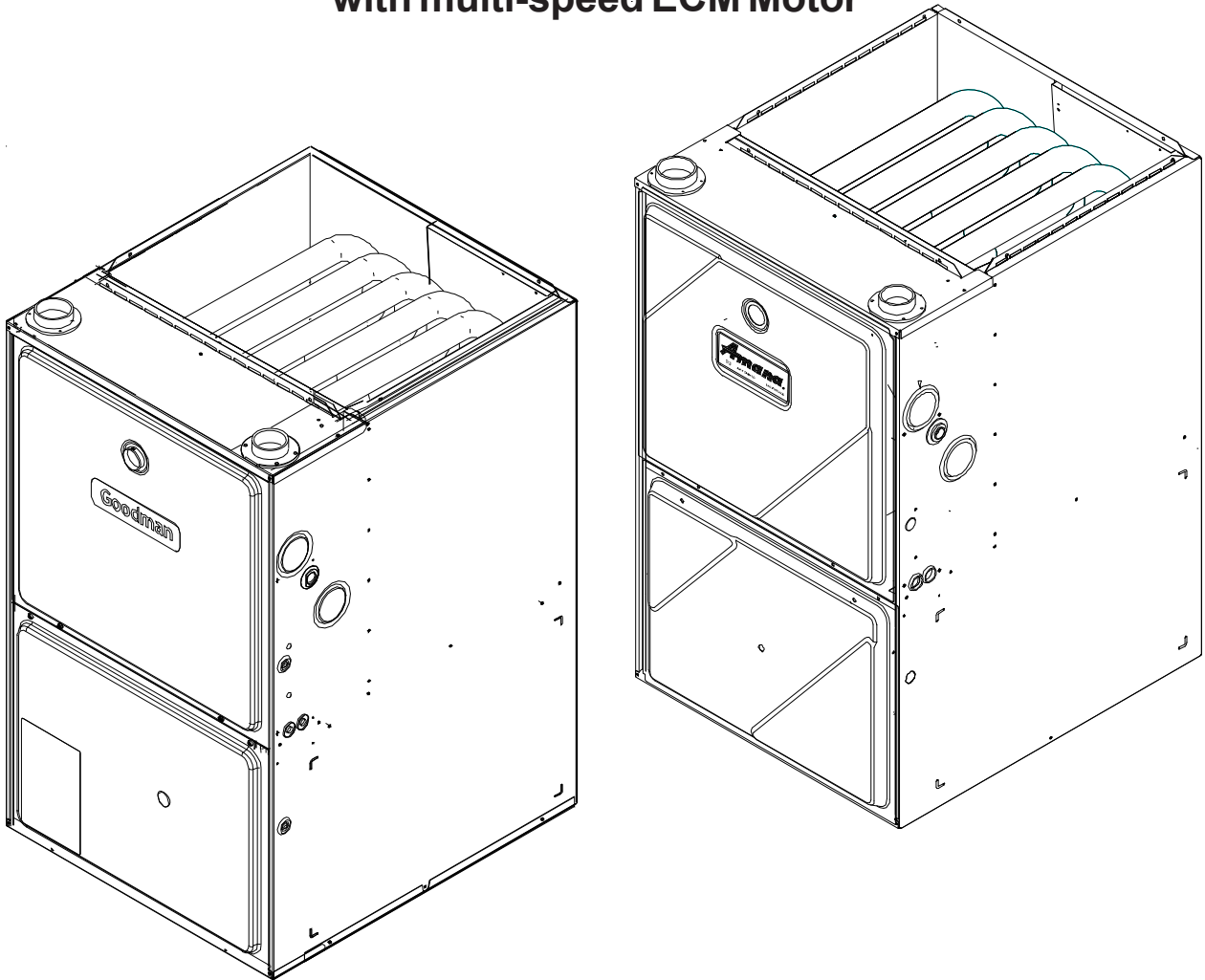


Service Instructions

Goodman® Brand GMEC96 & Amana® Brand AMEC96 Two Stage Furnace with multi-speed ECM Motor



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. The material in this manual does not supercede manufacturers installation and operation instructions.

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RS6612013
August 2014

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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 CERTIFIED BY GOODMAN.

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

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

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

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

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



DANGER



CARBON MONOXIDE POISONING HAZARD

Special warning for installation of furnaces or air handling units in enclosed area such as garages, utility rooms or parking areas. Carbon monoxide producing devices (such as automobile, space heater, gas water heater, etc.) Should not be operated in enclosed areas such as unventilated garages or utility rooms 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 and a carbon monoxide producing device is operated therein, there must be adequate direct outside ventilation. 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.



DANGER

RISQUE D'EMPOISONNEMENT AU MONOXYDE DE CARBONE

Avertissement special au sujet de l'installation d'appareils de chauffage ou de traitement d'air dans des endroits clos, tels les garages, les locaux d'entretien et les stationnements. Evitez de mettre en marche les appareils produisant du monoxyde de carbone (tels que les automobile, les appareils de chauffage autonome, etc.) dans des endroits non ventilés tels que les d'empoisonnement au monoxyde de carbone. Si vous devez faire fonctionner ces appareils dans un endroit clos, assurez-vous qu'il y ait une ventilation directe provenant de l'exterie. Les émissions de monoxyde de carbone peuvent être recirculés dans les endroits clos, si l'appareil de chauffage ou de traitement d'air sont en marche. Le monoxyde de carbone peut causer des maladies graves telles que des dommages permanents au cerveau et même la mort.



PELIGRO

RIESGO DE INTOXICACIÓN POR MONÓXIDO DE CARBONO

Advertencia especial para la instalación de calentadores ó maneja oras de aire en áreas cerradas como estacionamientos ó cuartos de servicio. Los equipos ó aparatos que producen monóxido de carbono (tal como automóvil, calentador de gas, calentador de agua por medio de gas, etc) no deben ser operados en áreas cerradas debido al riesgo de envenenamiento por monóxido de carbono (CO) que resulta de las emisiones de gases de combustión. Si el equipo ó aparato se opera en dichas áreas, debe existir una adecuada ventilación directa al exterior. Las emisiones de monóxido de carbono pueden circular a través del aparato cuando se opera en cualquier modo. El monóxido de carbono puede causar enfermedades severas como daño cerebral permanente ó muerte.

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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.

IMPORTANT INFORMATION

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 burners. Do not try to light the burners by hand.

