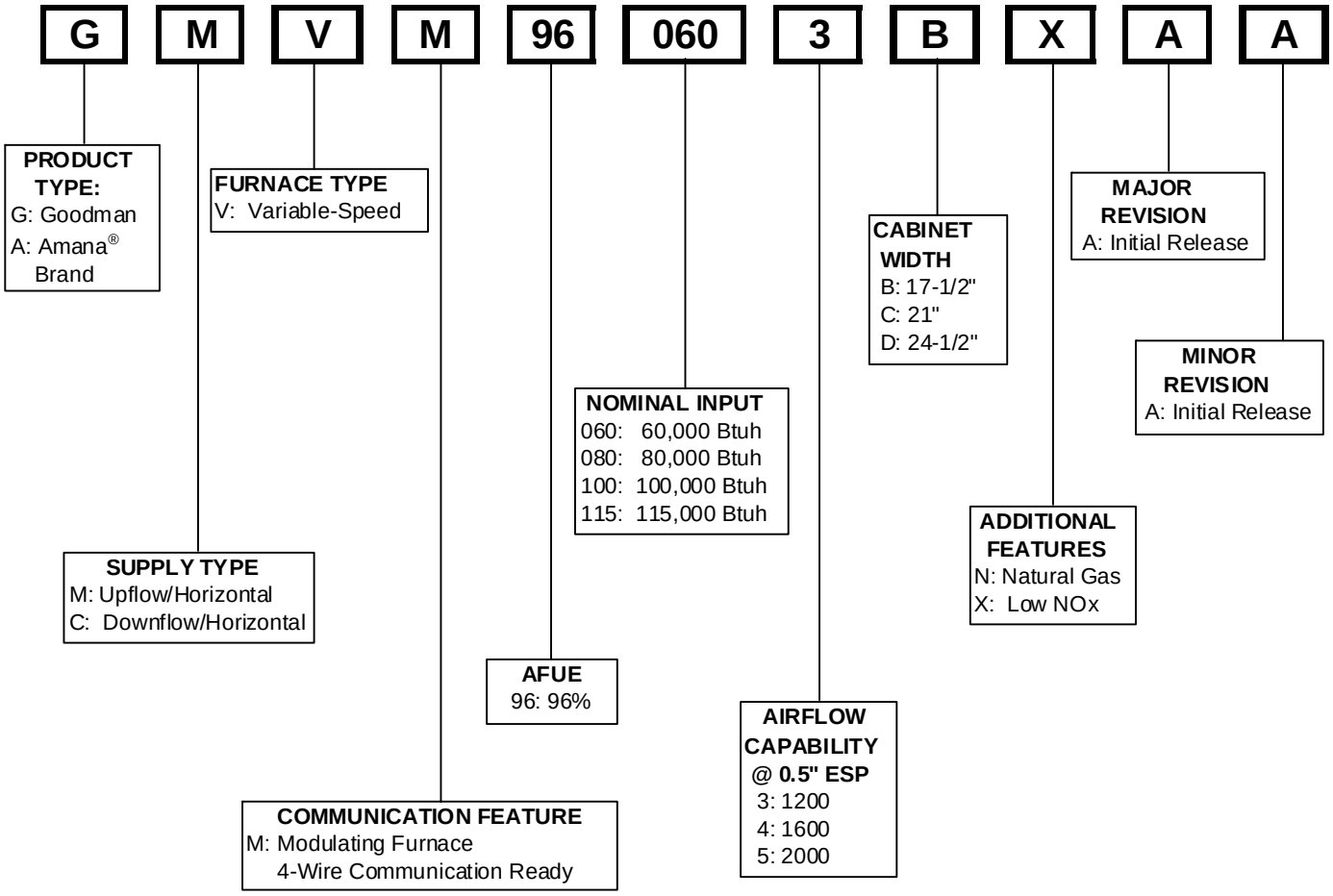
CONSUMER INFORMATION LINE
GOODMAN® BRAND PRODUCTS
TOLL FREE
1-877-254-4729 (U.S. only)
email us at:
customerservice@goodmanmfg.com
fax us at: (731) 856-1821
(Not a technical assistance line for dealers.)

CONSUMER INFORMATION LINE
AMANA® BRAND PRODUCTS
TOLL FREE
1-877-254-4729 (U.S. only)
email us at:
hac.consumer.affairs@amanahvac.com
fax us at: (731) 856-1821
(Not a technical assistance line for dealers.)

Outside the U.S., call 1-713-861-2500.
(Not a technical assistance line for dealers.) Your telephone company will bill you for the call.

PRODUCT IDENTIFICATION

The model and manufacturing number are used for positive identification of component parts used in manufacturing. Please use these numbers when requesting service or parts information.



PRODUCT IDENTIFICATION

MODEL #	MFG. #	DESCRIPTION
ACVM96******	**ACVM96******AA**	**Amana® Brand 96% Modulating Gas Furnace**, Downflow/Horizontal Left and Right, 40" tall, Induced Draft, ClimateTalk™ communicating furnace. Modulating gas input from 35% -100% of rated input. 4 wire serial ECM motor. Independent humidification with capable thermostat.
ACVM96******	**ACVM96******BA**	**Amana® Brand 96% Modulating Gas Furnace,** same as AA revision above, but BA revision models furnace cabinet Air Leakage must be <2.0%.
AMVM96******	**AMVM96******AA**	**Amana® Brand 96% Modulating Gas Furnace,** Upflow/Horizontal Left or Right, 40" tall, Induced Draft, ClimateTalk™ communicating furnace. Modulating gas input from 35% -100% of rated input. 4 wire serial ECM motor. Independent humidification with capable thermostat.
AMVM96******	**AMVM96******BA**	**Amana® Brand 96% Modulating Gas Furnace,** same as AA revision above, but BA revision models furnace cabinet Air Leakage must be <2.0%.

MODEL #	MFG. #	DESCRIPTION
GCVM96******	**GCVM96******AA**	**Goodman® Brand 96% Modulating Gas Furnace**, Downflow/Horizontal Left and Right, 40" tall, Induced Draft, ClimateTalk™ communicating furnace. Modulating gas input from 35% -100% of rated input. 4 wire serial ECM motor. Independent humidification with capable thermostat.
GCVM96******	**GCVM96******BA**	**Goodman® Brand 96% Modulating Gas Furnace**, same as the AA revision above but BA models furnace cabinet Air Leakage must be <2.0%.
GMVM96******	**GMVM96******AA**	**Goodman® Brand 96% Modulating Gas Furnace,** Upflow/Horizontal Left or Right, 40" tall, Induced Draft, ClimateTalk™ communicating furnace. Modulating gas input from 35% -100% of rated input. 4 wire serial ECM motor. Independent humidification with capable thermostat.
GMVM96******	**GMVM96******BA**	**Goodman® Brand 96% Modulating Gas Furnace**, same as the AA revision above but BA models furnace cabinet Air Leakage must be <2.0%.

PRODUCT IDENTIFICATION

MODEL #	MFG #	DESCRIPTION
AFE18-60A	N/A	**Fossil Fuel Kit.** The AFE18-60A control is designed for use where the indoor coil is located above/downstream of a gas or fossil fuel furnace when used with a heat pump. It will operate with single and two stage heat pumps and single and two stage furnaces. The AFE18-60A control will turn the heat pump unit off when the furnace is turned on. An anti-short cycle feature initiates a 3 minute timed off delay when the compressor goes off.
AMU1620 **AMU1625** **AMU2020** **AMU2025** **GMU1620** **GMU1625** **GMU2020** **GMU2025**	P1251305F P1251306F P1251307F P1251308F N/A	**Media Air Cleaner**. For use with current architectural grey Goodman® and Amana® Brand 96% variable speed, modulating furnace models. The Amana (AMU*) and Goodman (GMU*) Media Air Cleaner is a high efficiency air filtration device designed to remove dirt, dust, pollen and other microscopic particles from the air passing through it. Flexible performance range up to 2,000 CFM capacity. The air cleaner should be installed in the system so that all the system air is circulated through the air cleaner. The air cleaner will only remove the airborne contaminants delivered to it. Maximum performance is obtained when the system blower is set for continuous operation. Carbon filters (optional) are available.
ASAS-10 **ASAS-11** **ASAS-12** **ASAS-18**	P1251301F P1251302F P1251303F P1251304F	**Electronic Air Cleaner**. For use with current architectural grey Goodman® and Amana® Brand 96% variable speed, modulating furnace models. The High-Efficiency Electronic Air Cleaner is designed to remove air contaminants down to .01 microns. Carbon filters (optional) remove odors. Dual indicator lights show unit operation at a glance. Electronic proving switch cycles the air cleaner On/Off with the system fan. Durable powder-coat paint finish resists corrosion.
CFB17	P1228004F	**Downflow Subbase Kit**. For use with Goodman®, & Amana® Brand modulating furnace models. These kits are available for the following furnace widths: 17.5" wide (CFB17), 21" wide (CFB21) and 24" wide (CFB24). The kits must be used to prevent excessive temperature from reaching combustible materials, if the furnace is installed on a combustible floor. This subbase effectively separated the furnace base and plenum from combustible materials. To ensure safe installation, do not install the counterflow floor base directly on carpeting, tile, or other combustible material other than wood flooring.
CTK01	CTK01AA	**Communicating Thermostat Kit**- Digitally communicating touchscreen thermostat, a necessary part of any communicating system. Designed for use with compatible Amana® Brand or Goodman® Brand Air Handlers or Furnaces and outdoor split AC or Heat Pump units. This thermostat supports up to three stages of heat, two stages of cooling, dual fuel applications, dehumidification, filter maintenance reminders, outdoor temperature display and advanced menus including diagnostics. The CTK01AA kit includes a communicating touchscreen thermostat and sub base, 230V-24V 40va transformer, terminal blocks(2), wire jumpers, mounting screws, installation manual and homeowner guide.
CTK01BA	CTK01BA	**Communicating Thermostat Kit**- Digitally communicating touchscreen thermostat, a necessary part of any communicating system. Designed for use with compatible Amana® Brand or Goodman® Brand Air Handlers or Furnaces and outdoor split AC or Heat Pump units. This thermostat supports up to three stages of heat, two stages of cooling, dual fuel applications, dehumidification, filter maintenance reminders, outdoor temperature display and advanced menus including diagnostics. The CTK01BA kit includes a communicating touchscreen thermostat and sub base, terminal blocks(2), mounting screws, installation manual and homeowner guide.
CTK02**	CTK02**	**Communicating Thermostat Kit**- Digitally communicating thermostat, a necessary part of any communicating system. Designed for use with compatible Amana® Brand or Goodman® Brand Air Handlers or Furnaces and outdoor split AC or Heat Pump units. The CTK02** thermostat features full color, high definition display, advanced programming options including humidification control & heat and cool maximum temperature settings, a USB plug allowing dealers the ability to insert pre-programmed operating parameters and dealer information by use of an online data entry system.
CTK03A*	CTK03A*	**Communicating Thermostat Kit**- Digitally communicating touchscreen thermostat from Honeywell. Designed for use with compatible Amana® Brand or Goodman® Brand Air Handlers or Furnaces and outdoor split AC or Heat Pump units. The CTK03A* thermostat features full color high definition display, can be used with RedLINK wireless accessories.

PRODUCT IDENTIFICATION

MODEL #	MFG #	DESCRIPTION
DCVK-20 **DCVK-30**	P1254001F P1254002F	**Concentric Vent Kit**. For use with Amana® Brand Modulating furnace models. This kit is designed to allow terminations of a direct vent furnace to be "concentrically" vented through a wall or roof. This kit allows a single penetration to support terminations for both the vent/flue and the combustion air intake pipe. The DCVK-20 (2") and DCVK-30 (3") kits are certified for models listed above. See specification sheets on future models for use of the vent kit.
DEHUM1	P1227801F	**Dehumidistat.** For use with Goodman® & Amana® Brand two-stage variable speed modulating furnace models. Wall mounted, 24 volt humidity control available as a Dehumidistat used to reduce the airflow in the air conditioning mode when necessary to lower the humidity in an occupied home to prevent dew build-up associated with high humidity levels. This control features a moisture-sensitive nylon element and also provides positive ON-OFF settings for manual operation. The control is a normally closed switch that opens on humidity rise causing the blower to switch to a lower speed to control the humidity within the structure.
EFR01	P1221001 P1221002F	**External Filter Rack Kit**. For use with Goodman® and Amana® Brand 96% upflow, variable speed *MVM modulating gas furnaces. This kit is intended to provide a location, external to the furnace casing for installation of a permanent filter. The rack is mounted over the indoor air blower compartment area of either side panel, and provide filter retention as well as a location for attaching return air ductwork.
0170K00000S	N/A	**Side Wall Only Concentric Vent Kit**. For use with 96% modulating furnace models. This kit is to be used with 2" - 3" vent systems. The vent kit must terminate outside the structure. This kit is NOT intended for use with single pipe (indirect vent) installations.
0170K00001S	N/A	**Side Wall Only Concentric Vent Kit**. For use with 96% modulating furnace models. This kit is to be used with 2" vent systems. The vent kit must terminate outside the structure. This kit is NOT intended for use with single pipe (indirect vent) installation

MODEL #	MFG #	DESCRIPTION
LPLP03	N/A	**LP Gas Low Pressure Kit**. Designed for application on Goodman® and Amana® Brand's 80% and 90% single-stage, two-stage and modulating furnaces converted to LP gas. The kit monitors gas line pressure with a pressure switch and will open the circuit to the gas valve if the LP tank pressure gets low.
LPKMOD060UF	N/A	**LP Conversion Kit** For use with A/GMVM9603BX** furnace. The kit comes with a gas manifold equipped with LP orifices and modulating LP gas valve. New burners designed for use with LP gas are also included.
LPKMOD080UF	N/A	**LP Conversion Kit** For use with A/GMVM960805CX** furnace. The kit comes with a gas manifold equipped with LP orifices and modulating LP gas valve. New burners designed for use with LP gas are also included.
LPKMOD100UF	N/A	**LP Conversion Kit** For use with A/GMVM961005DX** furnace. The kit comes with a gas manifold equipped with LP orifices and modulating LP gas valve. New burners designed for use with LP gas are also included.
LPKMOD115UF	N/A	**LP Conversion Kit** For use with A/GMVM961155DX** furnace. The kit comes with a gas manifold equipped with LP orifices and modulating LP gas valve. New burners designed for use with LP gas are also included.
LPKMOD060CF	N/A	**LP Conversion Kit** For use with A/GCVM960604CX** furnace. The kit comes with a gas manifold equipped with LP orifices and modulating LP gas valve. New burners designed for use with LP gas are also included.
LPKMOD080CF	N/A	**LP Conversion Kit** For use with A/GCVM960805DX** furnace. The kit comes with a gas manifold equipped with LP orifices and modulating LP gas valve. New burners designed for use with LP gas are also included.
LPKMOD100CF	N/A	**LP Conversion Kit** For use with A/GCVM961005DX furnace. The kit comes with a gas manifold equipped with LP orifices and modulating LP gas valve. New burners designed for use with LP gas are also included.
RF000142	N/A	**Drain Coupling Kit** For use when the drain/vent elbow has been removed in a horizontal left installation. This kit prevents condensate from getting in the inducer and routes the condensate to a drain.

ACCESSORIES

AMANA® BRAND Furnace Accessories

MODEL NUMBER	AFE180-60A	AMU / GMU	ASAS / GSAS	CFB17	CFB21	CFB24	CTK01*	CTK02**	CTK03AA
Description	Fossil Fuel Kit	Media Air Cleaners	Electronic Air Cleaner	Downflow Subbase 17.5"	Downflow Subbase 21"	Downflow Subbase 24.5"	Com. Thermostat Kit	Com Thermostat Kit -Modulating, High Def	Com Thermostat Kit -Modulating, High Def
AMVM960603BX**	X	X	X				X	X	X
AMVM960805CX**	X	X	X				X	X	X
AMVM961005DX**	X	X	X				X	X	X
ACVM960604CX**	X	X	X		X		X	X	X
ACVM960805DX**	X	X	X			X	X	X	X

Not used in this application

MODEL NUMBER	0170K00000S	0170K00001S	DCVK-20	DCVK-30	DEHUM1	EFR01	LPKMOD-06/08/11UF LPKMOD-06/08/11CF
Description	Concentric Side Wall Vent Kit (3")	Concentric Side Wall Vent Kit (2")	Concentric Vent Kit (2")	Concentric Vent Kit (3")	Dehumidistat	External Filter Rack	Propane Gas Conversion Kit
AMVM960603BX**	X	X	X	X	X	X	X
AMVM960805CX**	X	X		X	X	X	X
AMVM961005DX**	X	X		X	X	X	X
ACVM960604CX**	X	X	X	X	X	X	X
ACVM960805DX**	X	X	X	X	X	X	X

Not used in this application

ACCESSORIES

GOODMAN® BRAND Furnace Accessories

MODEL NUMBER	AFE180-60A	AMU / GMU	ASAS / GSAS	CFB17	CFB21	CFB24	CTK01*	CTK02**	CTK03AA
Description	Fossil Fuel Kit	Media Air Cleaners	Electronic Air Cleaner	Downflow Subbase 17.5"	Downflow Subbase 21"	Downflow Subbase 24.5"	Com. Thermostat Kit	Com Thermostat Kit -Modulating, High Def	Com Thermostat Kit -Modulating, High Def
GMVM960603BX**	X	X	X				X	X	X
GMVM960805CX**	X	X	X				X	X	X
GMVM961005DX**	X	X	X				X	X	X
GMVM961155DX**	X	X	X				X	X	X
GCVM960604CX**	X	X	X		X		X	X	X
GCVM960805DX**	X	X	X			X	X	X	X
GCVM961005DX**	X	X	X			X	X	X	X

Not used in this application

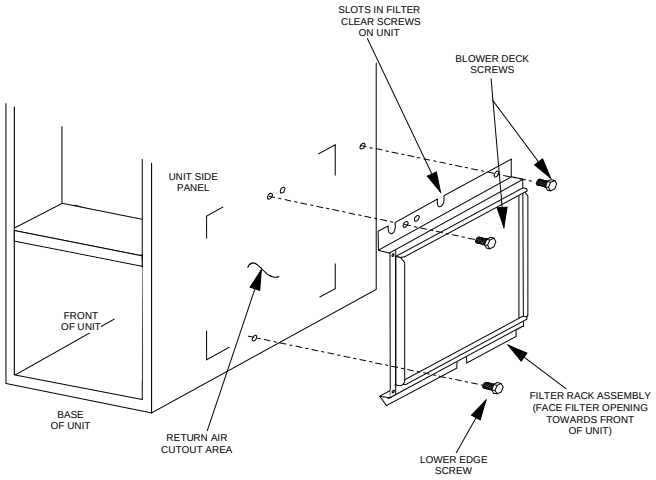
MODEL NUMBER	0170K00000S	0170K00001S	DCVK-20	DCVK-30	DEHUM1	EFR01	LPKMOD-06/08/11UF LPKMOD-06/08/11CF	RF000142
Description	Concentric Side Wall Vent Kit (3")	Concentric Side Wall Vent Kit (2")	Concentric Vent Kit (2")	Concentric Vent Kit (3")	Dehumidistat	External Filter Rack	Propane Gas Conversion Kit	Drain Kit
GMVM960603BX**	X	X	X	X	X	X	X	X
GMVM960805CX**	X	X		X	X	X	X	X
GMVM961005DX**	X	X		X	X	X	X	X
GMVM961155DX**	X	X		X	X	X	X	X
GCVM960604CX**	X	X	X	X	X	X	X	X
GCVM960805DX**	X	X	X	X	X	X	X	X
GCVM961005DX**	X	X		X	X	X	X	X

Not used in this application

ACCESSORIES

EXTERNAL FILTER RACK (EFR01)

Used on 96% Upflow Modulating Furnaces

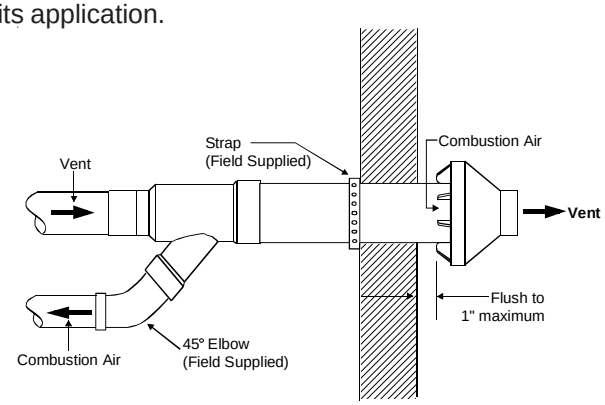


CONCENTRIC VENT CONVERSION KIT (DCVK-20 ◆ DCVK-30)

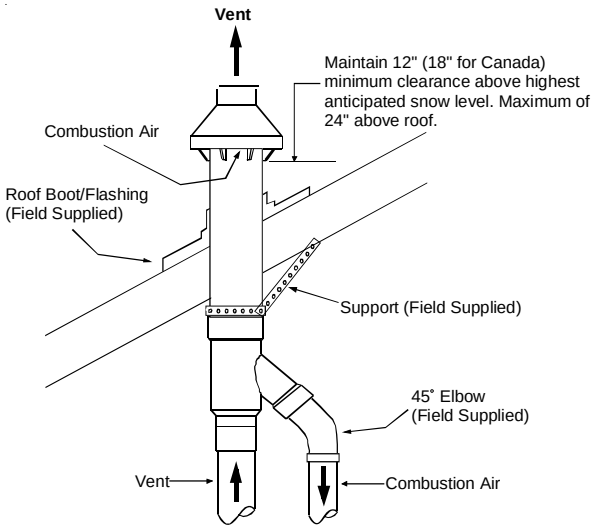
The DCVK-20 (2") or the DCVK-30 (3") is a concentric vent kit approved with furnaces listed in this manual.

This concentric vent kit allows for vertical or horizontal vent termination. The illustrations give a brief view of the kit and its application.

See the section in this manual under "Vent Flue and Combustion Air Pipe Terminations" for more information or consult the Installation and Operating Instructions (IO-619*).



DCVK
(Horizontal Installation)



DCVK
(Vertical Installation)

SIDE WALL VENT KIT (0170K00000S)

This side wall only vent kit #0170K00000S is to be used with 2" - 3" vent systems. This kit is **NOT intended** for use with single pipe (indirect vent) installations.

The vent kit must terminate outside the structure and may be installed with the intake and exhaust pipes located side-by-side or with one pipe above the other.

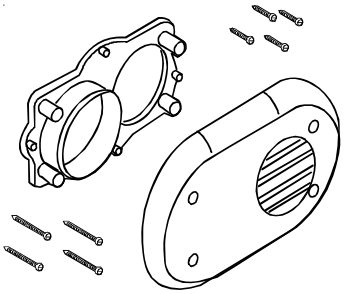
See the section in this manual under "Vent Flue and Combustion Air Pipe Terminations" for more information or consult the Installation Instructions (IO-635).

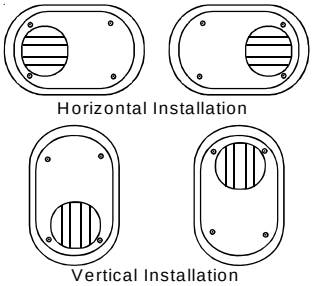
SIDE WALL VENT KIT (0170K00001S)

This side wall only vent kit #0170K00001S is to be used with 2" vent systems. This kit is **NOT intended** for use with single pipe (indirect vent) installations.

The vent kit must terminate outside the structure and may be installed with the intake and exhaust pipes located side-by-side or with one pipe above the other.

See the section in this manual under "Vent Flue and Combustion Air Pipe Terminations" for more information or consult the Installation Instructions (IO-805).





LIGHTING INSTRUCTIONS

FOR YOUR SAFETY READ BEFORE OPERATING

WARNING: If you do not follow these instructions Exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.

B. BEFORE OPERATING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
- Do not touch any electric 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.

C. Use only your hand to push in or turn the gas control lever. Never use tools. If the lever will not push in or turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.

D. Do not use this appliance if any part has been underwater. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been underwater.

LIRE AVANT DE METTRE EN MARCHELIRE

AVERTISSEMENT: Quiconque ne respecte pas à la lettre les instructions dans le presént manuel risque de déclencher un incendie ou une explosion entraînant des dommages matériels, des lesions corporelles ou la perte de vies humaines.

A. Cet appareil ne comporte pas de veilleuse. Il est muni d'un dispositif d'allumage qui allume automatiquement le brûleur. Ne pas tenter d'allumer le brûleur manuellement.

B. AVANT DE LE FAIRE FONCTIONNER, renifler tout autour de l'appariel pour decéler une odeur de gaz. Renifler prés du plancher, car certains gaz sont plus lourds que l'air et peuvent s'accumuler au niveau du sol.

QUE FAIRE S'IL Y A UNE ODEUR DE GAZ

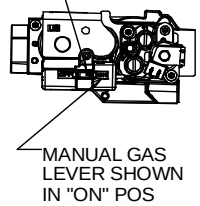
- Ne pas tenter d'allumer d'appareils.
- Ne toucher à aucun interrupteur; ne pas vous servir des téléphones dans le bâtiment.
- Appelez immédiatement votre fournisseur de gaz depuis un voisin. Suivez les instructions du fournisseur de gaz
- Si vous ne pouvez rejoindre le fournisseur de gaz, appelez le service des incendies.»

C. Ne pousser ou tourner la manette d'admission du gaz qu'à la main. Ne jamais emploer d'outil à cette fin. Si la manette reste coincée, ne tenter pas de la réparer; appelez un technicien qualifié. Quiconque tente de forcer la manette ou de la réparer peut provoquer une explosion ou un incendie.»

D. Ne pas se servir de cet appareil s'il a été plongé dans l'eau, même partiellement. Faire inspecter l'appareil par un technicien qualifié et remplacer toutr partie du systéme de contrôle et toute còmmande qui ont été plongées dans l'eau.»

OPERATING INSTRUCTIONS

1. STOP! Read the safety information above on this label.
2. Set the thermostat to lowest setting.
3. Turn off all electric power to the appliance.
4. This appliance is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
5. Push the gas control lever to "OFF" Position. Do not force.
6. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. If you then smell gas, STOP. Follow "B" in the safety. information above on this label if you don't smell gas, go to next step.
7. Push gas control lever to "ON".
8. Replace access panel.
9. Turn on all electric power to the appliance.
10. Set thermostat to desired setting.
11. If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance" and call your service technician or gas company.



MISE EN MARCHE

1. ARRÊTEZ Lisez les instructions de sécurité dans la section supérieure de cette étiquette.
2. Régler le thermostat à la température la plus basse.
3. Couper l'alimentation électrique de l'appareil.
4. Cet appareil menager etant dote d'un systeme d'allumage automatique, ne pas essayer à allumer le brûleur manuellement.
5. Pousse le levier du contrÔle du gaz a "OFF/ ARRET" position.
6. Attendre cinq (5) minutes pour laisser echapper tout le gaz. Renifler tout autour de l'appareil, y compris prés du plancher, pour déceler une odeur de gaz. Si c'est le cas, ARRÊTEZ. Passer à l'etape B des instructions de securite sur la portion superieure de cette etiquette. S'il n'y a pas d'odeur de gaz, passer à l'etàpe suivante.
7. Pousse le levier du contrôle du gaz à "ON/MARCHE" position.
8. Remettre en place le panneau d'accés.
9. Mettre l'appareil sous tension.
10. Régler le thermostat à la température désirée.
11. Si l'appareil ne se met pas en marche, suivre les instructions intitulées Comment couper l'admission de gaz de l'appareil et appeler un technicien qualifié ou le fournisseur de gaz.

TO TURN OFF GAS TO APPLIANCE

1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Push the gas control lever to "OFF" Position. Do not force.
4. Replace control access panel.

POUR COUPER L'ADMISSION DE GAZ DE L'APPAREIL

1. Régler le thermostat à la température la plus bassé.
2. Couper l'alimentation électrique de l'appareil s'il faut procéder à des operations d'entretien.
3. Pousse le levier du contrôle du gaz à "OFF/ ARRET" position. Ne pas forcer.
4. Remettre en place le panneau d'accés.

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PRODUCT DESIGN

Adhere to the following warnings and cautions when installing, adjusting, altering, servicing, or operating the furnace. To ensure proper installation and operation, thoroughly read this manual for specifics pertaining to the installation and application of this product.

WARNING

TO PREVENT PERSONAL INJURY OR DEATH DUE TO IMPROPER INSTALLATION, ADJUSTMENT, ALTERATION, SERVICE OR MAINTENANCE, REFER TO THIS MANUAL. FOR ADDITIONAL ASSISTANCE OR INFORMATION, CONSULT A QUALIFIED INSTALLER, SERVICER AGENCY OR THE GAS SUPPLIER.

WARNING

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

- DO NOT STORE OR USE GASOLINE OR OTHER FLAMMABLE VAPORS AND LIQUIDS 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.
- INSTALLATION AND SERVICE MUST BE PERFORMED BY A QUALIFIED INSTALLER, SERVICE AGENCY OR THE GAS SUPPLIER.

WARNING

THIS PRODUCT CONTAINS OR PRODUCES A CHEMICAL OR CHEMICALS WHICH MAY CAUSE SERIOUS ILLNESS OR DEATH AND WHICH ARE KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER, BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

WARNING

HEATING UNIT SHOULD NOT BE UTILIZED WITHOUT REASONABLE, ROUTINE, INSPECTION, MAINTENANCE AND SUPERVISION. IF THE BUILDING IN WHICH ANY SUCH DEVICE IS LOCATED WILL BE VACANT, CARE SHOULD BE TAKEN THAT SUCH DEVICE IS ROUTINELY INSPECTED, MAINTAINED AND MONITORED. IN THE EVENT THAT THE BUILDING MAYBE EXPOSED TO FREEZING TEMPERATURES AND WILL BE VACANT, ALL WATER-BEARING PIPES SHOULD BE DRAINED, THE BUILDING SHOULD BE PROPERLY WINTERIZED, AND THE WATER SOURCE CLOSED. IN THE EVENT THAT THE BUILDING MAY BE EXPOSED TO FREEZING TEMPERATURES AND WILL BE VACANT, ANY HYDRONIC COIL UNITS SHOULD BE DRAINED AS WELL AND, IN SUCH CASE, ALTERNATIVE HEAT SOURCES SHOULD BE UTILIZED.

WARNING

TO PREVENT POSSIBLE PROPERTY DAMAGE, PERSONAL INJURY OR DEATH DUE TO ELECTRICAL SHOCK, THE FURNACE MUST BE LOCATED TO PROTECT THE ELECTRICAL COMPONENTS FROM WATER.

DANGER
PELIGRO

CARBON MONOXIDE POISONING HAZARD

Special Warning for Installation of Furnace or Air Handling Units in Enclosed Areas such as Garages, Utility Rooms or Parking Areas

Carbon monoxide producing devices (such as an automobile, space heater, gas water heater, etc.) should not be operated in enclosed areas such as unventilated garages, utility rooms or parking areas because of the danger of carbon monoxide (CO) poisoning resulting from the exhaust emissions. If a furnace or air handler is installed in an enclosed area such as a garage, utility room or parking area and a carbon monoxide producing device is operated therein, there must be adequate, direct outside ventilation.

This ventilation is necessary to avoid the danger of CO poisoning which can occur if a carbon monoxide producing device continues to operate in the enclosed area. Carbon monoxide emissions can be (re)circulated throughout the structure if the furnace or air handler is operating in any mode.

CO can cause serious illness including permanent brain damage or death.

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WARNING

SHOULD OVERHEATING OCCUR OR THE GAS SUPPLY FAIL TO SHUT OFF, TURN OFF THE MANUAL GAS SHUTOFF VALVE EXTERNAL TO THE FURNACE BEFORE TURNING OFF THE ELECTRICAL SUPPLY.

WARNING

POSSIBLE PROPERTY DAMAGE, PERSONAL INJURY OR DEATH DUE TO FIRE, EXPLOSION, SMOKE, SOOT, CONDENSATION, ELECTRICAL SHOCK OR CARBON MONOXIDE MAY RESULT FROM IMPROPER INSTALLATION, REPAIR OPERATION, OR MAINTENANCE OF THIS PRODUCT.

PRODUCT DESIGN

Electrostatic Discharge (ESD) Precautions

NOTE: Discharge body's static electricity before touching unit. An electrostatic discharge can adversely affect electrical components.

Use the following precautions during furnace installation and servicing to protect the integrated control module from damage. By putting the furnace, the control, and the person at the same electrostatic potential, these steps will help avoid exposing the integrated control module to electrostatic discharge. This procedure is applicable to both installed and non-installed (ungrounded) furnaces.

1. Disconnect all power to the furnace. Do not touch the integrated control module or any wire connected to the control prior to discharging your body's electrostatic charge to ground.
2. Firmly touch a clean, unpainted, metal surface of the furnaces near the control. Any tools held in a person's hand during grounding will be discharged.
3. Service integrated control module or connecting wiring following the discharge process in step 2. Use caution not to recharge your body with static electricity; (i.e., do not move or shuffle your feet, do not touch ungrounded objects, etc.). If you come in contact with an ungrounded object, repeat step 2 before touching control or wires.
4. Discharge your body to ground before removing a new control from its container. Follow steps 1 through 3 if installing the control on a furnace. Return any old or new controls to their containers before touching any ungrounded object.

⚠ WARNING

TO PREVENT PROPERTY DAMAGE, PERSONAL INJURY OR DEATH DUE TO FIRE, DO NOT INSTALL THIS FURNACE IN A MOBILE HOME, TRAILER, OR RECREATIONAL VEHICLE.

Product Description

Features

General Information

The modulating furnace is part of the Goodman® brand & Amana® brand family of communicating ready products. The furnace may be used with conventional single or multi-stage thermostats as well as Goodman CTK01 communicating thermostats & CTK02** & CTK03 communicating-modulating thermostats using the ClimateTalk™ communicating protocol. Burner manifold pressure is controlled by negative air pressure created by the draft inducer. Gas valve, pressure switch assembly, and induced draft blower are linked together by pneumatic tubing. The furnace features a Honeywell gas valve capable of variable gas input rates as low as 35% and up to 100% of rated input. Indoor air is delivered by an Emerson UltraTech® ECM motor which bases the CFM need off of the burner input. The modulating furnace operation is based off of negative pressure created by the draft inducer. The Integrated Furnace Control (IFC) receives commands from the room thermostat. The IFC then controls the RPM of the (3 phase) inducer by varying the frequency and voltage to the inducer. This is known as variable frequency drive (VFD)..

Acceptable Equipment Combinations

With CTK0* Communicating Thermostat:

1. Modulating furnace alone
2. Modulating furnace with Goodman® brand / Amana® brand communicating split A/C or H/P unit (no separate dual fuel control is required)
3. Modulating furnace with non-communicating 1 stage A/C split unit (can not support a 2 stage A/C or a non-communicating heat pump)

With Conventional Non-Communicating Thermostat (Single or Multi-Stage)

1. Modulating furnace alone
2. Modulating furnace with Goodman / Amana communicating split A/C or H/P unit (a dual fuel thermostat or separate dual fuel control is required for H/P)
3. Modulating furnace with non-communicating split A/C or H/P (a dual fuel thermostat or separate dual fuel control is required for H/P)

Product Application

This furnace is primarily designed for residential home-heating applications. It is NOT designed or certified for use in mobile homes, trailers or recreational vehicles. Neither is it designed or certified for outdoor applications. The furnace **MUST** be installed indoors (i.e., attic space, crawl space, or garage area provided the garage area is enclosed with an operating door).

This furnace can be used in the following non-industrial commercial applications:

Schools, Office buildings, Churches, Retail stores,
Nursing homes, Hotels/motels,
Common or office areas

In such applications, the furnace must be installed with the following stipulations:

- It must be installed per the installation instructions provided and per local and national codes.
- It must be installed indoors in a building constructed on site.
- It must be part of a ducted system and not used in a free air delivery application.
- It must not be used as a "make-up" air unit.
- It must be installed with two-pipe systems for combustion air.

PRODUCT DESIGN

- All other warranty exclusions and restrictions apply This furnace is an ETL dual-certified appliance and is appropriate for use with natural or propane gas (**NOTE:** If using propane, a propane conversion kit is required).

Dual certification means that the combustion air inlet pipe is optional and the furnace can be vented as a:

Non-direct vent (single pipe) central forced air furnace in which combustion air is taken from the installation area or from air ducted from the outside or,

Direct vent (dual pipe) central forced air furnace in which all combustion air supplied directly to the furnace burners through a special air intake system outlined in these instructions.

This furnace may be used as a construction site heater **ONLY** if all of the following conditions are met:

- The vent system is permanently installed per these installation instructions.
- A room thermostat is used to control the furnace. Fixed jumpers that provide continuous heating CANNOT be used and can cause long term equipment damage.
- Return air ducts are provided and sealed to the furnace.
- A return air temperature range between 60ºF (16ºC) and 80ºF (27ºC) is maintained.
- Air filters are installed in the system and maintained during construction replaced as appropriate during construction, and upon completion of construction.
- The input rate and temperature rise are set per the furnace rating plate.
- 100% outside air is provided for combustion air requirements during construction. Temporary ducting can be used.

  NOTE: Do not connect the temporary duct directly to the furnace. The duct must be sized for adequate combustion and ventilation in accordance with the latest edition of the National Fuel Gas Code NFPA 54/ANSI Z223.1 or CAN/CSA B149.1 Installation Codes.
- The furnace heat exchanger, components, duct system, air filters and evaporator coils are thoroughly cleaned following final construction clean up.
- All furnace operating conditions (including ignition, input rate, temperature rise and venting) are verified according to these installation instructions.

NOTE: The Commonwealth of Massachusetts requires that the following additional requirements must also be met:

- Gas furnaces must be installed by a licensed plumber or gas fitter.
- A T-handle gas cock must be used.
- If the unit is to be installed in an attic, the passageway to and the service area around the unit must have flooring.

To ensure proper furnace operation, install, operate and maintain the furnace in accordance with these installation and operation instructions, all local building codes and ordinances. In their absence, follow the latest edition of the National Fuel Gas Code (NFPA 54/ANSI Z223.1), and/or CAN/CSA B149 Installation Codes, local plumbing or waste water codes, and other applicable codes.

A copy of the National Fuel Gas Code (NFPA 54/ANSI Z223.1) can be obtained from any of the following:

American National Standards Institute

1430 Broadway

New York, NY 10018

National Fire Protection Association

1 Batterymarch Park

Quincy, MA 02269

CSA International

8501 East Pleasant Valley

Cleveland, OH 44131

The rated heating capacity of the furnace should be greater than or equal to the total heat loss of the area to be heated. The total heat loss should be calculated by an approved method or in accordance with "ASHRAE Guide" or "Manual J-Load Calculations" published by the Air Conditioning Contractors of America.

A copy of the CAN/CSA B149 Installation Codes can also be obtained from:

CSA International

178 Rexdale Boulevard

Etobicoke, Ontario, Canada M9W 1R3

Location Requirements & Considerations

Follow the instructions listed below and the guidelines provided in the *Combustion and Ventilation Air Requirements* section when selecting a furnace location.

Furnace Models

The 96% AFUE modulating furnace comes in up flow / horizontal and down flow / horizontal models

Upflow Models

A/GMVM960603BX**

A/GMVM960805CX**

A/GMVM961005DX**

A/GMVM961155DX**

Down Flow Models

A/GCVM960604CX**

A/GCVM960805DX**

A/GCVM961005DX

PRODUCT DESIGN

Furnace Components

Heat Exchanger Assembly

The primary heat exchanger is a tubular type constructed of high quality steel (stainless steel for Amana Brand, aluminized for Goodman) the heat exchanger assembly consists of primary and secondary sections crimped together on a back transition plate. The secondary heat exchanger is a single pass coil consisting of stainless steel tubes and aluminum fins. These stainless steel tubes are expanded on to the aluminum fins to enhance heat transfer. Each tube in the secondary heat exchanger contains an internal turbulator to effectively scrub heat from the flue gases. Flue gas condensation takes place in the secondary heat exchanger as latent heat is transferred from the flue gases to heat the conditioned space.

Burners

Depending on the size of the furnace, each furnace will have from three to five inshot burners. Burners are precisely constructed of aluminized steel and designed to provide proper ignition and flame stability. When converting the modulating furnace to L.P. gas, the factory installed burners must be replaced by burners that come in the L.P. kit.

Gas Manifold Assembly

Each gas manifold is fitted with the appropriate number of #45 natural gas orifices. At 100% of gas input, each burner will provide approximately 20,000 BTUH. The A/GMVM951155DX models uses #43 gas orifices at 22,500 per hour. If converting to LP gas, the factory installed manifold assembly must be replaced by the manifold assembly provided in the LP kit.

ECM Motor

An Emerson® UltraTech® four wire indoor fan motor provides supply air to the conditioned space. This is the same motor used on Goodman & Amana previous generation communicating furnaces.

Induced Draft Blower (IDB)

All modulating furnace models use a three phase induced draft blower to draw flue gases through the heat exchanger. The inducer uses ball bearings and is permanently lubricated. This motor is driven at varying speeds by the VFD (variable frequency drive) section of the IFC. The IFC takes typical single phase power supplied to the furnace and converts it to a three phase supply to operate the draft inducer at the desired speed. The windings of the induced draft motor will have equal resistance +/- 5%. Normal resistance readings at room temperature will range from 14-17 ohms. The voltage supplied by the IFC to drive the induced draft blower will vary from 15-110 volts A/C between any two windings. This would be read between any two of the three power wires between the IFC and the induced draft blower. This voltage to the IBD will vary between furnace models and is dependant on what percentage of maximum fire is being called for. The power wires are colored red, white, and black. A green colored ground wire is also present.

Hot Surface Igniter

Modulating furnaces use a 115 volt silicon nitride hot surface igniter. This is the familiar and reliable 0131F00008S igniter with 17 second warm up time. At room temperature the igniter has a resistance range of 37 - 68 ohms. The H.S.I. is connected electrically to the IFC by a 3/16" push-on connection.

Gas Valve

Modulating furnaces use a 24 VAC pneumatically operated gas valve by Honeywell. The valve is energized by the integrated furnace control on a call for heat, wired in series through the front-cover pressure switch. The firing rate percentage is determined by the negative pressure created by the operation of the draft inducer. The gas valve is factory set and ***non-adjustable*** in the field. Do not remove the seal covering the regulator screws or attempt to adjust either of the regulator screws.

Inductor Coil

Wired in series with ¾ and 1 HP ECM motors; the inductor coil conditions the power supply to the motor, smoothing out spikes and electrical noise. With voltage applied to one side of the inductor coil, the output voltage to the motor should be the same as incoming voltage.

Integrated Furnace Control (IFC)

The IFC is the main control center for the furnace. It has many functions including;

- Receiving commands from the thermostat for heating, and cooling, continuous fan operation.
- Receiving commands for dehumidification and humidification.
- Communicating with the ECM motor for proper air delivery to the conditioned space.
- Assuring safe ignition by checking the state of pressure switches and limit switches before and after ignition.
- Assuring safe operation by continuously monitoring the presence of flame, the state of the pressure switches and limit and roll out switches.
- Displays information on the dual seven segment displays regarding thermostat call, air flow delivery and fault status
- Controlling the speed of the induced draft blower by variable voltage & frequency.

Features of the IFC:

<u>Aux Terminals</u> Located next to the low voltage connector, there are two terminals labeled aux in & aux out. A factory jumper is installed between these two terminals. As an option; the jumper may be removed and the terminals wired up to a normally closed float switch. The switch must be closed for normal operation. If the switch is sensed open, the IFC will:

- Terminate a call for gas heat.

PRODUCT DESIGN

- When the modulating furnace is installed with a communicating thermostat and a non-communicating a/c unit, the IFC will open the Y1 relay to turn off the condensing unit
- Log and display an auxiliary open error code
- Once the auxiliary switch re-closes the IFC reverts back to normal operation

Hum Terminals A pair of ¼" HUM terminals are located on the board to power a humidifier. These are dry contacts rated at 1 amp. A typical application of these contacts would be to supply one of the Hum contacts with power from the L1 terminal and connect the remaining Hum terminal to a humidifier transformer primary. When used with the CTK02** or CTK03 thermostat, these contacts will close with a call for humidity and the furnace indoor blower will be powered at continuous fan speed. When used with a 24 volt control system, the Hum contacts will close on a call for heat when the induced draft blower is powered.

EAC Terminal A ¼" EAC terminal is provided. Any time the indoor blower motor is powered, the EAC terminal will be powered. Contact is rated for 1 amp

Flame Proving. Flame signal is continuously monitored by the IFC. The flame rod, flame rod wire and proper grounding are all critical to proving the presence of flame. Because of the design of the Honeywell flame proving system, reading flame signal with a microamp meter will not provide reliable and consistent results and is therefore not a recommended practice. The IFC has a built in warning (E6) if flame signal is approaching the low threshold.

Field Test Mode This feature can be used by the service technician to quickly bring a furnace up to high fire. Entering field test mode will by-pass the staging routine and allow the furnace to run at 100% of rated input. To use field test mode; during a call for heat, press the fault recall button twice within 5 seconds, the display will change to Ft, then press and hold the fault recall button for a few seconds until the display flashes Ft. The furnace will stay in field test mode for 5 minutes or until the call for heat is removed.

Dual 7 Segment Displays The modulating furnace IFC has dual 7 segment displays to provide service information. This information includes; present thermostat demand, CFM, and fault codes.

Fault Recall This feature allows the service person to check for any fault history. The board memory is capable of recording and storing 10 fault codes. To use this feature, the furnace must not have an existing thermostat call. Pressure fault recall button from 2-5 seconds (until the display goes blank) then release, all faults will be displayed one at a time, beginning with the most recent, max of 3 consecutive faults will be stored. When all errors have been displayed the display returns to ON. To erase stored faults, hold the fault recall button until the display starts flashing, then release.

WARNING

TO PREVENT POSSIBLE EQUIPMENT DAMAGE, PROPERTY DAMAGE, PERSONAL INJURY OR DEATH, THE FOLLOWING BULLET POINTS MUST BE OBSERVED WHEN INSTALLING THIS UNIT.

WARNING

POSSIBLE PROPERTY DAMAGE, PERSONAL INJURY OR DEATH DUE TO FIRE, EXPLOSION, SMOKE, SOOT, CONDENSATION, ELECTRICAL SHOCK OR CARBON MONOXIDE MAY RESULT FROM IMPROPER INSTALLATION, REPAIR OPERATION, OR MAINTENANCE OF THIS PRODUCT.

- Centrally locate the furnace with respect to the proposed or existing air distribution system.
- Ensure the temperature of the return air entering the furnace is between 55°F and 100°F when the furnace is heating.
- Provide provisions for venting combustion products outdoors through a proper venting system. Special consideration should be given to vent/flue pipe routing and combustion air intake pipe when applicable. Refer to *Vent/Flue Pipe and Combustion Air Pipe -Termination Locations* for appropriate termination locations and to determine if the piping system from furnace to termination can be accomplished within the guidelines given. **NOTE:** The length of flue and/or combustion air piping can be a limiting factor in the location of the furnace.
- Locate the furnace so condensate flows downwards to the drain. Do not locate the furnace or its condensate drainage system in any area subject to below freezing temperatures without proper freeze protection. Refer to *Condensate Drain Lines and Trap* for further details.
- Ensure adequate combustion air is available for the furnace. Improper or insufficient combustion air can expose building occupants to gas combustion products that could include carbon monoxide. Refer to *Combustion and Ventilation Air Requirements.*
- Set the furnace on a level floor to enable proper condensate drainage. If the floor becomes wet or damp at times, place the furnace above the floor on a concrete base sized approximately 1-1/2" larger than the base of the furnace. Refer to the *Horizontal Applications and Considerations* for leveling of horizontal furnaces.
- Ensure upflow or horizontal furnaces are not installed directly on carpeting, or any other combustible material. The only combustible material allowed is wood.
- A special accessory subbase must be used for upright counterflow unit installations over any combustible material (including wood). Refer to subbase instructions for installation details. (**NOTE:** A subbase will not be required if an air conditioning coil is located beneath the furnace between the supply air opening and the combustible floor.

PRODUCT DESIGN

- Exposure to contaminated combustion air will result in safety and performance-related problems. Do not install the furnace where the combustion air is exposed to the following substances:
  - permanent wave solutions
  - chlorinated waxes or cleaners
  - chlorine-based swimming pool chemicals
  - water softening chemicals
  - deicing salts or chemicals
  - carbon tetrachloride
  - halogen type refrigerants
  - cleaning solutions (such as perchloroethylene)
  - printing inks
  - paint removers
  - varnishes
  - hydrochloric acid
  - cements and glues
  - antistatic fabric softeners for clothes dryers
  - and masonry acid washing materials
- Isolate a non-direct furnace from an area contaminated by any of the above substances. This protects the *non-direct vent* furnace from airborne contaminants. To ensure that the enclosed *non-direct vent* furnace has an adequate supply of combustion air, vent from a nearby uncontaminated room or from outdoors. Refer to the *Combustion and Ventilation Air Requirements* for details.
- If the furnace is used in connection with a cooling unit, install the furnace upstream or in parallel with the cooling coil. Premature heat exchanger failure will result if the cooling coil is placed upstream of the furnace.

  For vertical (upflow or downflow) applications, the minimum cooling coil width shall not be less than furnace width minus 1". Additionally, a coil installed above an upflow furnace or under a counterflow furnace may be the same width as the furnace or may be one size larger than the furnace. *Example: a "C" width coil may be installed with a "B" width furnace.*

  For upflow applications, the front of the coil and furnace must face the same direction.
- If the furnace is installed in a residential garage, position the furnace so that the burners and ignition source are located not less than 18 inches (457 mm) above the floor. Protect the furnace from physical damage by vehicles.
- If the furnace is installed horizontally, ensure the access doors are not on the "up/top" or "down/bottom" side of the furnace.
- Do not connect this furnace to a chimney flue that serves a separate appliance designed to burn solid fuel.
- On Counterflow Installations, the air conditioning coil must be downstream on the supply (positive) side of the furnace heat exchanger.
- *Counterflow Installation over a noncombustible floor.* Before setting the furnace over the plenum opening, ensure the surface around the opening is smooth and level. A tight seal should be made between the furnace base and floor by using a silicone rubber caulking compound or cement grout.
- *Counterflow Installation over a combustible floor.* If installation over a combustible floor becomes necessary, use an accessory subbase (see Specification Sheet applicable for your model for details.) A special accessory subbase must be used for upright counterflow unit installations over any combustible material including wood. Refer to subbase instructions for installation details. Follow the instructions with the subbase for proper installation.

Do not install the furnace directly on carpeting, tile, or other combustible material other than wood flooring. (**NOTE**: The subbase will not be required if an air conditioning coil is installed between the supply air opening on the furnace and the floor.)

CLEARANCES AND ACCESSIBILITY

***MVM96* MINIMUM CLEARNACE TO COMBUSTIBLE MATERIALS (INCHES)**

POSITION*	FRONT	SIDES	REAR	TOP	FLUE	FLOOR
Upflow	3	0	0	1	0	C
Horizontal	Alcove	6	0	4	0	C

* = All positioning is determined as installed unit is viewed from the front.
C = If placed on combustible floor, floor MUST be wood only.
NC = For installation on non-combustible floors only. A combustible subbase must be used for installations on combustible flooring.

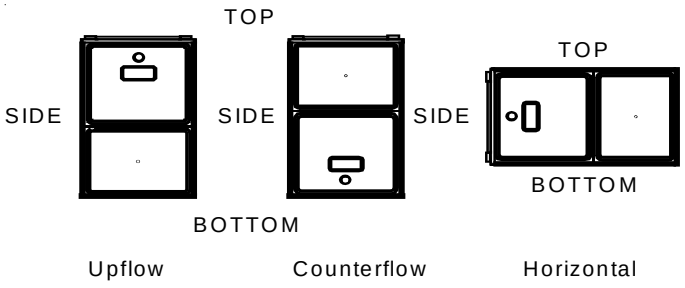
***CVM96* MINIMUM CLEARNACE TO COMBUSTIBLE MATERIALS (INCHES)**

POSITION*	FRONT	SIDES	REAR	TOP	FLUE	FLOOR
Upflow	1	0	0	1	0	NC
Horizontal	Alcove	6	0	4	0	C

* = All positioning is determined as installed unit is viewed from the front.
C = If placed on combustible floor, floor MUST be wood only.
NC = For installation on non-combustible floors only. A combustible subbase must be used for installations on combustible flooring.

Installations must adhere to the clearances to combustible materials to which this furnace has been design certified. The minimum clearance information for this furnace is provided on the unit's clearance label. These clearances must be permanently maintained. Clearances must also accommodate an installation's gas, electrical, and drain trap and drain line connections. If the alternate combustion air intake or vent/flue connections are used additional clearance must be provided to accommodate these connections. Refer to *Vent/Flue Pipe and Combustion Air Pipe* for details. **NOTE:** In addition to the required clearances to combustible materials, a minimum of 24 inches service clearance must be available in front of the unit.

PRODUCT DESIGN



A furnace installed in a confined space (i.e., a closet or utility room) must have two ventilation openings with a total minimum free area of 0.25 square inches per 1,000 BTU/hr of furnace input rating. Refer to Specification Sheet applicable to your model for minimum clearances to combustible surfaces. One of the ventilation openings must be within 12 inches of the top; the other opening must be within 12 inches of the bottom of the confined space.

Existing Furnace Removal

NOTE: When an existing furnace is removed from a venting system serving other appliances, the venting system may be too large to properly vent the remaining attached appliances.

The following vent testing procedure is reproduced from the **American National Standard/National Standard of Canada for Gas-Fired Central Furnaces ANSI Z21.4, CSA-2.3 latest edition Section 1.23.1.**

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

1. Seal any unused openings in the venting system;
2. Inspect the venting system for proper size and horizontal pitch, as required by the National Fuel Gas Code, ANSI Z223.1 or the Natural Gas and Propane Installation Code, CSA B149.1-05 and these instructions. Determine that there is no blockage or restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition.
3. As far as practical, close all building doors and windows and all doors between the space in which the appliance(s) connected to the venting system are located and other spaces of the building.
4. Close fireplace dampers.
5. Turn on clothes dryers and any appliance not connected to the venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they shall operate at maximum speed. Do not operate a summer exhaust fan.
6. Follow the lighting instructions. Place the appliance being inspected in operation. Adjust thermostat so appliance shall operate continuously.
7. Test for spillage from draft hood appliances at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle.
8. If improper venting is observed during any of the above tests, the venting system must be corrected in accordance with the National Fuel Gas Code ANSI Z223.1/NFPA 54 and/or National Gas and Propane Installation Code CSA B149.1-05.
9. After it has been determined that each appliance connected to the venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas burning appliance to their previous conditions of use.

If resizing is required on any portion of the venting system, use the appropriate table in Appendix G in the latest edition of the National Fuel Gas Code ANSI Z223.1 and/or CSA B149.1-05 Installation Codes.

Thermostat Location

The thermostat should be placed approximately five feet from the floor on a vibration-free, inside wall in an area having good air circulation. Do not install the thermostat where it may be influenced by any of the following:

- Drafts, or dead spots behind doors, in corners, or under cabinets.
- Hot or cold air from registers.
- Radiant heat from the sun.
- Light fixtures or other appliances.
- Radiant heat from a fireplace.
- Concealed hot or cold water pipes, or chimneys.
- Unconditioned areas behind the thermostat, such as an outside wall.

Consult the instructions packaged with the thermostat for mounting instructions and further precautions.

Combustion & Ventilation Air Requirements

⚠ WARNING

TO AVOID PROPERTY DAMAGE, PERSONAL INJURY OR DEATH, SUFFICIENT FRESH AIR FOR PROPER COMBUSTION AND VENTILATION OF FLUE GASES MUST BE SUPPLIED. MOST HOMES REQUIRE OUTSIDE AIR BE SUPPLIED INTO THE FURNACE AREA.

Improved construction and additional insulation in buildings have reduced heat loss by reducing air infiltration and escape around doors and windows. These changes have helped in reducing heating/cooling costs but have created a problem supplying combustion and ventilation air for gas fired and other fuel burning appliances. Appliances that pull air out of the house (clothes dryers, exhaust fans, fireplaces, etc.) increase the problem by starving appliances for air.

House depressurization can cause back drafting or improper combustion of gas-fired appliances, thereby exposing building occupants to gas combustion products that could include carbon monoxide.

PRODUCT DESIGN

If this furnace is to be installed in the same space with other gas appliances, such as a water heater, ensure there is an adequate supply of combustion and ventilation air for the other appliances. Refer to the latest edition of the National Fuel Gas Code NFPA 54/ANSI Z223.1 or CAN/CSA B149 Installation Codes or applicable provisions of the local building codes for determining the combustion air requirements for the appliances.

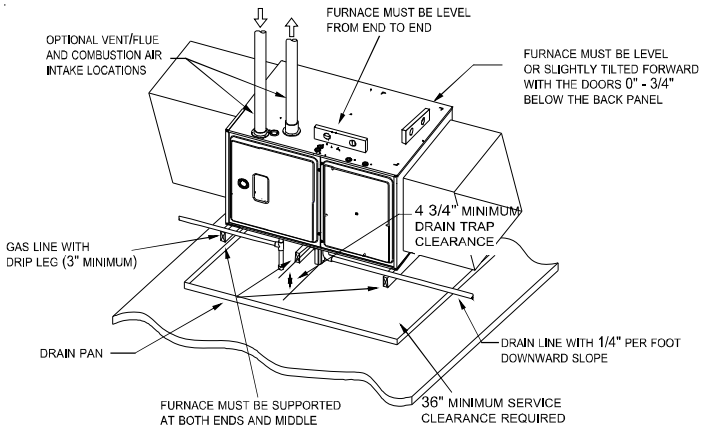
Most homes will require outside air be supplied to the furnace area by means of ventilation grilles or ducts connecting directly to the outdoors or spaces open to the outdoors such as attics or crawl spaces.

Installation Positions

This furnace may be installed in an upright position or horizontal on either the left or right side panel. Do not install this furnace on its back. For *upright upflow* furnaces, return air ductwork may be attached to the side panel(s) and/or basepan. For *horizontal upflow* furnaces, return air ductwork must be attached to the basepan. For both *upright or horizontal counterflow* furnaces, return ductwork must be attached to the basepan (top end of the blower compartment). **NOTE:** Ductwork must never be attached to the back of the furnace. Contact your distributor for proper airflow requirements and number of required ductwork connections. Refer to "Recommended Installation Positions" figure for appropriate installation positions, ductwork connections, and resulting airflow arrangements.

Horizontal Applications & Considerations

Horizontal applications, in particular, may dictate many of the installation's specifics such as airflow direction, ductwork connections, flue and combustion air pipe connections, etc. The basic application of this furnace as a horizontal furnace differs only slightly from an upright installation. When installing a furnace horizontally, additional consideration must be given to the following:

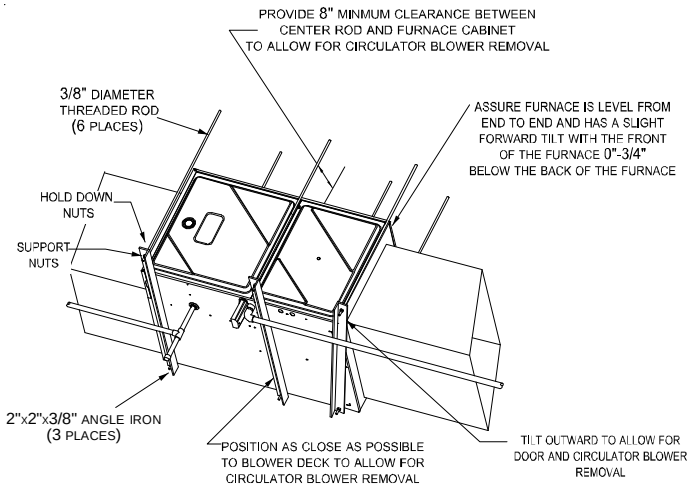


Horizontal Furnace

Furnace Suspension

If suspending the furnace from rafters or joists, use 3/8" threaded rod and 2"x2"x1/8" angle iron as shown in the following diagram. The length of rod will depend on the application and the clearances necessary.

If the furnace is installed in a crawl space it must be suspended from the floor joist or supported by a concrete pad. Never install the furnace on the ground or allow it to be exposed to water.



Drain Trap and Lines

In horizontal applications the condensate drain trap is secured to the furnace side panel, suspending it below the furnace. A minimum clearance of 4 3/4 inches below the furnace must be provided for the drain trap. Additionally, the appropriate downward piping slope must be maintained from the drain trap to the drain location. Refer to *Condensate Drain Trap and Lines* for further details. If the drain trap and drain line will be exposed to temperatures near or below freezing, adequate measures must be taken to prevent condensate from freezing.

Leveling

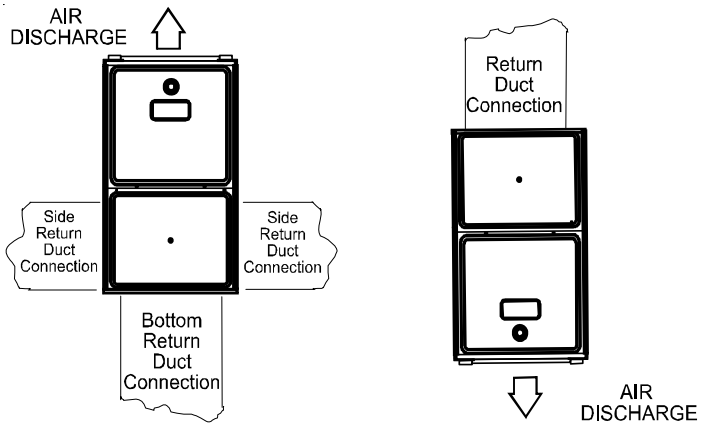
Leveling ensures proper condensate drainage from the heat exchanger and induced draft blower. For proper flue pipe drainage, the furnace must be level lengthwise from end to end. The furnace should also be level from back to front or have a slight tilt with the access doors downhill (approximately 3/4 inches) from the back panel. The slight tilt allows the heat exchanger condensate, generated in the recuperator coil, to flow forward to the recuperator coil front cover.

PRODUCT DESIGN

Alternate Vent/Flue and Combustion Air Connections

In horizontal installations with the furnace laying on the left hand side, the alternate vent connection may be used. In this configuration, the internal elbow is removed The standard piping connections may also be used in these positions. Refer to *Vent/Flue Pipe and Combustion Air Pipe* for details concerning the conversion to the alternate vent/flue and combustion air connections.

When using the horizontal alternate vent configuration, you must use the RF000142 vent drain kit. See following illustration.



Recommended Installation Positions

NOTE: Alternate "vertical" piping connections can not be used when an upflow furnace is installed with supply air discharging to the right, or when a counterflow furnace is installed with supply air discharging to the left. In either case, use the standard flue and combustion air piping connections.

Alternate Electrical and Gas Line Connections

This furnace has provisions allowing for electrical and gas line connections through either side panel. In horizontal applications the connections can be made either through the "top" or "bottom" of the furnace.

Drain Pan

A drain pan must be provided if the furnace is installed above a conditioned area. The drain pan must cover the entire area under the furnace (and air conditioning coil if applicable).

Freeze Protection

Refer to *Horizontal Applications and Conditions - Drain Trap and Lines.*

Propane Gas/High Altitude Installations

⚠ WARNING

POSSIBLE PROPERTY DAMAGE, PERSONAL INJURY OR DEATH MAY OCCUR IF THE CORRECT CONVERSION KITS ARE NOT INSTALLED. THE APPROPRIATE KITS MUST BE APPLIED TO ENSURE SAFE AND PROPER FURNACE OPERATION. ALL CONVERSIONS MUST BE PERFORMED BY A QUALIFIED INSTALLER OR SERVICE AGENCY.

This furnace is shipped from the factory configured for natural gas up to 10,000 ft. altitude. Propane conversions require the proper LP kit to compensate for the energy content difference between natural and propane gas.

LP kits include a manifold assembly, including an LP gas valve, orifices and LP burners.

Gas	Altitude	Kit	Orifice	Manifold Pressure		Pressure Switch Change
				High Stage	Low Stage	
Natural	0-7000	None	#45[1]	3.5" w.c.	1" w.c.	None
Propane		LPKMOD*****	1.25MM[2]	10.0" w.c.	2.6" w.c.	None

NOTE: In Canada, gas furnaces are only certified to 4500 feet.

[1] Except 115,000 BTU: #43

[2] Except 115,000 BTU: #55

Furnace Model	LP Kit
A/GMVM960603BX	LPKMOD060UF
A/GMVM960805CX	LPKMOD080UF
A/GMVM961005DX	LPKMOD100UF
A/GMVM961155DX	LPKMOD115UF
A/GCVM960604CX	LPKMOD060CF
A/GCVM960805DX	LPKMOD080CF
A/GCVM961005DX	LPKMOD100CF

The indicated kits must be used to insure safe and proper furnace operation. All conversions must be performed by a qualified installer, or service agency.

PRODUCT DESIGN

Vent/Flue Pipe & Combustion Air Pipe

WARNING

FAILURE TO FOLLOW THESE INSTRUCTIONS CAN RESULT IN BODILY INJURY OR DEATH. CAREFULLY READ AND FOLLOW ALL INSTRUCTIONS GIVEN IN THIS SECTION.

WARNING

UPON COMPLETION OF THE FURNACE INSTALLATION, CAREFULLY INSPECT THE ENTIRE FLUE SYSTEM BOTH INSIDE AND OUTSIDE OF THE FURNACE TO ASSURE IT IS PROPERLY SEALED. LEAKS IN THE FLUE SYSTEM CAN RESULT IN SERIOUS PERSONAL INJURY OR DEATH DUE TO EXPOSURE TO FLUE PRODUCTS, INCLUDING CARBON MONOXIDE.

A condensing gas furnace achieves its high level of efficiency by extracting almost all of the heat from the products of combustion and cooling them to the point where condensation takes place. Because of the relatively low flue gas temperature and water condensation requirements, PVC pipe is used as venting material.

This furnace must not be connected to Type B, BW, or L vent or vent connector, and must not be vented into any portion of a factory built or masonry chimney except when used as a pathway for PVC as described later in this section. Never common vent this appliance with another appliance or use a vent which is used by a solid fuel appliance. Do not use commercially available "no hub connectors" other than those shipped with this product.

It is the responsibility of the installer to follow the manufacturers' recommendations and to verify that all vent/flue piping and connectors are compatible with furnace flue products. Additionally, it is the responsibility of the installer to ensure that all piping and connections possess adequate structural integrity and support to prevent flue pipe separation, shifting, or sagging during furnace operation.

DUAL CERTIFICATION: NON-DIRECT/DIRECT VENT

This furnace is dual certified and may be installed as a non-direct vent (single pipe) or direct vent (dual pipe) appliance. A *non-direct vent* installation requires only a vent/flue pipe, while a *direct vent* installation requires both a vent/flue pipe and a combustion air intake pipe. Refer to the appropriate section for details concerning piping size, length, number of elbows, furnace connections, and terminations.

WARNING

TO AVOID BODILY INJURY, FIRE OR EXPLOSION, SOLVENT CEMENTS MUST BE KEPT AWAY FROM ALL IGNITION SOURCES (I.E., SPARKS, OPEN FLAMES, AND EXCESSIVE HEAT) AS THEY ARE COMBUSTIBLE LIQUIDS. AVOID BREATHING CEMENT VAPORS OR CONTACT WITH SKIN AND/OR EYES.

Two- or three-inch nominal diameter PVC Schedule 40 pipe meeting ASTM D1785, PVC primer meeting ASTM F656, and PVC solvent cement meeting ASTM D2564 specifications must be used. Fittings must be DWV type fittings meeting ASTM D2665 and ASTM D3311. Carefully follow the pipe manufacturer's instructions for cutting, cleaning, and solvent cementing of PVC.

The use of Schedule 40 PVC or ABS cellular core (Foam Core) plastic pipe is also acceptable as a flue/vent and intake pipe material. PVC primer meeting ASTM F656 and PVC solvent cement meeting ASTM D2564 specifications must be used. Fittings must be DWV type fittings meeting ASTM D2665 and ASTM D3311. Carefully follow the manufactures instructions for cutting, cleaning and solvent cementing of PVC.

MATERIALS AND JOINING METHODS

As an alternative to PVC pipe, primer, solvent cement, and fittings, ABS materials which are in compliance with the following specifications may be used. Two-or-three-inch ABS Schedule 40 pipe must meet ASTM D1527 and, if used in Canada, must be CSA listed. Solvent cement for ABS to ABS joints must meet ASTM D2235 and, if used in Canada, must be CSA listed. The solvent cement for the PVC to ABS transition joint must meet ASTM D3138. Fittings must be DWV type fittings meeting ASTM D2661 and ASTM D3311 and, if used in Canada, must be CSA listed. Carefully follow the manufacturers' instructions for cutting, cleaning, and solvent cementing PVC and/or ABS.

All 90° elbows must be medium radius (1/4 bend DWV) or long radius (Long sweep 1/4 bend DWV) types conforming to ASTM D3311. A medium radius (1/4 bend DWV) elbow measures 3 1/16" minimum from the plane of one opening to the centerline of the other opening for 2" diameter pipe, and 4 9/16" minimum for 3" pipe.

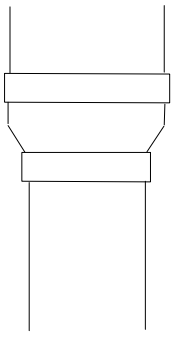
PROPER VENT/FLUE AND COMBUSTION AIR PIPING PRACTICES

Adhere to these instructions to ensure safe and proper furnace performance. The length, diameter, and number of elbows of the vent/flue pipe and combustion air pipe (when applicable) affects the performance of the furnace and must be carefully sized. All piping must be installed in accordance with local codes and these instructions.

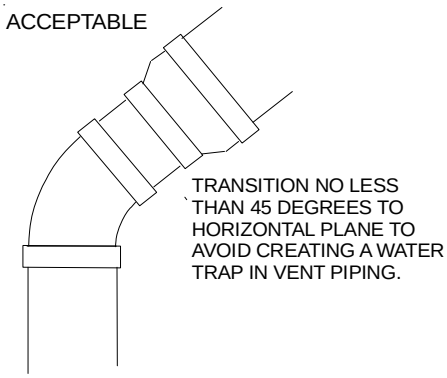
Piping must be adequately secured and supported to prohibit sagging, joint separation, and/or detachment from the furnace. Horizontal runs of vent/flue piping must be supported every three to five feet and must maintain a 1/4 inch per foot downward slope, back towards the furnace, to properly return condensate to the furnace's drain system.

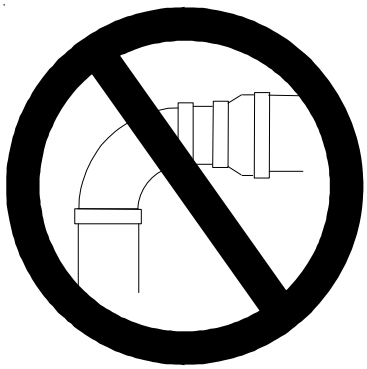
PREFERRED

TRANSITION MADE IN VERTICAL SECTION OF PIPE



PRODUCT DESIGN





Precautions should be taken to prevent condensate from freezing inside the vent/flue pipe and/or at the vent/flue pipe termination. All vent/flue piping exposed to temperatures below 35°F (2°C) for extended periods of time must be insulated with 1/2" thick closed cell foam. Also all vent/flue piping exposed outdoors in excess of the terminations shown in this manual (or in unheated areas) must be insulated with 1/2" thick closed cell foam. Inspect piping for leaks prior to installing insulation.

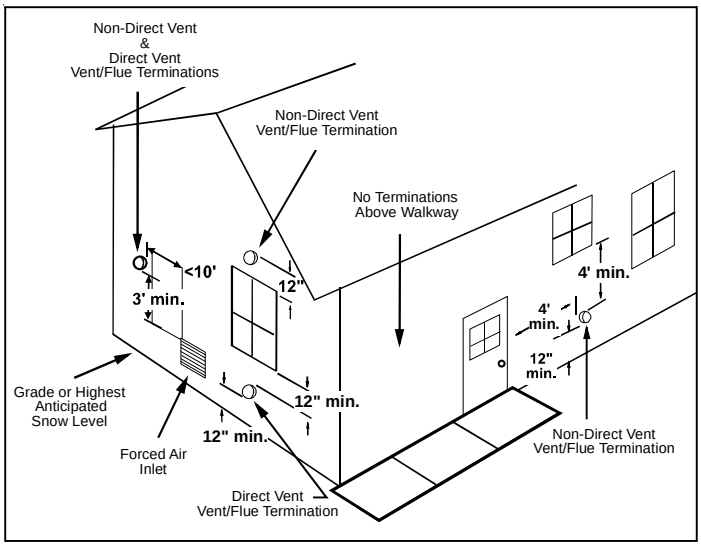
TERMINATION LOCATIONS

NOTE: Refer to *Location Requirements and Considerations* for combustion air contaminant restrictions.

The following bullets and diagram describe the restrictions concerning the appropriate location of vent/flue pipe and combustion air intake pipe (when applicable) terminations. Refer to *Non-Direct Vent (Single Pipe) Piping* and *Direct Vent (Dual Pipe) Piping* located in this section for specific details on termination construction.

- All terminations (flue and/or intake) must be located at least 12 inches above ground level or the anticipated snow level.
- Vent terminations (non-direct and direct vent) must terminate at least 3 feet above any forced air inlet located within 10 feet.

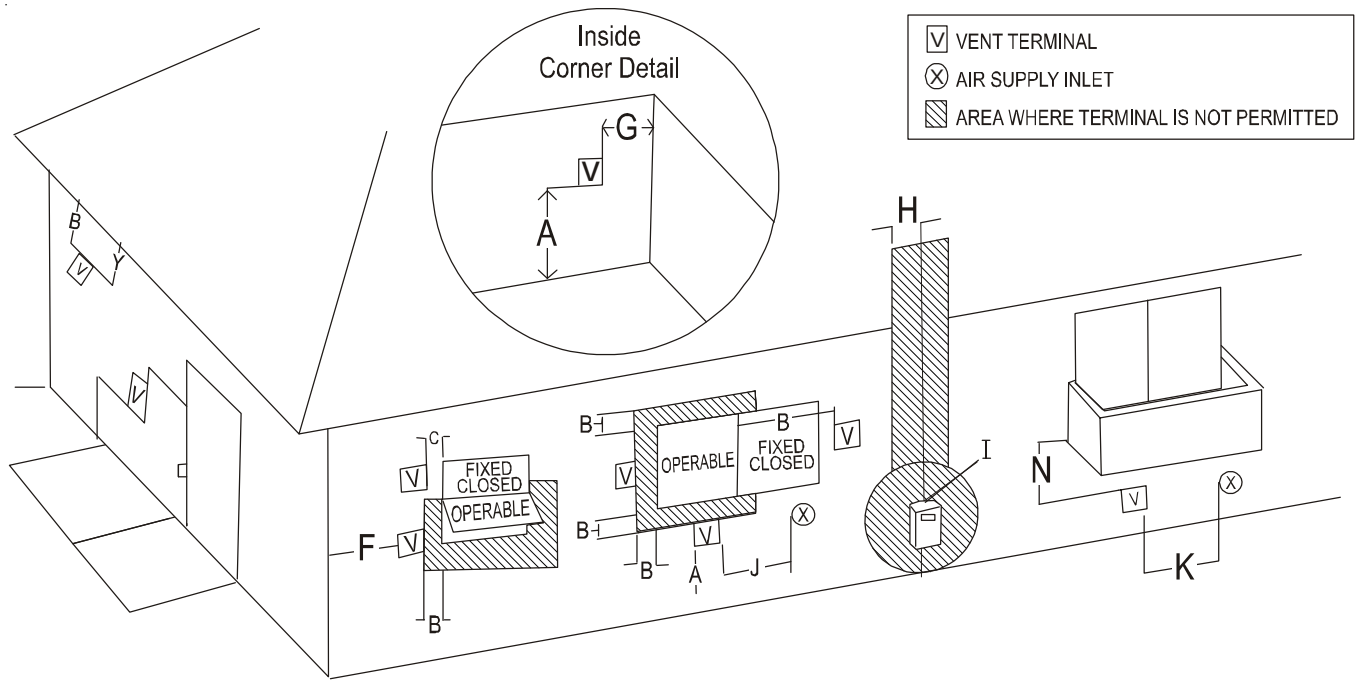
  NOTE: This provision does not apply to the combustion air intake termination of a direct vent application.
- The vent termination of a *non-direct vent* application must terminate at least 4 feet below, 4 feet horizontally from, or 1 foot above any door, window, or gravity air inlet into any building.
- The vent termination of a *direct vent* application must terminate at least 12 inches from any opening through which flue gases may enter a building (door, window, or gravity air inlet).
- The vent termination of vent pipe run vertically through a roof must terminate at least 12 inches above the roof line (or the anticipated snow level) and be at least 12 inches from any vertical wall (including any anticipated snow build up).
- A vent termination shall not terminate over public walkways or over an area where condensate or vapor could create a nuisance or hazard or could be detrimental to the operation of regulators, relief valves, or other equipment.
- The combustion air intake termination of a direct vent application should not terminate in an area which is frequently dusty or dirty.



Vent Termination Clearances

NOTE: In Canada, the CAN/CSA B149 Gas Installation Code takes precedence over the preceding termination restrictions.

PRODUCT DESIGN



DIRECT VENT TERMINAL CLEARANCES

		Canadian Installations [1]	U.S. Installations [2]
A=	Clearance above grade, veranda, porch, deck or balcony. (See 1.24.6-i(9)b.)	12 in. (30 cm)	12 in. (30 cm)
B=	Clearance to window or door that may be opened.	6 in. (15 cm) for appliances 10,000 Btuh (3 kW), 12 in. (30 cm) for appliances > 10,000 Btuh (3 kW) and 100,000 Btuh (30 kW), 36 in. (91 cm) for appliances > 100,000 Btuh (30 kW).	6 in. (15 cm) for appliances 10,000 Btuh (3 kW), 9 in. (23 cm) for appliances > 10,000 Btuh (3 kW) and 50,000 Btuh (15 kW), 12 in. (30 cm) for appliances > 500,000 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 ft. (91 cm) within a height 15 ft. (4.5 m) above the meter/regulator assembly.	*
I=	Clearance to service regulator vent outlet.	3 ft. (91 cm).	*
J=	Clearance to nonmechanical air supply inlet to building or the combustion air inlet to any other appliance.	6 in. (15 cm) for appliances 10,000 Btuh (3 kW), 12 in. (30 cm) for appliances > 10,000 Btuh (3kW) and 100,000 Btuh (30 kW), 36 in. (91 cm) for appliances > 100,000 Btuh (30 kW).	6 in. (15 cm) for appliances 10,000 Btuh (3 kW), 9 in. (23 cm) for appliances > 10,000 Btuh (3kW) and 50,000 Btuh (15 kW), 12 in. (30 cm) for appliances > 50,000 Btuh (15 kW).
K=	Clearance to a mechanical air supply inlet.	6 ft. (1.83 m)	3 ft. (91 cm) above if within 10 ft. (3 m) horizontally.
L=	Clearance above paved sidewalk or paved driveway located on public property.	7 ft. (2.13m) †	*
M=	Clearance under veranda, porch, deck or balcony.	12 in. (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 fanily 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 *CSA B149.1*, the following statement shall be included:

"Clearance in accordance wtih local installation codes and the requirements of the gas supplier and the manufacturer's installation instruction."