B. BEFORE OPERATING smell 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 telephone in your building.
- Immediately call your supplier from a neighbor's phone. Follow the gas suppliers instructions.

• If you cannot reach your gas supplier, call the fire department.

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

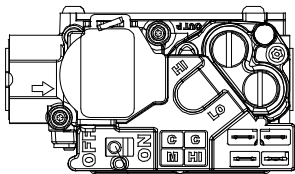
D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

WARNING: Improper installation, adjustment, alteration, service or maintenance can cause injury or property damage. Refer to the user's information manual provided with this furnace. For assistance or additional information consult a qualified installer, service agency or the gas supplier.

This furnace must be installed in accordance with the manufacturers instructions and local codes. In the absence of local codes, follow the National Fuel Gas Code, ANSI Z223.1.

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 automatic ignition system which automatically lights the burners. Do not try to light the burners by hand.
5. Remove control access panel.
6. Move the gas control switch or knob to "OFF".



GAS CONTROL SWITCH SHOWN IN "ON" POSITION

7. Wait five (5) minutes to clear out any gas. If you then smell gas, STOP! Follow "B" in the safety information above on this label. If you don't smell gas, go to the next step.
8. Move the gas control switch or knob to "ON".
9. Replace control access panel.
10. Turn on all electric power to the appliance.
11. Set the thermostat to the desired setting.
12. If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance" and call your service technician or gas supplier.

For indoor installation.

PGB & PGJ
For outdoor installation only.

WARNING: If not installed, operated and maintained in accordance with the manufacturer's instructions, this product could expose you to substances in fuel combustion which can cause death or serious illness and which are known to the State of California to cause cancer, birth defects or other reproductive harm. This product contains fiberglass insulation. Fiberglass insulation contains a chemical known by the State of California to cause cancer.

TO TURN OFF GAS TO APPLIANCE

1. Set the thermostat to its lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Remove control access panel.
4. Move the gas control switch or knob to "OFF". Do not force.
5. Replace control access panel.

FOR YOUR SAFETY Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

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IMPORTANT INFORMATION

CONSIGNES DE SÉCURITÉ - LIRE AVANT D'ALLUMER L'APPAREIL

AVERTISSEMENT: Le non-respect des instructions qui suivent peut entraîner un risque d'incendie ou d'explosion causant des dommages, des blessures ou la mort.

A. Cet appareil comporte pas de veilleuse. Il est muni d'un mécanisme qui allume automatiquement le brûleur. N'allumez pas le brûleur manuellement.

B. Sentir tout autour de l'appareil **AVANT D'ALLUMER** afin de détecter toute fuite de gaz. Assurez-vous de sentir tout près du plancher car certains gaz sont plus lourds que l'air et se déposent sur le plancher.

SI VOUS SENTEZ UNE ODEUR DE GAZ:

- Ne tentez d'allumer aucun appareil.
- Ne touchez pas aux interrupteurs électriques; n'utiliser aucun téléphone dans l'édifice où vous vous trouvez.
- Appelez immédiatement votre fournisseur de gaz en utilisant le téléphone d'un voisin et suivez les instructions du fournisseur.
- Appelez les pompiers si vous ne parvenez pas à rejoindre votre fournisseur de gaz.

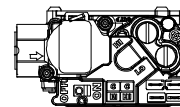
C. N'utiliser que votre main pour pousser ou tourner le commande du gaz. N'utilisez jamais d'outils. Si vous ne parvenez pas à pousser ou à tourner la commande, ne tentez pas de la réparer; appelez un réparateur qualifié. Forcer la commande ou essayer de la réparer peut entraîner un risque d'incendie ou d'explosion.

D. N'utilisez pas cet appareil si l'une de ses parties a été dans l'eau. Si cela se produit, demandez immédiatement à un réparateur qualifié d'inspecter l'appareil et de remplacer toute pièce du système de contrôle et toute commande de gaz ayant été dans l'eau.

0140F0002P

INSTRUCTIONS DE SERVICE

1. **UN INSTANT!** Lisez d'abord les consignes de sécurité ci-dessus.
2. Réglez le thermostat à son point le plus bas.
3. Coupez l'alimentation électrique de l'appareil.
4. Cet appareil est muni d'un mécanisme qui allume automatiquement le brûleur. Ne tentez pas d'allumer le brûleur manuellement.
5. Retirez le panneau d'accès de la commande.
6. Mettez la commande de gaz à la position ARRÊT ("OFF").
7. Attendez cinq (5) minutes afin de permettre à tout gaz présent d'être évacué. Si vous sentez une odeur de gaz à ce moment, **ARRÊTÉZ!** et suivez les consignes de sécurité données au paragraphe B ci-dessus. Si vous ne sentez pas de gaz, passez à l'étape suivante.
8. Mettez la commande de gaz à la position MARCHÉ ("ON").
9. Remettez le panneau d'accès de la commande en place.
10. Rétablissez l'alimentation électrique de l'appareil.
11. Réglez le thermostat à la température désirée.
12. Si l'appareil ne fonctionne pas, suivez les instructions intitulées "Arrêt du gaz" et appelez un réparateur qualifié ou votre fournisseur de gaz.



Commande de gaz en position "MARCHÉ"

ARRÊT DU GAZ

1. Réglez le thermostat à son point le plus bas.
2. Coupez l'alimentation électrique de l'appareil si vous devez effectuer un entretien.
3. Retirez le panneau d'accès de la commande.
4. Mettez la commande de gaz à la position ARRÊT ("OFF").
5. Remettez le panneau d'accès de la commande en place.