OTHER THAN DIRECT VENT TERMINAL CLEARANCES

		Canadian Installations [1]	U.S. Installations [2]
A=	Clearance above grade, veranda, porch, deck or balcony. (See 1.24.6-i(9)b.)	12 in. (30 cm)	12 in. (30 cm)
B=	Clearance to window or door that may be opened.	6 in. (15 cm) for appliances 10,000 Btuh (3 kW), 12 in. (30 cm) for appliances > 10,000 Btuh (3 kW) and 100,000 Btuh (30 kW), 36 in. (91 cm) for appliances > 100,000 Btuh (30 kW).	4 ft. (1.2 m) below or to side of opening; 1 ft. (300 m) above opening.
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 ft. (91 cm) within a height 15 ft. (4.5 m) above the meter/regulator assembly.	*
I=	Clearance to sevice regulator vent outlet.	3 ft. (91 cm).	*
J=	Clearance to nonmechanical air supply inlet to building or the combustion air inlet to any other appliance.	6 in. (15 cm) for appliances 10,000 Btuh (3 kW), 12 in. (30 cm) for appliances > 10,000 Btuh (3kW) and 100,000 Btuh (30 kW), 36 in. (91 cm) for appliances > 100,000 Btuh (30 kW).	4 ft. (1.2 m) below or to side of opening; 1 ft. (300 m) above opening.
K=	Clearance to a mechanical air supply inlet.	6 ft. (1.83 m)	3 ft. (91 cm) above if within 10 ft. (3 m) horizontally.
L=	Clearance above paved sidewalk or paved driveway located on public property.	7 ft. (2.13m) †	7 ft. (2.13m)
M=	Clearance under veranda, porch, deck or balcony.	12 in. (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 paveable driveway that is located between two single family dwellings and serves both dwelling.

‡ 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 *CSA B149.1*, the following statement shall be included:

"Clearance in accordance wtih local installation codes and the requirements of the gas supplier and the manufacturer's installation instruction."

PRODUCT DESIGN

Special Venting Requirements For Installations In Canada

All installations in Canada must conform to the requirements of CSAB149 code. All vent system components, including primer and cement, must be listed to ULC S636. The certified pipe and fittings should be clearly marked with the ULC standard "S636". The primer and cement used must be of the same manufacturer as the vent system. For Royal Pipe System 636; use GVS-65 Primer (Purple) and GVS-65 PVC Solvent Cement. For IPEX System 636, use PVC/CPVC Primer, Purple or clear. Use PVC Solvent Cement (Gray).

For Canadian installations, ABS may be used as a combustion air pipe only. ABS is not an approved vent material in Canada. If ABS is used as a combustion air pipe, it must be CSA certified. Always follow the manufacturer's instructions in the use of primer and cement. Do not use primer and cement around potential sources of ignition. Do not use primer or cement beyond its expiration date.

The vent can be run through an existing unused chimney provided the space between the vent pipe and the chimney is insulated and closed with a weather-tight, corrosion-resistant flashing.

Standard Furnace Connections

It is the responsibility of the installer to ensure that the piping connections to the furnace are secure, airtight, and adequately supported.

As shipped, attachment "couplings" for vent/flue and combustion air intake pipe connections are provided on the furnace's top cover (upflow) or basepan (counterflow). To use the standard connections, field supplied vent/flue pipe and combustion air intake pipe (when applicable) should be secured directly to the furnace at these locations.

Vent/Flue Pipe

Vent/flue pipe can be secured to the vent/flue coupling using the rubber coupling and worm gear hose clamps provided with this furnace (see "Standard Connections" figure). The rubber coupling allows separation of the vent/flue pipe from the furnace during servicing. Combustion Air and Vent piping should be routed in a manner to avoid contact with refrigerant lines, metering devices, condensate drain lines, etc.

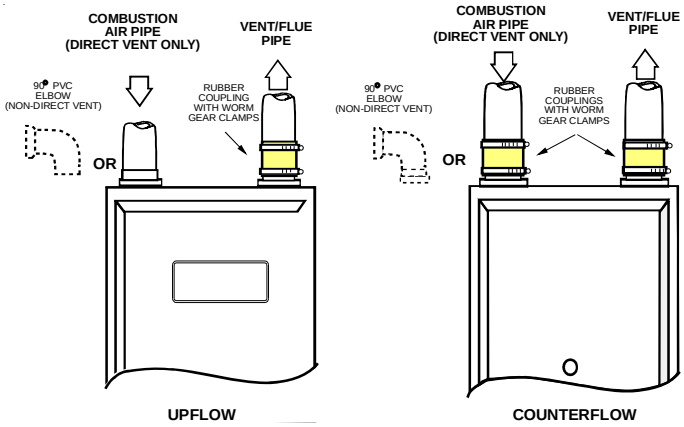
Combustion Air Pipe

Direct Vent Installations

On *upflow* units secure the combustion air intake pipe directly to the air intake coupling. On *counterflow* units secure the combustion air intake pipe to the air intake coupling using the rubber coupling and worm gear hose clamps provided with the unit. The counterflow rubber coupling allows service removal of air intake piping internal to the furnace blower compartment.

Non-Direct Vent Installations

A minimum of one 90° elbow should be installed on the combustion air intake "coupling" to guard against inadvertent blockage.



Standard Connections

WARNING

EDGES OF SHEET METAL HOLES MAY BE SHARP. USE GLOVES AS A PRECAUTION WHEN REMOVING HOLE PLUGS.

Alternate Vent/Flue Location

The alternate vent/flue location is the large hole directly in line with the induced draft blower outlet. To use the alternate vent/flue location refer to the following steps and the "Alternate Vent/Flue Location" figure.

NOTE: Counterflow instructions follow the upflow instructions.

1. Remove and save the four screws securing the vent/flue coupling to the furnace top panel.

Counterflow units.

Remove and save the four screws securing the vent/flue coupling to the furnace basepan. Also remove the three screws securing the furnace's internal vent/flue piping to the blower deck.

2. *Upflow* and *Counterflow* units.

   Loosen the worm gear hose clamps on the rubber elbow and detach it from both the induced draft blower and the vent/flue pipe.

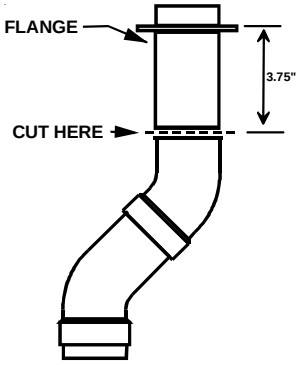
3. *Upflow* and *Counterflow* units.

   Remove the vent/flue pipe from the furnace.

4. Cut the vent/flue pipe 3.75 inches from the flanged end of the pipe (see "Vent/Flue Pipe Cuts" figure). The section of pipe attached to the coupling will reach through the side panel to the induced draft blower. Discard remaining pipe and elbows.

Counterflow units.

Cut the vent/flue pipe 3.75 inches from the blower deck coupling (see "Vent/Flue Pipe Cuts" figure). Save vent/flue pipe attached to blower deck coupling for use in the alternate location. Discard remaining pipe and elbows.



Vent/Flue Pipe Cuts

5. Remove plastic plug from alternate vent/flue location. Relocate and install plug in standard vent/flue location (top cover).

Counterflow units.

Remove plastic plug from alternate vent/flue location. Relocate and install plug in standard vent/flue location (basepan). Plug remaining hole in blower deck with plastic plug included in the drain kit bag.

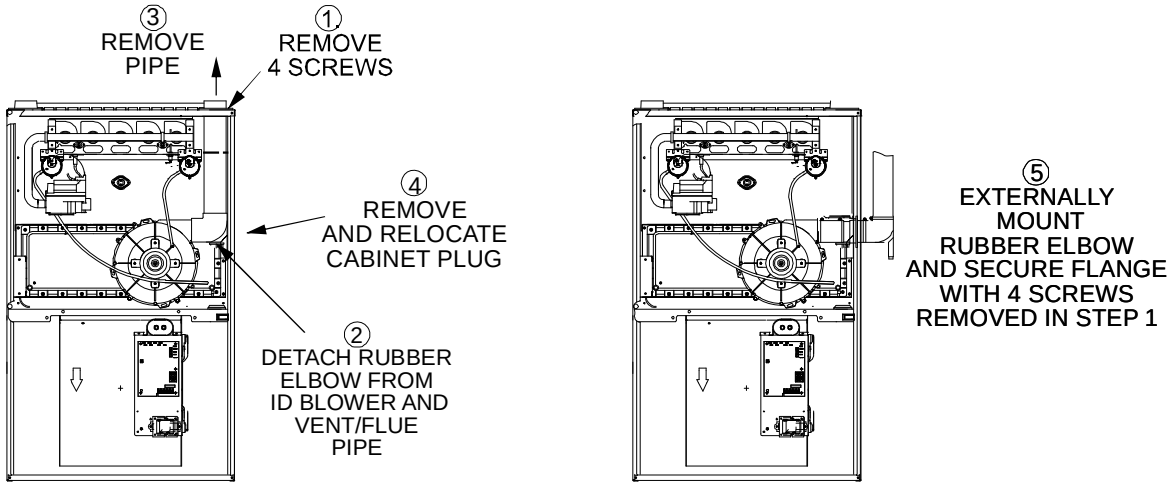
6. *Upflow* and *Counterflow* units.

   Insert cut section of vent/flue pipe and coupling into alternate vent/flue location. Using a rubber coupling and worm gear hose clamps from the drain kit bag, attach the vent/flue pipe and coupling to the induced draft blower. Secure the coupling to the cabinet using the screws removed in step 1 or with field-supplied 3/8" #8 self tapping screws.

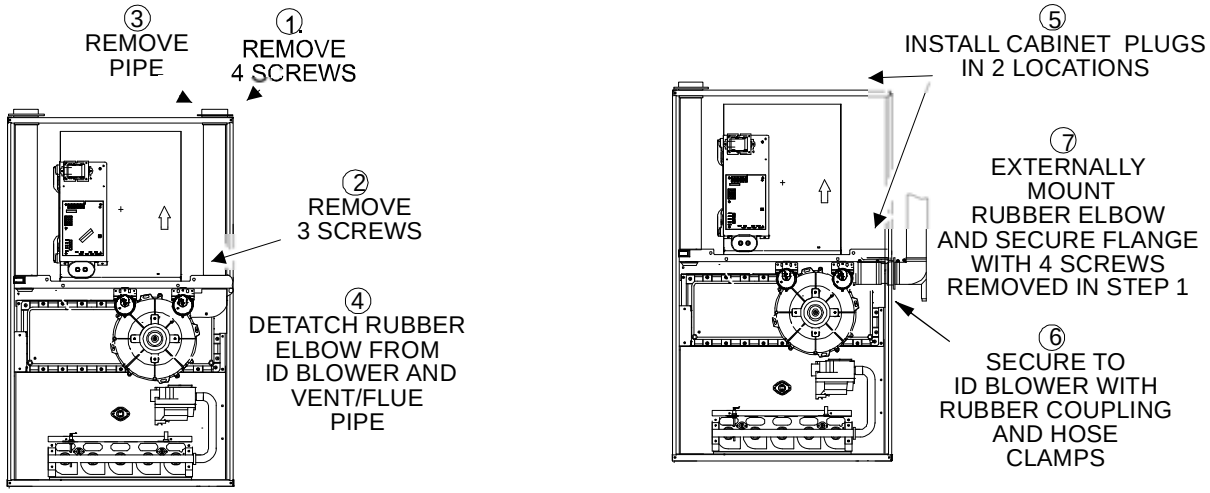
⚠ WARNING

THE RUBBER ELBOW IS NOT DESIGNED TO SUPPORT A LOAD. WHEN THE RUBBER ELBOW IS MOUNTED EXTERNALLY TO THE FURNACE CABINET, EXTREME CARE MUST BE TAKEN TO ADEQUATELY SUPPORT FIELD-SUPPLIED VENT/FLUE PIPING, AS DAMAGE CAN RESULT IN LEAKS CAUSING BODILY INJURY OR DEATH DUE TO EXPOSURE TO FLUE GASES, INCLUDING CARBON MONOXIDE

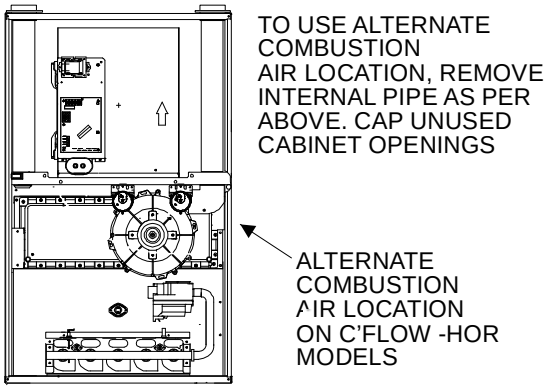
PRODUCT DESIGN



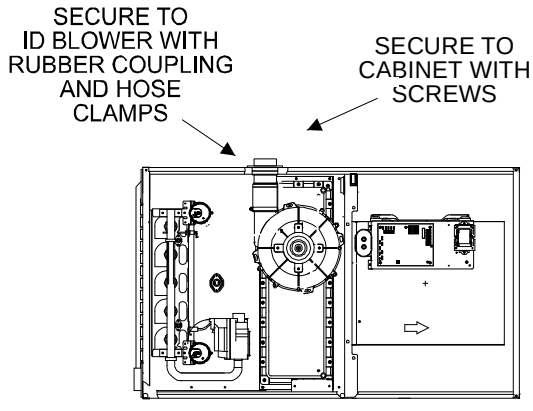
UPFLOW-HORIZONTAL MODELS ALTERNATE VENT CONNECTION



COUNTERFLOW-HORIZONTAL MODEL ALTERNATE VENT



COUNTERFLOW-HORIZONTAL MODEL ALTERNATE COMBUSTION AIR LOCATION



HORIZONTAL LEFT INSTALLATION USING ALTERNATE VENT LOCATION REQUIRES THE ADDITION OF AN RF000142 VENT DRAIN KIT WHEN ELIMINATING ELBOW

7. *Upflow* and *Counterflow* units.

   For **upright installations**, externally mount the rubber elbow to the vent/flue coupling using a worm gear hose clamp. Secure field supplied vent/flue piping to the rubber elbow using a worm gear hose clamp. **NOTE:** Use of the alternate vent/flue location for upright installations, requires the drain trap be installed on the same side of the unit as the flue pipe.

8. *Upflow* and *Counterflow* units.

   For ***horizontal installations***, externally secure the field-supplied vent/flue pipe directly to the vent/flue coupling using a PVC or ABS coupling or elbow.

Alternate Combustion Air Intake Location

The alternate combustion air intake location consists of a large, unobstructed hole (alternate vent connection is aligned with the Induced Draft Blower). To use the alternate combustion air intake location, refer to the following steps, and the "Alternate Combustion Air Intake Location" figure.

1. Remove and save the four screws securing the combustion air intake coupling to the basepan. Remove an additional three screws securing the furnace's internal combustion air intake pipe to the blower deck.
2. Remove the combustion air intake pipe from the furnace and cut the pipe at the basepan coupling. Save the basepan coupling and gasket from the blower deck coupling for use in the alternate location. Discard the remaining pipe.
3. Remove plastic plug from alternate combustion air intake location. Relocate and install plug in standard air intake location (basepan). Plug the remaining hole in the blower deck with the plastic plug included in the drain kit bag.
4. With the gasket facing the cabinet side panel, and the flange's flat spot facing forward, secure the combustion air intake coupling to the cabinet using the screws removed in step 1 or with field-supplied 3/8" #8 self -drilling screws.

⚠ CAUTION

BE SURE NOT TO DAMAGE INTERNAL WIRING OR OTHER COMPONENTS WHEN REINSTALLING COUPLING AND SCREWS.

5. For ***non-direct vent installation***s installed *horizontally*, a minimum of one 90° elbow should be installed on the combustion air intake coupling to guard against inadvertent blockage. No elbow is required on the alternate combustion air intake of *upright* installations, however, a minimum clearance of 2 inches is required to assure proper air supply.
6. For ***direct vent installations***, secure field-supplied combustion air intake pipe directly to the air intake coupling.

   NOTE: A PVC coupling or elbow is required on counterflow units.

Non-Direct Vent (Single Pipe) Piping

Non-direct vent installations require only a vent/flue pipe. The vent pipe can be run horizontally with an exit through the side of the building or run vertically with an exit through the roof of the building. The vent can also be run through an existing *unused* chimney; however, it must extend a minimum of 12 inches above the top of the chimney. The space between the vent pipe and the chimney must be closed with a weather-tight, corrosion-resistant flashing. For details concerning connection of the vent/flue pipe to the furnace, refer to *Vent/Flue Pipe and Combustion Air - Standard Furnace Connections* or *Alternate Furnace Connections* for specific details. Refer to the following *Non-Direct Vent (Single Pipe) Piping - Vent/Flue Pipe Terminations* for specific details on termination construction.

Although *non-direct vent* installations do not require a combustion air intake *pipe*, a minimum of one 90° elbow should be attached to the furnace's combustion air intake *if*: an upright installation uses the standard intake location, or a horizontal installation uses the alternate air intake location. This elbow will guard against inadvertent blockage of the air intake.

Vent/Flue Pipe Lengths and Diameters

Refer to the following table for applicable length, elbows, and pipe diameter for construction of the vent/flue pipe system of a non-direct vent installation. In addition to the vent/flue pipe, a single 90° elbow should be secured to the combustion air intake to prevent inadvertent blockage. The tee used in the vent/flue termination must be included when determining the number of elbows in the piping system.

*MVM9/*CVM9 Direct Vent (2 - Pipe) and Non-Direct Vent (1- Pipe) [6]										
Maximum Allowable Length of Vent/Flue Pipe & Combustion Air Pipe (ft) [1] [2]										
Unit Input (Btu)	Pipe Size [4] (in.)	Number of Elbows [3] [5]								
		0	1	2	3	4	5	6	7	8
60,000	2 or 2 1/2	250	245	240	235	230	225	220	215	210
80,000	2 or 2 1/2	250	245	240	235	230	225	220	215	210
80,000	3	250	243	236	229	222	215	208	201	194
100,000	2 or 2 1/2	90	85	80	75	70	65	60	55	50
100,000	3	250	243	236	229	222	215	208	201	194
115,000	2 or 2 1/2	75	70	65	60	55	50	45	40	35
115,000	3	220	213	206	199	192	185	178	171	164

1) Maximum allowable limits listed on individual lengths for inlet and flue and NOT a combination.
2) Minimum requirement for each vent pipe is five (5) feet in length and one elbow/tee.
3) Tee used in the vent/flue termination must be included when determining the number of elbows in the piping system.
4) 2 1/2" or 3" diameter pipe can be used in place of 2" diameter pipe.
5) Increased Clearance Configurations using (2) 45 deg. Elbows should be considered equivalent to one 90 deg. elbow.
6) One 90° elbow should be secured to the combustion air intake connection.

PRODUCT DESIGN

VENT/FLUE PIPE TERMINATIONS

NOTE: If either a 90 degree or 45 degree elbow is used for termination, it must be pointed downward.

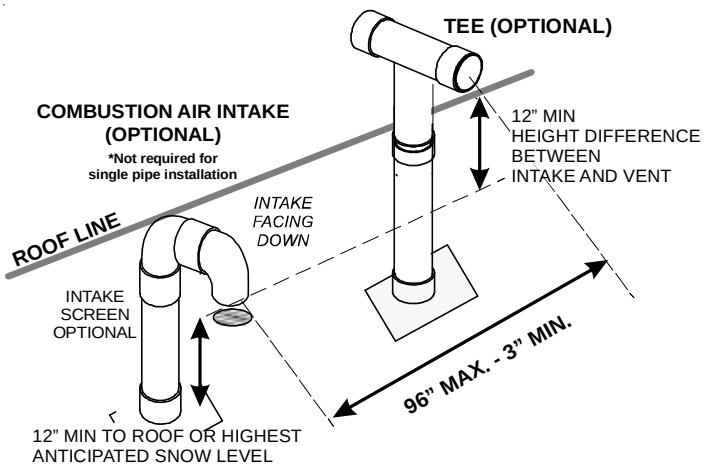
The vent/flue pipe may terminate vertically, as through a roof, or horizontally, as through an outside wall.

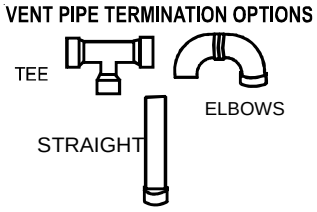
Vertical vent/flue pipe terminations should be as shown in the following figure. Refer to *Vent/Flue Pipe and Combustion Air Pipe - Termination Locations* for details concerning location restrictions. The penetration of the vent through the roof must be sealed tight with proper flashing such as is used with a plastic plumbing vent.

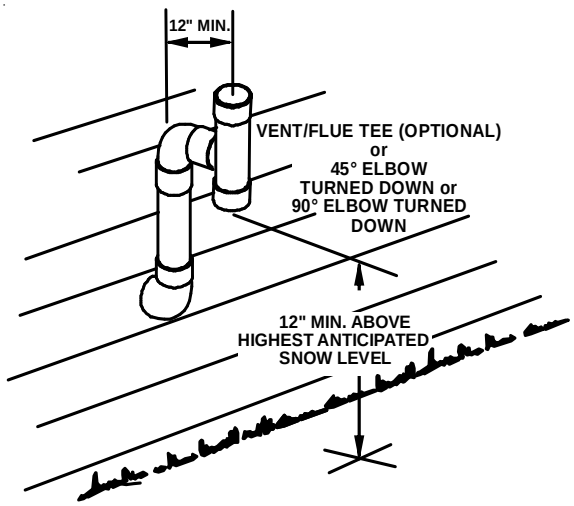
Horizontal vent/flue pipe terminations should be as shown in the following figure. Refer to *Vent/Flue Pipe and Combustion Air Pipe - Termination Locations* for details concerning location restrictions. A 2 3/8" diameter wall penetration is required for 2" diameter pipe. A 3" diameter hole is required for a 2 1/2" pipe and a 3 1/2" diameter hole is required for 3" diameter pipe. The wall penetration should be sealed with silicone caulking material.

In a basement installation, the vent/flue pipe can be run between joist spaces. If the vent pipe must go below a joist and then up into the last joist space to penetrate the header, two 45° elbows should be used to reach the header rather than two 90° elbows.

NOTE: Terminate both pipes in the same pressure zone (same side of roof, no major obstacles between pipes, etc.).







Horizontal Termination (Single Pipe) Above Highest Anticipated Snow Level

DIRECT VENT (DUAL PIPE) PIPING

The inlet air screens provided in the installation instruction packet are available for the installer to use in the inlet of the combustion air pipe to prevent animals from building nests in the combustion air pipe. Installation of screens, while strongly recommended, is not required and will not affect performance of the unit.

Direct vent installations require both a combustion air intake and a vent/flue pipe. The pipes may be run horizontally and exit through the side of the building or run vertically and exit through the roof of the building. The pipes may be run through an existing *unused* chimney; however, they must extend a minimum of 12 inches above the top of the chimney. The space between the pipes and the chimney must be closed with a weather tight, corrosion resistant flashing. Both the combustion air intake and a vent/flue pipe terminations must be in the same atmospheric pressure zone. Refer to *Vent/Flue and Combustion Air Pipe - Termination Locations* or *Concentric Vent Termination* for specific details on termination construction. For details concerning connection of pipes to the furnace, refer to the *Vent/Flue Pipe and Combustion Pipe - Standard Furnace Connections* or *Alternate Furnace Connections.*

VENT/FLUE & COMBUSTION AIR PIPE LENGTHS &DIAMETERS

Refer to the following table for applicable length, elbows, and pipe diameter for construction of the vent/flue and combustion air intake pipe systems of a direct vent (dual pipe) installation. The number of elbows tabulated represents the number of elbows and/or tees in each (Vent/Flue & Combustion Air Intake) pipe. If there is a difference between the two pipes, count the pipe with the most fittings. Elbows and/or tees used in the terminations must be included when determining the number of elbows in the piping systems.

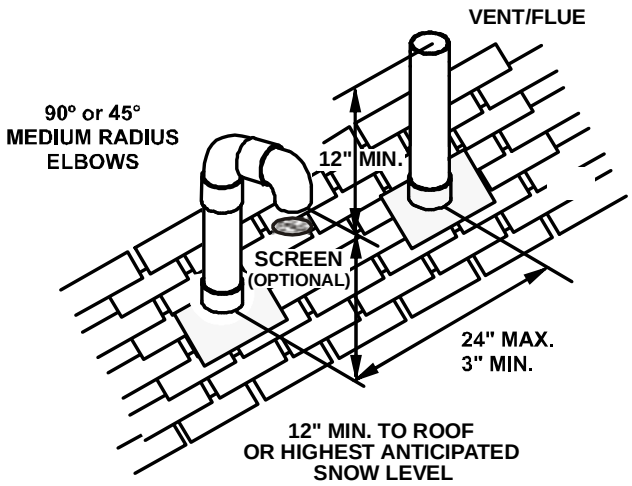
PRODUCT DESIGN

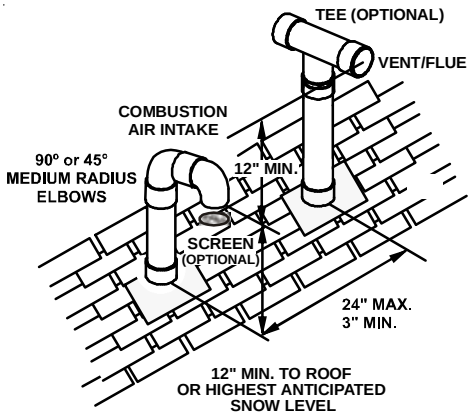
If the combustion air intake pipe is to be installed above a finished ceiling or other area where dripping of condensate will be objectionable, insulation of the combustion air pipe may be required. Use 1/2" thick closed cell foam insulation such as Armaflex™ or Insultube™ where required.

VENT/FLUE AND COMBUSTION AIR PIPE TERMINATIONS

The vent/flue and combustion air pipes may terminate vertically, as through a roof, or horizontally, as through an outside wall.

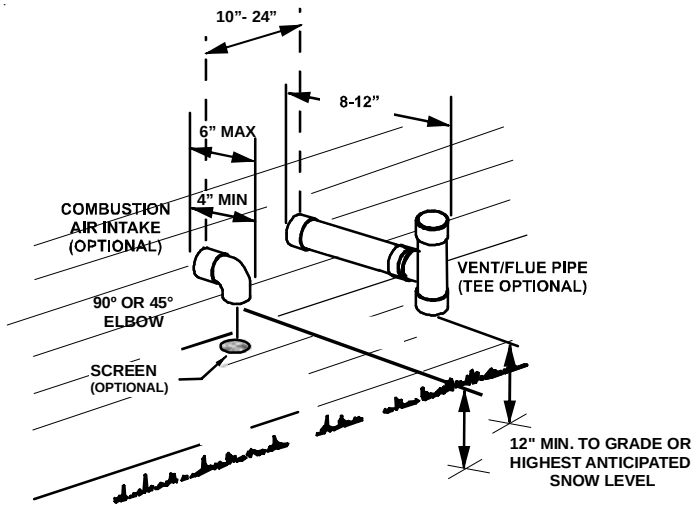
Vertical pipe terminations should be as shown in the following figure. *Refer to Vent/Flue Pipe and Combustion Pipe - Termination Locations* for details concerning location restrictions. The penetrations through the roof must be sealed tight with proper flashing such as is used with a plastic plumbing vent.





Vertical Terminations (Dual Pipe)

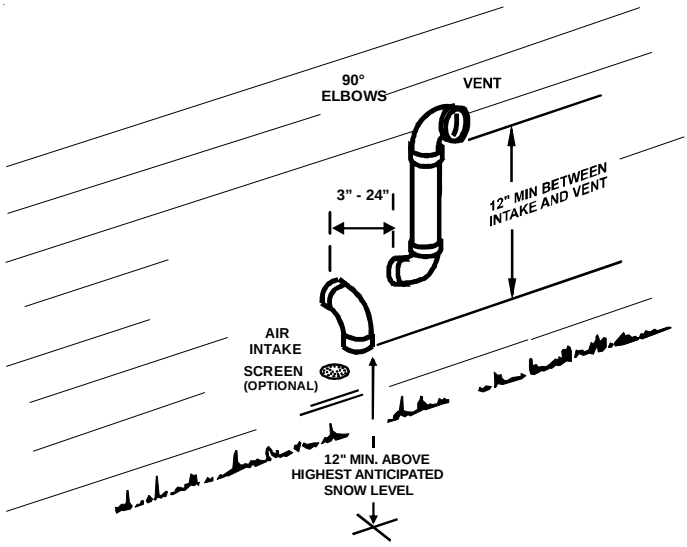
Horizontal terminations should be as shown in the following figure. Refer to *Vent/Flue Pipe and Combustion Pipe - Termination Location* for location restrictions. A 2 3/8" diameter wall penetration is required for 2" diameter pipe. A 3" diameter hole is required for a 2 1/2" pipe and a 3 1/2" diameter hole is required for 3" diameter pipe. The wall penetration should be sealed with caulking material.



Standard Horizontal Terminations (Dual Pipe)

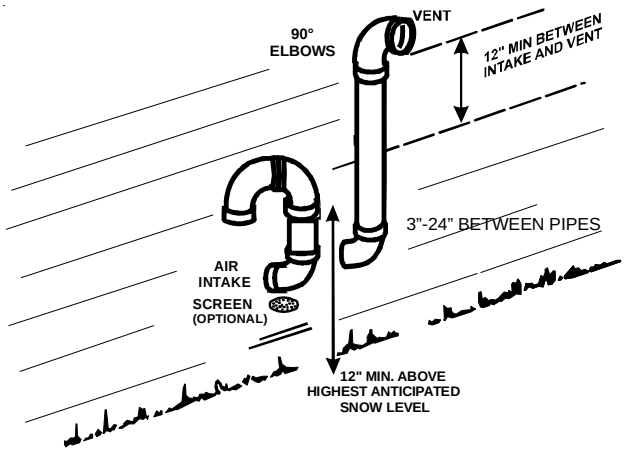
Vent & Combustion Air Intake Measurements for Standard Horizontal Terminations (Dual Pipe)

Center to center = 10" min / 24" max.
Vertical separation: 0" - 24"
Vent termination from wall = 8" min / 12" max.
Combustion air intake from wall = 6" max.
Vent and intake clearance to ground
or anticipated snow level = 12" min.



Alternate Horizontal Vent Termination (Dual Pipe)

PRODUCT DESIGN



Combustion Air Intake may also be snorkeled to obtain 12" min ground clearance.

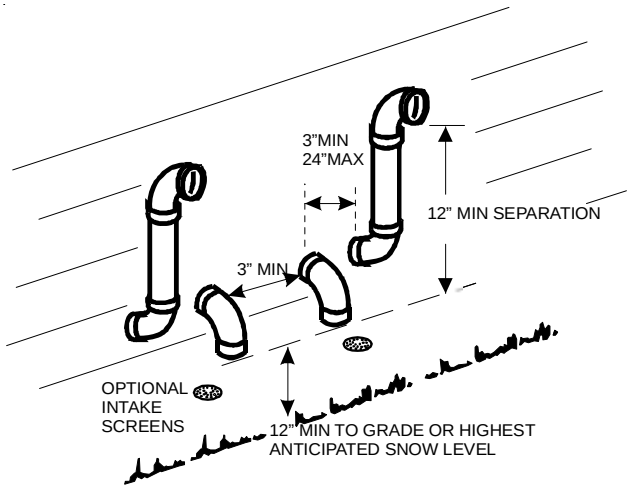
Alternate Vent Termination Above Anticipated Snow Level (Dual Pipe)

In a basement installation, the pipes may be run between the joist spaces. If the pipes must go below the joist and then up into the last joist space to penetrate the header, two 45° elbows should be used to reach the header rather than two 90° elbows.

VENT/INTAKE TERMINATIONS FOR INSTALLATION OF MULTIPLE DIRECT VENT FURNACES

If more than one direct vent furnace is to be installed vertically through a common roof top, maintain the same minimum clearances between the exhaust vent and air intake terminations of adjacent units as with the exhaust vent and air intake terminations of a single unit.

If more than one direct vent furnace is to be installed horizontally through a common side wall, maintain the clearances as in the following figure. Always terminate all exhaust vent outlets at the same elevation and always terminate all air intakes at the same elevation.



Termination of Multiple Direct Vent Furnaces

CONCENTRIC VENT TERMINATION

Refer to the directions provided with the Concentric Vent Kit (DCVK) for installation specifications.

PRODUCT DESIGN

Condensate Drain Lines & Drain Trap

A condensing gas furnace achieves its high level of efficiency by extracting almost all of the heat from the products of combustion and cooling them to the point where condensation takes place. The condensate which is generated must be piped to an appropriate drain location.

In *upright* installations, the furnace's drain hoses may exit either the right or left side of the furnace. **NOTE:** If the alternate vent/flue outlet is utilized in an upright installation, the drain trap and drain connections must be located on the same side as the alternate vent/flue outlet.

In *horizontal* installations, the drain hoses will exit through the bottom (down side) of the unit with the drain trap suspended beneath the furnace. The field-supplied drain system must be in accordance with all local codes and the instructions in the following sections.

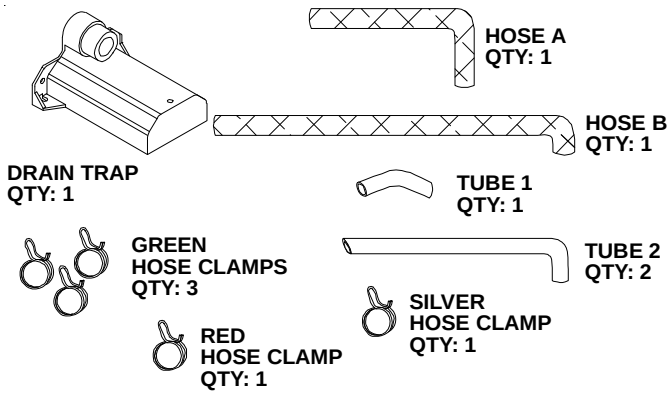
Follow the bullets listed below when installing the drain system. Refer to the following sections for specific details concerning furnace drain trap installation and drain hose hook ups.

- The drain trap supplied with the furnace must be used.
- The drain line between furnace and drain location must be constructed of 3/4" PVC.
- The drain line between furnace and drain location must maintain a 1/4 inch per foot downward slope toward the drain.
- Do not trap the drain line in any other location than at the drain trap supplied with the furnace.
- Do not route the drain line outside where it may freeze.
- If the drain line is routed through an area which may see temperatures near or below freezing, precautions must be taken to prevent condensate from freezing within the drain line.
- If an air conditioning coil is installed with the furnace, a common drain may be used. An open tee must be installed in the drain line, near the cooling coil, to relieve positive air pressure from the coil's plenum. This is necessary to prohibit any interference with the function of the furnace's drain trap.

NOTE: In vertical installations, air conditioning coil condensate may drain into the furnace trap as long as there is a trap between the coil and the furnace trap and the drain pipe is not terminating below the water level of the furnace trap.

Standard Right or Left Side Drain Hose Connections

All installations positions require the use of the drain trap, hoses, tubes, and clamps. The following quantity of hoses, tubes, and hose clamps are provided with the unit.



Hose and Tube Identification

OPERATION

UPRIGHT INSTALLATIONS-TRAP ON RIGHT SIDE

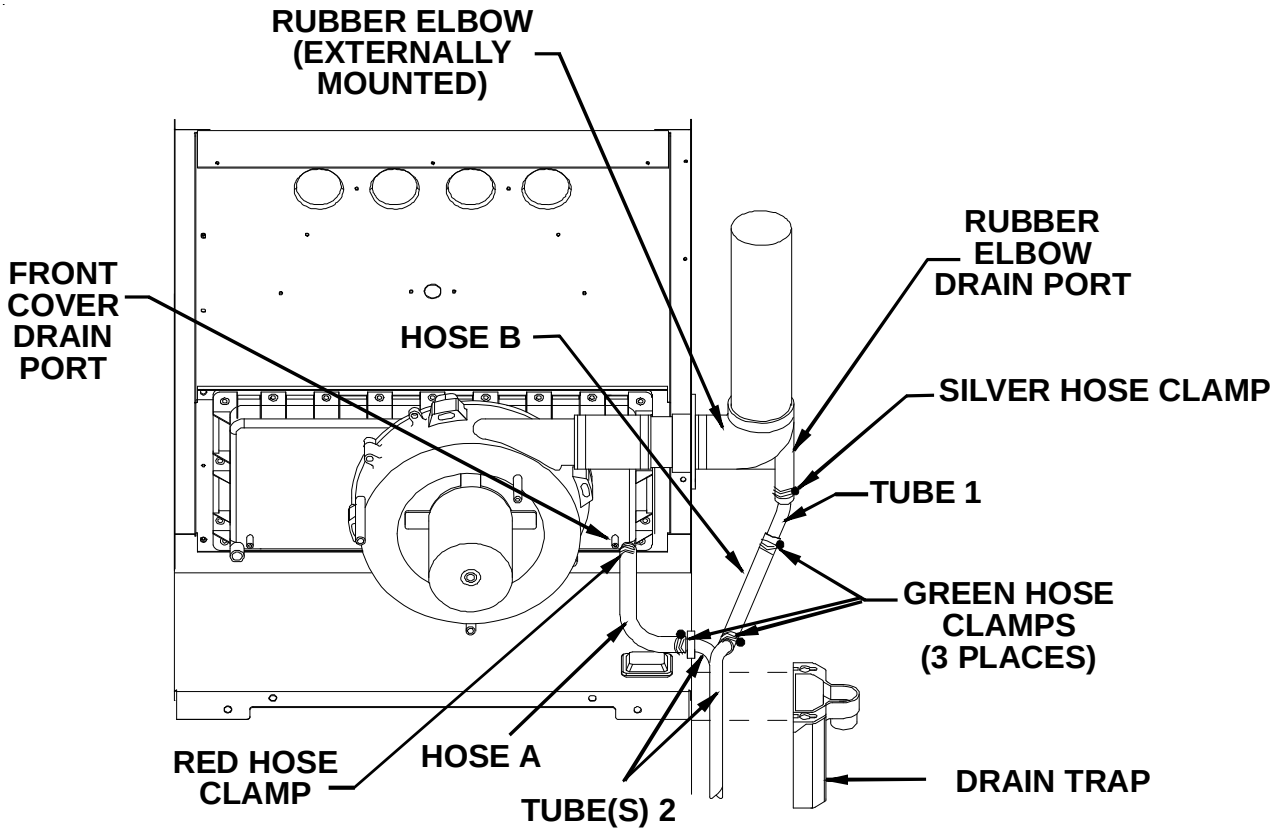
In a upright installation drain hoses are connected to drain ports on the rubber elbow and the recuperator coil front cover. The drain lines are then routed through the right side panel and into the drain trap secured to the outside of the cabinet.

NOTE: Refer to *Alternate Vent/Flue Hose Connections* for upright installations using an alternate vent/flue outlet.

1. Remove the rubber plug from the right side of the front cover drain port.
2. Secure Hose A to front cover drain port with a red hose clamp. Route hose to rear side panel grommet hole.
3. Cut and remove 1/4 inch from the end of the drain port on the rubber elbow.
4. Insert Tube 1 into rubber elbow drain port and secure with silver hose clamp. Angle tube outward toward front of furnace.
5. Cut 17 3/4 inches from the long end of Hose B and discard. Secure the remaining hose to Tube 1 with a green hose clamp. Route the other end of Hose B to front right side panel grommet hole.

For details concerning mounting of the drain trap, refer to *Horizontal Drain Trap Mounting.*

6. Insert short end of each of tube 2 through side panel grommet holes. Secure tubes to hoses A and B with green hose clamps. Ensure hoses and tubes maintain a downward slope for proper drainage and that they are not kinked or binding.



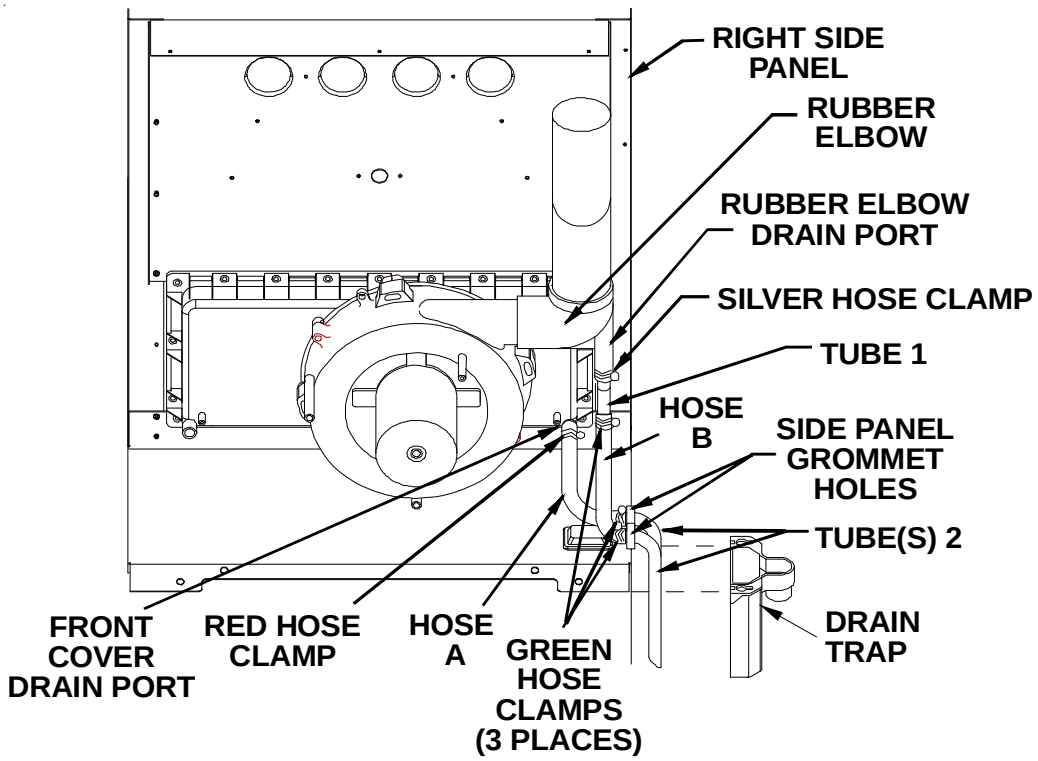
Upright "Standard" Connections - Right Side
(Upflow Shown, Counterflow Similar)

OPERATION

Alternate Vent/Flue Drain Hose Connections

Upright installations using the *alternate* vent/flue outlet will require "right-side only" drain hoses to be connected as follows. Refer to *Vent/Flue Pipe and Combustion Air Pipe* for details on alternate vent/flue pipe connection.

1. Remove the rubber plug/cap from the right-side drain port on the front cover . Save for use in step 3.
2. Secure Hose A to front cover drain port with a red hose clamp. Route hose to rear right side panel grommet hole.
3. Remove grommet from front right-side panel drain hole. Seal hole in grommet with large end of plug. Reinstall grommet and plug into side panel drain hole.
4. Cut 1/4 inch from the end of the drain port on the externally mounted rubber elbow. Discard cut portion.
5. Insert Tube 1 into rubber elbow drain port and secure with a silver hose clamp. Angle tube toward trap.
6. Cut 17 3/4 inches from the long end of Hose B and discard.
7. Secure straight end of Hose B to exposed end of Tube 1 with a green hose clamp. Route hose toward right side panel grommet holes.
8. Insert short end of one Tube 2 through rear right side panel grommet drain hole. Secure tube to Hose A with a green hose clamp.
9. Insert short end of remaining Tube 2 into Hose B from rubber elbow and secure with green hose clamp. Ensure hoses and tubes maintain a downward slope for proper drainage and are not kinked or binding.



Upright "Alternate" Connections - Right Side Only
(Upflow Shown, Counterflow Similar)

OPERATION

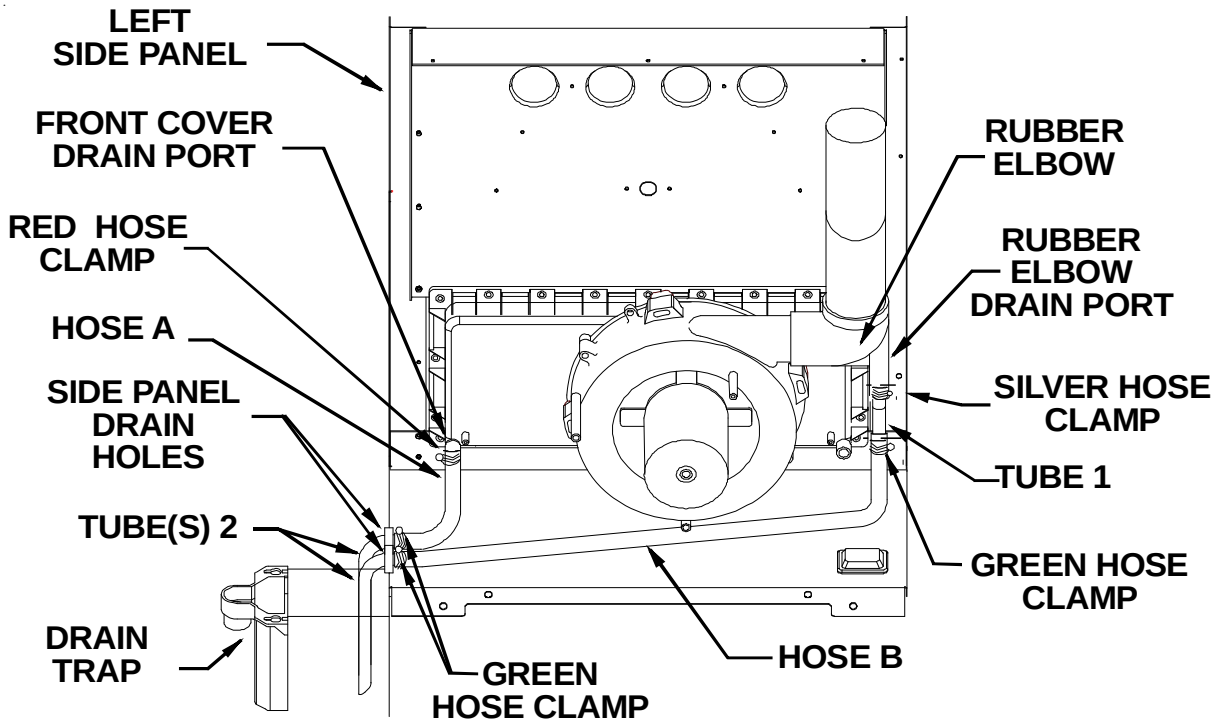
UPRIGHT INSTALLATIONS-TRAP ON LEFT SIDE

NOTE: For left side trap installation, grommets must be moved to the left side of the furnace and the plugs installed on the right side of the furnace.

1. Remove the rubber plug/cap from the left side drain port on the front cover.
2. Secure Hose A to front cover drain port with a red hose clamp. Route hose to rear side panel grommet hole.
3. Cut and remove 1/4 inch from the end of the drain port on the rubber elbow.
4. Insert Tube 1 into rubber elbow drain port and secure with silver hose clamp. Angle tube outward toward front of furnace.
5. Cut "X" inches from the long end of Hose B and discard. Refer to table for appropriate length to cut. Secure remaining hose to Tube 1 with a green hose clamp. Route other end of Hose B to front left side panel grommet hole.

NOTE: Long hose "B" must always be connected to Tube 1 and the elbow and not on the front cover.

6. Insert short end of each Tube 2 through side panel grommet holes. Secure tubes to Hose A and Hose B with green hose clamps. Ensure hoses and tubes maintain a downward slope for proper drainage and that they are not kinked or binding.



Upright "Standard" Connections - Left Side
(Upflow Shown, Counterflow Similar)

Cabinet Width (inches)	Models (kBTU_Tons)	"X" Length to Cut From Long End of Hose B (inches)
17 1/2	60_3	7
21	60_4 80_5	3 1/2
24 1/2	80_5 100_5 115_5	None

UPRIGHT DRAIN TRAP MOUNTING (LEFT OR RIGHT SIDE PANEL)

1. Insert drain tubes into drain trap and position the drain trap against the side panel. **NOTE:** Drain tubes must reach the bottom of the drain trap.
2. Secure drain trap to side panel at the mounting holes (dimples or crosshairs on counterflow models) located below the grommet drain holes.
3. Attach PVC drain line to drain trap outlet with either a 90° elbow or coupling.

OPERATION

HORIZONTAL INSTALLATIONS

RIGHT SIDE DOWN

Horizontal installations with the right side down require that the drain hoses be connected to the right side front cover drain port and the rubber elbow drain port.

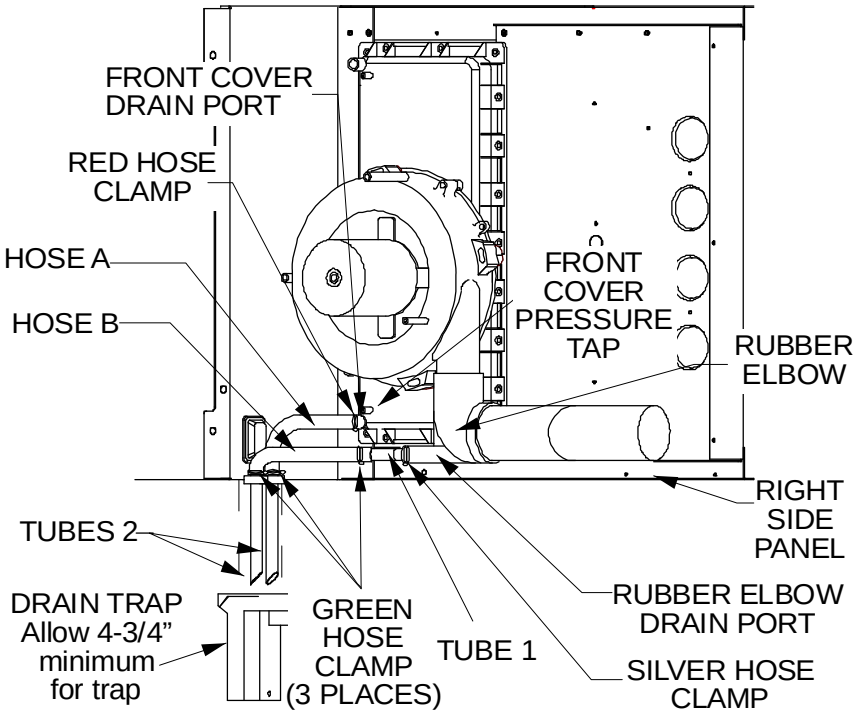
NOTE: On counterflow models, relocation of the front cover pressure switch hose is required.
Make connections as follows:

1. Remove the rubber plug/cap from right side of the front cover drain port.

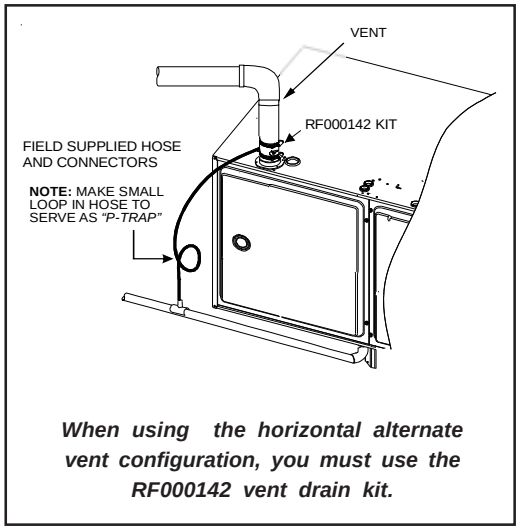
   Counterflow furnaces

   Relocate the front cover pressure switch hose connection from the left side pressure tap to the right (down) side tap. The pressure switch hose must be connected to the down side to guard against blocked drain conditions. Cut hose to appropriate length to minimize sagging. Plug left (unused) pressure tap with plug removed from right side.
2. Secure Hose A to front cover drain tap with a red hose clamp. Route hose to rear right (down) side panel grommet holes.
3. Cut 1/4 inch from the end of the drain port on the rubber elbow and discard.
4. Insert Tube 1 into rubber elbow drain port and secure with a silver hose clamp. Angle tube outward toward front of furnace.
5. Cut 17 3/4 inches from the long end of Hose B and discard.
6. Secure remaining end of Hose B to exposed end of Tube 1 with a green hose clamp. Route hose to front right down side panel grommet holes.
7. Cut 5 1/2 inches straight length from the long end of each Tube 2 and discard the radius pieces.
8. Insert approximately one inch of each Tube 2 through the right down side panel grommet holes. Secure tubes to Hose A and Hose B using green hose clamps. Ensure hoses and tubes maintain a downward slope for proper drainage and are not kinked or bound.

For details concerning mounting of the drain trap, refer to *Condensate Drain Lines and Drain Trap - Horizontal Drain Trap Mounting.*



Horizontal Connections - Right Side Down
(Upflow Shown, Counterflow Similar)



When using the horizontal alternate vent configuration, you must use the RF000142 vent drain kit.

OPERATION

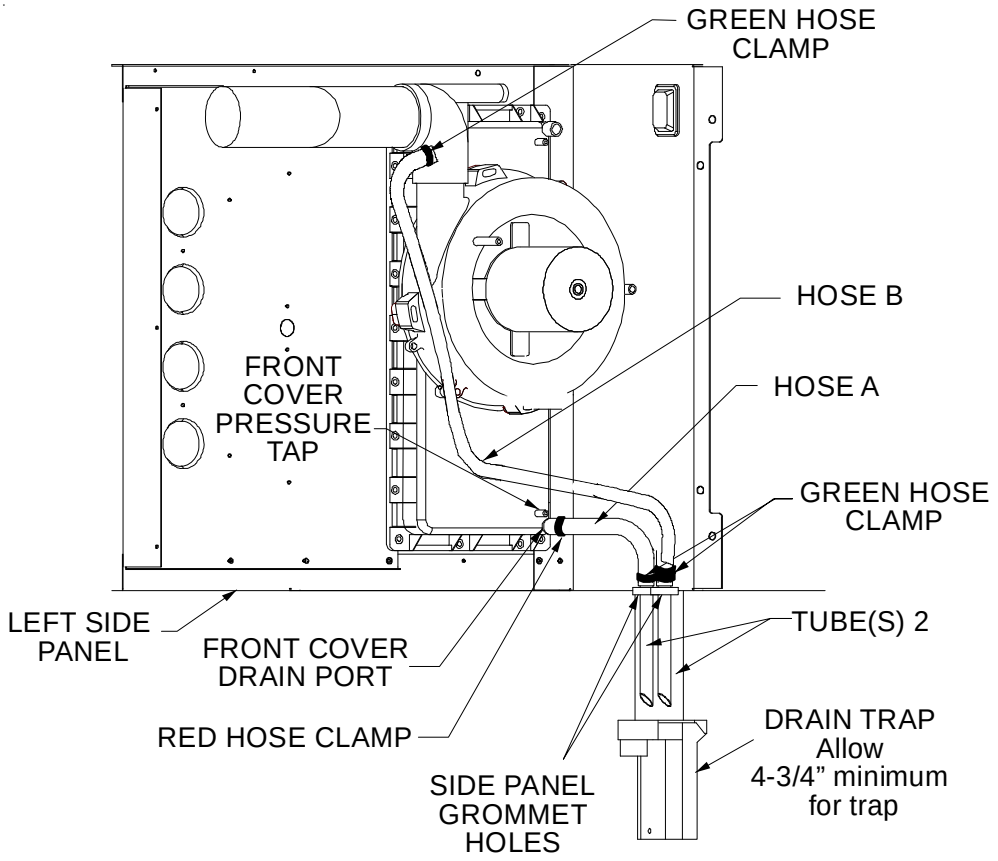
Horizontal installations with the left side panel down will require drain hoses to be connected to the left side front cover drain port and the side drain port on the rubber elbow.

1. Remove the rubber plug/cap from the front cover left (down) side drain port.
2. Relocate the front cover pressure switch hose connection from the right side (as shipped) pressure tap to the left (down) side tap. The pressure switch hose must be connected to the down side to guard against blocked drain conditions. Cut hose to appropriate length to minimize sagging. Plug right (unused) pressure tap with plug removed from left side.
3. Secure Hose A to front cover drain port with a red hose clamp. Route hose to rear left (down) side panel grommet holes. **NOTE:** For left side drainage, grommets must be relocated to left side panel.
4. Remove the rubber cap from the side drain port on the rubber elbow.
5. Secure the short end of Hose B to rubber elbow side drain port using a green hose clamp. **NOTE:** For left side drainage, route hose to far left (down) side panel grommet holes. **NOTE:** Horizontal left side connections (when using new side port drain elbow) does not require connecting a hose to the induced draft blower housing.
6. Cut 5 1/2 inches straight length from the long end of each Tube 2 and discard radius ends.
7. Insert approximately one inch of each Tube 2 through left side panel grommet hole. Secure tubes to Hose A and Hose B with a green hose clamps. **NOTE:** Tube must reach bottom of trap. Ensure hoses and tubes maintain a downward slope for proper drainage and that they are not kinked or binding.

For details concerning mounting of the drain trap, refer to *Condensate Drain Lines and Drain Trap - Horizontal Drain Trap Mounting.*

HORIZONTAL DRAIN TRAP MOUNTING (LEFT OR RIGHT SIDE PANEL)

1. Position the drain trap against side panel with drain tubes inserted into trap. Note that the trap may be orientated with the outlet facing either the furnace's top cover or base pan.
2. Secure drain trap to side panel at the dimples or crosshairs located on either side of the grommet drain holes.
3. Confirm that tubes reach bottom of drain trap and that all hoses maintain a downward slope and are not kinked or binding.
4. Attach PVC drain line to drain trap outlet with either a 90° elbow or coupling.



Horizontal Connections - Left Side Down
(Upflow Shown, Counterflow Similar)

OPERATION

Electrical Connections

WARNING

HIGH VOLTAGE !

TO AVOID THE RISK OF ELECTRICAL SHOCK, WIRING TO THE UNIT MUST BE POLARIZED AND GROUNDED.

WARNING

HIGH VOLTAGE !

TO AVOID PERSONAL INJURY OR DEATH DUE TO ELECTRICAL SHOCK, DISCONNECT ELECTRICAL POWER BEFORE SERVICING OR CHANGING ANY ELECTRICAL WIRING.

CAUTION

LABEL ALL WIRES PRIOR TO DISCONNECTION WHEN SERVICING CONTROLS. WIRING ERRORS CAN CAUSE IMPROPER AND DANGEROUS OPERATION. VERIFY PROPER OPERATION AFTER SERVICING.

Wiring Harness

The wiring harness is an integral part of this furnace. Field alteration to comply with electrical codes should not be required. Wires are color coded for identification purposes. Refer to the wiring diagram for wire routings. If any of the original wire as supplied with the furnace must be replaced, it must be replaced with wiring material having a temperature rating of at least 105° C. Any replacement wiring must be a copper conductor.

115 Volt Line Connections

Before proceeding with electrical connections, ensure that the supply voltage, frequency, and phase correspond to that specified on the unit rating plate. Power supply to the furnace must be NEC Class 1, and must comply with all applicable codes. The furnace must be electrically grounded in accordance with local codes or, in their absence, with the latest edition of The National Electric Code, ANSI NFPA 70 and/or The Canadian Electric Code CSA C22.1.

Use a separate fused branch electrical circuit containing properly sized wire, and fuse or circuit breaker. The fuse or circuit breaker must be sized in accordance with the maximum overcurrent protection specified on the unit rating plate. An electrical disconnect must be provided at the furnace location.

Connect hot, neutral, and ground wires as shown in the wiring diagram located on the unit's blower door. For direct vent applications, the cabinet opening to the junction box must be sealed air tight using either an UL approved bushing such as Heyco Liquid Tight or by applying non-reactive UL approved sealant to bushing.

Line polarity must be observed when making field connections. Line voltage connections can be made through either the right or left side panel. The furnace is shipped configured for a right side (left side for counterflows) electrical connection with the junction box located inside the burner compartment. To make electrical connections through the opposite side of the furnace, the junction box must be relocated to the other side of the burner compartment prior to making electrical connections. To relocate the junction box, follow the steps shown below.

NOTE: Wire routing must not to interfere with circulator blower operation, filter removal, or routine maintenance.

Junction Box Relocation

WARNING

EDGES OF SHEET METAL HOLES MAY BE SHARP. USE GLOVES AS A PRECAUTION WHEN REMOVING HOLE PLUGS.

WARNING

TO PREVENT PERSONAL INJURY OR DEATH DUE TO ELECTRIC SHOCK, DISCONNECT ELECTRICAL POWER BEFORE INSTALLING OR SERVICING THIS UNIT.

WARNING

HIGH VOLTAGE !

TO AVOID THE RISK OF INJURY, ELECTRICAL SHOCK OR DEATH, THE FURNACE MUST BE ELECTRICALLY GROUNDED IN ACCORDANCE WITH LOCAL CODES OR IN THEIR ABSENCE, WITH THE LATEST EDITION OF THE NATIONAL ELECTRIC CODE.

Line voltage connections can be made through either the right or left side panel. The furnace is shipped configured for a right side electrical connection. To make electrical connections through the opposite side of the furnace, the junction box must be relocated to the left side prior to making electrical connections. To relocate the junction box, perform the following steps.

1. Remove the burner compartment door.
2. Remove and save the two screws securing the junction box to the side panel.
3. Relocate junction box and associated plugs and grommets to opposite side panel. Secure with screws removed in step 2.

WARNING

TO AVOID THE RISK OF INJURY, ELECTRICAL SHOCK OR DEATH, THE FURNACE MUST BE ELECTRICALLY GROUNDED IN ACCORDANCE WITH LOCAL CODES OR, IN THEIR ABSENCE, WITH THE LATEST EDITION OF THE NATIONAL ELECTRICAL CODE.

OPERATION

To ensure proper unit grounding, the ground wire should run from the furnace ground screw located inside the furnace junction box all the way back to the electrical panel. **NOTE:** Do not use gas piping as an electrical ground. To confirm proper unit grounding, turn off the electrical power and perform the following check.

1. Measure resistance between the neutral (white) connection and one of the burners.
2. Resistance should measure 10 ohms or less.

This furnace is equipped with a blower door interlock switch which interrupts unit voltage when the blower door is opened for servicing. Do not defeat this switch.

24 Volt Thermostat Wiring

IMPORTANT NOTE

Wire routing must not interfere with circulator blower operation, filter removal or routine maintenance.
A removable plug connector is provided with the control to make thermostat wire connections. This plug may be removed, wire connections made to the plug, and replaced. It is STRONGLY recommended that multiple wires into a single terminal be twisted together prior to inserting into the plug connector. Failure to do so may result in intermittent operation.

IMPORTANT NOTE

Dip switch #13 MUST be set to match thermostat type. To use the CTK01 communicating thermostat, dip switch #13 must be set to ON position. This is also the correct setting for a non-communicating 2-stage thermostat. To use CTK02 modulating thermostat, check to make sure dip switch #13 is in the OFF position (factory position). This is also the correct position when using a non-communicating single-stage thermostat.**

When installed with a non-communicating thermostat, the furnace integrated control module provides terminals for both "W1" and "W2", and "Y1" and "Y2" thermostat connections. This allows the furnace to support the following system applications: 'Two-Stage Heating Only', 'Two-Stage Heating with Single Stage Cooling', and 'Two-Stage Heating with Two-Stage Cooling'. Refer to the following figures for proper connections to the integrated control module.

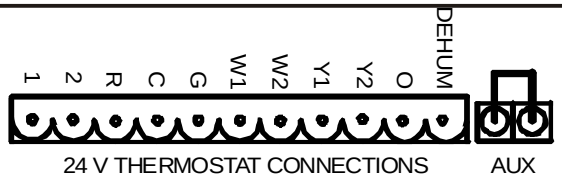
Low voltage connections can be made through either the right or left side panel. Thermostat wiring entrance holes are located in the blower compartment. The following figure shows connections for a "heat/cool system".

This furnace is equipped with a 40 VA transformer to facilitate use with most cooling equipment. Consult the wiring diagram, located on the blower compartment door, for further details of 115 Volt and 24 Volt wiring.

NOTE: Use of ramping profiles requires a jumper between Y1 and O.

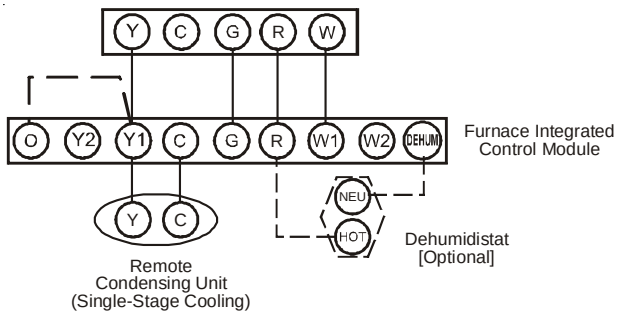
IMPORTANT NOTE

Thermostat "R" required if outdoor unit is equipped with a Comfort Alert™ module or if the outdoor unit is a part of the ComfortNet™ family of equipment.



Low Voltage Connections with Auxiliary Terminals

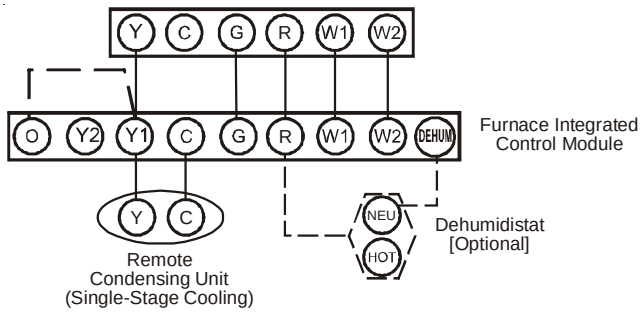
The auxiliary contacts are shipped with a factory installed jumper. As an option, the auxiliary contacts may be wired to a normally closed float switch. In the event of open contacts, the furnace will be disabled until the condition is corrected. These are 24 volt terminals fed internally, do not apply another voltage source to these terminals.



Thermostat - Single-Stage Heating with Single-Stage Cooling

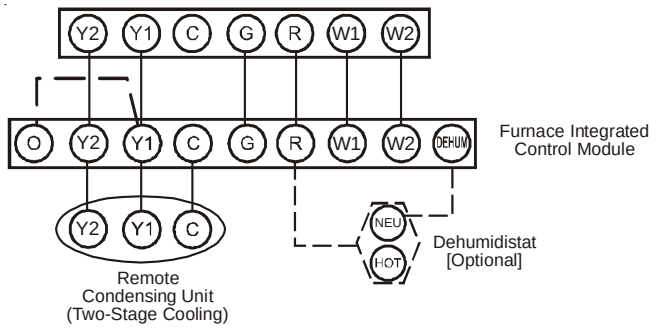
IMPORTANT NOTE

To apply a single-stage Heating Thermostat, the thermostat selector switch on the Integrated Control Module MUST be set on single-stage.



Thermostat - Two-Stage Heating with Single-Stage Cooling

OPERATION



Thermostat - Two-Stage Heating with Two-Stage Cooling

IMPORTANT NOTE

SET DIP SWITCH #14 TO ON POSITION WHEN USING A 2-STAGE COOLING THERMOSTAT.

Thermostat Wiring Diagrams

THERMOSTAT APPLICATION

The modulating furnace can be operated with a CTK01 communicating thermostat or a CTK02** or CTK03AA communicating-modulating thermostat. It also facilitates operation with a non-communicating single or two stage heat / cool thermostat.

NOTE: DIP switch #13 (Heating thermostat selection)must be checked and set regardless of the thermostat chosen. Factory setting is OFF (single stage), this is also the correct position if using CTK02** thermostat. To use a CTK01 or a non-communicating two stage thermostat, set the switch to the ON position.

Operation with CTK03AA

1. Humidification Options are ON / OFF with the CTK03AA. When “On” is selected, the humidification relay on the furnace control board will function during a heat call if a humidity demand exists. Selecting “Off” means the humidification relay will not function.
2. If the CTK03AA is set up so the compressor off delay is 0 min, it will display a cool / heat call immediately regardless of the delay built into the outdoor unit control board. This means the CTK03AA could show COOL ON when the outdoor unit is still in a delay period. The recommendation is to set up the compressor delay to at least 3 minutes
3. Dual Fuel – When the CTK03AA calls for gas heat, the heat pump will shut off, after a delay of approximately 3 minutes it will then turn on gas heat.
4. Dehumidification (lowering of CFM to 85%) only happens during low stage cooling operation. The dehumidification feature is not active during high stage cool. The CTK03AA can be set up to overcool the home in order to reach the RH set point.

NOTE: In non-communicating installations with a condensing unit, DIP switch #14 must be checked and set to match a single or two stage condensing unit. Factory setting is OFF (single stage).

24 VOLT DEHUMIDISTAT WIRING

The optional usage of a dehumidistat allows the furnace’s circulator blower to operate at a slightly lower speed (85% of desired speed) during a combined thermostat call for cooling and dehumidistat call for dehumidification. This can be done through an independent dehumidistat or through a thermostat’s DEHUM terminal (if available). This lower blower speed enhances dehumidification of the conditioned air as it passes through the AC coil. For proper function, a dehumidistat applied to this furnace must operate on 24 VAC and utilize a switch which *opens on humidity rise.* Refer to the “Thermostat Wiring Diagrams” figure for additional wiring details.

To install/connect a dehumidistat:

1. Turn OFF power to furnace.
2. Secure one dehumidistat lead to the terminal marked “DEHUM” on the furnace integrated control module.
3. Secure the other dehumidistat lead to the terminal marked “R” on the furnace integrated control module.
4. Secure the dehumidistat ground wire (typically the green lead) to the ground screw on the furnace junction box. **NOTE:** Ground wire may not be present on all dehumidistats.
5. Turn ON power to furnace.

To enable the dehumidify function on the integrated control module, set the dehumidification ENABLE DIP switch from OFF to ON.

Once the switch is set, the dehumidify function is enabled during a *combination* call for cooling (T-Stat) and dehumidification (DEHUM-Stat). Refer to the DIP switch chart in the back section of this manual.

FOSSIL FUEL APPLICATIONS

This furnace can be used in conjunction with a heat pump in a fossil fuel application. A fossil fuel application refers to a combined gas furnace and heat pump installation which uses an outdoor temperature sensor to determine the most cost efficient means of heating (heat pump or gas furnace).

A heat pump thermostat with *three stages of heat* is required to properly use a two-stage furnace in conjunction with a heat pump. Refer to the fossil fuel kit installation instructions for additional thermostat requirements.

Strictly follow the wiring guidelines in the fossil fuel kit installation instructions. All furnace connections must be made to the furnace two-stage integrated control module and the “FURNACE” terminal strip on the fossil fuel control board.

OPERATION

115 Volt Line Connection of Accessories (Humidifier and Electronic Air Cleaner)

WARNING

HIGH VOLTAGE !

To avoid personal injury or death due to electrical shock, disconnect electrical power before servicing or changing any electrical wiring.

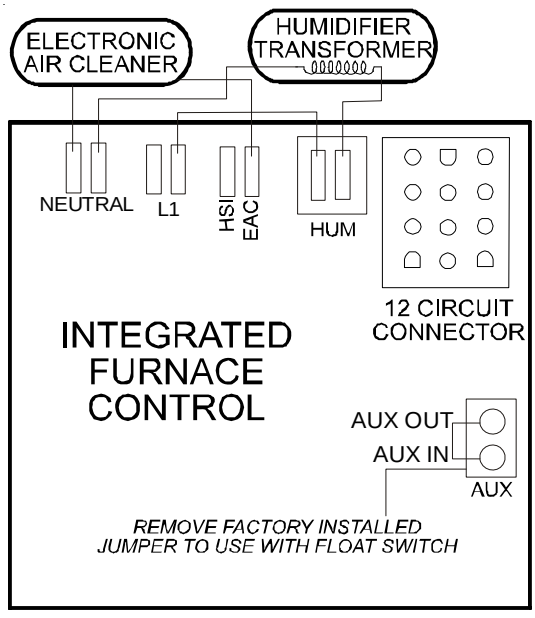
The furnace integrated control module is equipped with line voltage accessory terminals for controlling power to an electronic air cleaner.

The accessory load specifications are as follows. (The furnace control board also has a set of dry contacts for humidifier connection.)

Humidifier	1.0 Amp maximum at 120 VAC
Electronic Air Cleaner	1.0 Amp maximum at 120 VAC

Turn OFF power to the furnace before installing any accessories. Follow the humidifier or air cleaner manufacturers' instructions for locating, mounting, grounding, and controlling these accessories. Accessory wiring connections are to be made through the 1/4" quick connect terminals provided on the furnace integrated control module. The Electronic air cleaner hot terminal is identified as EAC. *It is necessary to remove the protective tab on the board cover to access the EAC Terminal.* The EAC neutral terminal is identified as NEUTRAL. A line voltage humidifier may be connected between one of the HUM contacts and NEUTRAL. The other HUM contact must be fed from the L1 terminal.

All field wiring must conform to applicable codes. Connections should be made as shown in the following figure.



Accessories Wiring

If it is necessary for the installer to supply additional line voltage wiring to the inside of the furnace, the wiring must conform to all local codes, and have a minimum temperature rating of 105°C. All line voltage wire splices must be made inside the furnace junction box.

The integrated furnace control HUM (dry contacts) are closed whenever the inducer is energized in a non-communicating installation. When used with a CTK02** communicating thermostat, the HUM terminals are closed whenever there is a call for humidity. The integrated control module electronic air cleaner terminals (EAC) are energized with 115 volts whenever the circulator blower is energized.

24 Volt Humidifier

A 24 volt humidifier can be powered by feeding one of the HUM terminals with a field installed wire from the R terminal or by connecting to the NO side of the low fire pressure switch.

Gas Supply and Piping

The furnace rating plate includes the approved furnace gas input rating and gas types. The furnace must be equipped to operate on the type of gas applied. This includes any conversion kits required for alternate fuels and/or high altitude.

CAUTION

To prevent unreliable operation or equipment damage, the inlet gas supply pressure must be as specified on the unit rating plate with all other household gas fired appliances operating.

Inlet gas supply pressures must be maintained within the ranges specified in the following table. The supply pressure must be constant and available with all other household gas fired appliances operating. The minimum gas supply pressure must be maintained to prevent unreliable ignition. The maximum must not be exceeded to prevent unit overfiring.

Inlet Gas Supply Pressure		
Natural Gas	Minimum: 4.5" w.c.	Maximum: 10.0" w.c.
Propane Gas	Minimum: 11.0" w.c.	Maximum: 13.0" w.c.

High Altitude

The modulating furnace is approved up to 10,000 ft altitude.

Do **not** derate the furnace by adjusting the manifold pressure to a lower pressure.

In some areas the gas supplier may artificially derate the gas in an effort to compensate for the effects of altitude. If the gas is artificially derated, the appropriate orifice size must be determined based upon the BTU/ft^3 content of the derated gas and the altitude. Refer to the National Fuel Gas Code, NFPA 54/ANSI Z223.1, and information provided by the gas supplier to determine the proper orifice size.

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OPERATION

PROPANE GAS CONVERSION

WARNING

POSSIBLE PROPERTY DAMAGE, PERSONAL INJURY OR DEATH MAY OCCUR IF THE CORRECT CONVERSION KITS ARE NOT INSTALLED. THE APPROPRIATE KITS MUST BE APPLIED TO ENSURE SAFE AND PROPER FURNACE OPERATION. ALL CONVERSIONS MUST BE PERFORMED BY A QUALIFIED INSTALLER OR SERVICE AGENCY.

This unit is configured for natural gas. The appropriate manufacturer's propane gas conversion kit, must be applied for propane gas installations.

LP KIT	MODEL
LPKMOD060UF	*MVM960603BX
LPKMOD080UF	*MVM960805CX
LPKMOD100UF	*MVM961005DX
LPKMOD115UF	*MVM961155DX
LPKMOD060CF	*CVM960604CX
LPKMOD080CF	*CVM960805DX
LPKMOD100CF	*CVM961005DX

(*= A or G)

The indicated kits must be used to insure safe and proper furnace operation. All conversions must be performed by a qualified installer, or service agency.

GAS PIPING CONNECTIONS

WARNING

TO AVOID POSSIBLE UNSATISFACTORY OPERATION OF EQUIPMENT DAMAGE DUE TO UNDERFIRING OR EQUIPMENT, USE THE PROPER SIZE OF NATURAL/PROPANE GAS PIPING NEEDED WHEN RUNNING PIPE FROM THE METER/TANK TO THE FURNACE.

When sizing a trunk line, be sure to include all appliances which will operate simultaneously when sizing a trunk line.

The gas piping supplying the furnace must be properly sized based on the gas flow required, specific gravity of the gas, and length of the run. The gas line installation must comply with local codes, or in their absence, with the latest edition of the National Fuel Gas Code, NFPA 54/ANSI Z223.1.