IMPORTANT INFORMATION

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 MARCHÉ

AVERTISSEMENT: Quiconque ne respecte pas à la lettre les instructions dans le présent manuel risque de déclencher un incendie ou une explosion entraînant des dommages matériels, des lésions 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'appareil pour détecter une odeur de gaz. Renifler près 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

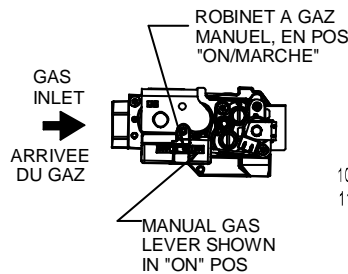
- Ne pas tenter d'allumer d'appareils.
- Ne toucher à aucun interrupteur; ne pas vous servir des téléphones dans le bâtiment.
- Appelez immédiatement votre fournisseur de gaz depuis un voisin. Suivez les instructions du fournisseur de gaz.
- Si vous ne pouvez rejoindre le fournisseur de gaz, appelez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

C. Ne pousser ou tourner la manette d'admission du gaz qu'à la main. Ne jamais employer 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 toute partie du système de contrôle et toute commande 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 MARCHÉ

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 ménager étant doté d'un système d'allumage automatique, ne pas essayer d'allumer le brûleur manuellement.
5. Pousse le levier du contrôle du gaz à "OFF/ARRET" position.
6. Attendre cinq (5) minutes pour laisser échapper tout le gaz. Renifler tout autour de l'appareil, y compris près du plancher, pour détecter une odeur de gaz. Si c'est le cas, ARRÊTEZ. Passer à l'étape B des instructions de sécurité sur la portion supérieure de cette étiquette. S'il n'y a pas d'odeur de gaz, passer à l'étape suivante.
7. Pousse le levier du contrôle du gaz à "ON/MARCHE" position.
8. Remettre en place le panneau d'accès.
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.

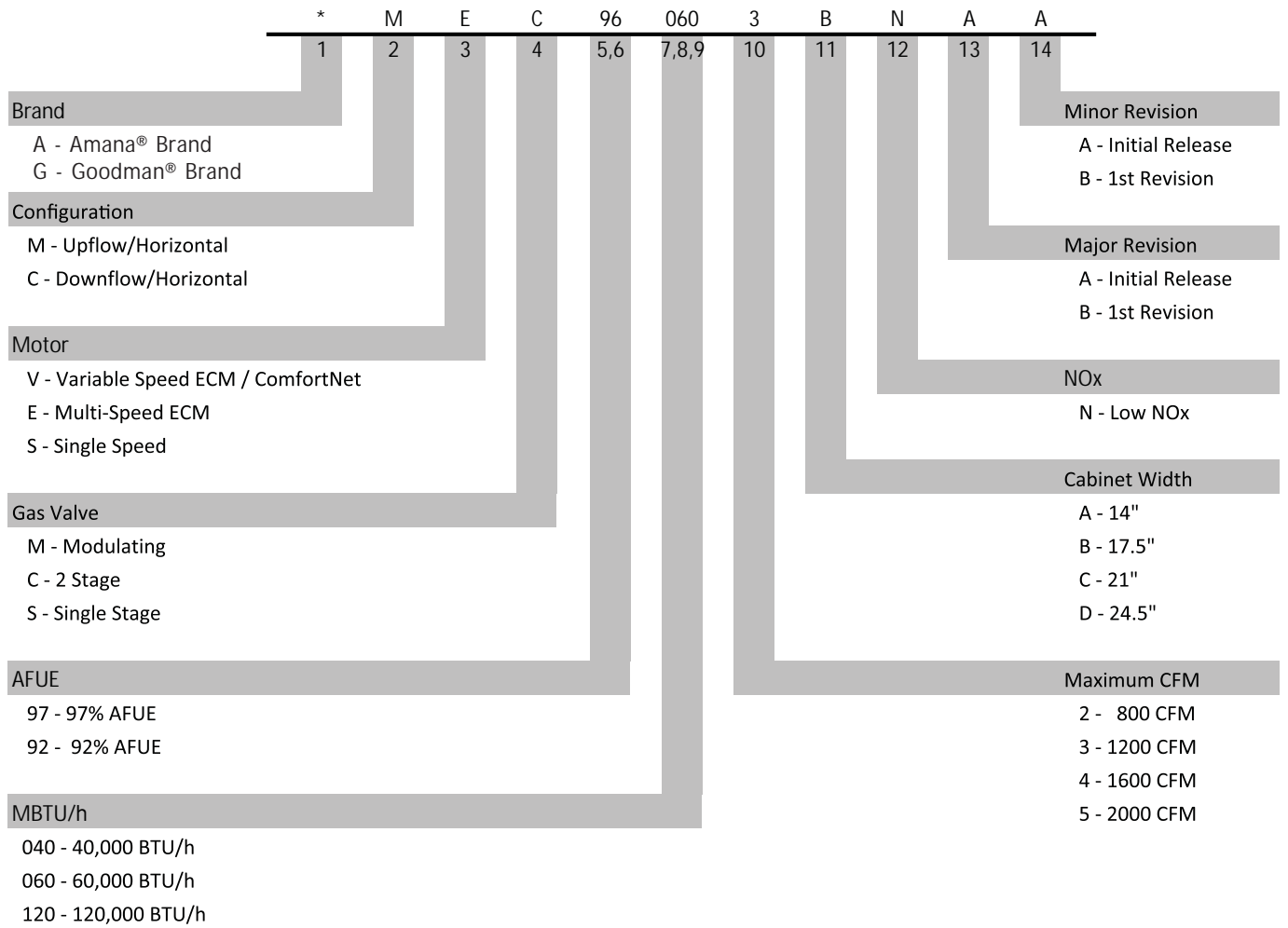
POUR COUPER L'ADMISSION DE GAZ DE L'APPAREIL

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

0140F00596 REV A

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.



MODEL #	MFG. #	DESCRIPTION
AMEC96	AMEC060302BNAA	Amana® Brand 96% Two Stage Heating / Two Stage Cooling Gas Furnace. Up flow/Horizontal Left and Right, 34.5" tall, Induced Draft, Nidec multi-speed ECM motor. Stainless Steel tubular heat exchanger. 115 volt silicon nitride igniter. Left or right gas vent
	AMEC960402BNAA	
	AMEC060603BNAA	
	AMEC960803BNAA	
	AMEC961004CNAA	
GMEC96	AMEC961205DNAA	Goodman® Brand 96% Two Stage Heating / Two Stage Cooling Gas Furnace. Up flow/Horizontal Left and Right, 34.5" tall, Induced Draft, Nidec multi-speed ECM motor. Aluminized Steel tubular heat exchanger. 115 volt silicon nitride igniter. Left or right gas vent
	GMEC060302BNAA	
	GMEC960402BNAA	
	GMEC060603BNAA	
	GMEC960803BNAA	
GMEC961004CNAA		
GMEC961205DNAA		

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. 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. 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.
DCVK-20 DCVK-30	P1254001F P1254002F	Concentric Vent Kit. For use with Amana® Brand high efficiency 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.
0170K00000S	N/A	Side Wall Only Concentric Vent Kit. For use with high efficiency 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 high efficiency 90% furnace models. This kit is to be used with 2" only vent systems. The vent kit must terminate outside the structure. This kit is NOT intended for use with single pipe (indirect vent) installations.
EFR02	P1221001 P1221002F	External Filter Rack Kit. 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.
LPLP03	N/A	LP Gas Low Pressure Kit. Designed for application on Goodman® and Amana® Brand's 80% and 90% single-stage and two-stage gas fired furnace products installed on LP gas listed in this manual. This kit includes harness adaptors to work with White-Rodgers single & two stage gas valves, Honeywell single and two-stage gas valves, as well as modulating gas valves.
RF000142	N/A	Vent Drain Coupling. For use when the furnaces is installed in horizontal left position and the internal elbow is removed.