Natural Gas Capacity of Pipe
In Cubic Feet of Gas Per Hour (CFH)

Length of Pipe in Feet	Nominal Black Pipe Size				
	1/2"	3/4"	1"	1 1/4"	1 1/2"
10	132	278	520	1050	1600
20	92	190	350	730	1100
30	73	152	285	590	980
40	63	130	245	500	760
50	56	115	215	440	670
60	50	105	195	400	610
70	46	96	180	370	560
80	43	90	170	350	530
90	40	84	160	320	490
100	38	79	150	305	460

(Pressure 0.5 psig or less and pressure drop of 0.3" W.C.; Based on 0.60 Specific Gravity Gas)

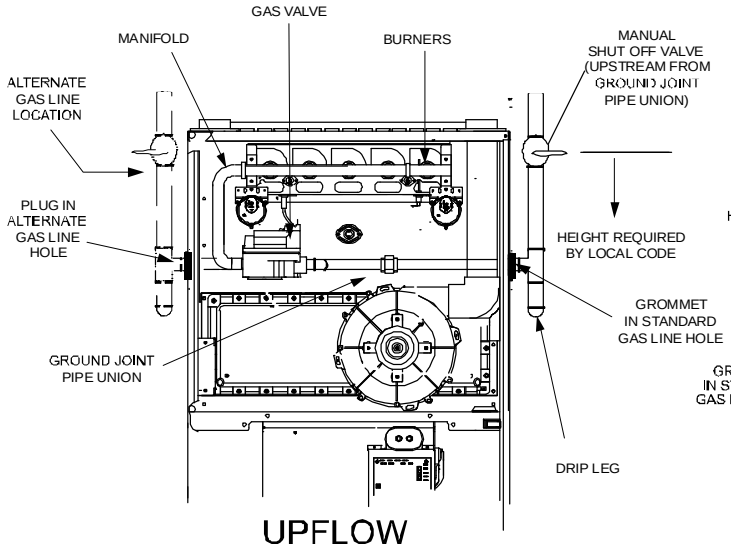
$$CFH = \frac{\text{BTUH Furnace Input}}{\text{Heating Value of Gas (BTU/Cubic Foot)}}$$

To connect the furnace to the building's gas piping, the installer must supply a ground joint union, drip leg, manual shutoff valve, and line and fittings to connect to gas valve. In some cases, the installer may also need to supply a transition piece from 1/2" pipe to a larger pipe size.

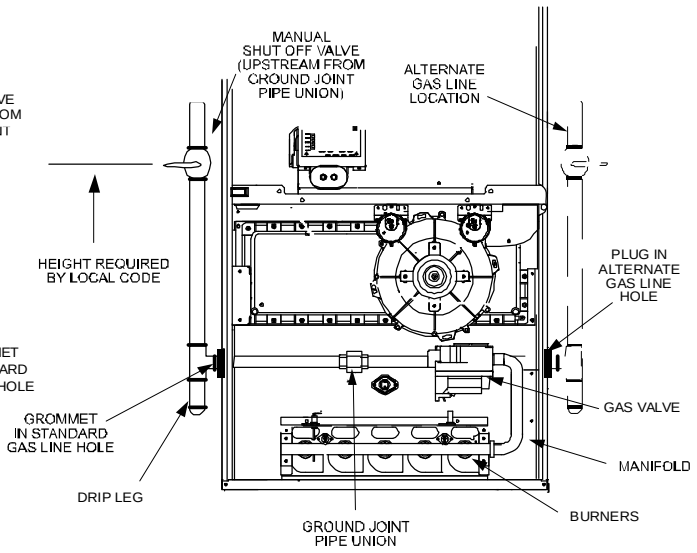
The following stipulations apply when connecting gas piping. Refer to *Gas Piping Connections* figure for typical gas line connections to the furnace.

- Gas piping must be supported external to the furnace cabinet so that the weight of the gas line does not distort the burner rack, manifold or gas valve.
- Use black iron or steel pipe and fittings for building piping. Where possible, use new pipe that is properly chamfered, reamed, and free of burrs and chips. If old pipe is used, be sure it is clean and free of rust, scale, burrs, chips, and old pipe joint compound.
- Use pipe joint compound on male threads ONLY. Always use pipe joint compound (pipe dope) that is APPROVED FOR ALL GASSES. DO NOT apply compound to the first two threads.
- Use ground joint unions.
- Install a drip leg to trap dirt and moisture before it can enter the gas valve. The drip leg must be a minimum of three inches long.
- Install a 1/8" NPT pipe plug fitting, accessible for test gage connection, immediately upstream of the gas supply connection to the furnace.
- Always use a back-up wrench when making the connection to the gas valve to keep it from turning. The orientation of the gas valve on the manifold must be maintained as shipped from the factory. Maximum torque for the gas valve connection is 375 in-lbs; excessive over-tightening may damage the gas valve.
- Install a manual shutoff valve between the gas meter and unit within six feet of the unit. If a union is installed, the union must be downstream of the manual shutoff valve, between the shutoff valve and the furnace.

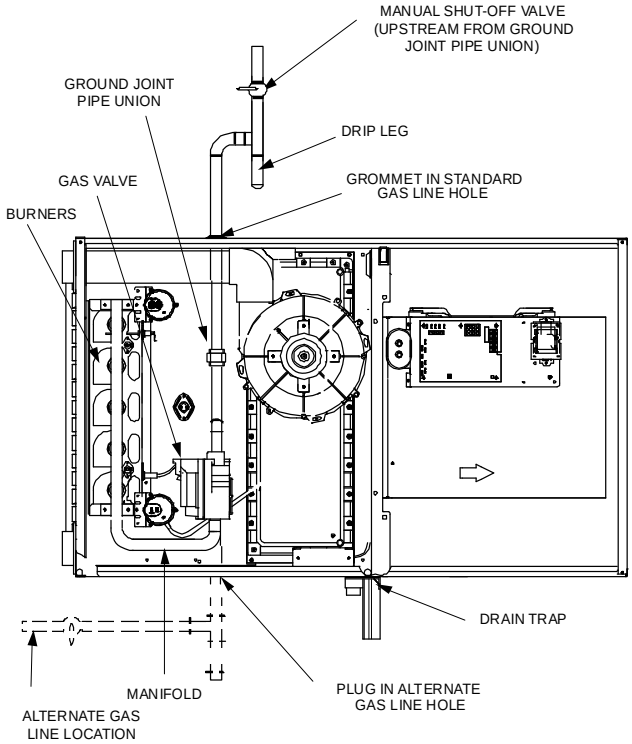
OPERATION



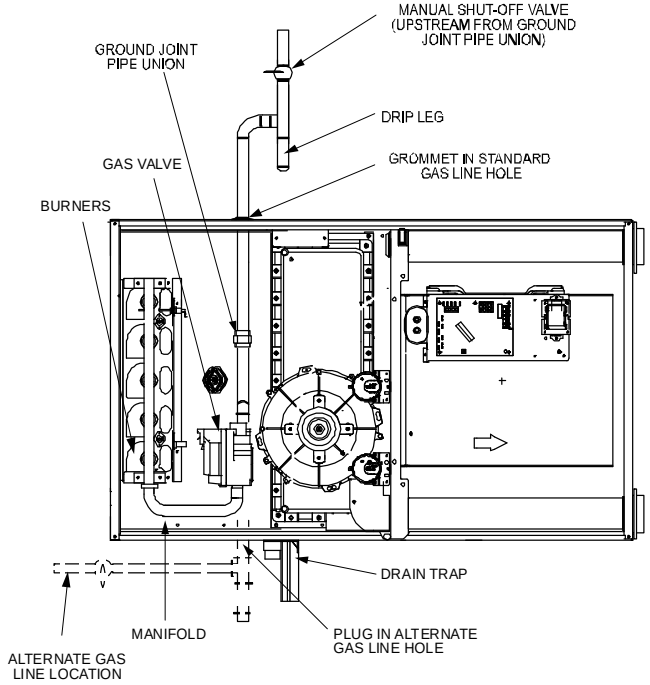
UPFLOW



COUNTERFLOW



HORIZONTAL [UPFLOW MODEL]



HORIZONTAL[COUNTERFLOW]

NOTES: 1. WHEN GAS LINE IS IN THE ALTERNATE LOCATION, SWAP THE POSITION OF THE PLUG AND GROMMET.

2. DRIP LEG MAY TERMINATE WITH A 1/2" X 1/8" PIPE PLUG TO ACCOMMODATE LINE GAS PRESSURE MEASUREMENT.

Gas Piping Connections

- Tighten all joints securely.
- Connect the furnace to the building piping by one of the following methods:
  - Rigid metallic pipe and fittings.
  - Semi-rigid metallic tubing and metallic fittings. Aluminum alloy tubing must not be used in exterior locations. In order to seal the grommet cabinet penetration, rigid pipe must be used to reach the outside of the cabinet. A semi-rigid connector to the gas piping may be used from there.
- Use listed gas appliance connectors in accordance with their instructions. Connectors must be fully in the same room as the furnace.
- Protect connectors and semirigid tubing against physical and thermal damage when installed. Ensure aluminum-alloy tubing and connectors are coated to protect against external corrosion when in contact with masonry, plaster, or insulation, or subjected to repeated wetting by liquids such as water (except rain water), detergents, or sewage.

DIRECT/STANDARD INLET PIPING

WARNING

EDGES OF SHEET METAL HOLES MAY BE SHARP. USE GLOVES AS A PRECAUTION WHEN REMOVING HOLE PLUGS.

When gas piping enters *directly* to the gas valve through the *standard* inlet hole, the installer must supply straight pipe with a ground joint union to reach the exterior of the furnace. The rigid pipe must be long enough to reach the outside of the cabinet to seal the grommet cabinet penetration. A semi-rigid connector to the gas piping can be used outside the cabinet per local codes.

INDIRECT/ALTERNATE INLET PIPING

When gas piping enters *indirectly* to the gas valve through the *alternate* gas inlet hole the following fittings (starting from the gas valve) to reach the outside of the cabinet must be supplied:

- Close nipple.
- 90 degree elbow.
- 2½ inch nipple.
- 90 degree elbow.
- Straight pipe, with a ground joint union, to reach the exterior of the furnace. The rigid pipe must be long enough to reach the outside of the cabinet so as to seal the grommet cabinet penetration. A semi-rigid connector to the gas piping can be used outside the cabinet per local codes.

GAS PIPING CHECKS

Before placing unit in operation, leak test the unit and gas connections.

WARNING

TO AVOID THE POSSIBILITY OF EXPLOSION OR FIRE, NEVER USE A MATCH OR OPEN FLAME TO TEST FOR LEAKS.

Check for leaks using an approved chloride-free soap and water solution, an electronic combustible gas detector, or other approved testing methods.

NOTE: Never exceed specified pressures for testing. Higher pressure may damage the gas valve and cause subsequent overfiring, resulting in heat exchanger failure.
Disconnect this unit and shutoff valve from the gas supply piping system before pressure testing the supply piping system with pressures in excess of 1/2 psig (3.48 kPa).

Isolate this unit from the gas supply piping system by closing its external manual gas shutoff valve before pressure testing supply piping system with test pressures equal to or less than 1/2 psig (3.48 kPA).

PROPANE GAS TANKS AND PIPING

WARNING

IF THE GAS FURNACE IS INSTALLED IN A BASEMENT, AN EXCAVATED AREA OR CONFINED SPACE, IT IS STRONGLY RECOMMENDED TO CONTACT A PROPANE SUPPLIER TO INSTALL A GAS DETECTING WARNING DEVICE IN CASE OF A GAS LEAK.

- **SINCE PROPANE GAS IS HEAVIER THAN AIR, ANY LEAKING GAS CAN SETTLE IN ANY LOW AREAS OR CONFINED SPACES.**
- **PROPANE GAS ODORANT MAY FADE, MAKING THE GAS UNDETECTABLE EXCEPT WITH A WARNING DEVICE.**

A gas detecting warning system is the only reliable way to detect a propane gas leak. Rust can reduce the level of odorant in propane gas. Do not rely on your sense of smell. Contact a local propane gas supplier about installing a gas detecting warning system. If the presence of gas is suspected, follow the instructions listed in the *Safety Precautions* section of this manual.

All propane gas equipment must conform to the safety standards of the National Board of Fire Underwriters, NBFU Manual 58.

For satisfactory operation, propane gas pressure must be 10" WC $\pm$ .5" WC at the furnace manifold with all gas appliances in operation. Maintaining proper gas pressure depends on three main factors:

1. Vaporization rate, depending on temperature of the liquid, and "wetted surface" area of the container or containers.

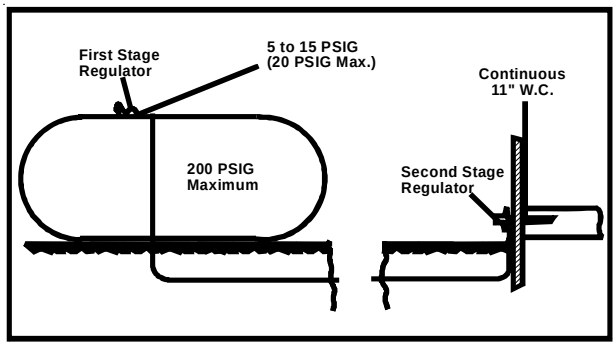
OPERATION

2. Proper pressure regulation. (Two-stage regulation is recommended for both cost and efficiency).
3. Pressure drop in lines between regulators, and between second stage regulator and the appliance. Pipe size will depend on length of pipe run and total load of all appliances.

Complete information regarding tank sizing for vaporization, recommended regulator settings, and pipe sizing is available from most regulator manufacturers and propane gas suppliers.

Since propane gas will quickly dissolve white lead and most standard commercial compounds, special pipe dope must be used. Shellac-based compounds resistant to the actions of liquefied petroleum gases such as Gasolac®, Stalactic®, Clyde's® or John Crane® are satisfactory.

Refer to the following illustration for typical propane gas installations and piping.



Propane Gas Installation (Typ.)

Sizing Between First and Second Stage Regulator*
Maximum Propane Capacities listed are based on 2 psig pressure drop at 10 psig setting.
Capacities in 1,000 BTU/hour.

Pipe or Tubing Length Feet	Tubing Size, O.D. Type L					Nominal Pipe Size Schedule 40	
	3/8"	1/2"	5/8"	3/4"	7/8"	1/2"	3/4"
10	730	1,700	3,200	5,300	8,300	3,200	7,500
20	500	1,100	220	3,700	5,800	2,200	4,200
30	400	920	2,000	2,900	4,700	1,800	4,000
40	370	850	1,700	2,700	4,100	1,600	3,700
50	330	770	1,500	2,400	3,700	1,500	3,400
60	300	700	1,300	2,200	3,300	1,300	3,100
80	260	610	1,200	1,900	2,900	1,200	2,600
100	220	540	1,000	1,700	2,600	1,000	2,300
125	200	490	900	1,400	2,300	900	2,100
150	190	430	830	1,300	2,100	830	1,900
175	170	400	780	1,200	1,900	770	1,700
200	160	380	730	1,100	1,800	720	1,500

To convert to capacities at 15 psig settings - multiply by 1.130
To convert to capacities at 5 psig settings - multiply by 0.879

Propane Gas Piping Chart I

Sizing Between Second or Second Stage Regulator & Appliance*
Maximum Propane Capacities listed are based on 1/2" W.C. pressure drop at 11" W.C. setting.
Capacities in 1,000 BTU/hour.

Pipe or Tubing Length Feet	Tubing Size, O.D. Type L					Nominal Pipe Size Schedule 40				
	3/8"	1/2"	5/8"	3/4"	7/8"	1/2"	3/4"	1"	1-1/4"	1-1/2"
10	39	92	199	329	501	275	567	1,071	2,205	3,307
20	26	62	131	216	346	189	393	732	1,496	2,299
30	21	50	107	181	277	152	315	590	1,212	1,858
40	19	41	90	145	233	129	267	504	1,039	1,559
50	18	37	79	131	198	114	237	448	913	1,417
60	16	35	72	1,211	187	103	217	409	834	1,275
80	13	29	62	104	155	89	185	346	724	1,066
100	11	26	55	90	138	78	162	307	630	976
125	10	24	48	81	122	69	146	275	567	866
150	9	21	43	72	109	63	132	252	511	787
200	8	19	39	66	100	54	112	209	439	665
250	8	17	36	60	93	48	100	185	390	590

*Data in accordance with NFPA pamphlet No. 54

Propane Gas Piping Chart II

Circulating Air & Filters

DUCT WORK - AIR FLOW

⚠ WARNING

NEVER ALLOW THE PRODUCTS OF COMBUSTION, INCLUDING CARBON MONOXIDE, TO ENTER THE RETURN DUCT WORK OR CIRCULATION AIR SUPPLY.

Duct systems and register sizes must be properly designed for the CFM and external static pressure rating of the furnace. Design the ductwork in accordance with the recommended methods of "Air Conditioning Contractors of America" Manual D.

Install the duct system in accordance with Standards of the National Board of Fire Underwriters for the Installation of Air Conditioning, Warm Air Heating and Ventilating Systems. Pamphlets No. 90A and 90B.

A closed return duct system must be used, with the return duct connected to the furnace. **NOTE:** Ductwork must never be attached to the back of the furnace. For upflow installations requiring 1800 CFM or more, use either two side returns or bottom return or a combination of side /bottom. Flexible joints may be used for supply and return connections to reduce noise transmission. To prevent the blower from interfering with combustion air or draft when a central return is used, a connecting duct must be installed between the unit and the utility room wall. Never use a room, closet, or alcove as a return air chamber.

CHECKING DUCT STATIC

Refer to your furnace rating plate for the maximum ESP (external duct static) rating.

Total external static refers to everything external to the furnace cabinet. Cooling coils, filters, ducts, grilles, registers must all be considered when reading your total external static pressure. The supply duct pressure must be read between the furnace and the cooling coil. This reading is usually taken by removing the "A" shaped block off plate from the end on the coil; drilling a test hole in it and reinstalling the block off plate. Take a duct static reading at the test hole. Tape up the test hole after your test is complete. The negative pressure must be read between the filter and the furnace blower.

OPERATION

Too much external static pressure will result in insufficient air that can cause excessive temperature rise. This can cause limit switch tripping and heat exchanger failure.

To determine total external duct static pressure, proceed as follows;

1. With clean filters in the furnace, use a draft gauge (inclined manometer) to measure the static pressure of the return duct at the inlet of the furnace. (Negative Pressure)
2. Measure the static pressure of the supply duct. (Positive Pressure)
3. The difference between the two numbers is .4" w.c.

Example:

static reading from return duct = -0.1" w.c.

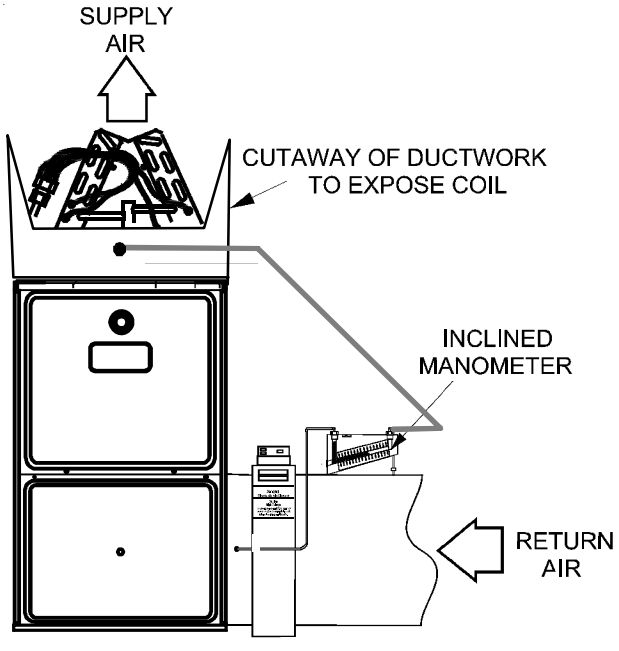
static reading from supply duct = 0.3" w.c.

total external static pressure on this system = 0.4" w.c.

NOTE: Both readings may be taken simultaneously and read directly on the manometer if so desired. If an air conditioner coil or Electronic Air Cleaner is used in conjunction with the furnace, the readings must also include theses components, as shown in the following drawing.

4. Consult proper tables for the quantity of air.

If the total external static pressure exceeds the maximum listed on the furnace rating plate, check for closed dampers, registers, undersized and/or oversized poorly laid out duct work.



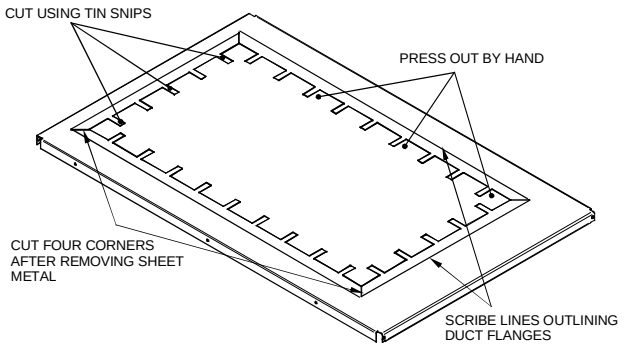
Checking Static Pressure

Bottom Return Air Opening [Upflow Models]

The bottom return air opening on upflow models utilizes a "lance and cut" method to remove sheet metal from the duct opening in the base pan. To remove, simply press out the lanced sections by hand to expose the metal strips retaining the sheet metal over the duct opening. Using tin snips, cut the metal strips and remove the sheet metal covering the duct opening. In the corners of the opening, cut the sheet metal along the scribe lines to free the duct flanges. Using the scribe line along the duct flange as a guide, unfold the duct flanges around the perimeter of the opening using a pair of seamer pliers or seamer tongs. **NOTE:** Airflow area will be reduced by approximately 18% if duct flanges are not unfolded. This could cause performance issues and noise issues.

WARNING

Edges of sheet metal holes may be sharp. Use gloves as a precaution when removing sheet metal from return air openings.



Duct Flange Cut Outs

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

When the furnace is installed without a cooling coil, it is recommended that a removable access panel be provided in the outlet air duct. This opening shall be accessible when the furnace is installed and shall be of such a size that the heat exchanger can be viewed for visual light inspection or such that a sampling probe can be inserted into the airstream. The access panel must be made to prevent air leaks when the furnace is in operation.

When the furnace is heating, the temperature of the return air entering the furnace must be between 55°F and 100°F.

OPERATION

Filters - Read This Section Before Installing The Return Air Duct work

Filters must be used with this furnace. Discuss filter maintenance with the building owner. Filters do not ship with this furnace, but must be provided, sized and installed externally by the installer. Filters must comply with UL900 or CAN/ULCS111 standards. If the furnace is installed without filters, the warranty will be voided.

On upflow units, guide dimples locate the side return cutout locations. Use a straight edge to scribe lines connecting the dimples. Cut out the opening on these lines. **NOTE:** An undersized opening will cause reduced airflow.

Refer to Minimum Filter Area tables to determine filter area requirements.

		UPFLOW COOLING AIRFLOW REQUIREMENT (CFM)						
		600	800	1000	1200	1400	1600	2000
Input Airflow	0603__XA	---	---	627*	627*	672	768	---
	0805__XA	---	---	---	836*	836*	836*	960
	1005__XA 1155__XA	---	---	---	940*	940*	940*	960

		COUNTERFLOW COOLING AIRFLOW REQUIREMENT (CFM)						
		600	800	1000	1200	1400	1600	2000
Input Airflow	0604__XA	---	---	320*	320*	336	384	---
	0805__XA 1005__XA	---	---	---	427*	427*	427*	480

*Minimum filter area dictated by heating airflow requirement.

Permanent Minimum Filter Area (sq. in)

[Based on a 600 ft/min filter face velocity]

		UPFLOW COOLING AIRFLOW REQUIREMENT (CFM)						
		600	800	1000	1200	1400	1600	2000
Input Airflow	0603__XA	---	---	564*	564*	672	768	
	0805__XA	---	---	---	752*	752*	768	960
	1005__XA 1155__XA	---	---	---	940*	940*	940*	960

		COUNTERFLOW COOLING AIRFLOW REQUIREMENT (CFM)						
		600	800	1000	1200	1400	1600	2000
Input Airflow	0604__XA	---	---	641*	641*	672	768	---
	0805__XA 1005__XA	---	---	---	854*	854*	854*	960

*Minimum filter area dictated by heating airflow requirement.

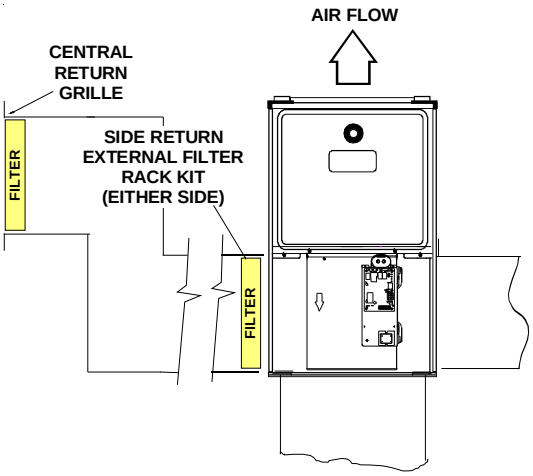
Disposable Minimum Filter area (sq. in)

[Based on 300 ft/min filter face velocity]

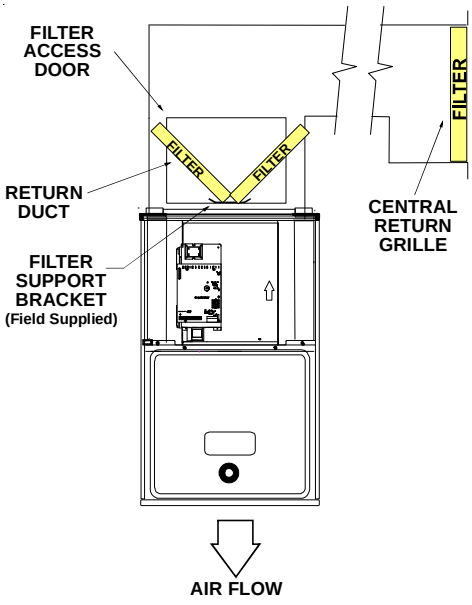
Upright Installations

Depending on the installation and/or customer preference, differing filter arrangements can be applied. Filters can be installed in the central return register or a side panel external filter rack kit (upflows). As an alternative a media air filter or electronic air cleaner can be used as the requested filter.

The following figure shows possible filter locations.



Possible Upright Upflow



Possible Upright Counterflow Filter Locations

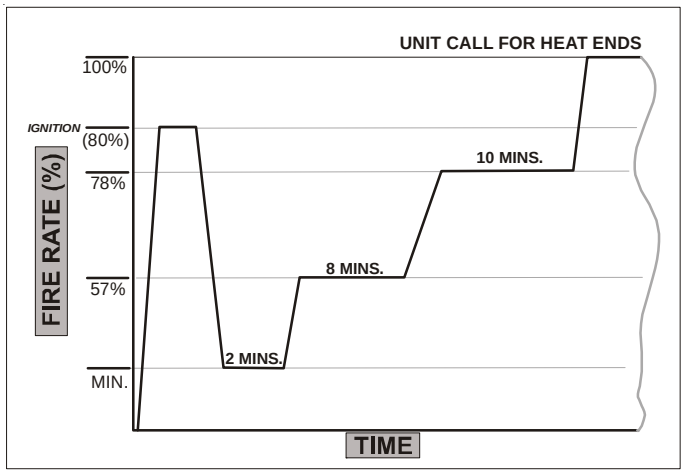
OPERATION

HORIZONTAL INSTALLATIONS

Filters must be installed in either the central return register or in the return air duct work.

Startup Procedure & Adjustment

Furnace must have a 115 VAC power supply properly connected and grounded. Proper polarity must be maintained for correct operation. In addition to the following start-up and adjustment items, refer to further information in *Operational Checks* section.

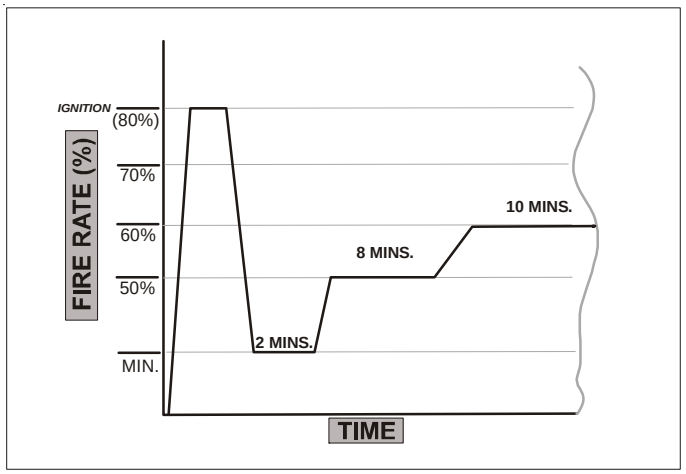


Operation with Conventional 1-Stage Thermostat (DIP switch selections 1-Stage heat)

Call for heat, thermostat energizes W1 on IFC (W2 input is ignored).

After a successful Light Off Sequence and expiration of the Ignition Stabilization Period:

- After 2 minutes, the IFC increases to 57% at a rate of 1% per second
- After 10 total minutes, the IFC increases to 78% at a rate of 1% per second.
- After 20 total minutes, the IFC increases to 100% at a rate of 1% per second for the remainder of the call for heat.
- The circulator is adjusted to the appropriate CFM, corresponding to the current firing rate.



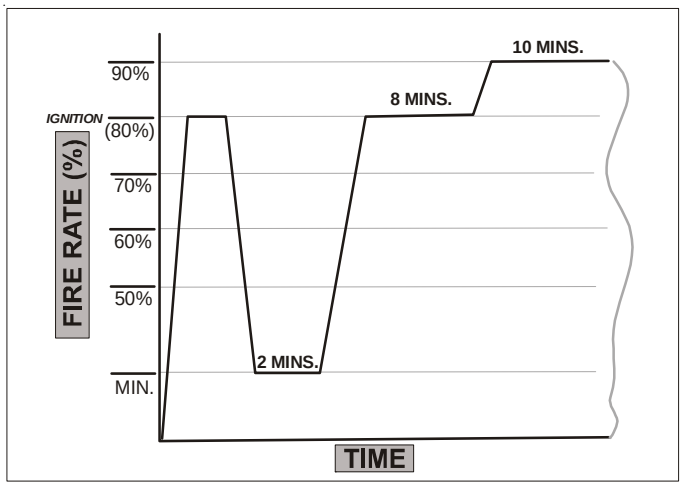
Operation with Conventional 2-Stage Thermostat (DIP switch selects 2-stage heat)

Call for 1st-Stage Heat - Thermostat contacts close R to W1.

After a successful Light Off Sequence and expiration of the Ignition Stabilization Period:

- The IFC adjusts to the low firing rate.
- After 2 minutes, the IFC increases to 50% fort he next 8 minutes.
- Thereafter, the IFC will increase 10%, at a rate of 1% per second, every 10 minutes for the remainder of the call for heat (See above figure).
- The circulator is adjusted to the appropriate CFM, corresponding to the current firing rate.

OPERATION

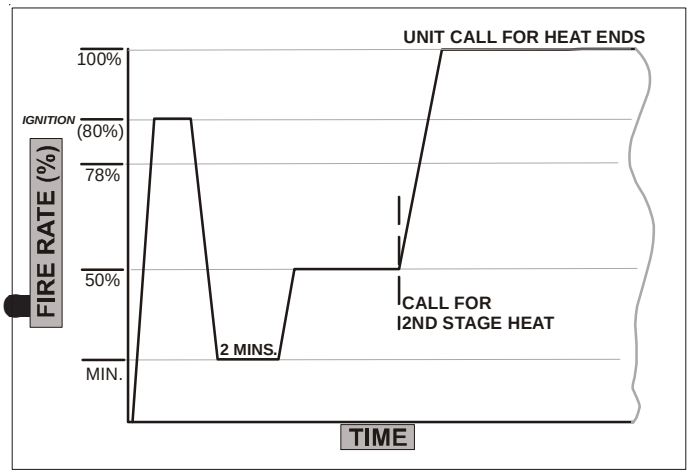


Operation with Conventional 2-Stage Thermostat (DIP switch selects 2-stage heat)

Call for 2nd-Stage Heat - Thermostat contacts close R to W1 and W2.

After a successful Light Off Sequence and expiration of the Ignition Stabilization Period:

- The IFC adjusts to the low firing rate.
- After 2 minutes, the IFC increases to 80%.
- Thereafter, the IFC will increase 10%, at a rate of 1% per second, every 10 minutes for the remainder of the call for heat.
- The circulator is adjusted to the appropriate CFM, corresponding to the current firing rate.



Call for 2nd-Stage Heat with 1st-Stage call for heat call in progress, with conventional 2-Stage Thermostat.

- The IFC increases the firing rate to 100% at a rate of 1% per second for the remainder of the W2 call.
- The circulator is adjusted to the appropriate CFM, corresponding to the current firing rate.

Call for 2nd-Stage Heat satisfied; Call for 1st-Stage Heat remains.

- The IFC remains at the current firing rate until the 1st-Stage call for heat is satisfied.

HEATING OPERATION WITH CTK01 THERMOSTAT (COMMUNICATING)

- When the Thermostat Heat Setup DIP switch is set to 2-Stage heat, the IFC operation will be compatible with a CTK01communicating thermostat.
- When a call for heat is sent, the furnace will go through the Light Off Sequence, After the successful Light Off Sequence and expiration of the Ignition Stabilization Period:
- The IFC adjusts to the low firing rate.
- After 2 minutes, the IFC accepts the specific Heat Requested Demand.
- If the differential is equal to or less than 2 degrees, the IFC will follow the conventional 2-Stage algorithm, equivalent to a W1 request..
- If the heat differential is greater than 2 degrees, the IFC will follow the conventional 2-Stage algorithm, equivalent to a W2 request.
- The circulator will operate per the heat airflow profile.

HEATING OPERATION WITH CTK02** THERMOSTAT (MODULATING COMMUNICATING)

- When the Thermostat Heat Setup DIP switch is set to 1-Stage heat, the IFC operation will be compatible with a modulating communicating thermostat (CTK02**).
- When a call for heat is sent, the furnace will go through the Light Off Sequence, After the successful Light Off Sequence and expiration of the Ignition Stabilization Period:
- The IFC adjusts to the low firing rate.
- After 2 minutes, the IFC accepts the specific Heat Requested Demand.
- If the differential is 2 degrees or less, the Heat Current Demand Status will show 50%.
- If the specific Heat Requested Demand is above 2 degrees, the Heat Current Demand Status will track the specific Heat Requested Demand.
- The circulator will operate per the heat airflow profile.

HEAT ANTICIPATOR SETTING

The heat anticipator in the room thermostat must be correctly adjusted to obtain the proper number of cycles per hour and to prevent “overshooting” of the setting. Set the heat anticipator setting to 0.7 amps. Follow the thermostat manufacturer’s instructions on how to adjust the heat anticipator setting.

DRAIN TRAP PRIMING

The drain trap must be primed prior to furnace startup. To prime, fill the drain trap with water. This ensures proper furnace drainage upon startup and prohibits the possibility of flue gases escaping through the drain system. Air conditioning condensate may be drained into the furnace trap. Please see requirements in *Condensate Drain Lines & Drain Trap* section.

OPERATION

Furnace Operation

Purge gas lines of air prior to startup. Be sure not to purge lines into an enclosed burner compartment.

Check for leaks using an approved chloride-free soap and water solution, an electronic combustible gas detector, or other approved method. Verify that all required kits (propane gas, etc.) have been appropriately installed.

Furnace Startup

1. Close the manual gas shutoff valve external to the furnace.
2. Turn off the electrical power to the furnace.
3. Set the room thermostat to the lowest possible setting.
4. Remove the burner compartment door.

NOTE: This furnace is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.

5. Move the furnace gas valve manual control to the OFF position.
6. Wait five minutes then smell for gas. Be sure check near the floor as some types of gas are heavier than air.
7. If you smell gas after five minutes, immediately follow the *Safety Instructions* on page 5 of this manual. If you do not smell gas after five minutes, move the furnace gas valve manual control to the ON position.
8. Replace the burner compartment door.
9. Open the manual gas shutoff valve external to the furnace.
10. Turn on the electrical power to the furnace.
11. Adjust the thermostat to a setting above room temperature.
12. After the burners are lit, set the thermostat to desired temperature.

Furnace Shutdown

1. Set the thermostat to the lowest setting.

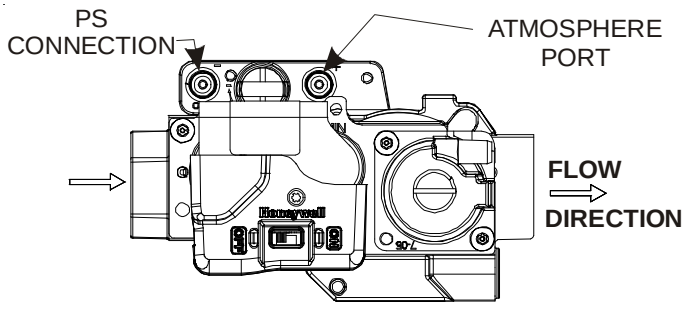
   The integrated control will close the gas valve and extinguish flame. Following a 15 second delay, the induced draft blower will be de-energized. After a 120, 150, 180 or 210-second delay period (field selectable delay OFF [90, 120, 150, 180] plus 30-second ramp down), the circulator blower de-energizes.
2. Remove the burner compartment door and move the furnace gas valve manual control to the OFF position.
3. Close the manual gas shutoff valve external to the furnace.
4. Replace the burner compartment door.

Gas Supply Pressure Measurement

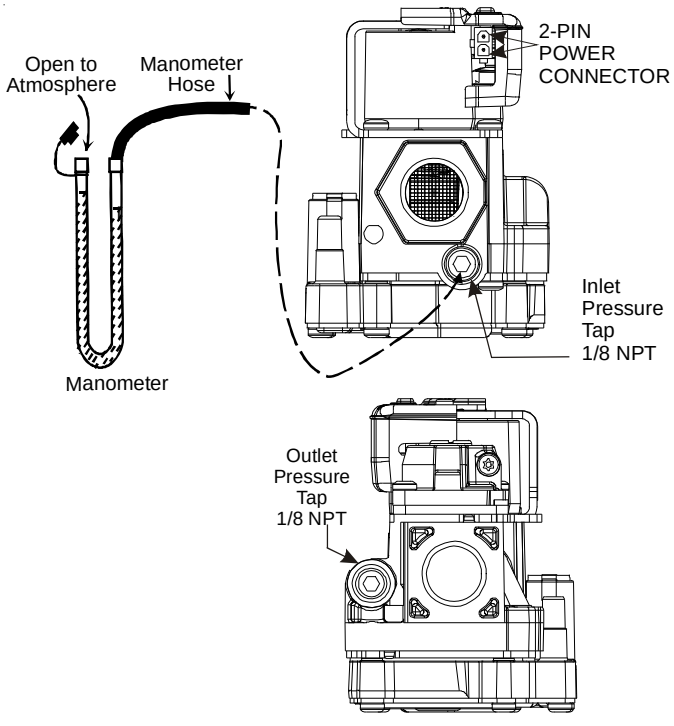
CAUTION

TO PREVENT UNRELIABLE OPERATION OR EQUIPMENT DAMAGE, THE INLET GAS SUPPLY PRESSURE MUST BE AS SPECIFIED ON THE UNIT RATING PLATE WITH ALL OTHER HOUSEHOLD GAS FIRED APPLIANCES OPERATING.

The line pressure supplied to the gas valve must be within the range specified below. The supply pressure can be measured at the gas valve inlet pressure boss or at a hose fitting installed in the gas piping drip leg. The supply pressure must be measured with the burners operating. To measure the gas supply pressure, use the following procedure.



Honeywell Model VR9205R



Honeywell Model VR9205R Connected to Manometer

OPERATION

1. Turn OFF gas to furnace at the manual gas shutoff valve external to the furnace.
2. Connect a calibrated water manometer (or appropriate gas pressure gauge) at either the gas valve inlet pressure boss or the gas piping drip leg. See Honeywell VR9205R gas valve figure for location of inlet pressure boss.