INSTALLATION CONSIDERATIONS

Introduction


This is a Category IV furnace. This furnace uses a pressurized venting system and must be installed per National and local codes requirements and the installation manual that was shipped with the furnace.


The *MEC96 34.5" furnace is one of the products in our newly redesigned line of shorter chassis furnaces. It is available in the following sizes and suitable for up flow / horizontal installation.


- *MEC960302BNAA
- *MEC960402BNAA
- *MEC960603BNAA
- *MEC960803BNAA
- *MEC961004CNAA
- *MEC961205DNAA

Safety

Please adhere to the following warnings and cautions when installing, adjusting, altering, servicing, or operating the furnace.

 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, 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
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.

Charge (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 uninstalled (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 furnace 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 any static electricity from 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.

Product Application

This product is designed for use as a residential home gas furnace. It is **not** designed or certified for use in mobile home, trailer, or recreational vehicle applications.

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 installation instructions.

The *MEC96 furnaces are ETL certified appliances and are appropriate for use with natural or propane gas. (**NOTE:** If using propane gas, a propane conversion kit is required).


*MEC96 furnaces are dual certified.

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 this manual and the installation instructions.

To ensure proper installation, operation and servicing, thoroughly read the installation and service manuals for specifics pertaining to the installation, servicing and application of this product.

 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.

INSTALLATION CONSIDERATIONS

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.

To ensure proper furnace operation, install, operate, maintain and service the furnace in accordance with the installation, operation and service 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/CGA 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

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

CSA International
178 Rexdale Boulevard
Etobicoke, Ontario, Canada M9W, 1R3

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.

Location Requirements and Considerations

WARNING

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

Follow the instructions listed below when selecting a furnace location. Refer also to the guidelines provided in the *Combustion and Ventilation Air Requirements* section in this manual or the installation instructions for details.

- 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.

- If the furnace is installed in an application where the typical operating sound level of a furnace is deemed objectionable, an optional sound reduction kit is available. Consult your local distributor for more details.
- 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.

90% Furnaces: Refer to the *Vent/Flue Pipe and Combustion Air Pipe - Termination Locations* section in this manual or the installation instructions for appropriate termination locations. Also for 90% furnaces, refer to the *Vent/Flue Pipe and Combustion Air Pipe - Termination Locations* section in this manual or the installation instructions 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 90% furnace so that the condensate can be piped at a downward slope away from the furnace 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 the *Condensate Drain Lines and Trap* section in this manual or the installation instructions for further details.
- Set the 90% 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* section in this manual or the installation instructions 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.
- 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:

- chlorinated waxes or cleaners
- chlorine-based swimming pool chemicals
- water softening chemicals
- deicing salts or chemicals
- carbon tetrachloride
- halogen type refrigerants

INSTALLATION CONSIDERATIONS

- 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 vent* furnace if it is installed near an area frequently 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* section in this manual or the installation instructions for details.
- If the furnace is used in connection with a cooling unit, install the furnace upstream or in parallel with the cooling unit coil. Premature heat exchanger failure will result if the cooling unit coil is placed in the return air of the furnace.
- 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, the furnace access doors must be vertical so that the burners fire horizontally into the heat exchanger. Do not install the unit with the access doors on the “up/top” or “down/bottom” side of the furnace.

Clearances and Accessibility

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. Refer to Specification Sheet for minimum clearances to combustible materials. 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 on a 90% furnace, additional clearances must be provided to accommodate these connections. Refer to *Vent Flue Pipe and Combustion Air Pipe* section in this manual or the installation instructions 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.

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. 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. In a typical construction, the clearance between the door and door frame is usually adequate to satisfy this ventilation requirement.

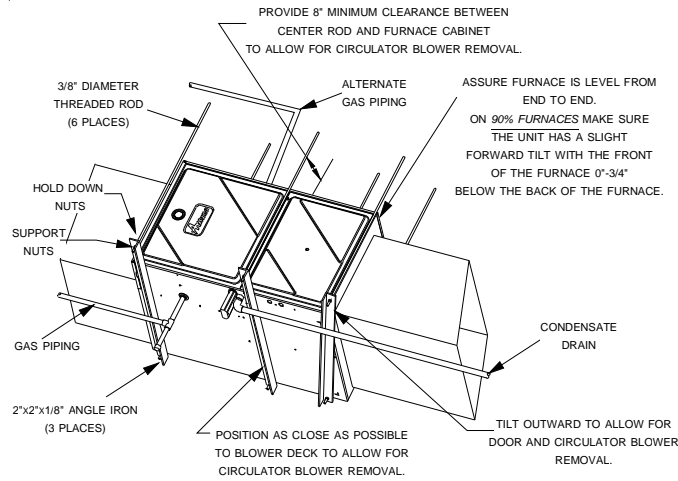
MINIMUM CLEARANCES TO COMBUSTIBLE MATERIALS						
POSITION	SIDES	REAR	FRONT	BOTTOM	FLUE	TOP
Upflow	0"	0"	1"	C	0"	1"
Horizontal	6"	0"	1"	C	0"	4"

- C = if placed on combustible floor, the floor MUST be wood ONLY.
- For servicing or cleaning, a 24" front clearance is recommended.
- Unit connections (electrical, flue, and drain) may necessitate greater clearances than the minimum clearances listed above
- In all case, accessibility clearance must take precedence over from the enclosure where accessibility clearances are greater.
- Approved for line contact in the horizontal position.

INSTALLATION CONSIDERATIONS

Furnace Suspension

If suspending the furnace from rafters or joist, use 3/8" threaded rod and 2"x2"x1/8" angle iron as shown in the following figure. If the furnace is installed in a crawl space it must also 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. The length of rod will depend on the application and the clearances necessary.