NOTE: If measuring gas pressure at the drip leg or Honeywell VR9205R gas valve, a field-supplied hose barb fitting must be installed prior to making the hose connection.

3. Turn ON the gas supply and operate the furnace and all other gas consuming appliances on the same gas supply line.

   Field Test Mode is intended to help a service person

   troubleshoot and check out an installed appliance.

   To enter Field Test Mode the Fault Recall Push-Button

   must be pressed twice within a 5 second period at any

   time during a heating cycle, at which time the display

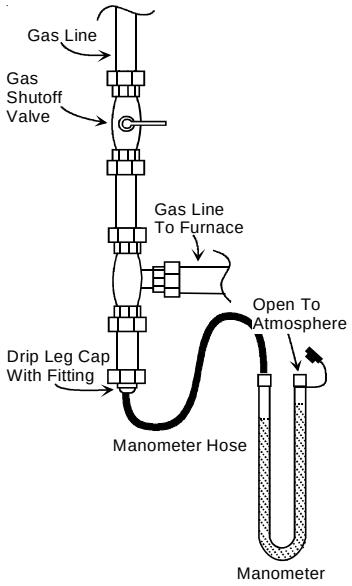
   will show “Ft”. While the display is showing “Ft”, pressing and holding the Fault Recall Push-Button for 3 seconds will enable the field test mode and override the normal firing rate sequence at a rate of 100% for 5 minutes or until the end of the call for heat. The display will show the normal “Hi” while the control is firing at 100%. If the Fault Recall Push-Button has not been pressed within 5 seconds of displaying “Ft” the display will revert back to normal.

4. Measure furnace gas supply pressure with burners firing. Supply pressure must be within the range specified in the *Inlet Gas Supply Pressure* table.

Inlet Gas Supply Pressure		
Natural Gas	Minimum: 4.5" w.c.	Maximum: 10.0" w.c.
Propane Gas	Minimum: 11.0" w.c.	Maximum: 13.0" w.c.

If supply pressure differs from table, make the necessary adjustments to pressure regulator, gas piping size, etc., and/or consult with local gas utility.

5. Turn OFF gas to furnace at the manual shutoff valve and disconnect manometer. Reinstall plug before turning on gas to furnace.
6. Turn OFF any unnecessary gas appliances stated in step 3.



Measuring Inlet Gas Pressure (Alt. Method)

GAS MANIFOLD PRESSURE MEASUREMENT

CAUTION

TO PREVENT UNRELIABLE OPERATION OR EQUIPMENT DAMAGE, THE GAS MANIFOLD PRESSURE MUST BE AS SPECIFIED ON THE UNIT RATING PLATE. GAS VALVE IS FACTORY SET AND DOES NOT REQUIRE ANY FIELD ADJUSTMENT. DO NOT ATTEMPT TO ADJUST VALVE.

The manifold pressure must be measured with the burners operating. To measure the manifold pressure, use the following procedure.

1. Turn OFF gas to furnace at the manual gas shutoff valve external to the furnace.
2. Turn off all electrical power to the system.
3. Outlet pressure tap connections: Remove the outlet pressure boss plug. Install an 1/8" NPT hose barb fitting into the outlet pressure tap.
4. Attach a hose and manometer to the outlet pressure barb fitting.
5. Turn ON the gas supply.
6. Turn on power and close thermostat “R” and “W1” contacts to provide a call for low stage heat.
7. Modulating furnaces light at 80% of max input. For natural gas the expected manifold pressure at ignition will be in a range of 1.8" - 2.5" WC. For LP gas the range will be 5.8" - 6.8" WC.

   NOTE: Measure the gas manifold pressure with the burners firing. After every time the main power is turned off and back on, the furnace will enter a calibration routine on the next call for heat *The inducer will ramp up and down during the calibration routine. After calibration, the furnace will proceed to ignition cycle.*

8. Field Test Mode is intended to help a service person troubleshoot and check out an installed appliance by bringing the furnace up to High fire (100% input), by-passing the normal modulating routine.

   To enter Field Test Mode the Fault Recall Push-Button must be pressed twice within a 5 second period at any time during a heating cycle, at which time the display will show "Ft". While the display is showing "Ft", pressing and holding the Fault Recall Push-Button for 3 seconds will enable the field test mode and override the normal firing rate sequence at a rate of 100% for 5 minutes or until the end of the call for heat. The display will show the normal "Hi" while the control is firing at 100%. If the Fault Recall Push-Button has not been pressed within 5 seconds of displaying "Ft" the display will revert back to normal.

   NOTE: Gas valve is factory set and does NOT require any field adjustment. Do NOT attempt to adjust valve.

9. Turn off all electrical power and gas supply to the system.
10. Remove the manometer hose from the hose barb fitting.
11. Remove the 1/8" NPT hose barb fitting from the outlet pressure tap. Replace the outlet pressure boss plug and seal with a high quality thread sealer.
12. Turn on electrical power and gas supply to the system.
13. Close thermostat contacts "R" and "W1/W2" to energize the valve.

Using a leak detection solution or soap suds, check for leaks at outlet pressure boss plug. Bubbles forming indicate a leak. SHUT OFF GAS AND REPAIR ALL LEAKS IMMEDIATELY!

NOTE: For natural gas to LP conversion, consult the furnace Specification Sheet.

Manifold Gas Pressure			
Gas		Range	Nominal
Natural	High Stage	3.2 - 3.8" w.c.	3.5" w.c.
Propane	High Stage	9.5 - 10.5" w.c.	10.0" w.c.

GAS INPUT RATE MEASUREMENT (NATURAL GAS ONLY)

The gas input rate to the furnace must never be greater than that specified on the unit rating plate. To measure natural gas input using the gas meter, use the following procedure.

1. Turn OFF the gas supply to all other gas-burning appliances except the furnace.
2. While the furnace is operating, time and record one complete revolution of the smallest gas meter dial.
3. Calculate the number of seconds per cubic foot (sec/ ft^3) of gas being delivered to the furnace. If the dial is a one cubic foot dial, divide the number of seconds recorded in step 2 by one. If the dial is a two cubic foot dial, divide the number of seconds recorded in step 2 by two.
4. Calculate the furnace input in BTUs per hour (BTU/hr). Input equals the sum of the installation's gas heating value and a conversion factor (hours to seconds) divided by the number of seconds per cubic foot. The measured input must not be greater than the input indicated on the unit rating plate.

   EXAMPLE:

   Installation's gas heating (HTG) value: 1,000 BTU/ft^3 (Obtained from gas supplier)

   Installation's seconds per cubic foot: 34 sec/ ft^3

   Conversion Factor (hours to seconds): 3600 sec/hr

   Input = (Htg. value x 3600) ÷ seconds per cubic foot

   Input = (1,000 BTU/ft^3 x 3600 sec/hr) ÷ 34 sec/ ft^3

   Input = 106,000 BTU/hr

NOTE: The final manifold pressure cannot vary by more than ± 0.3" w.c. for Natural and ± 0.5" for LP from the specified setting. Consult your local gas supplier if additional input rate adjustment is required.

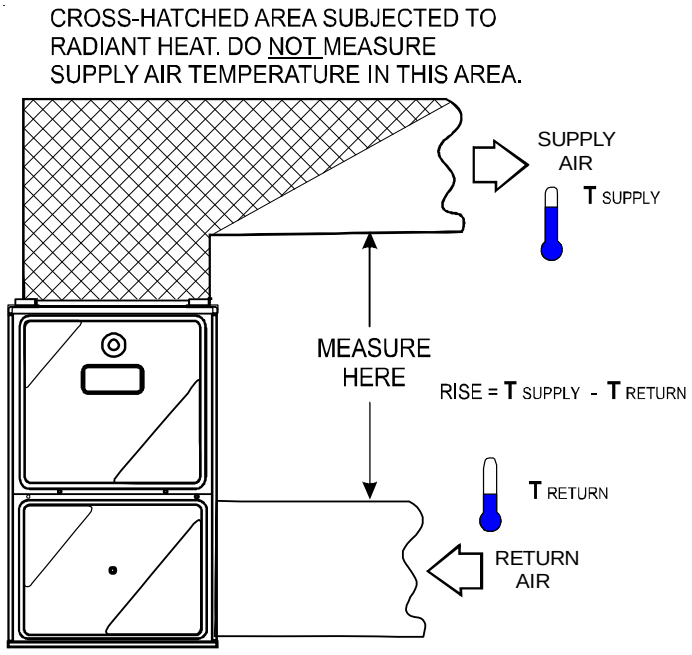
5. Turn ON gas to and relight all other appliances turned off in step 1. Be certain that all appliances are functioning properly and that all pilot burners are operating.

Temperature Rise

Temperature rise must be within the range specified on the unit rating plate. An incorrect temperature rise may result in condensing in or overheating of the heat exchanger. An airflow and temperature rise table is provided in the Specification Sheet applicable to your model. Determine and adjust temperature rise as follows:

1. Operate furnace with burners firing for approximately ten minutes. Ensure all registers are open and all duct dampers are in their final (fully or partially open) position.
2. Place thermometers in the return and supply ducts as close to the furnace as possible. Thermometers must not be influenced by radiant heat by being able to "see" the heat exchanger.
3. Subtract the return air temperature from the supply air temperature to determine the air temperature rise. Allow adequate time for thermometer readings to stabilize.
4. Adjust temperature rise by adjusting the circulator blower speed. Increase blower speed to reduce temperature rise. Decrease blower speed to increase temperature rise. Refer to *Startup Procedure and Adjustment -Circulator Blower Speeds* for speed changing details.

OPERATION



Temperature Rise Measurement

CIRCULATOR BLOWER SPEEDS

WARNING

TO AVOID PERSONAL INJURY OR DEATH DUE TO ELECTRICAL SHOCK, TURN OFF POWER TO THE FURNACE BEFORE CHANGING SPEED TAPS.

This furnace is equipped with a multi-speed circulator blower. This blower provides ease in adjusting blower speeds. The heating blower speed is shipped set at "B", and the cooling blower speed is set at "D". These blower speeds should be adjusted by the installer to match the installation requirements so as to provide the correct heating temperature rise and correct cooling CFM.

Use the dual 7-segment LED display adjacent to the DIP switches to obtain the approximate airflow quantity. The airflow quantity is displayed as a number on the display, rounded to the nearest 100 CFM. The display alternates airflow delivery indication and the operating mode indication.

Example: The airflow being delivered is 1225 CFM. The display indicates 12. If the airflow being delivered is 1275, the display indicates 13.

1. Determine the tonnage of the cooling system installed with the furnace. If the cooling capacity is in BTU/hr divide it by 12,000 to convert capacity to TONs.

   Example: Cooling Capacity of 30,000 BTU/hr.

   30,000/12,000 = 2.5 Tons

2. Determine the proper air flow for the cooling system. Most cooling systems are designed to work with air flows between 350 and 450 CFM per ton. Most manufacturers recommend an air flow of about 400 CFM per ton.

   Example: 2.5 tons X 400 CFM per ton = 1000 CFM

The cooling system manufacturer's instructions must be checked for required air flow. Any electronic air cleaners or other devices may require specific air flows, consult installation instructions of those devices for requirements.

3. Knowing the furnace model, locate the high stage cooling air flow charts in the Specification Sheet applicable to your model. Look up the cooling air flow determined in step 2 and find the required cooling speed and adjustment setting.

   Example: A *MVM960603BX furnace installed with a 2.5 ton air conditioning system. The air flow needed is 1000 CFM. Looking at the cooling speed chart for *MVM960603BX, find the air flow closest to 1000 CFM. A cooling airflow of 1000 CFM can be attained by selecting the cooling speed "C" and the adjustment to "normal".

4. Continuous fan speed is selectable at 25%, 50%, 75% or 100% of the furnace's maximum airflow capability.

   Example: If the furnace's maximum airflow capability is 2000 CFM, the continuous fan speed will be 0.25 x 2000 or 500 CFM.

5. Locate the blower speed selection DIP switches on the integrated control module. Select the desired "cooling" speed tap by positioning switches 1 and 2 appropriately. Select the desired "adjust" tap by positioning switches 9 and 10 appropriately. Refer to the DIP switch chart for switch positions and their corresponding taps. Verify CFM by noting the number displayed on the dual 7-segment LED display.

6. The multi-speed circulator blower also offers several custom ON/OFF ramping profiles. These profiles may be used to enhance cooling performance and increase comfort level. The ramping profiles are selected using DIP switches 7 and 8. Refer to the following figure for switch positions and their corresponding taps. Refer to the bullet points below for a description of each ramping profile. Verify CFM by noting the number displayed on the dual 7-segment LED display.

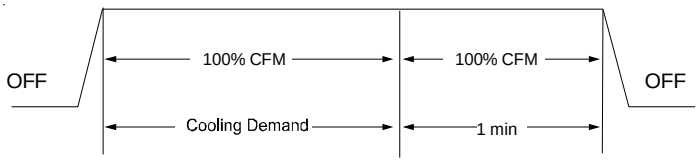
Switch Bank	Purpose	Function	Dip Switch																	
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	Cooling Speed Tap	A	OFF	OFF	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
		B	ON	OFF	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
		C	OFF	ON	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
		D	**ON**	**ON**	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Heating Speed Tap	A	---	---	OFF	OFF	---	---	---	---	---	---	---	---	---	---	---	---	---	---
		B	---	---	**ON**	**OFF**	---	---	---	---	---	---	---	---	---	---	---	---	---	---
		C	---	---	OFF	ON	---	---	---	---	---	---	---	---	---	---	---	---	---	---
		D	---	---	ON	ON	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Continuous Fan Speed Tap	A	---	---	---	---	OFF	OFF	---	---	---	---	---	---	---	---	---	---	---	---
		B	---	---	---	---	**ON**	**OFF**	---	---	---	---	---	---	---	---	---	---	---	---
		C	---	---	---	---	OFF	ON	---	---	---	---	---	---	---	---	---	---	---	---
		D	---	---	---	---	ON	ON	---	---	---	---	---	---	---	---	---	---	---	---
2	Cooling Ramping	A	---	---	---	---	---	---	**OFF**	**OFF**	---	---	---	---	---	---	---	---	---	---
		B	---	---	---	---	---	---	ON	OFF	---	---	---	---	---	---	---	---	---	---
		C	---	---	---	---	---	---	OFF	ON	---	---	---	---	---	---	---	---	---	---
		D	---	---	---	---	---	---	ON	ON	---	---	---	---	---	---	---	---	---	---
	Adjust Taps	0 Trim Adjust	---	---	---	---	---	---	---	---	**OFF**	**OFF**	---	---	---	---	---	---	---	---
		Plus 10%	---	---	---	---	---	---	---	---	ON	OFF	---	---	---	---	---	---	---	---
		Minus 10%	---	---	---	---	---	---	---	---	OFF	ON	---	---	---	---	---	---	---	---
		0 Trim Adjust	---	---	---	---	---	---	---	---	ON	ON	---	---	---	---	---	---	---	---
	Heat Off Delay	90 Seconds	---	---	---	---	---	---	---	---	---	---	OFF	OFF	---	---	---	---	---	---
		120 Seconds	---	---	---	---	---	---	---	---	---	---	ON	OFF	---	---	---	---	---	---
		150 Seconds	---	---	---	---	---	---	---	---	---	---	**OFF**	**ON**	---	---	---	---	---	---
		180 Seconds	---	---	---	---	---	---	---	---	---	---	ON	ON	---	---	---	---	---	---
3	T-Stat Heat	1 Stage Stat	---	---	---	---	---	---	---	---	---	---	---	---	**OFF**	---	---	---	---	---
		2 Stage Stat	---	---	---	---	---	---	---	---	---	---	---	---	ON	---	---	---	---	---
	Compressor	1-Stage Compressor	---	---	---	---	---	---	---	---	---	---	---	---	---	**OFF**	---	---	---	---
		2-Stage Compressor	---	---	---	---	---	---	---	---	---	---	---	---	---	ON	---	---	---	---
	Dehum	Disabled	---	---	---	---	---	---	---	---	---	---	---	---	---	---	**OFF**	---	---	---
		Enabled	---	---	---	---	---	---	---	---	---	---	---	---	---	---	ON	---	---	---
	Bias	Disabled	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	OFF	---	---
		Enabled	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	**ON**	---	---
	Pull Up	Disabled	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	OFF	---
		Enabled	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	**ON**	---
	Pull Down	Disabled	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	OFF
		Enabled	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	**ON**

--- Not applicable (Indicates factory setting)

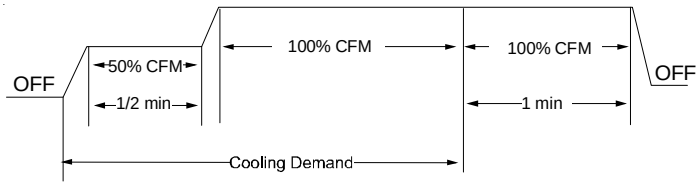
Communicating thermostats are used only with Bias, Pull Up, Pull Down dip switches.

OPERATION

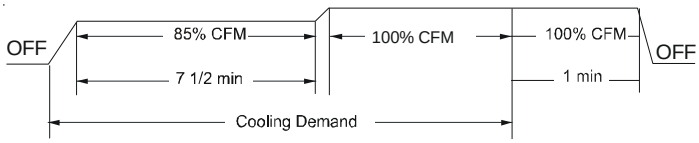
- **Profile A** provides only an OFF delay of one (1) minute at 100% of the cooling demand airflow.



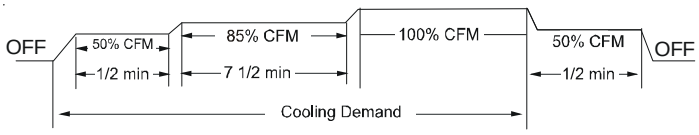
- **Profile B** ramps up to full cooling demand airflow by first stepping up to 50% of the full demand for 30 seconds. The motor then ramps to 100% of the required airflow. A one (1) minute OFF delay at 100% of the cooling airflow is provided.



- **Profile C** ramps up to 85% of the full cooling demand airflow and operates there for approximately 7 1/2 minutes. The motor then steps up to the full demand airflow. Profile C also has a one (1) minute 100% OFF delay.



- **Profile D** ramps up to 50% of the demand for 1/2 minute, then ramps to 85% of the full cooling demand airflow and operates there for approximately 7 1/2 minutes. The motor then steps up to the full demand airflow. Profile D has a 1/2 minute at 50% airflow OFF delay.



7. Select the heating speed for your model from the heating speed chart in the Specification Sheet. The "adjust" setting (already established by the cooling speed selection) determines which set of speeds are available. The selected speed must provide a temperature rise within the rise range listed with the particular model.
8. Select the desired "heating" speed tap by positioning switches 3 and 4 appropriately. Refer to figure above. Verify CFM by noting the number displayed on the dual 7-segment LED display.

In general lower heating speeds will: reduce electrical consumption, lower operating sound levels of the blower, and increase the outlet air temperature delivered to the home. The speeds available allow the blower performance to be optimized for the particular homeowner's needs.

DIP Switches

There are 18 DIP switches on the modulating furnace IFC. Switches are located in 3 rows, each having 6 switches. Switches are numbered from 1 to 18. The "ON" position is "UP'. The chart shows all 18 DIP switches, their function and their factory position.

Switches 1 & 2 Select cooling speed A, B, C or D. Factory setting is D (both switches up in the "ON" position. These switches are ignored when using a CTK0* communicating thermostat.

Switches 3 & 4 Select heating speed A, B, C or D. Factory setting is B (3 ON, 4 OFF) These switches are ignored when using a CTK0* communicating thermostat.

Switches 5 & 6 Select continuous fan speed A, B, C or D. Factory setting is B (5 ON, 6 OFF) These selections are based off of percentages of the maximum CFM that each model furnace is rated for; A = 25%, B = 50%, C = 75%, D = 100%. These switches are ignored when using a CTK0* communicating thermostat.

Switches 7 & 8 Select cooling ramping profiles A, B, C or D. Factory setting is A (both switches down in the "OFF" position).Each ramping profile provides a different routine for the indoor blower motor to follow in a call for cooling. Rather than bringing the motor up to cooling speed immediately, ramping profiles bring the motor up to cooling speed in stages.

NOTE: Reductions in CFM for ramping are not added to reductions in CFM for DEHUM. Example; CFM is reduced for the fist several minutes of a cooling call by 15%, if a call for DEHUM is present during this CFM reduction; CFM will not be reduced by another 15%. Rather, after the ramping time period has expired, the CFM would continue at the 15% reduction to satisfy the DEHUM request. These switches are ignored when using a CTK0* communicating thermostat .

Switches 9 & 10 Select CFM Trim Adjustment. Choices are 0%, + 10%, -10%. Factory setting is A. Trim adjustments add or subtract from the CFM selections made by heat and cool CFM selections. Trim adjustments affect cooling, and heating fan speeds. These switches are ignored when using a CTK0* communicating thermostat .

Switches 11 & 12 Select fan off delay in heat. Choices are 90, 120, 150, or 180 seconds. Factory setting is C, 150 seconds. These switches are ignored when using a CTK0* communicating thermostat.

Switch 13 Selects thermostat type for heating. Factory setting for this switch is OFF, this is the correct setting for a conventional single stage stat or a CTK02** communicating-modulating stat. To use a conventional two stage heating thermostat or a CTK0* thermostat, move this switch to the ON position.

OPERATION

Switch 14 Selects compressor setup for cooling. Factory position is OFF. This is the correct position for a single stage condensing unit. In this position, Y from the room thermostat would connect to Y1 on the IFC. Full CFM selected by switches 1 & 2 will be delivered during a Y1 call. If using a two stage outdoor unit, move this switch to the ON position and wire Y1 from the room stat to Y1 on the IFC, wire Y2 on the room stat to Y2 on the IFC. This switch is ignored when using a CTK0* communicating thermostat.

Switch 15 Selects DEHUM. Enabling this feature will reduce CFM in a call for cooling by 15%. Factory position is OFF, in this position DEHUM is disabled. To use this feature the DIP switch must be turned to the ON position and a normally closed dehumidistat be used. This switch is ignored when using a CTK0* communicating thermostat.

Switches 16, 17, 18 These are system switches critical to the ClimateTalk™ communicating network and must be left in the factory enabled ON position.

Pressure Switch Calibration Routine The modulating furnace must go through a pressure switch calibration routine before it can begin its first heat cycle. This is performed automatically by the furnace and requires no action on the part of the installer other than to have the system components installed completely and correctly. On the initial power up, or any time that power to the furnace is switched off then back on again and a call for heat is applied, the furnace will go through a calibration routine. During the calibration routine the IFC runs the induced draft blower at different speeds to determine the opening and closing points of the pressure switches. It records this information and uses it as reference points for determining the draft inducer speeds for all gas input rates from 35% - 100%.

Before beginning a calibration routine, the IFC will check that both pressure switches are in the open position.

- The IFC powers the draft inducer at a predetermined speed and checks to see if the LPS has closed
- If the LPS is not closed the IFC will increase the draft inducer RPM in small steps until it detects a closed LPS.
- The IFC then begins to reduce RPM until it detects that the LPS is open.
- It records the RPM point where the LPS went open
- The IFC then increases the inducer RPM by a large predetermined step and checks to see if the HPS is closed.
- If the HPS is not closed the IFC will increase the draft inducer RPM in small steps until it detects a closed HPS.

System	System Operating Mode	Airflow Demand Source
Air Conditioner + Furnace	Cooling	Air Conditioner
	Heating	Furnace
	Continuous Fan	Thermostat
Heat Pump + Furnace	Cooling	Heat Pump
	Heat Pump Heating Only	Heat Pump
	Auxiliary Heating	Furnace
	Continuous Fan	Thermostat
Furnace + Non-Comm 1stg Air Conditioner	Cooling	Furnace
	Heating	Furnace
	Continuous Fan	Thermostat

For example, assume the system is an air conditioner matched with a furnace. With a call for low stage cooling, the air conditioner will calculate the system's low stage cooling airflow demand. The air conditioner will then send a fan request along with the low stage cooling airflow demand to the furnace. Once received, the furnace will send the low stage cooling airflow demand to the ECM motor. The ECM motor then delivers the low stage cooling airflow. See the applicable ComfortNet air conditioner or heat pump installation manual for the airflow delivered during cooling or heat pump heating.

In continuous fan mode, the CTK0* thermostat provides the airflow demand. The CTK02** thermostat may be configured for one of threecontinuous fan speed settings allow for 25%, 50% or 75% airflow, based on the furnaces' maximum airflow capability. During continuous fan operation, the thermostat sends a fan request along with the continuous fan demand to the furnace. The furnace, in turn, sends the demand to the ECM motor. The ECM motor delivers the requested continuous fan airflow.

Fossil Fuel Applications

This furnace can be used in conjunction with a ComfortNet™ compatible heat pump in a fossil fuel application. A fossil fuel application refers to a combined gas furnace and heat pump installation which uses an outdoor temperature sensor to determine the most cost efficient means of heating (heat pump or gas furnace). When used with the CTK0* thermostat, the furnace/heat pump system is automatically configured as a fossil fuel system. The balance point temperature may be adjusted via the CTK0* thermostat advanced user menus (see CTK0* instructions for additional information).

OPERATION

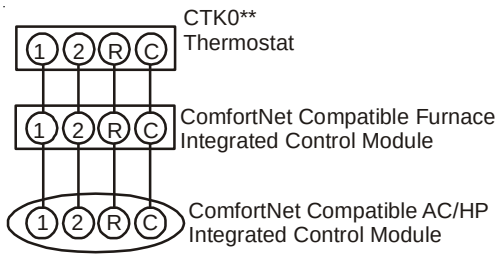
CTK0* WIRING

NOTE: Refer to *Electrical Connections* for 115 volt line connections to the furnace.

NOTE: A removable plug connector is provided with the control to make thermostat wire connections. This plug may be removed, wire connections made to the plug, and replaced. Multiple wires imust be twisted together prior to inserting into the plug connector. Failure to do so may result in intermittent operation.
Typical 18 AWG thermostat wire may be used to wire the system components. One hundred (100) feet is the maximum length of wire between indoor unit and outdoor unit, or between indoor unit and thermostat. Wire runs over (100) feet require larger gauge wire.

FOUR-WIRE INDOOR AND OUTDOOR WIRING

Typical ComfortNet wiring will consist of four wires between the indoor unit and outdoor unit and between the indoor unit and thermostat. The required wires are: (a) data lines, 1 and 2; (b) thermostat "R" (24 VAC hot) and "C" (24 VAC common).



System Wiring using Four-Wires

TWO-WIRE OUTDOOR, FOUR-WIRE INDOOR WIRING

Two wires can be utilized between the indoor and outdoor units. For this wiring scheme, only the data lines, 1 and 2, are needed between the indoor and outdoor units. A 40VA, 208/230 VAC to 24VAC transformer must be installed in the outdoor unit to provide 24VAC power to the outdoor unit's electronic control. The transformer is included with the CTK01AA kit. See kit instructions for mounting and wiring instructions. If using a CTK02 or CTK01BA, an accessory transformer is available (TFK01). Four wires are required between the indoor unit and thermostat.

NOTE: Use of the CTK0* transformer is recommended if installing a dual fuel/fossil fuel system. Failure to use the transformer in the outdoor unit could result in over loading of the furnace transformer.

1ST STAGE COOLING – CONVENTIONAL THERMOSTAT

- A call for cooling is signaled by:
- R powering Y1 and O simultaneously
- R powering Y1, O and G simultaneously
- The compressor and condenser fan are energized directly from the Y1 terminal from the thermostat.
- The circulator is energized after cool fan on delay.
- If the '2 Stage Cooling' DIP switch is set to:
- ON, then circulator will run at low cooling speed with Y1 request
- OFF, then circulator will run at high cooling speed with Y1 request (a Y2 request will be ignored)
- The circulator will operate according to one of the selectable ramping profiles.
- When the cool request is satisfied, the circulator is de-energized per one of the selectable ramping profiles.

2ND STAGE COOLING – CONVENTIONAL THERMOSTAT

- The '2 Stage Cooling' DIP switch on the IFC must be ON to enable 2 stage cooling control with a conventional thermostat.
- A call for 2nd stage cooling is signaled by the shorting of R to Y2 while a valid call for first stage cooling exists.
- After the cool fan on delay, the circulator is energized at the low cooling speed when the 1st stage cool request is detected and switches to high cooling speed immediately after the 2nd stage cool request is detected.
- The circulator will be controlled according to the selected ramping profile.
- When the cool requests are satisfied, the circulator is de-energized per the selected ramping profile.

COOLING OPERATION WITH A COMMUNICATING THERMOSTAT AND CONVENTIONAL SINGLE STAGE A/C

- The call for cooling will be communicated via the ClimateTalk™ protocol.
- The Y1 terminal of the IFC becomes an output via the on board Y1 relay
- The IFC does not provide short cycle protection.
- The circulator operates as commanded by the communicating thermostat.

COOLING OPERATION WITH A COMMUNICATING THERMOSTAT AND OUTDOOR UNIT

- The furnace receives the CFM demand from the communicating outdoor unit.

CALL FOR COOL WITH CALL FOR HEAT PRESENT – DUAL FUEL DEFROST OPERATION

- While in defrost, the standard light off sequence will be followed. The IFC will then fire at 100% for the remainder of the defrost call.
- While in defrost the circulator will use the selected heat speed.

OPERATION

Fan Mode

Conventional Thermostat

Two seconds after G request becomes active without Y1 request, IFC will run the circulator at the appropriate speed (as selected by the DIP switches), unless circulator is running as a result of Heat or Cool mode. The circulator speed required by the heat or cool demand always has priority over G speed.

Communicating Thermostat

If a conventional G request is present without a heat or cool request from the communicating thermostat, the circulator will run at the selected fan speed.

Humidity Control

Humidifier Output – Conventional Thermostat

One set of isolated relay contacts are wired to a pair of terminals for connection to a humidifier. When the inducer is on the IFC closes the humidifier relay contacts, except from the calibration routine where the humidifier relay contacts are always open.

Humidifier Output – Communicating Thermostat

One set of isolated relay contacts are wired to a pair of terminals for connection to a humidifier. Upon receipt of a Humidification Requested Demand the IFC will:

- Close the humidifier relay contacts
- Energize the circulator at the circulation speed (G speed) unless the circulator is commanded to a different speed by a heat demand.

Dehumidification – Conventional Thermostat

- DEHUM functionality is enabled by a DIP switch setting.
- The IFC varies circulator speed operation based on the DEHUM signal from the thermostat
- If 24VAC (R) is not connected to DEHUM (through a Humidistat) and both Y1 and O terminals are energized, then the IFC control reduces the cooling CFM by 15%.
- If both Y1 and O terminals are not energized, the DEHUM signal is ignored
- DEHUM is ignored during any heating request.

Learn Push-Button

Pressing the learn button re-sets the communicating network and allows the IFC to search for communicating equipment The press and release of the button starts the same learning process as during power-up of the system.

ClimateTalk™ Communication LEDs

The IFC has two LEDs :

- Red communications LED – Indicates the status of the network
- OFF is normal condition.
- 2 slow flashes on power-up: ON for ¼ second, OFF for ¾ second, ON for ¼ second, OFF.
- Continuous slow flash indicates communication failure: ON for ¼ second, OFF for ¾ second…
- Green receive LED – Indicates network traffic
- Fast, sporadic flashes indicates normal bus communication.
- ON solid indicates a Data 1 / Data 2 miswire.

Model	Tap	Low Stage Cool	High Stage Cool	100% Heat *CFM
CVM960604CX	A	370	660	1220
	B	540	860	1340
	C	790	1150	1460
	D	980	1470	1590
CVM960805DX	A	530	900	1600
	B	730	1100	1710
	C	930	1430	1800
	D	1220	1880	1910
CVM961005DX	A	500	780	1730
	B	740	1070	1770
	C	920	1380	1840
	D	1160	1780	1870
MVM960603BX	A	390	630	950
	B	550	800	1050
	C	680	1000	1170
	D	800	1210	1270
MVM960805CX	A	540	830	1600
	B	750	1090	1690
	C	980	1460	1800
	D	1210	1800	1890
MVM961005DX	A	510	790	1810
	B	710	1100	1850
	C	910	1410	1890
	D	1160	1830	1940
MVM961155DX	A	510	790	1810
	B	710	1100	1850
	C	910	1410	1890
	D	1160	1830	1940

*100% CFM shown. CFM will vary proportionally with the gas valve BTU/H input.

Airflow Table

7. Select the heating speed for your model from the heating speed chart in the Specification Sheet. The "adjust" setting (already established by the cooling speed selection) determines which set of speeds are available. The selected speed must provide a temperature rise within the rise range listed with the particular model.
8. Select the desired "heating" speed tap by positioning switches 3 and 4 appropriately. Refer to figure above. Verify CFM by noting the number displayed on the dual 7-segment LED display.

In general lower heating speeds will: reduce electrical consumption, lower operating sound levels of the blower, and increase the outlet air temperature delivered to the home. The speeds available allow the blower performance to be optimized for the particular homeowner's needs.

BLOWER HEAT OFF DELAY TIMINGS

The integrated control module provides a selectable heat off delay function. The heat off delay period may be set to 90, 120, 150, 180 seconds using the DIP switches or jumper provided on the control module. The delay is factory shipped at 150 seconds but may be changed to suit the installation requirements and/or homeowner preference.

ComfortNet System

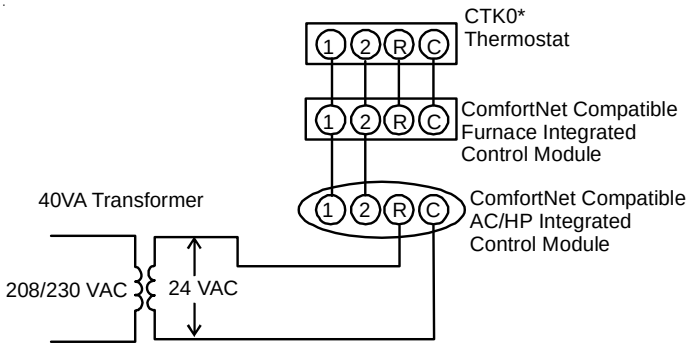
OVERVIEW

NOTE: *DIP switch #13* ***MUST*** *be set to match thermostat type. To use the CTK01 communicating thermostat, DIP switch #13 must be set to ON position. This is also the correct setting for a non-communicating 2-stage thermostat. To use the CTK02** modulating thermostat, check to make sure DIP switch #13 is in the OFF position (factory position). This is also the correct position when using a non-communicating single stage thermostat.*

The ComfortNet system is a system that includes a ComfortNet compatible furnace and air conditioner or heat pump with a CTK0* thermostat. A valid ComfortNet system could also be a compatible furnace, CTK0* thermostat and non-compatible, single stage air conditioner. Any other system configurations are considered invalid ComfortNet systems and must be connected as a traditional (or non-communicating) system (*see Electrical Connections* for wiring connections).

A ComfortNet heating/air conditioning system differs from a non-communicating/traditional system in the manner in which the indoor unit, outdoor unit and thermostat interact with one another. In a traditional system, the thermostat sends commands to the indoor and outdoor units via analog 24 VAC signals. It is a one-way communication path in that the indoor and outdoor units typically do not return information to the thermostat.

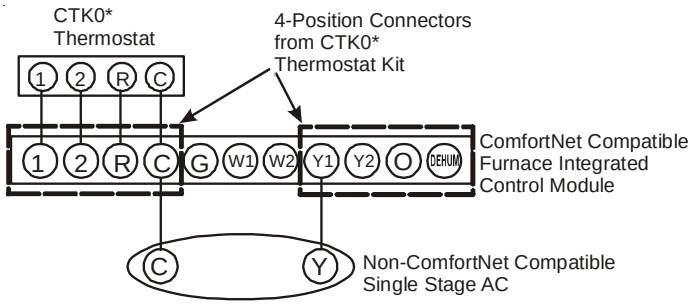
The indoor unit, outdoor unit and thermostat comprising a ComfortNet system "communicate" digitally with one another, creating a two-way communications path. The thermostat still sends commands to the indoor and outdoor units. However, the thermostat may also request and receive information from both the indoor and outdoor units. This information may be displayed on the ComfortNet thermostat. The indoor and outdoor units also interact with one another. The outdoor unit may send commands to or request information from the indoor unit. This two-way digital communications between the thermostat and subsystems (indoor/outdoor unit) and between subsystems is the key to unlocking the benefits and features of the ComfortNet system.



System Wiring using Two-Wires between Furnace and AC/HP and Four-Wires between Furnace and Thermostat

COMFORTNET COMPATIBLE FURNACE WITH NON-COMFORTNET COMPATIBLE SINGLE-STAGE AIR CONDITIONER

Four wires are required between the furnace and thermostat. Two wires are required between the furnace control and single stage air conditioner. For this system configuration, the "Y1" terminal on the integrated furnace control becomes an output rather than an input. The "Y1" connection to the outdoor unit is made using both 4-position thermostat connectors in the CTK0* kit. Remove the red keying tabs from the on-board connector block and position both 4-position connector such that "1", "2", "R", "C", and "Y1" positions are filled.



System Wiring between Furnace and Non-Communicating Compatible Single Stage Air Conditioner

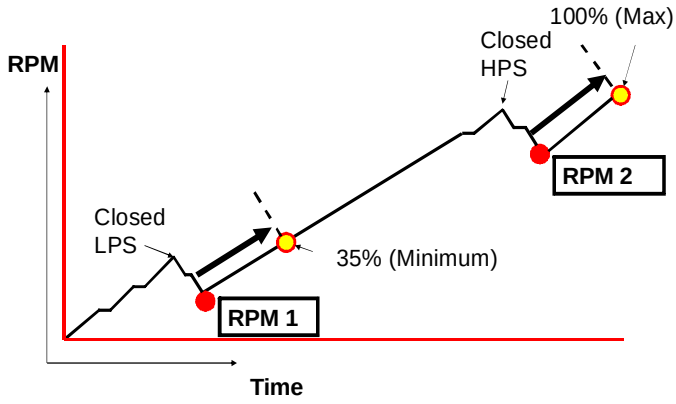
ABBREVIATIONS & DEFINITIONS

Pressure Switch Calibration Routine The modulating furnace must go through a pressure switch calibration routine before it can begin its first heat cycle. This is performed automatically by the furnace and requires no action on the part of the installer other than to have the system components installed completely and correctly. On the initial power up, or any time that power to the furnace is switched off then back on again and a call for heat is applied, the furnace will go through a calibration routine. During the calibration routine the IFC runs the induced draft blower at different speeds to determine the opening and closing points of the pressure switches. It records this information and uses it as reference points for determining the draft inducer speeds for all gas input rates from 35% - 100%.

Before beginning a calibration routine, the IFC will check that both pressure switches are in the open position.

- The IFC powers the draft inducer at a predetermined speed and checks to see if the LPS has closed.
- If the LPS is not closed the IFC will increase the draft inducer RPM in small steps until it detects a closed LPS.
- The IFC then begins to reduce RPM until it detects that the HPS is open.
- It records the RPM point where the HPS went open.
- The IFC then adds a predetermined amount of draft inducer RPM to both the recorded points.
- These new RPM points are the draft inducer speed for 35% (lowest input rate) and 100% (highest input rate).