90% Suspended Furnace Shown

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 Z21.47, latest edition, CSA-2.3b, 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:

- Seal any unused openings in the venting system;
- Inspect the venting system for proper size and horizontal pitch, as required by the National Fuel Gas Code, ANSI Z223.1 or the CSA B149 Installation Codes and these instructions. Determine that there is no blockage or restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition;
- In so 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. 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. Close fireplace dampers;
- Follow the lighting instructions. Place the appliance being inspected in operation. Adjust thermostat so appliance shall operate continuously;
- Test for draft hood equipped spillage at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle;

- 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 improper venting is observed during any of the above tests, the common venting system must be corrected.

Corrections must be in accordance with the latest edition of the National Fuel Gas Code NFPA 54/ANSI Z223.1 and/or CSA B149 Installation Codes.

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 Installation Codes.

Thermostat Requirements


A two stage heat/cool thermostat is recommended. A single stage heating thermostat may be used. It is recommended that a high quality thermostat with a "C" terminal is used to operate the furnace.

Thermostat Location

In an area having good air circulation, locate the thermostat about five feet high on a vibration-free inside wall. 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 and dehumidistat, such as an outside wall.

COMBUSTION AND VENTILATION AIR REQUIREMENTS

 **WARNING**

POSSIBLE PROPERTY DAMAGE, PERSONAL INJURY OR DEATH MAY OCCUR IF THE FURNACE IS NOT PROVIDED WITH ENOUGH FRESH AIR FOR PROPER COMBUSTION AND VENTILATION OF FLUE GASES. MOST HOMES REQUIRE OUTSIDE AIR BE SUPPLIED TO 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.

When the furnace is installed as a direct ven (2-pipe) furnace, no special provisions for air for combustion are required. However, if this furnace is to be installed in the same

INSTALLATION CONSIDERATIONS

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 (Section 9.3), or CAN/CGA B149 Installation Codes (Sections 7.2, 7.3, or 7.4), 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.

The following information on air for combustion and ventilation is reproduced from the **National Fuel Gas Code NFPA 54/ANSI Z223.1 Section 9.3**.

9.3* Air for Combustion and Ventilation.

9.3.1 General.

9.3.1.1 Air for combustion, ventilation, and dilution of flue gases for appliances installed in buildings shall be obtained by application of one of the methods covered in 9.3.2 through 9.3.6. Where the requirements of 9.3.2 are not met, outdoor air shall be introduced in accordance with methods covered in 9.3.3 through 9.3.6.

Exception No. 1: This provision shall not apply to direct vent appliances.

9.3.1.2 Appliances of other than natural draft design and other than Category 1 vented appliances shall be provided with combustion, ventilation, and dilution air in accordance with the appliance manufacturer's instructions.

9.3.1.3 Appliances shall be located so as not to interfere with proper circulation of combustion, ventilation, and dilution air.

9.3.1.4 Where used, a draft hood or a barometric draft regulator shall be installed in the same room or enclosure as the appliance served so as to prevent any difference in pressure between the hood or regulator and the combustion air supply.

9.3.1.5 Makeup air requirements for the operation of exhaust fans, kitchen ventilation systems, clothes dryers, and fireplaces shall be considered in determining the adequacy of a space to provide combustion air requirements.

9.3.2 Indoor Combustion Air. The required volume of indoor air shall be determined in accordance with the method in 9.3.2.1 or 9.3.2.2 except that where the air infiltration rate is known to be less than 0.40 ACH, the method in 9.3.2.2 shall be used. The total required volume shall be the sum of the required volume calculated for all appliances located within the space. Rooms communicating directly with the space in which the appliances are installed through openings not furnished with doors, and through combustion air openings sized and located in accordance with 9.3.2.3, are considered a part of the required volume.

9.3.2.1* Standard Method. The minimum required volume shall be 50 ft³ per 1,000/Btu/hour (4.8m³/kW).

9.3.2.2* Known Air Infiltration Rate Method. Where the air infiltration rate of a structure is known, the minimum required volume shall be determined as follows:

(1) For appliances other than fan-assisted, calculate using the following equation:

$$\text{Required Volume}_{\text{other}} \geq \frac{21 \text{ ft}^3}{\text{ACH}} \left(\frac{I_{\text{other}}}{1000 \text{ Btu/hr}} \right)$$

(2) For fan-assisted appliances, calculate using the following equation:

$$\text{Required Volume}_{\text{fan}} \geq \frac{15 \text{ ft}^3}{\text{ACH}} \left(\frac{I_{\text{fan}}}{1000 \text{ Btu/hr}} \right)$$

where:

I_{other} = all appliances other than fan-assisted input in Btu per hour

I_{fan} = fan-assisted appliances input in Btu per hour

ACH = air change per hour (percent of volume of space exchanged per hour, expressed as a decimal)

(3) For purposes of this calculation, an infiltration rate greater than 0.60 ACH shall not be used in the equations in 9.3.2.2(1) and 9.3.2.2(2).

9.3.2.3 Indoor Opening Size and Location. Openings used to connect indoor spaces shall be sized and located in accordance with the following:

(1)* *Combining spaces on the same story.* Each opening shall have a minimum free area of 1 in.²/1000Btu/hr (2200 mm²/kW) of the total input rating of all appliances in the space but not less than 100 in.² (0.60m²). One opening shall commence within 12 in. (300 mm) of the top, and one opening shall commence within 12 in. (300 mm) of the bottom, of the enclosure [see Figure A.9.3.2.3(1)]. The minimum dimension of air openings shall be not less than 3 in. (80 mm).

NOTE: Each opening must have a free area of not less than one square inch per 1000 BTU of the total input rating of all equipment in the enclosure, but not less than 100 square inches.

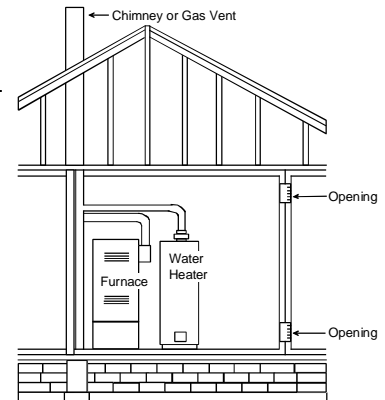


Figure A.9.2.3.3.(1) All Combustion Air from Adjacent Indoor Spaces through Indoor Combustion Air Openings.

(2) *Combining spaces in different stories.* The volumes of spaces in different stories shall be considered as communicating spaces where such spaces are connected by one or more openings in doors or floors having a total minimum free area of 2 in.²/1000 Btu/hr (4400 mm²/kW) of total input rating of all appliances.

9.3.3 Outdoor Combustion Air. Outdoor combustion air shall be provided through opening(s) to the outdoors in accordance with the methods in 9.3.3.1 or 9.3.3.2. The minimum dimension of air openings shall not be less than 3 in. (80 mm).

INSTALLATION CONSIDERATIONS

9.3.3.1 Two Permanent Openings Method. Two permanent openings, one commencing within 12 in. (300 mm) of the top and one commencing within 12 in. (300 mm) of the bottom, of the enclosure shall be provided. The openings shall communicate directly, or by ducts, with the outdoors or spaces that freely communicate with the outdoors, as follows:

(1)* Where directly communicating with the outdoors or where communicating to the outdoors through vertical ducts, each opening shall have a minimum free area of 1 in.²/4000 Btu/hr (550 min²/kW) of total input rating of all appliances in the enclosure. [See Figure A.9.3.3.1(1)(a) and Figure A.9.3.3.1(1)(b).]

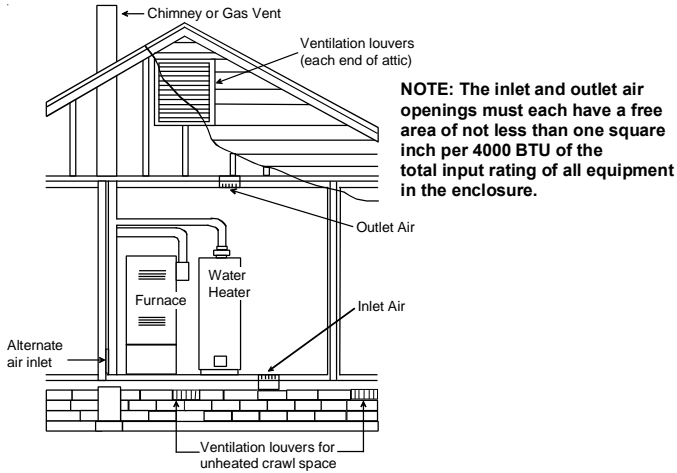


Figure A.9.3.3.1(1)(a) All Combustion Air From Outdoors - Inlet Air from Ventilated Crawl Space and Outlet Air to Ventilated Attic.

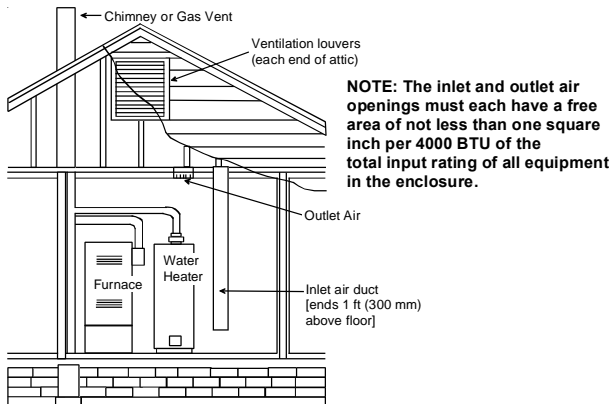


Figure A.9.3.3.1(1)(b) All Combustion Air From Outdoors through Ventilated Attic.

(2)* Where communicating with the outdoors through horizontal ducts, each opening shall have a minimum free area of 1 in.²/2000 Btu/hr (1100 min²/kW) of total input rating of all appliances in the enclosure. [See Figure A.9.3.3.1(2).]

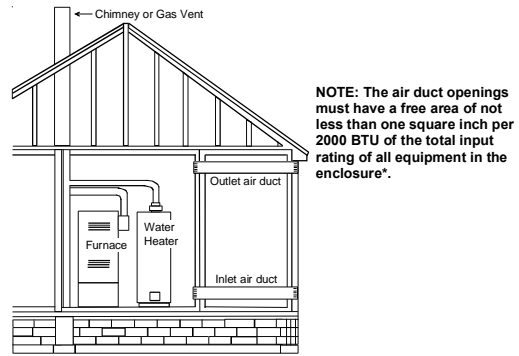


Figure A.9.3.3.1(2) All Combustion Air From Outdoors through Horizontal Ducts.

9.3.3.2* One Permanent Opening Method. One permanent openings, commencing within 12 in. (300 mm) of the top of the enclosure, shall be provided. The appliance shall have clearances of at least 1 in. (25 mm) from the sides and back and 6 in. (150 mm) from the front of the appliance. The opening shall directly communicate with the outdoors or shall communicate through a vertical or horizontal duct to the outdoors or spaces that freely communicate with the outdoors (see Figure A.9.3.3.2) and shall have a minimum free area of the following:

- (1) 1 in.²/3000 Btu/hr (700 mm² per kW) of the total input rating of all appliances located in the enclosure, and
- (2) Not less than the sum of the areas of all vent connectors in the space.

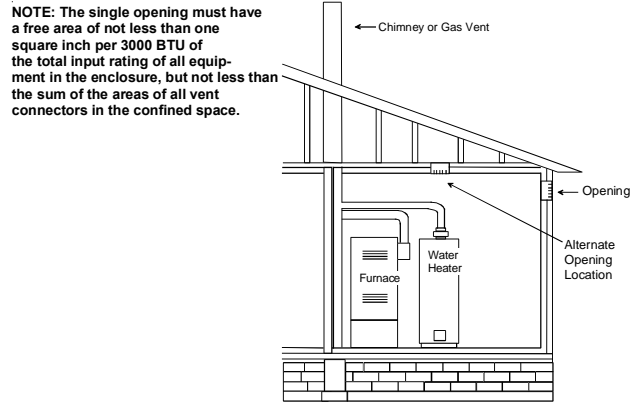


Figure A.9.3.3.2 All Combustion Air From Outdoors through Single Combustion Air Opening.

9.3.4 Combination Indoor and Outdoor Combustion Air. The use of a combination of indoor and outdoor combustion air shall be in accordance with (1) through (3) (see example calculation in Annex JJ):

- (1) *Indoor Openings:* Where used, openings connecting the interior spaces shall comply with 9.3.2.3.
- (2) *Outdoor Opening(s) Location.* Outdoor opening(s) shall be located in accordance with 9.3.3.
- (3) *Outdoor Opening(s) Size.* The outdoor opening(s) size shall be calculated in accordance with the following:
 - (a) The ratio of the interior spaces shall be the available volume of all communicating spaces divided by the required volume.
 - (b) The outdoor size reduction factor shall be 1 minus the ratio of interior spaces.