  The IFC then is able to control draft inducer speed through the IFC-VFD throughout the entire range of



Inducer Calibration Routine

Abbreviations and Definitions

- **IFC**: Integrated furnace control
- **HSI**: Hot surface element
- **LPS**: Low pressure switch
- **IDB**: Induced draft blower
- **HPS**: High pressure switch
- **Variable Frequency Drive (VFD)**: Control of the induced draft blower is carried out by Variable Frequency Drive. By varying the voltage and frequency to the draft inducer, the RPM can be controlled. A section of the IFC is dedicated to this task.
- **Trial for Ignition Period (TFI)**: The period of time between initiation of gas flow and the action to shut off the gas flow in the event of failure to establish proof of the supervised ignition source or the supervised main burner flame.
- **Gas Valve Sequence Period:** The total period of time of gas flow starting from the first initiation of gas to the final action to shut off the gas before going to lockout.
- **Ignition Activation Period (IAP)**: The period between energizing the main gas valve and deactivation of the ignition source prior to the end of TFI.
- **Flame Recognition Period (FRP)**: The period between deactivation of the ignition source and the expiration of the TFI.
- **Flame Failure Response Time (FFRT)**: The period between loss of the supervised main burner flame and the action to shut off the gas supply.
- **Igniter Warm-up Time**: The length of time allowed for the hot surface igniter to heat up prior to the initiation of gas flow.
- **Pre-purge Time**: The period of time intended to allow for the dissipation of any unburned gas or residual products of combustion at the beginning of a furnace operating cycle prior to initiating ignition. Beginning from the moment the pressure switch is sensed closed and lasting until the ignition source is energized.
- **Inter-purge Time**: The period of time intended to allow for the dissipation of any unburned gas or residual products of combustion, just prior to initiating ignition retries during the Ignition Retries sequence.
- **Post-purge Time**: The period of time to allow for the dissipation of any unburned gas or residual products of combustion at the end of a furnace burner operating cycle. Post-purge begins at the loss of flame sense.
- **Ignition Stabilization Period** – The period between sensing of the main burner flame and the transition from the Ignition Firing Rate to the Target Firing Rate.
- **Ignition Recycles**: The additional attempts within the same thermostat cycle for ignition after loss of the supervised ignition source or the supervised main burner flame.
- **Ignition Retries**: The additional attempts within the same thermostat cycle for ignition when the supervised main burner flame is not proven within the Trial for Ignition Period.

ABBREVIATIONS & OPERATION

- **Low Fire Rate**: The lowest firing rate the IFC controls to during a heating cycle.
- **High Firing Rate:** The maximum firing rate that an installed appliance can attain based on manifold orifices and the high pressure switch setting.
- **Ignition Firing Rate:** The target firing rate at which the appliance always lights off. The appliance stays at this firing rate until the Ignition Stabilization Period expires. It then moves to the target firing rate called for by the operating sequence.
- **Target Firing Rate:** The firing rate that the IFC controls the inducer to attain at a given time in the operating sequence.
- **Heat Fan On Delay**: The period between proof of the supervised main burner flame and the activation of the blower motor at the low heat speed.
- **Heat Fan Off Delay**: The period between the loss of supervised main burner flame after the call for heat has ended and the deactivation of the blower motor.
- **2nd Stage On Delay**: This applies to systems configured for 1-stage thermostats. The length of time operating in normal low fire mode before switching to mid fire mode.
- **Auto Restart Delay**: The time delay waited before the control is able to perform a new trial for ignition in the case of Soft Lockout.
- **Soft Lockout**: A state caused a system fault such as loss of flame or pressure switch failure .
- **Hard Lockout**: A state caused by a failure internal to the control or by a system fault such as a flame rollout
- **Fault Debouncing Time**: The period between a system fault occurring and the IFC recognizing the fault has occurred. This time varies depending on the specific fault.
- **Factory Shared Data**: Data used by a ClimateTalk™ device for specific configuration parameters. This data will be programmed in at the Goodman factory.

Heat Exchanger Prepurge	15 sec	---
HSI Warm Up	17 sec	Same for all trials
Ignition Activation Period	3 sec	---
Flame Recognition Period	1 sec	---
Trial For Ignition	4 sec	TFI = IAP + FRP
Gas Valve Sequence Period	12 sec	---
Ignition Stabilization Period	10 sec	---
Flame Debounce Period	2 sec	Time it takes to debounce flame presence or failure
Post-purge	29 sec	---
Inter-purge	30 sec	---
Auto Restart Delay	60 min	---
Ignition Retries	2	3 trials total
Ignition Recycles – Flame Failure	2	3 flame losses total
Flame Failure Response Time	2 sec max	@ 1uA

Other Parameters		---
Low Fire Rate	35%	% of target high fire rate
Ignition Fire Rate	80%	% of target high fire rate
High Fire Rate	100%	---

Ignition Activation Chart

Ignition Retries:

When flame is not sensed during the Trial for Ignition Period:

- The valve is de-energized.
- The inducer remains energized at ignition speed during the Inter-purge Period.
- The circulator if already running remains energized at the current CFM for the circulator fan off delay period.
- When the Inter-purge Period expires, the control proceeds to the HSI Warm-up and then a new Trial for Ignition is started again for up to a maximum of two additional trials (3 attempts total). After the third Trial for Ignition has failed to light the burner the IFC proceeds to Soft Lockout through the Post-purge where the inducer remains energized at the ignition speed. Error code “E0” is flashed during the Soft Lockout period.

  The retry count is cleared if flame is sensed for longer than 10 seconds after exiting Trial for Ignition, or upon exit of Soft Lockout.

Ignition Recycles:

When flame is established during Trial for Ignition, and then lost:

- The gas valve is de-energized.
- The inducer moves to the ignition speed and holds for the Inter-purge Period.

- The circulator if already running remains energized at the current CFM for the circulator fan off delay period.
- When the Inter-purge Period expires, the control proceeds to the HSI Warm-up and then a new Trial for Ignition is started.
- A maximum of two recycles (3 flame losses) are allowed on a single call for heat before the control proceeds to Soft Lockout through the Post-purge where the inducer remains energized at the current speed. Error code "E0" is flashed during the Soft Lockout period.
- The recycle count is not cleared until the current demand for heat is satisfied or upon exit of Soft Lockout.

Rollout Circuit Operation

If the manual reset rollout switch circuit opens during a heating cycle:

- The valve is immediately de-energized.
- The inducer will run for the Post-purge period at its current speed
- If the circulator fan is on it will run for the normal fan off delay at the current heat speed.
- An error code is logged and displayed indicating the rollout switch circuit has opened.
- All future thermostat heat requests are ignored..

The IFC will remain in this state until the rollout switch closes. Once the manual rollout switch has been reset the IFC will clear the error code and return to normal operation.

If the rollout switch circuit opens in any mode, other than Heat, it will be ignored.

Limit Switch Operation

If the limit switch circuit is open during a heating cycle:

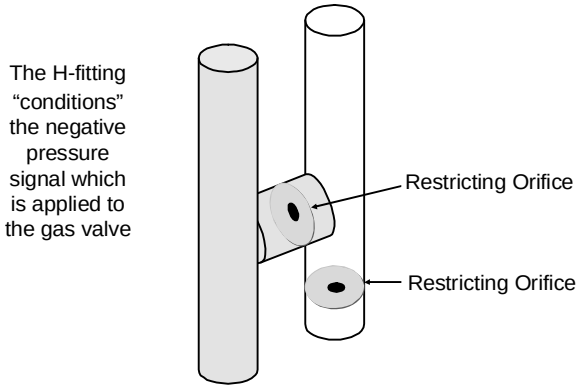
- The valve is immediately de-energized.
- The inducer will run for the Post-purge period at its current speed.
- The circulator is immediately energized at high heat speed. The IFC will remain in this state until the limit switch circuit closes.
- The IFC logs and displays an error code indicating the limit circuit is open.
- Once the limit switch circuit closes and a call for heat is present, a new ignition sequence is started and the circulator will remain energized for the selected fan off delay. If the burner is lit before expiration of the selected fan off delay, the fan off timing is stopped and the circulator will adjust to the speed requested by the heating sequence.

If the limit switch circuit opens in any mode, other than Heat, it will be ignored.

Pressure Switch Configuration

- The IFC monitors the contacts of a SPST (single pole single throw) low pressure switch with a set point that ensures the switch will be closed at approximately 35% of the firing rate of the furnace.
- The IFC monitors the contacts of a SPST high pressure switch with a set point that ensures the switch will be closed at approximately 100% of the firing rate of the furnace.

H Fitting



"H" Fitting

The low pressure switch assembly includes an H fitting assembly and tubing that provides pressure signals to the Honeywell amplified gas/air gas valve. The H fitting contains an orifice which conditions the negative air pressure controlling the gas valve. This has the effect of allowing only smooth changes in air pressure to reach the gas valve.

Low Pressure Switch Operation

- If a call for heat exists and the low pressure switch is closed already (before the ignition sequence has begun), the IFC will wait 5 minutes. After the 5 minute delay, and if the LPS is still closed, the IFC will log and display an error code indicating the low pressure switch is stuck closed. When the LPS is sensed open, the IFC clears the error code and resumes normal operation.

If the ignition sequence has begun and the low pressure switch fails to close within 30 seconds, the IFC logs and displays an error code indicating the low pressure switch is stuck open. The inducer continues to run for a total of 5 minutes, at which time the IFC de-energizes the inducer and then attempts the Calibration routine immediately. If during the 5 minute interval LPS is sensed closed or call for heat is removed, the IFC clears the error code and resumes normal operation.

SERVICE & OPERATION

High Pressure Switch Operation

- High Pressure Switch action is used to determine the inducer speed required to achieve the 100% firing rate of the appliance. The determination is made by the IFC during the calibration process.
- The HPS must remain closed during 100% fire operation. If it opens during 100% fire operation, the IFC will increase the inducer speed at a rate of 1% per sec in an attempt to re-close the pressure switch up to the maximum allowed RPM. If the HPS is re-closed successfully, the IFC will complete the Heat mode and perform the Calibration routine on the next call for heat. If the HPS remains open, the IFC will end the Heat mode through the Post-purge and perform the Calibration routine immediately (error code "E9" is flashed until calibration routine is successful).
- High Pressure Switch check takes place during the Calibration routine. If the switch is stuck open or closed calibration will not be completed and the appropriate error code will be logged and displayed.

Hot Surface Igniter Operation

The IFC energizes a relay to control the line voltage Hot Surface Igniter. The HSI warm up time will be fixed for all ignition trials. Both the continuity of the igniter and the ability of the relay to energize the igniter are continuously monitored during the Igniter Warm-up and Ignition Activation Periods.

ECM Motor

An Emerson® UltraTech® four wire indoor fan motor provides supply air to the conditioned space. This is the same motor used on Goodman & Amana previous generation communicating furnaces.

The ECM motor consists of two sections;

1. A motor body containing 3 phase motor windings
2. An electronic control module (end bell).

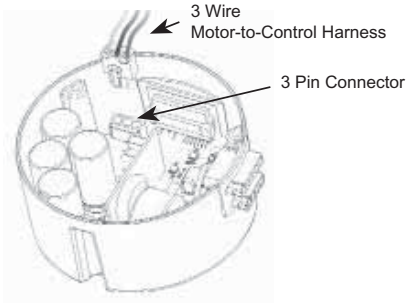
In the event of a non-operating motor; the following items should be checked. There are two harnesses which connect the blower motor to the IFC. The line voltage (5 Pin) harness provides 115 volts directly off of the IFC L1 and neutral terminals on ½ hp ECM motors. On furnaces with ¾ and 1 HP ECM motors, L1 is fed to the motor through an inductor coil. The inductor coil conditions the power supply to the motor smoothing out spikes and electrical noise. The low voltage harness is a 4 wire harness that supplies 12 volts DC to terminals 1 & 4 of the motor and communicating signals on terminals 3 & 4.

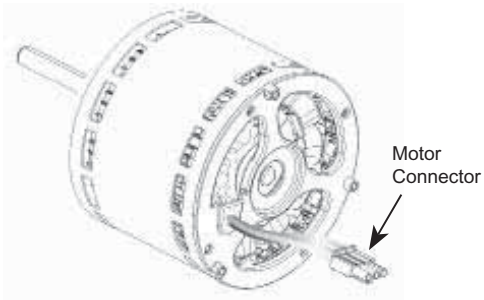
⚠ WARNING

THE CONTROL MODULE CONTAINS COMPONENTS WHICH CAN HOLD AN ELECTRICAL CHARGE FOR SEVERAL MINUTES. BEFORE THE MOTOR IS TAKEN APART, IT MUST BE ALLOWED TO DISSIPATE VOLTAGE BY WAITING FIVE MINUTES BEFORE IT IS INSPECTED INTERNALLY. THE END BELL CAN BE SEPARATED FROM THE MOTOR BODY BY REMOVING THE THREE SCREWS WHICH JOIN THEM. ONCE THE SCREWS ARE REMOVED, THE INTERANL HARNESS CAN BE SEPARATED. THE CONTROL MODULE AND MOTOR CAN THEN BE INSPECTED SEPARATELY.

The motor contains three windings of equal resistance + / - 10%. Resistance between windings is generally less than 10 ohms and will vary between models. To take this reading; the ohm meter leads are placed in the wiring harness, previously disconnected from the internal control unit connector.

Inspect capacitors inside the control unit for bulging or swollen caps. The end bell should be replaced if components appear swollen or bulging. A functioning control unit should have a phase to phase resistance of greater than 100K between any two pins. A separated control unit is shown below. To take this reading; the ohm meter leads are placed in the end bell socket and not in the wiring harness.





Beyond basic visual checks and voltage / resistance checks; the Emerson ECM motor may be tested with an Emerson UltraCheck-EZ™ diagnostic tool (Goodman Part UTT-01). This tool will test the motor windings and also the communicating module of the motor.

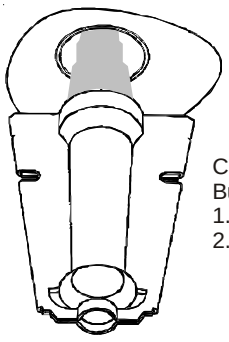
OPERATIONAL CHECKS

LED	LED Status	Indication	Possible Causes	Corrective Action(s)
Red Communications LED	Off	• Normal condition	• None	• None
	2 Flashes	• Out-of-box reset	• Control power up • Learn button depressed	• None
Green Receive LED	Rapid Flashing	• Normal network traffic	• Control is “talking” on network as expected	• None
	On Solid	• Data 1/ Data 2 miss-wire	• Data 1 and data 2 wires reversed at furnace, thermostat or communicating compatible outdoor AC/HP • Short between data 1 and data 2 wires. • Short between data 1 or data 2 wires and R (24VAC) or C (24VAC common).	• Check communications wiring (data 1/ data 2 wires). • Check wire connections at terminal block • Check data 1/ data 2 voltages.

Operational Checks

Burner Flame

The burner flames should be inspected with the burner compartment door installed. Flames should be stable, quiet, soft, and blue (dust may cause orange tips but they must not be yellow). Flames should extend directly outward from the burners without curling, floating, or lifting off. Flames must not impinge on the sides of the heat exchanger firing tubes.



Check the
Burner Flames for:
1. Stable, soft and blue.
2. Not curling, floating or lifting off.

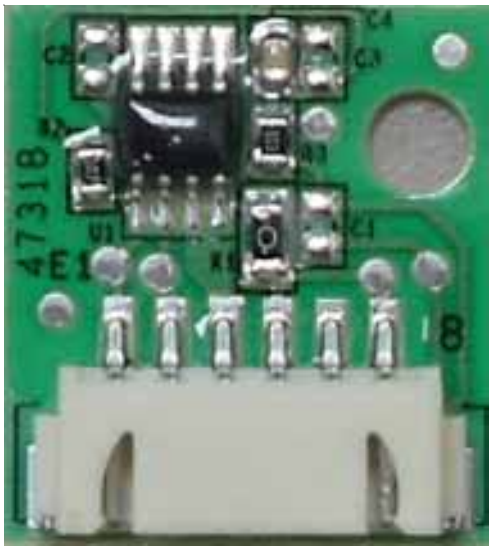
Burner Flame

Memory Chips

Memory chips are a service only item and are not sent out with new equipment. They are used only in the rare occurrence where communicating equipment shared data needs to be restored.

Memory chips should not be routinely installed at the time of installation. A memory chip is not required when an individual control board or motor is replaced.

A memory chip is only required when all communicating components have been replaced with service parts containing no shared data. If either an existing control board or ECM motor needed to be replaced, the service part would upload the necessary data from the remaining communicating component. In a fully communicating system, this would include the communicating thermostat and communicating outdoor unit control board as the necessary data is stored in all communicating devices.



A furnace void of shared data will not function in a legacy or a fully communicating installation. The furnace display would show “d0” indicating that there is no shared data in the furnace control board. If it is ever necessary to use a memory chip, the specific memory chip for your furnace number must be used.

OPERATIONAL CHECKS

To use a memory chip;

1. Power down all HVAC equipment in the system.
2. As when handling any electronic components, discharge any static electricity you may be carrying by touching grounded metal.
3. Insert the memory card in the slot on the control board.
4. Power the system back up and allow a few minutes for the network to establish communication between all devices.
5. Furnace control board will display “OP” or ‘ON” (depending on board part number).
6. Check operation.
7. Memory chip can be left on the control board (recommended) or removed once equipment is powered down again.

Safety Circuit Description

A number of safety circuits are employed to ensure safe and proper furnace operation. These circuits serve to control any potential safety hazards and serve as inputs in the monitoring and diagnosis of abnormal function. These circuits are continuously monitored during furnace operation by the integrated control module.

Integrated Furnace Control (IFC)

The integrated control module is an electronic device which, if a potential safety concern is detected, will take the necessary precautions and provide diagnostic information through an LED display.

Primary Limit

The primary limit control is located on the partition panel and monitors heat exchanger compartment temperatures. It is a normally-closed (electrically), automatic reset, temperature-activated sensor. The limit guards against overheating as a result of insufficient conditioned air passing over the heat exchanger.

Auxiliary Limit

The auxiliary limit controls are located on or near the circulator blower and monitors blower compartment temperatures. They are a normally-closed (electrically), auto-reset sensors. These limits guard against overheating as a result of insufficient conditioned air passing over the heat exchanger.

Rollout Limit

The rollout limit controls are mounted on the burner/manifold assembly and monitor the burner flame. They are normally-closed (electrically), manual-reset sensors. These limits guard against burner flames not being properly drawn into the heat exchanger.

Pressure Switches

The pressure switches are normally-open (closed during operation) negative air pressure-activated switches. They monitor the airflow (combustion air and flue products) through the heat exchanger via pressure taps located on the induced draft blower and the coil front cover. These switches guard against insufficient airflow (combustion air and flue products) through the heat exchanger and/or blocked condensate drain conditions.

Flame Sensor

The flame sensor is a probe mounted to the burner/manifold assembly which uses the principle of flame rectification to determine the presence or absence of flame.

Troubleshooting

WARNING

HIGH VOLTAGE !

TO AVOID PERSONAL INJURY OR DEATH DUE TO ELECTRICAL SHOCK, DISCONNECT ELECTRICAL POWER BEFORE PERFORMING ANY SERVICE OR MAINTENANCE.

Refer to the *Troubleshooting Codes* for assistance in determining the source of unit operational problems. The dual 7-segment LED display will display an error code that may contain a letter and number. The error code may be used to assist in troubleshooting the unit.

Resetting From Lockout

Furnace lockout results when a furnace is unable to achieve ignition after three attempts during a single call for heat. It is characterized by a non-functioning furnace and a **E0** code displayed on the dual 7-segment display. If the furnace is in “lockout”, it will (or can be) reset in any of the following ways.

1. Automatic reset. The integrated control module will automatically reset itself and attempt to resume normal operations following a one hour lockout period.
2. Manual power interruption. Interrupt 115 volt power to the furnace.
3. Manual thermostat cycle. Lower the thermostat so that there is no longer a call for heat for 1 -20 seconds then reset to previous setting.

NOTE: If the condition which originally caused the lockout still exists, the control will return to lockout. Refer to the *Troubleshooting Codes* for aid in determining the cause.

MAINTENANCE

Maintenance

WARNING

TO AVOID ELECTRICAL SHOCK, INJURY OR DEATH, DISCONNECT ELECTRICAL POWER BEFORE PERFORMING ANY MAINTENANCE. IF YOU MUST HANDLE THE IGNITER, HANDLE WITH CARE. TOUCHING THE IGNITER ELEMENT WITH BARE FINGERS, ROUGH HANDLING OR VIBRATION COULD DAMAGE THE IGNITER RESULTING IN PREMATURE FAILURE. ONLY A QUALIFIED SERVICER SHOULD EVER HANDLE THE IGNITER.

ANNUAL INSPECTION

The furnace should be inspected by a qualified installer, or service agency at least once per year. This check should be performed at the beginning of the heating season. This will ensure that all furnace components are in proper working order and that the heating system functions appropriately. Pay particular attention to the following items. Repair or service as necessary.

- Flue pipe system. Check for blockage and/or leakage. Check the outside termination and the connections at and internal to the furnace.
- Heat exchanger. Check for corrosion and/or buildup within the heat exchanger passageways.
- Burners. Check for proper ignition, burner flame, and flame signal.
- Drainage system. Check for blockage and/or leakage. Check hose connections at and internal to furnace.
- Wiring. Check electrical connections for tightness and/or corrosion. Check wires for damage.
- Filters.

FILTERS

CAUTION

TO ENSURE PROPER UNIT PERFORMANCE, ADHERE TO THE FILTER SIZES GIVEN IN THE RECOMMENDED MINIMUM FILTER SIZE TABLE OR SPECIFICATION SHEET APPLICABLE TO YOUR MODEL.

FILTER MAINTENANCE

Improper filter maintenance is the most common cause of inadequate heating or cooling performance. Filters should be cleaned (permanent) or replaced (disposable) every two months or as required.

BURNERS

Visually inspect the burner flames periodically during the heating season. Turn on the furnace at the thermostat and allow several minutes for flames to stabilize, since any dislodged dust will alter the flames normal appearance. Flames should be stable, quiet, soft, and blue (dust may cause orange tips but they must not be yellow). They should extend directly outward from the burners without curling, floating, or lifting off. Flames must not impinge on the sides of the heat exchanger firing tubes.

INDUCED DRAFT AND CIRCULATOR BLOWERS

The bearings in the induced draft blower and circulator blower motors are permanently lubricated by the manufacturer. No further lubrication is required. Check openings on motor housing for accumulation of dust which may cause overheating. Clean as necessary.

CONDENSATE TRAP AND DRAIN SYSTEM (QUALIFIED SERVICER ONLY)

Annually inspect the drain tubes, drain trap, and field-supplied drain line for proper condensate drainage. Check drain system for hose connection tightness, blockage, and leaks. Clean or repair as necessary.

FLAME SENSOR (QUALIFIED SERVICER ONLY)

Under some conditions, the fuel or air supply can create a nearly invisible coating on the flame sensor. This coating acts as an insulator causing a drop in the flame sense signal. If the flame sense signal drops too low the furnace will not sense flame and will lock out. The flame sensor should be carefully cleaned by a qualified servicer using steel wool.

SERVICING

SERVICING

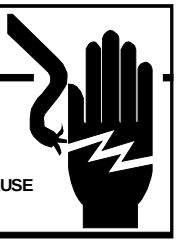
SERVICING

S-1 CHECKING VOLTAGE

WARNING

HIGH VOLTAGE

DISCONNECT ALL POWER BEFORE SERVICING OR CHANGING ANY ELECTRICAL WIRING. MULTIPLE POWER SOURCES MAY BE PRESENT. FAILURE TO DO SO MAY CAUSE PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.



1. Remove the blower door to gain entry to the Junction Box.
2. Remove cover from the Junction Box and gain access to incoming power lines.

With Power ON:

WARNING

LINE VOLTAGE NOW PRESENT

3. Using a voltmeter, measure the voltage across the hot and neutral connections. Line voltage should measure 115 +/- 10%. Measure from black (hot) to ground should also read 115 volts +/- 10%. Measuring from white (neutral) to ground should read 0 volts

NOTE: To energize the furnace, the Door Interlock Switch must be engaged at this point.

4. No reading - indicates open wiring, open line voltage fuse, no power, or faulty Door Interlock Switch from unit to fused disconnect service. Repair as needed.
5. With proper voltage at line voltage connectors, energize the furnace blower motor by jumpering terminals R to G on the integrated ignition control.
6. With the blower motor in operation, the voltage should be 115 volts ± 10 percent.
7. If the reading falls below the minimum voltage, check the line wire size. Long runs of undersized wire can cause low voltage. If wire size is adequate, notify the local power company of the condition.
8. After completing check and/or repair, replace Junction Box cover and reinstall the service panel doors.
9. Turn on electrical power and verify proper unit operation.

S-2 CHECKING WIRING

WARNING

DISCONNECT ALL POWER BEFORE SERVICING.

1. Check wiring visually for signs of overheating, damaged insulation and loose connections.
2. Use an ohmmeter to check continuity of any suspected open wires.
3. If any wires must be replaced, replace with AWM, 105°C. 2/64 thick insulation of the same gauge or its equivalent.

CHECKING THERMOSTAT, WIRING AND ANTICIPATOR

S-3A THERMOSTAT AND WIRING

WARNING

DISCONNECT ALL POWER BEFORE SERVICING.

1. Remove the blower compartment door to gain access to the thermostat low voltage wires located at the furnace integrated control module terminals.
2. Remove the thermostat low voltage wires at the furnace control panel terminal board.
3. Jumper terminals R to W on the integrated ignition control.

With Power On (and Door Interlock Switch closed):

NOTE: For this test, DIP switch #13 must be in OFF position.)

WARNING

LINE VOLTAGE NOW PRESENT

4. Induced Draft Motor must run and pull in pressure switch.
5. If the hot surface ignitor heats and at the end of the ignitor warm-up period the gas valve opens and the burners ignite, the trouble is in the thermostat or wiring.
6. With power off, check the continuity of the thermostat and wiring. Repair or replace as necessary.

If checking the furnace in the air conditioning mode, proceed as follows.

7. With power off, Jumper terminals R to Y (or Y1 or Y2 for two-stage models) to G.
8. Turn on the power.
9. If the furnace blower motor starts and the condensing unit runs, then the trouble is in the thermostat or wiring. Repair or replace as necessary.
10. After completing check and/or repair of wiring and check and/or replacement of thermostat, reinstall blower compartment door.
11. Turn on electrical power and verify proper unit operation.

SERVICING

S-3B HEATING ANTICIPATOR/ CYLCE RATE

Older heating thermostats may have an adjustable anticipator. This is a wire wound adjustable heater which is energized during the "ON" cycle to help prevent overheating of the conditioned space.

The anticipator is a part of the thermostat and if it should fail for any reason, the thermostat must be replaced.

Other thermostats have a cycle rate adjustment to adjust cycles per hour. This should be set to match system type.

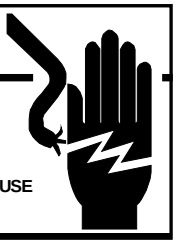
S-4 CHECKING TRANSFORMER AND CONTROL CIRCUIT

A step-down transformer 120 volt primary to 24 volt secondary, 40 VA (Heating and Cooling Models) supplies ample capacity of power for either operation.

WARNING

HIGH VOLTAGE

DISCONNECT **ALL** POWER BEFORE SERVICING OR CHANGING ANY ELECTRICAL WIRING. MULTIPLE POWER SOURCES MAY BE PRESENT. FAILURE TO DO SO MAY CAUSE PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.



1. Remove blower compartment door to gain access to the thermostat low voltage wires located at the furnace integrated control module.
2. Remove the thermostat low voltage wires at the furnace integrated control module terminals.

With Power On (and Door Interlock Switch closed

WARNING

LINE VOLTAGE NOW PRESENT

3. Use a voltmeter, check voltage across terminals R and C. Must read 24 VAC.
4. No voltage indicates faulty transformer, open fuse, bad wiring, bad splice, or open door interlock switch.
5. Check transformer primary voltage at incoming line voltage connections, fuse, splices, and blower door interlock switch.
6. If line voltage is available to the primary side of transformer and not at secondary side, the transformer is inoperative. Replace.
7. After completing check and/or replacement of transformer and check and/or repair of control circuit, reinstall blower compartment door.
8. Turn on electrical power and verify proper unit operation.

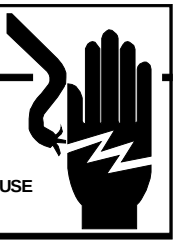
S-300 CHECKING PRIMARY LIMIT CONTROL

All modulating furnaces use a nonadjustable, automatic reset, bi-metal type limit control. The primary limit control is located on the front panel of the furnace between heat exchanger tubes. This is a normally closed control.

WARNING

HIGH VOLTAGE

DISCONNECT **ALL** POWER BEFORE SERVICING OR CHANGING ANY ELECTRICAL WIRING. MULTIPLE POWER SOURCES MAY BE PRESENT. FAILURE TO DO SO MAY CAUSE PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.



1. Turn off all voltage sources
2. Remove the two wires from the limit switch
3. Using an ohmmeter, check for a closed circuit across the two limit contacts (this will be the same reading that you see by touching your two meter leads together)

S-301 CHECKING AUXILIARY LIMIT CONTROL

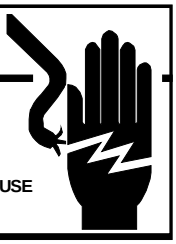
Automatic Reset Auxiliary Limit Located in Blower Housing

Modulating furnaces use an auxiliary limit(s) (automatic reset) control connected in series with the main limit switch. If its temperature should be exceeded, it will open, interrupting the voltage in the limit circuit. The auxiliary limit is located on the side of the blower housing. This is a normally closed switch. To check auxiliary limits; perform the following steps.

WARNING

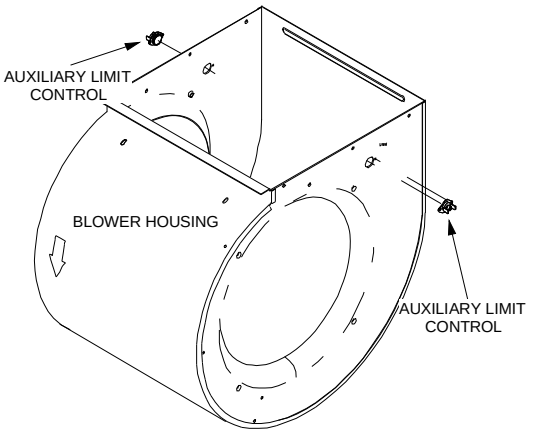
HIGH VOLTAGE

DISCONNECT **ALL** POWER BEFORE SERVICING OR CHANGING ANY ELECTRICAL WIRING. MULTIPLE POWER SOURCES MAY BE PRESENT. FAILURE TO DO SO MAY CAUSE PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.



1. Turn off all power sources
2. Remove the two wires from the auxiliary limit switch
3. Using an ohmmeter, check for a closed circuit across the two limit contacts (this will be the same reading that you see by touching your two meter leads together)

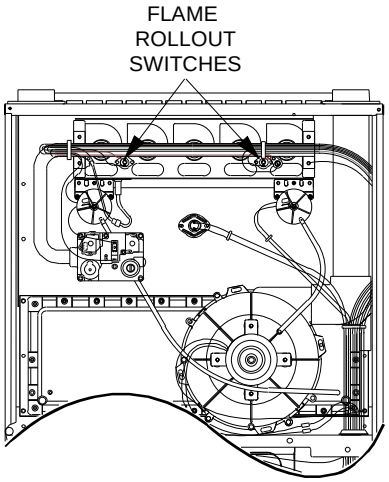
SERVICING



Auxiliary Limit Control Location

S-302 CHECKING FLAME ROLLOUT CONTROL

A temperature activated manual reset control is mounted to the manifold assembly on modulating furnace, as shown in the following illustration.



Flame Rollout Switch Location

(90% Upflow Furnace Shown, Counterflow Similar)

⚠ WARNING

HIGH VOLTAGE

DISCONNECT ALL POWER BEFORE SERVICING OR CHANGING ANY ELECTRICAL WIRING. MULTIPLE POWER SOURCES MAY BE PRESENT. FAILURE TO DO SO MAY CAUSE PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.

1. Turn off all power sources
2. Remove the two wires from the roll out switch
3. Using an ohmmeter, check for a closed circuit across the two roll out switch contacts (this will be the same reading that you see by touching your two meter leads together).

S-303 INDUCED DRAFT BLOWER MOTOR

Induced Draft Blower (IDB)

All modulating furnace models use a three phase induced draft blower to draw flue gases through the heat exchanger. The inducer uses ball bearings and is permanently lubricated. This motor is driven at varying speeds by the VFD (variable frequency drive) section of the IFC. The IFC takes typical single phase power supplied to the furnace and converts it to a three phase supply to operate the draft inducer at the desired speed. The windings of the induced draft motor will have equal resistance +/- 5%. Normal resistance readings at room temperature will range from 14-17 ohms. The voltage supplied by the IFC to drive the induced draft blower will vary from 15-110 volts A/C between any two windings. This would be read between any two of the three power wires between the IFC and the induced draft blower. This voltage to the IBD will vary between furnace models and is dependant on what percentage of maximum fire is being called for. The power wires are colored red, white and black. A green colored ground wire is also present.

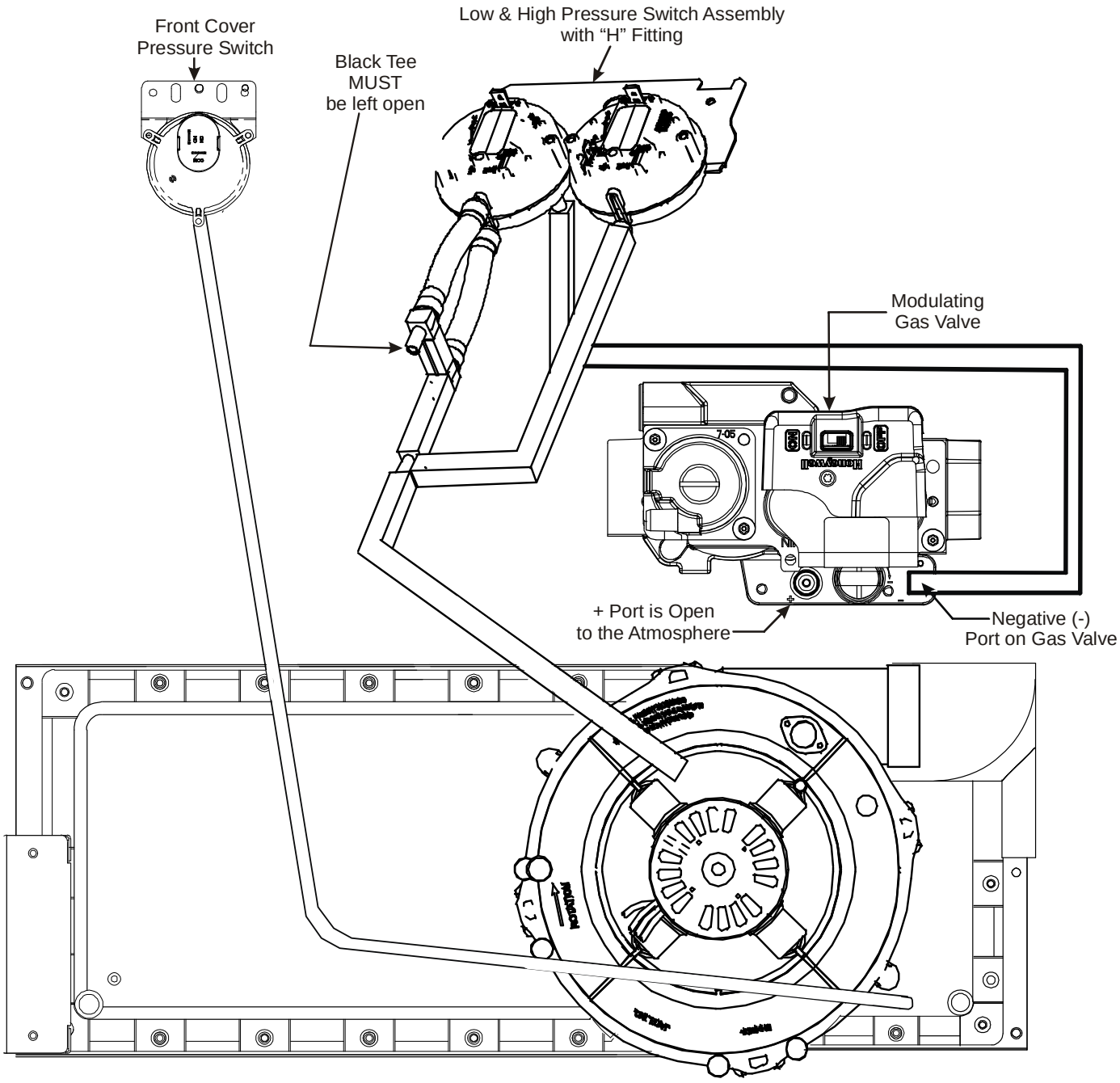
S-304 CHECKING MODULATING GAS VALVE

Gas ValveModulating furnaces use a 24 VAC pneumatically operatedgas valve by Honeywell. The valve is energized by the inte-grated furnace control on a call for heat, wired in series through the front-cover pressure switch. The firing rate percentage is determined by the negative pressure created by the operation of the draft inducer. The gas valve is factory set and non-adjustable in the field. Do not remove the seal covering the regulator screws or attempt to adjust either of the regulator screws. Even though the modulating gas valve is non-adjustable in the field, gas industry procedure dictates that the installing / servicing technician should know that the appliance is operating as designed before leaving newly installed or serviced equipment. The gas valve is equipped with 1/8 NPT fittings to access both the inlet and manifold gas pressures. To do a manifold gas pressure check, the furnace can be operated in field test mode. This mode will quickly bring the furnace up to high fire. To enter field test mode; during a call for heat, press the fault recall button twice within a five second period; when the dual seven segment displays show Ft, press the fault recall button again to enter field test mode.The furnace will stay in field test for five minutes or until the call for heat is satisfied. Gas valve orientation must be such that the switch is facing out towards the front of the furnace.

S-304A CHECKING INDUCTOR COIL

Wired in series with ¾ and 1 HP ECM motors; the inductor coil conditions the power supply to the motor, smoothing out spikes and electrical noise. With voltage applied to one side of the inductor coil, the output voltage to the motor should be the same as incoming voltage.

MODULATING FURNACE PNEUMATIC TUBING DIAGRAM



Upflow Model Shown

For representation only. Actual unit may vary in appearance.

SERVICING

S-305 CHECKING MAIN BURNERS

The main burners are used to provide complete combustion of various fuels in a limited space, and transfer this heat of the burning process to the heat exchanger.

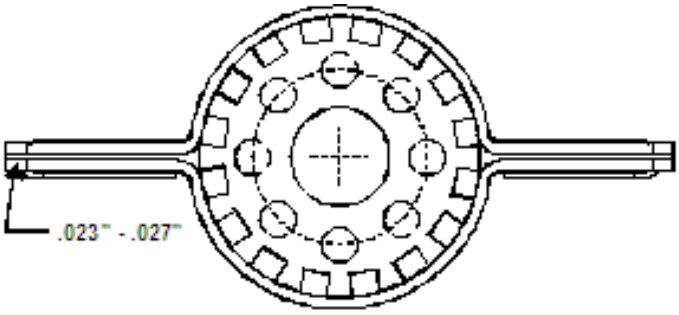
Proper ignition, combustion, and extinction are primarily due to burner design, orifice sizing, gas pressure, primary and secondary air, vent and proper seating of burners.

Depending on the size of the furnace, each furnace will havefrom three to five inshot burners. Burners are precisely constructed of aluminized steel and designed to provide proper ignition and flame stability. When converting a modulating furnace to L.P. gas, the factory installed burners must be replaced by burners that come in the L.P. kit.