INSTALLATION CONSIDERATIONS

- (c) The minimum size of outdoor opening(s) shall be the full size of outdoor opening(s) calculated in accordance with 9.3.3, multiplied by the reduction factor. The minimum dimension of air openings shall not be less than 3 in. (80 mm).

9.3.5 Engineered Installations. Engineered combustion air installations shall provide an adequate supply of combustion, ventilation, and dilution air and shall be approved by the authority having jurisdiction.

9.3.6 Mechanical Combustion Air Supply. Where all combustion air is provided by a mechanical air supply system, the combustion air shall be supplied from outdoors at the minimum rate of 0.35 ft³/min per 1000 Btu/hr (0.034 m³/min per kW) for all appliances located within the space.

9.3.6.1 Where exhaust fans are installed, additional air shall be provided to replace the exhausted air.

9.3.6.2 Each of the appliances served shall be interlocked to the mechanical air supply system to prevent main burner operation where the mechanical air supply system is not in operation.

9.3.6.3 Where combustion air is provided by the building's mechanical ventilation system, the system shall provide the specified combustion air rate in addition to the required ventilation air.

9.3.7 Louvers, Grilles, and Screens.

9.3.7.1 Louvers and Grilles. The required size of openings for combustion, ventilation, and dilution air shall be based on the net free area of each opening. Where the free area through a design of louver or grille or screen is known, it shall be used in calculating the size opening required to provide the free area specified. Where the louver and grille design and free area are not known, it shall be assumed that wood louvers will have 25 percent free area, and metal louvers and grilles will have 75 percent free area. Nonmotorized louvers and grilles shall be fixed in the open position.

9.3.7.2 Minimum Scree Mesh Size. Screens shall not be smaller than 1/4 in. mesh.

9.3.7.3 Motorized Louvers. Motorized louvers shall be interlocked with the appliance so they are proven in the full open position prior to main burner ignition and during main burner operation. Means shall be provided to prevent the main burner from igniting should the louver fail to open during burner startup and to shut down the main burner if the louvers close during burner operation.

9.3.8 Combustion Air Ducts. Combustion air ducts shall comply with 9.3.8.1 through 9.3.8.8.

9.3.8.1 Ducts shall be constructed of galvanized steel or a material having equivalent corrosion resistance, strength, and rigidity.

Exception: Within dwellings units, unobstructed stud and joist spaces shall not be prohibited from conveying combustion air, provided that not more than one fireblock is removed.

9.3.8.2 Ducts shall terminate in an unobstructed space, allowing free movement of combustion air to the appliances.

9.3.8.3 Ducts shall serve a single space.

9.3.8.4 Ducts shall not serve both upper and lower combustion air openings where both such openings are used. The separation between ducts servicing upper and lower combustion air openings shall be maintained to the source of combustion air.

9.3.8.5 Ducts shall not be screened where terminating in an attic space.

9.3.8.6 Horizontal upper combustion air ducts shall not slope downward toward the source of combustion air.

9.3.8.7 The remaining space surrounding a chimney liner, gas vent, special gas vent, or plastic piping installed within a masonry, metal, or factory built chimney shall not be used to supply combustion air.

Exception: Direct vent appliances designed for installation in a solid fuel-burning fireplace where installed in accordance with the manufacture's installation instructions.

9.3.8.8 Combustion air intake openings located on the exterior of the building shall have the lowest side of the combustion air intake openings located at least 12 in. (300 mm) vertically from the adjoining grade level.

Horizontal Applications and Considerations

Horizontal applications, in particular, may dictate many of the installation's specifics such as airflow direction, ductwork connections, flue and/or combustion air pipe connections, etc. The basic application of this furnace as a horizontal furnace differs only slightly from an upright installation.

Horizontal Installations

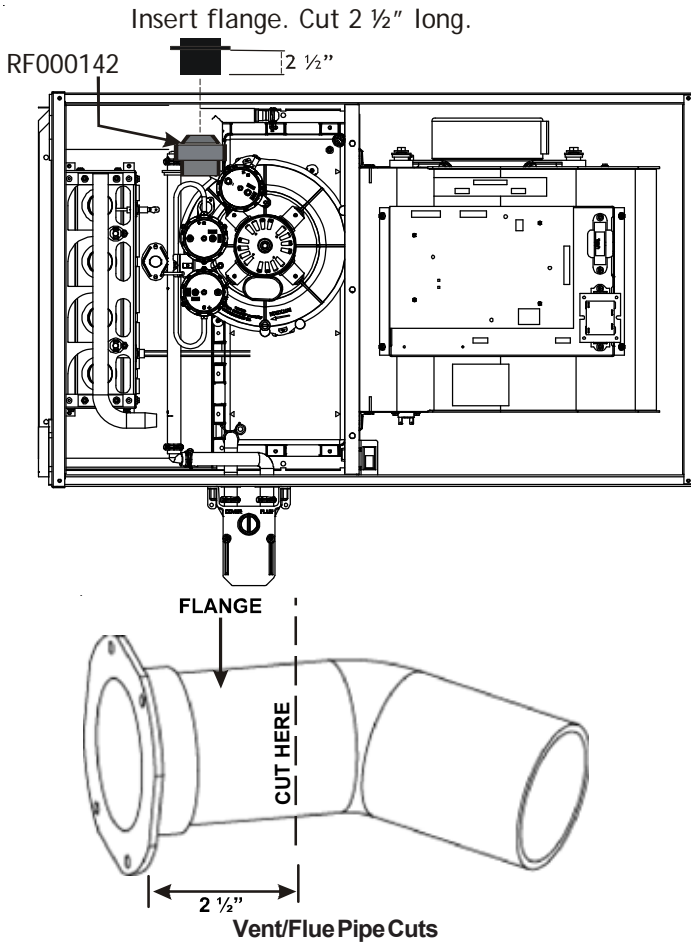
1. Horizontal installations require 5.5" under the furnace to accommodate the drain trap.
2. Horizontal furnaces must be installed with 3/4" slope from back to front to permit condensate flow towards the front of the furnace.

When installing a *MEC96 horizontally with the left side down, there are two options for connecting the vent pipe to the furnace.