⚠ WARNING

DISCONNECT ALL GAS AND ELECTRICAL POWER SUPPLY.

In checking main burners, look for signs of rust, oversized and undersized carry over ports restricted with foreign material, etc, refer to Beckett Burner drawing.



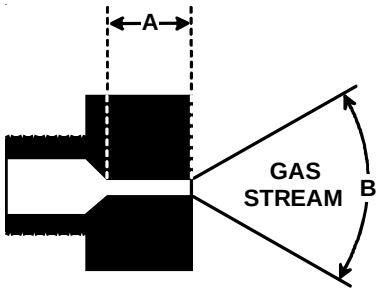
Beckett Burner

S-306 CHECKING ORIFICES

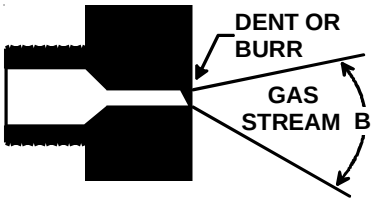
A fixed gas orifice is used in all Goodman® brand & Amana® brand furnaces. That is an orifice which has a fixed bore and position as shown in the following drawing.

No resizing should be attempted until all factors are taken into consideration such as inlet and manifold gas pressure, alignment, and positioning, specific gravity and BTU content of the gas being consumed.

Orifices should be treated with care in order to prevent damage. They should be removed and installed with a box-end wrench in order to prevent distortion. In no instance should an orifice be peened over and redrilled.



The length of Dimension "A" determines the angle of Gas Stream "B".



A dent or burr will cause a severe deflection of the gas stream.

S-307 CHECKING GAS PRESSURE

Gas Supply Pressure Measurement

⚠ CAUTION

TO PREVENT UNRELIABLE OPERATION OR EQUIPMENT DAMAGE, THE INLET GAS SUPPLY PRESSURE MUST BE AS SPECIFIED ON THE UNIT RATING PLATE WITH ALL OTHER HOUSEHOLD GAS FIRED APPLIANCES OPERATING.

Gas inlet and manifold pressures should be checked in accordance to the type of fuel being consumed.

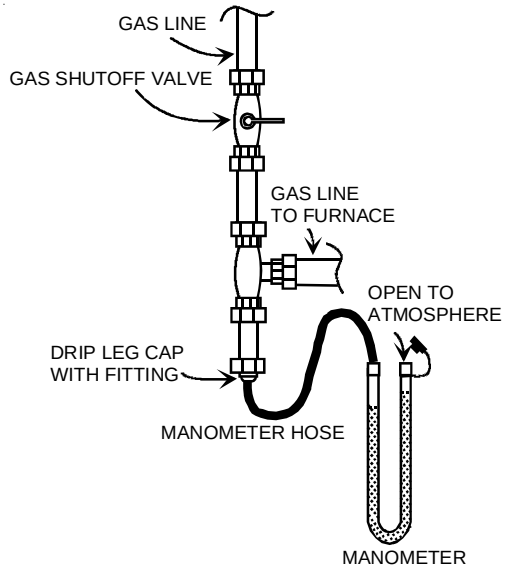
The line pressure supplied to the gas valve must be within the range specified below. The supply pressure can be measured at the gas valve inlet pressure tap or at a hose fitting installed in the gas piping drip leg. The supply pressure must be measured with the burners operating. To measure the gas supply pressure, use the following procedure.

⚠ WARNING

DISCONNECT ELECTRICAL POWER AND SHUT OFF GAS SUPPLY.

1. After turning off gas to furnace at the manual gas shutoff valve external to the furnace, remove burner compartment door to gain access to the gas valve.
2. Connect a calibrated water manometer (or appropriate gas pressure gauge) at either the gas valve inlet pressure tap or the gas piping drip leg as shown in the following figures.

SERVICING



Measuring Inlet Gas Pressure (Alternate Method)

3. Turn ON the gas and electrical power supply and operate the furnace and all other gas consuming appliances on the same gas supply line.
4. Measure furnace gas supply pressure with burners firing. Supply pressure must be within the range specified in the following table.

To test manifold pressure the furnace must be put into "field test mode" to bring the furnace up to 100% input.

5. Disconnect manometer after turning off gas at manual shutoff valve. Reinstall plug before turning on gas to furnace.
6. Turn OFF any unnecessary gas appliances started in step 3.
7. Turn on gas to furnace and check for leaks. If leaks are found, repair and then reinstall burner compartment door.
8. Turn on electrical power and verify proper unit operation.

The gas valve is factory set and ***non-adjustable*** in the field. Do not remove the seal covering the regulator screws or attempt to adjust either of the regulator screws. Even though the modulating gas valve is non-adjustable in the field, gas industry procedure dictates that the installing / servicing technician should know that the appliance is operating as designed before leaving newly installed or serviced equipment. The gas valve is equipped with 1/8 NPT fittings to access both the inlet and manifold gas pressures. To do a manifold gas pressure check the furnace can be operated in ***field test mode.*** This mode will quickly bring the furnace up to high fire. To enter field test mode; during a call for heat, press the fault recall button twice within a five second period; when the dual seven segment displays show Ft, press the fault recall button again to enter field test mode. The furnace will stay in field test for five minutes or until the call for heat is satisfied. Gas valve orientation must be such that the switch is facing out towards the front of the furnace.

Manifold pressure for natural gas is pre-set to be between 3.2" WC to 3.8"WC. If the furnace has been converted to LP gas, the manifold pressure will be 9.7"WC to 10.3"W.

Manifold Gas Pressure	
Natural Gas	3.5" w.c.
Propane Gas	10.0" w.c.

S-308 CHECKING HOT SURFACE IGNITOR

Modulating furnaces use a 115 volt silicon nitride hot surface igniter. This is the familiar and reliable 0131F00008S igniter with 17 second warm up time. At room temperature the igniter has a resistance range of 37 - 68 ohms. The H.S.I. isconnected electrically to the IFC by a 3/16" push-on connection.

S-309 CHECKING FOR FLASHBACK

Flashback will also cause burning in the burner venturi, but is caused by the burning speed being greater than the gas-air flow velocity coming from a burner port.

Flashback may occur at the moment of ignition, after a burner heats up or when the burner turns off. The latter is known as extinction pop.

Since the end results of flashback and delayed ignition can be the same (burning in the burner venturi) a definite attempt should be made to determine which has occurred. If flashback should occur, check for the following:

1. Improper gas pressure - adjust to proper pressure (See *S-307 CHECKING GAS PRESSURE*)..
2. Check burner for proper alignment and/or replace burner.
3. Improper orifice size - check orifice for obstruction.

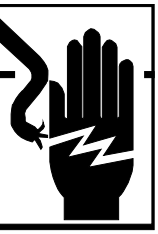
S-310 CHECKING PRESSURE CONTROL

The pressure control is a safety device to prevent the combustion cycle from occurring with inadequate venting caused by a restricted or blocked vent pipe on the modulating furnace. Also on the modulating furnaces there is a pressure control that will prevent the combustion cycle from occurring with inadequate condensate drainage due to a partial or blocked recuperator coil or drain.

⚠ WARNING

HIGH VOLTAGE

DISCONNECT ALL POWER BEFORE SERVICING OR INSTALLING THIS UNIT. MULTIPLE POWER SOURCES MAY BE PRESENT. FAILURE TO DO SO MAY CAUSE PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.

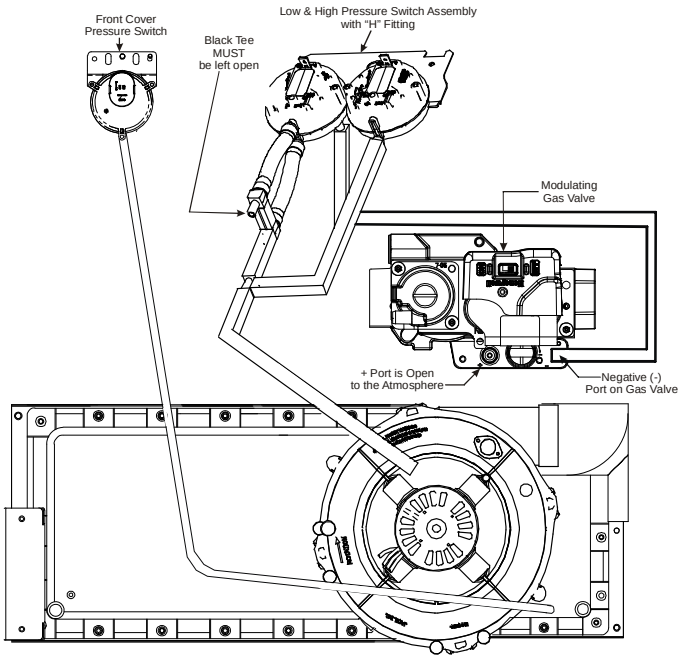


1. Remove burner compartment door to gain access to pressure switch(es).
2. Remove wires from the pressure switch(es) electrical terminals.
3. Using a VOM check from common terminal to NO (Normally Open) - should read open.

If switch reads as above proceed to Step 4, otherwise replace control.

4. Remove the pressure control hose from the control and interconnect with an inclined manometer as shown in the following figures.

MODULATING FURNACE PNEUMATIC TUBING DIAGRAM



Upflow Model Shown

For representation only. Actual unit may vary in appearance.

S-311 HIGH ALTITUDE APPLICATION

Modulating furnaces are approved up to 10,000 ft altitude. No kit or changes are needed.

S-312 CHECKING FOR DELAYED IGNITION

Delayed ignition is a delay in lighting a combustible mixture of gas and air which has accumulated in the combustion chamber.

When the mixture does ignite, it may explode and/or rollout causing burning in the burner venturi.

If delayed ignition should occur, the following should be checked:

1. Improper gas pressure - adjust to proper pressure (See *S-307 CHECKING GAS PRESSURE*).
2. Improper burner positioning - burners should be in locating slots, level front to rear and left to right.
3. Carry over (lighter tube or cross lighter) obstructed - clean.
4. Main burner orifice(s) deformed, or out of alignment to burner - replace.

S-313 CHECKING INTEGRATED IGNITION CONTROL BOARDS

NOTE: Failure to earth ground the furnace, reversing the neutral and hot wire connection to the line (polarity), or a high resistance connection in the neutral line may cause the control to lockout due to failure to sense flame.

⚠ WARNING

TO AVOID THE RISK OF ELECTRICAL SHOCK, WIRING TO THE UNIT MUST BE PROPERLY POLARIZED AND GROUNDED. DISCONNECT POWER BEFORE PERFORMING SERVICE LISTED BELOW.

The ground wire must run from the furnace all the way back to the electrical panel. Proper grounding can be confirmed by disconnecting the electrical power and measuring resistance between the neutral (white) connection and the burner closest to the flame sensor. Resistance should be less than 10 ohms.

The ignition control is a combination electronic and electromechanical device and is not field repairable. Complete unit must be replaced.

⚠ WARNING

LINE VOLTAGE NOW PRESENT

These tests must be completed within a given time frame due to the operation of the ignition control.

The ignition control is capable of diagnosing many furnace failures to help in troubleshooting. The PCBKF200 and PCBKF201 controls utilize a dual, 7-segment LED display to indicate diagnostic codes.

When the control is powered up normally the light will be on continuously. The PCBKF200 and PCBKF201displays will indicate **"ON"** when powered and in standby mode.

This can be used to test for 120 volts and 24 volts to the control since both must be present for the light to be on. If this step fails, check for 120 volts to the control and check the transformer and its associated wiring. If this step is successful give the control a call for heat and wait five (5) seconds or until the furnace goes into lockout. If the control detects a failure it will now be shown on the diagnostic indicator light/display. Refer to the *Abnormal Operation* section in the *Sequence of Operation* section of this manual for more detail on failure codes

The indicator light/display may be viewed by looking through the sight glass in the blower compartment door. The failure codes are retrieved via an on-board, momentary push button switch. Pressing the button for 2-5 seconds will force the failure codes to be displayed on the diagnostic indicator.

SERVICING

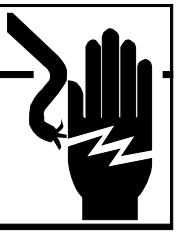
S-314 CHECKING FLAME SENSOR

A flame sensing device is used in conjunction with the ignition control module to prove combustion. If proof of flame is not present the control will de-energize the gas valve and "retry" for ignition or lockout.

WARNING

HIGH VOLTAGE

DISCONNECT ALL POWER BEFORE SERVICING OR INSTALLING THIS UNIT. MULTIPLE POWER SOURCES MAY BE PRESENT. FAILURE TO DO SO MAY CAUSE PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.



Flame signal is continuously monitored by the IFC. The flame rod, flame rod wire, and proper grounding are all critical to proving the presence of flame. Because of the design of the Honeywell flame proving system, reading flame signal with a microamp meter will not provide reliable and consistent results and is therefore not a recommended practice. The IFC has a built in warning (E6) if flame signal is approaching the low threshold.

NOTE: Contaminated fuel or combustion air can create a nearly invisible coating on the flame sensor. This coating works as an insulator causing a loss in the flame sense signal. If this situation occurs the flame sensor must be cleaned with steel wool.

Symptoms of Abnormal Operation (Non-communicating & ComfortNet™ Thermostat)	Diagnostic/Status LED Codes	Fault Description	ComfortNet Thermostat Only		Possible Causes	Corrective Actions	Notes & Cautions
			Message	Code			
• Furnace fails to operate • Integrated control module LED display provides IF error code.. • ComfortNet thermostat "Call for Service" icon illuminated • ComfortNet thermostat scrolls "Check Furnace" message	IF	• Integrated control module has an internal fault	*INTERNAL FAULT*	*EE*	• Improper wiring to the furnace or integrated control module.	• Assure proper wiring to furnace and integrated control module. • Verify power to the furnace and integrated control module is stable and within specifications. • Replace bad integrated control module.	• Turn power OFF prior to repair. • Read precautions in "Electrostatic Discharge" section of manual. • Replace integrated control module with current replacement parts.
• LED display indicates On	On	• Normal operation	None	None	• Normal operation	• None	• Normal operation
• Furnace fails to operate • Integrated control module LED display provides E0 error code. • ComfortNet thermostat "Call for Service" icon illuminated. • ComfortNet thermostat scrolls "Check Furnace" message.	E0	• Furnace lockout due to an excessive number of ignition "retries" or flame "recycles" (3 total).	*LOCKOUT*	*E0*	• Failure to establish flame. Cause may be no gas to burners, front cover pressure switch stuck open, bad igniter or igniter alignment, improper orifices, or coated/oxidized or improperly connected flame sensor. • Loss of flame after establishment. Cause may be interrupted gas supply, lazy burner flames (improper gas pressure or restriction in flue and/or combustion air piping), front cover pressure switch opening, or improper induced draft blower performance.	• Locate and correct gas interruption. • Check front cover pressure switch operation (hose, wiring, contact operation). Correct if necessary. Make sure furnace is draining properly. • Replace or realign igniter. • Check flame sense signal. Sand sensor if coated and/or oxidized. • Check flue piping for blockage, proper length, elbows, and termination. • Verify proper induced draft blower performance.	• Turn power OFF prior to repair. • Igniter is fragile, handle with care. • Clean flame rod with steel wool. • See "Vent/Flue Pipe" section for piping details.
• Furnace fails to operate. • Integrated control module LED display provides E1 error code. • ComfortNet thermostat "Call for Service" icon illuminated. • ComfortNet thermostat scrolls "Check Furnace" message.	E1	• Low stage pressure switch circuit is closed at start of heating cycle.	*PS1 CLOSED*	*E1*	• Low stage pressure switch contacts sticking. • Shorts in pressure switch circuit wiring.	• Replace low stage pressure switch. • Repair short in wiring.	• Turn power OFF prior to repair. • Replace pressure switch with correct replacement part.
• Induced draft blower runs continuously with no further furnace operation. • Integrated control module LED display provides E2 error code. • ComfortNet thermostat "Call for Service" icon illuminated. • ComfortNet thermostat scrolls "Check Furnace" message.	E2	• Low stage pressure switch circuit is not closed.	*PS1 OPEN*	*E2*	• Pressure switch hose blocked pinched, or connected improperly. • Blocked flue and/or inlet air pipe, blocked drain system or weak induced draft blower. • Incorrect pressure switch set point or malfunctioning switch contacts. • Loose or improperly connected wiring. • Inducer not running. • H fitting atmospheric port blocked.	• Inspect pressure switch hose. Repair/replace if necessary. • Inspect flue and/or inlet air piping for blockage, proper length, elbows, and termination. • Check drain system. Correct as necessary. • Check induced draft blower performance. Correct as necessary. • Correct pressure switch set point or contact motion. • Tighten or correct wiring connection. • Clean H fitting.	• Turn power OFF prior to repair. • Replace pressure switch with correct replacement part. • Replace induced draft blower with correct replacement part. • Take care to assemble/install H fitting in factory configuration.

Symptoms of Abnormal Operation (Non-communicating & ComfortNet™ Thermostat)	Diagnostic/Status LED Codes	Fault Description	ComfortNet Thermostat Only		Possible Causes	Corrective Actions	Notes & Cautions
			Message	Code			
• Circulator blower runs continuously. No furnace operation. • Integrated control module LED display provides E3 error code. • ComfortNet thermostat "Call for Service" icon illuminated. • ComfortNet thermostat scrolls "Check Furnace" message.	E3	• Primary limit.	*HIGH LIMIT OPEN*	*E3*	• Insufficient conditioned air over the heat exchanger. Blocked filters, restrictive ductwork, improper circulator blower speed, or failed circulator blower motor. • Loose or improperly connected wiring.	• Check filters and ductwork for blockage. Clean filters or remove obstruction. • Check circulator blower speed and performance. Correct speed or replace blower motor if necessary. • Tighten or correct wiring connection.	• Turn power OFF prior to repair. • See Specification Sheet applicable to your model for allowable rise range and proper circulator speed.
• Induced draft blower and circulator blower runs continuously. No furnace operation. • Integrated control module LED display provides E4 error code. • ComfortNet thermostat "Call for Service" icon illuminated. • ComfortNet thermostat scrolls "Check Furnace" message.	E4	• Flame sensed when it should not be present.	*IMPROPER FLAME*	*E4*	• Short to ground in flame sense circuit. • Lingering burner flame. • Slow closing gas valve.	• Correct short at flame sensor or in flame sensor wiring. • Check for lingering flame. • Verify proper operation of gas valve. Replace if necessary.	• Turn power OFF prior to repair.
• Furnace fails to operate • Integrated control module LED display provides EC error code. • ComfortNet thermostat "Call for Service" icon illuminated. • ComfortNet thermostat scrolls "Check Furnace" message.	EC	• Inducer motor overcurrent fault.	*INDUCER FAULT OR INDUCER LOCKOUT*	*EC*	• Lingering Inducer motor overcurrent detected.	• Reset system power and verify inducer is running properly. • Replace inducer or integrated control module, if necessary.	
• No furnace operation. • Integrated control module LED display provides Ed error code.	Ed	• Manual reset rollout switch is open	*ROLLOUT OPEN*	*Ed*	• Orifice plate out of position. • Blocked heat exchanger. • Burners out of alignment. • Defective heat exchanger.	• Line up orifice plate. • Remove Blockage from heat exchanger. • Line up burners. • Check for flame disturbance on roll out when blower comes on.	• Turn power OFF prior to repair.
• No furnace operation. • Integrated control module LED display provides Ef error code.	EF	• Open auxiliary input.	*AUXILIARY OPEN*	*EF*	• Open circuit between aux in or aux out. • Missing jumper. • Open float switch..	• Install jumper. • Inspect float switch.	• Turn power OFF prior to repair.
• No furnace operation. • Integrated control module LED display provides E5 error code. • ComfortNet thermostat displays "Battery Power".	E5	• Open Fuse	Not Displayed	Not Displayed	• Short in low voltage wiring	• Locate and correct short in low voltage wiring	• Turn power OFF prior to repair. • Replace fuse with 3-amp automotive type
• Normal furnace operation. • Integrated control module LED display provides E6 error code.	E6	• Flame sense micro amp signal is low	*WEAK FLAME*	*E6*	• Flame sensor is coated/oxidized. • Flame sensor incorrectly .positioned in burner flame. • Lazy burner flame due to improper gas pressure or combustion air.	• Clean flame sensor if coated/oxidized. • Inspect for proper sensor alignment. • Check inlet air piping for blockage, proper length, elbows, and termination. • Compare current gas pressure to rating plate. Adjust as needed.	• Turn power OFF prior to repair. • Clean flame sensor with steel wool. • See "Vent/Flue Pipe" section for piping details. • See rating plate for proper gas pressure.

Symptoms of Abnormal Operation (Non-communicating & ComfortNet™ Thermostat)	Diagnostic/Status LED Codes	Fault Description	ComfortNet Thermostat Only		Possible Causes	Corrective Actions	Notes & Cautions
			Message	Code			
• Furnace fails to operate on high stage; furnace operates normally on low stage. • Integrated control module LED display provides E8 error code.	E8	• High stage pressure switch circuit is closed at start of heating cycle. • Induced draft blower is operating. • Furnace is operating on low stage only	*PS2 CLOSED*	*E8*	• High stage pressure switch contacts sticking. • Shorts in pressure switch circuit wiring.	• Replace high stage pressure switch. • Repair short in wiring	• Turn power OFF prior to repair. • Replace pressure switch with correct replacement part.
• Furnace fails to operate on high stage; furnace operates normally on low stage. • Integrated control module LED display provides E9 error code.	E9	• High stage pressure switch circuit is not closed. • Induced draft blower is operating. • Furnace is operating on low stage only	*PS2 OPEN*	*E9*	• Pressure switch hose blocked pinched, or connected improperly. • Blocked flue and/or inlet air pipe, blocked drain system or weak induced draft blower. • Incorrect pressure switch set point or malfunctioning switch contacts. • Loose or improperly connected wiring.	• Inspect pressure switch hose. Repair/replace if necessary. • Inspect flue and/or inlet air piping for blockage, proper length, elbows, and termination. Check drain system. Correct as necessary. • Check induced draft blower performance. Correct as necessary. • Correct pressure switch set point or contact motion. • Tighten or correct wiring connection.	• Turn power OFF prior to repair. • Replace pressure switch with correct replacement part. • Replace induced draft blower with correct replacement part.
• Furnace fails to operate. • Integrated control module LED display provides EA error code. • ComfortNet thermostat “Call for Service” icon illuminated. • ComfortNet thermostat scrolls “Check Furnace” message.	EA	• Polarity of 115 volt AC is reversed	*REVERSED PLTY*	*EA*	• Polarity of 115 volt AC power to furnace or integrated module is reversed. • Reversed unit ground.	• Review wiring diagram to correct polarity. • Verify proper ground. Correct if necessary. • Check and correct wiring.	• Turn power OFF prior to repair.
• Furnace fails to operate. • Integrated control module LED display provides d0 error code. • ComfortNet thermostat “Call for Service” icon illuminated. • ComfortNet thermostat scrolls “Check Furnace” message.	d0	• Data not yet on network.	*NO NET DATA*	*d0*	• Furnace does not contain any shared data.	• Populate shared data set using memory card.	• Turn power OFF prior to repair • Use memory card for the specific model. • Insert memory card BEFORE turning power ON. Memory card may be removed after data is loaded. • Turn power OFF before removing memory card. • Error code will be cleared once data is loaded.

Symptoms of Abnormal Operation (Non-communicating & ComfortNet™ Thermostat)	Diagnostic/Status LED Codes	Fault Description	ComfortNetThermostat Only Message	Code	Possible Causes	Corrective Actions	Notes & Cautions
• Operation different than expected or no operation. • Integrated control module LED display provides **d4** error code. • ComfortNet thermostat "Call for Service" icon illuminated. • ComfortNet thermostat scrolls "Check Furnace" message.	d4	• Invalid memory card data.	*INVALID MC DATA*	*d4*	• Shared data set on memory card has been rejected by integrated control module	• Verify shared data set is correct for the specific model. Re-populate data using correct memory card if required.	• Turn power OFF prior to repair • Use memory card for the specific model. • Insert memory card BEFORE turning power ON. Memory card may be removed after data is loaded. • Turn power OFF before removing memory card. • Error code will be cleared once data is loaded.
• Furnace fails to operate. • Integrated control module LED display provides **b0** error code. • ComfortNet thermostat "Call for Service" icon illuminated. • ComfortNet thermostat scrolls "Check Furnace" message.	b0	• Circulator blower motor is not running when it should be running.	*MOTOR NOT RUN*	*b0*	• Loose wiring connection at circulator motor power leads or circulator motor power leads disconnected. • Open circuit in inductor or loose wiring connection at inductor (3/4 Hp and 1 Hp models only). • Failed circulator blower motor.	• Tighten or correct wiring connection. • Verify continuous circuit through inductor. Replace if open or short circuit. • Check circulator blower motor. Replace if necessary.	• Turn power OFF prior to repair • Replace inductor with correct replacement part. • Replace circulator motor with correct replacement part.
• Furnace fails to operate. • Integrated control module LED display provides **b1** error code. • ComfortNet thermostat "Call for Service" icon illuminated. • ComfortNet thermostat scrolls "Check Furnace" message.	b1	• Integrated control module has lost communications with circulator blower motor.	*MOTOR COMM*	*b1*	• Loose wiring connection at circulator motor control leads. • Failed circulator blower motor. • Failed integrated control module.	• Tighten or correct wiring connection. • Check blower motor with UTT-01 Emerson tester • Check integrated control module. Replace if necessary.	• Turn power OFF prior to repair • Replace circulator motor with correct replacement part. • Replace integrated control module with correct replacement part.
• Furnace fails to operate. • Integrated control module LED display provides **b2** error code. • ComfortNet thermostat "Call for Service" icon illuminated. • ComfortNet thermostat scrolls "Check Furnace" message.	b2	• Circulator blower motor horse power in shared data set does not match circulator blower motor horse power.	*MOTOR MISMATCH*	*b2*	• Incorrect circulator blower motor in furnace. • Incorrect shared data set in integrated control module.	• Verify circulator blower motor horse power is the same specified for the specific furnace model. Replace if necessary. • Verify shared data set is correct for the specific model. Re-populate data using correct memory card if required.	• Turn power OFF prior to repair • Replace motor with correct replacement part. • Use memory card for the specific model • Insert memory card BEFORE turning power ON. Memory card may be removed after data is loaded. • Turn power OFF before removing memory card. • Error code will be cleared once shared data and motor horse power match.
• Furnace operates at reduced performance. • Airflow delivered is less than expected. • Integrated control module LED display provides **b3** error code.	b3	• Circulator blower motor is operating in a power, temperature, or speed limiting condition.	*MOTOR LIMITS*	*b3*	• Blocked filters. • Restrictive ductwork. • Undersized ductwork. • High ambient temperatures.	• Check filters for blockage. Clean filters or remove obstruction. • Check ductwork for blockage. Remove obstruction. Verify all registers are fully open. • Verify ductwork is appropriately sized for system. Resize/replace ductwork if necessary. • See *"Product Description" and "Location Requirements & Considerations"* for furnace installation requirements.	• Turn power OFF prior to repair.

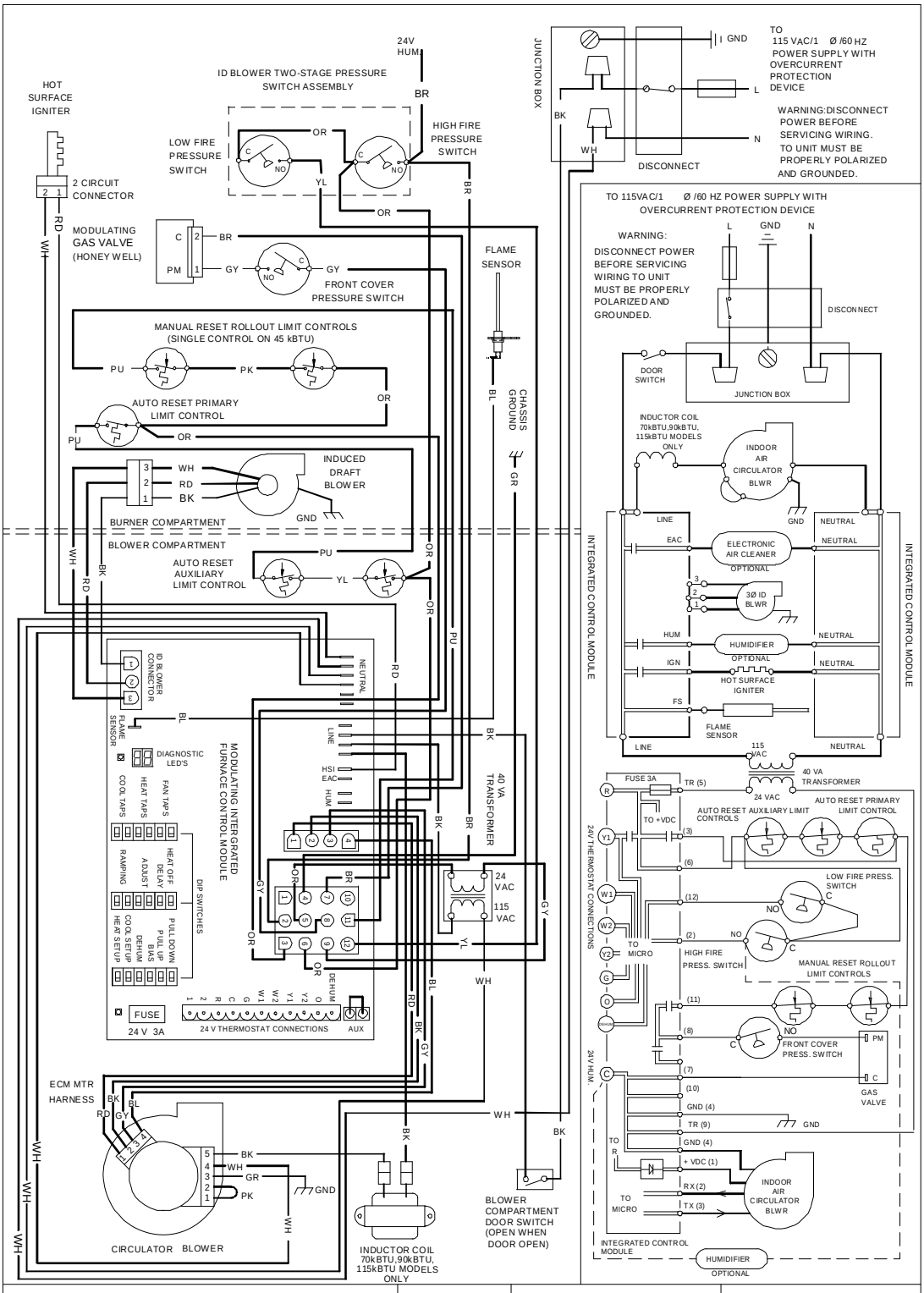
Symptoms of Abnormal Operation (Non-communicating & ComfortNet™ Thermostat)	Diagnostic/Status LED Codes	Fault Description	ComfortNet Thermostat Only		Possible Causes	Corrective Actions	Notes & Cautions
			Message	Code			
• Furnace fails to operate. • Integrated control module LED display provides **b4** error code. • ComfortNet thermostat "Call for Service" icon illuminated. • ComfortNet thermostat scrolls "Check Furnace" message.	b4	• Circulator blower motor senses a loss of rotor control. • Circulator blower motor senses high current.	*MOTOR TRIPS*	*b4*	• Abnormal motor loading, sudden change in speed or torque, sudden blockage of furnace air inlet or outlet. • High loading conditions, blocked filters, very restrictive ductwork, blockage of furnace air inlet or outlet.	• Check filters, filter grills/registers, duct system, and furnace air inlet/outlet for blockages.	• Turn power OFF prior to repair.
• Furnace fails to operate. • Integrated control module LED display provides **b5** error code. • ComfortNet thermostat "Call for Service" icon illuminated. • ComfortNet thermostat scrolls "Check Furnace" message.	b5	• Circulator blower motor fails to start 10 consecutive times.	*MTR LCKD ROTOR*	*b5*	• Obstruction in circulator blower housing. • Seized circulator blower motor bearings. • Failed circulator blower motor.	• Check circulator blower for obstructions. Remove and repair/replace wheel/motor if necessary. • Check circulator blower motor shaft rotation and motor. Replace motor if necessary.	• Turn power OFF prior to repair • Replace motor with correct replacement part. • Replace wheel with correct replacement part.
• Furnace fails to operate. • Integrated control module LED display provides **b6** error code. • ComfortNet thermostat "Call for Service" icon illuminated. • ComfortNet thermostat scrolls "Check Furnace" message.	b6	• Circulator blower motor shuts down for over or under voltage condition. • Circulator blower motor shuts down due to over temperature condition on power module.	*MOTOR VOLTS*	*b6*	• High AC line voltage to furnace. • Low AC line voltage to furnace. • High ambient temperatures.	• Check power to furnace. Verify line voltage to furnace is within the range specified on the furnace rating plate. • See *"Product Description"* and *"Location Requirements & Considerations"* for furnace installation requirements.	• Turn power OFF prior to repair.
• Furnace fails to operate. • Integrated control module LED display provides **b7** error code. • ComfortNet thermostat "Call for Service" icon illuminated. • ComfortNet thermostat scrolls "Check Furnace" message.	b7	• Circulator blower motor does not have enough information to operate properly. • Motor fails to start 40 consecutive times.	*MOTOR PARAMS*	*b7*	• Error with integrated control module. • Motor has a locked rotor condition.	• Check integrated control module. Verify control is populated with correct shared data set. See data errors above for details. • Check for locked rotor condition (see error code above for details).	• Turn power OFF prior to repair. • Replace with correct replacement part(s). • Use memory card for the specific model.
• Furnace operates at reduced performance. • Integrated control module LED display provides **b9** error code.	b9	• Airflow is lower than demanded.	*LOW ID AIRFLOW*	*b9*	• Blocked filters. • Restrictive ductwork. • Undersized ductwork.	• Check filters for blockage. Clean filters or remove obstruction. • Check ductwork for blockage. Remove obstruction. Verify all registers are fully open. • Verify ductwork is appropriately sized for system. Resize/replace ductwork if necessary.	• Turn power OFF prior to repair.

Status Codes

	NO POWER
On	NORMAL OPERATION
A	INDICATES AIRFLOW, FOLLOWED BY CFM
b0	BLOWER MOTOR NOT RUNNING
b1	BLOWER COMMUNICATION ERROR
b2	BLOWER HP MIS-MATCH
b3	BLOWER MOTOR OPERATING IN POWER, TEMPERATURE, OR SPEED LIMIT
b4	BLOWER MOTOR CURRENT TRIP OR LOST ROTOR
b5	BLOWER MOTOR LOCKED ROTOR
b6	BLOWER OVER/UNDER VOLTAGE TRIP OR OVER TEMPERATURE TRIP
b7	INCOMPLETE PARAMETERS SENT TO MOTOR
b9	LOW INDOOR AIRFLOW
C	CLIMATETALK COMPRESSOR COOLING / CONVENTIONAL COMPRESSOR COOLING WHEN 1-STAGE COMPRESSOR IS SET UP
C1	LOW STAGE COOL
C2	HIGH STAGE COOL
d	CLIMATETALK COMPRESSOR COOLING WITH DEHUMIFICATION / CONVENTIONAL COMPRESSOR COOLING WITH DEHUMIDIFICATION WHEN 1-STAGE COMPRESSOR IS SET UP
d0	DATA NOT YET ON NETWORK
d1	CONVENTIONAL 1-STAGE COMPRESSOR COOLING WITH DEHUMIDIFICATION WHEN 2-STAGE COMPRESSOR IS SET UP
d2	CONVENTIONAL 2-STAGE COMPRESSOR COOLING WITH DEHUMIDIFICATION WHEN 2-STAGE COMPRESSOR IS SET UP
d4	INVALID MEMORY CARD DATA
dF	DEFROST DEMAND
E0	LOCKOUT DUE TO EXCESSIVE RETRIES OR RECYCLES
E1	LOW STAGE PRESSURE SWITCH STUCK CLOSED AT START OF HEATING CYCLE
E2	LOW STAGE PRESSURE SWITCH STUCK OPEN
E3	OPEN HIGH LIMIT SWITCH
E4	FLAME DETECTED WHEN NO FLAME SHOULD BE PRESENT
E5	OPEN FUSE
E6	LOW FLAME SIGNAL
E7	IGNITER FAULT OR IMPROPER GROUNDING
E8	HIGH STAGE PRESSURE SWITCH STUCK CLOSED AT START OF HEATING CYCLE
E9	HIGH STAGE PRESSURE SWITCH STUCK OPEN
EA	REVERSED 115 VAC POLARITY
EC	INDUCER MOTOR OVERCURRENT FAULT
Ed	ROLLOUT SWITCH OPEN
EF	AUXILIARY INPUT OPEN
F	CONTINUOUS FAN
Ft	FIELD TEST MODE
H	INDICATES GAS HEAT, FOLLOWED BY PERCENTAGE OF DEMAND
HI	HIGH HEAT = 100%
IF	INTERNAL FAULT
P	CLIMATETALK COMPRESSOR HEATING / CONVENTIONAL COMPRESSOR HEATING WHEN 1-STAGE COMPRESSOR IS SET UP
P1	CONVENTIONAL 1-STAGE COMPRESSOR HEATING WHEN 2-STAGE COMPESSOR IS SET UP
P2	CONVENTIONAL 2-STAGE COMPRESSOR HEATING WHEN 2-STAGE COMPESSOR IS SET UP
50	% OF HIGH HEAT

WARNING

HIGH VOLTAGE!
Disconnect ALL power before servicing or installing this unit. Multiple power sources may be present. Failure to do so may cause property damage, personal injury or death.



NOTES:

1. SET HEAT ANTICIPATOR ON ROOM THERMOSTAT AT 0.7 AMPS.
2. MANUFACTURER'S SPECIFIED REPLACEMENT PARTS MUST BE USED WHEN SERVICING.
3. IF ANY OF THE ORIGINAL WIRE AS SUPPLIED WITH THE FURNACE MUST BE REPLACED, IT MUST BE REPLACED WITH WIRING MATERIAL HAVING A TEMPERATURE RATING OF AT LEAST 105°C. USE COPPER CONDUCTORS ONLY.
4. UNIT MUST BE PERMANENTLY GROUNDED AND CONFORM TO N.E.C. AND LOCAL CODES.
5. TO RECALL THE LAST 10 FAULTS, MOST RECENT TO LEAST RECENT, DEPRESS SWITCH FOR MORE THAN 2 SECONDS WHILE IN STANDBY (NO THERMOSTAT INPUTS)

0140F00863-B

COLOR CODES:
PK PINK
BR BROWN
WH WHITE
BL BLUE
GY GRAY
RD RED
YL YELLOW
OR ORANGE
PU PURPLE
GR GREEN
BK BLACK

LOW VOLTAGE FIELD
LOW VOLTAGE (24V)
HI VOLTAGE (115V)
HI VOLTAGE FIELD
JUNCTION
TERMINAL
INTERNAL TO INTEGRATED CONTROL
PLUG CONNECTION

EQUIPMENT GND
FIELD GND
FIELD SPLICE
SWITCH (TEMP)
IGNITER
SWITCH PRESSURE
OVERCURRENT PROT. DEVICE

Wiring is subject to change. Always refer to the wiring diagram on the unit for the most up-to-date wiring.