1. Venting may be connected to the furnace vent pipe fitting on the original top (now the end) of the furnace
2. The internal vent pipe and elbow may be removed from the furnace to permit the vent to exit the top (original side) of the furnace. If this option is used, an RF000142 Vent-Drain coupling must be used to keep condensate from collecting in the inducer assembly

Refer to the following instructions and illustration.

INSTALLATION CONSIDERATIONS



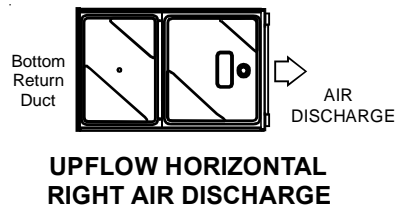
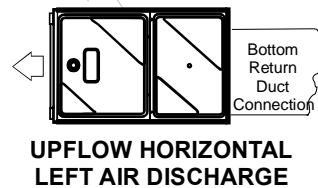
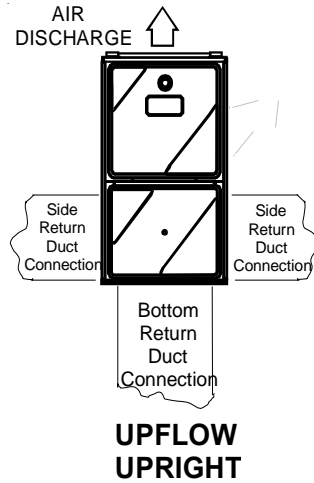
1. Remove screws from the vent flange.
2. Remove the internal elbow and vent pipe
3. Cut 2 1/2" from the flange .
4. Remove cabinet plug adjacent to inducer outlet and install an original cabinet vent hole.
5. Install RF000142 coupling on inducer outlet.
6. Install flanged vent section removed in step 2 and secure with clamps.
7. Secure flange to cabinet using screws removed in step 1.

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 5.5" 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* section in this manual or the installation instructions 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. **NOTE:** The use of insulation and/or heat tape is recommended. Failure to provide proper condensate drainage can result in property damage.

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") 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.



90% Furnace Recommended Installation Positions

Alternate Electrical and Gas Line Connections

The furnaces have 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).

INSTALLATION CONSIDERATIONS

Freeze Protection

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. **NOTE:** The use of insulation and/or heat tape is recommended. Failure to provide proper condensate drainage can result in property damage.

Propane Gas and/or 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 INSURE 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 at standard altitude. Propane gas installations require an orifice change to compensate for the energy content difference between natural and propane gas.

High altitude installations may require both a pressure switch and an orifice change. These changes are necessary to compensate for the natural reduction in the density of both the gas fuel and the combustion air at higher altitude.

Refer to the *Accessories Charts* in this manual or product Specification Sheet for a tabular listing of appropriate manufacturer's kits for propane gas and/or high altitude installations. 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.

VENT/FLUE PIPE AND 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 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.

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.

Materials and Joining Methods

 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.

Precautions should be taken to prevent condensate from freezing inside the vent/flue pipe and/or at the vent/flue pipe termination. It is our recommendation that all vent/flue piping exposed to temperatures below 35°F for extended periods of time should 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) should be insulated with 1/2" thick closed cell foam. Inspect piping for leaks prior to installing insulation.

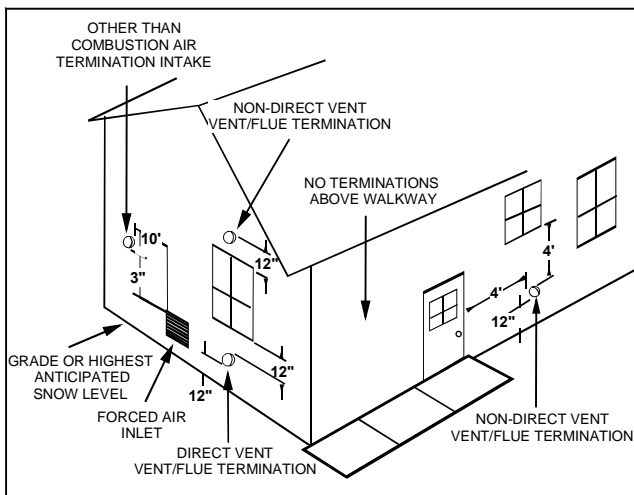
The following bullets and diagram describe the restrictions concerning the appropriate location of vent/flue pipe and combustion air intake pipe (when applicable) terminations. Refer to or the installation instructions for specific details on termination construction.

- All terminations must be located at least 12 inches above ground level or the anticipated snow level.
- Vent terminations 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).

INSTALLATION CONSIDERATIONS

- 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.

NOTE: In Canada, the B149 Fuel Gas Code takes precedence over the preceding termination restrictions.



90% Furnace Vent Termination Clearances

CAUTION

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

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.

CAUTION

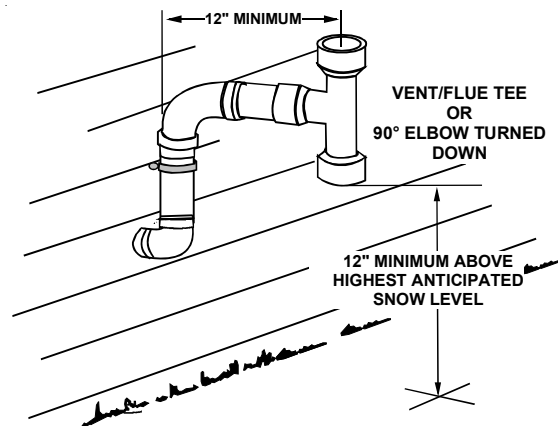
BE SURE NOT TO DAMAGE INTERNAL WIRING OR OTHER COMPONENTS WHEN REINSTALLING COUPLING AND SCREWS.

Vent/Flue Pipe Lengths (Non-Direct Vent) and Diameters

Refer to the following tables 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 must be secured to the combustion air intake to prevent inadvertent blockage. The tee or elbows used in the vent/flue termination must be included when determining the number of elbows in the piping system.

*MEC96 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)}							
		1	2	3	4	5	6	7	8
40,000	2 or 2 1/2	120	115	110	105	100	95	90	85
60,000	2 or 2 1/2	95	90	85	80	75	70	65	60
80,000 "B"	2 or 2 1/2	75	70	65	60	55	50	45	40
80,000 "B"	3	200	193	186	179	172	165	158	151
80,000 "C"	2 or 2 1/2	25	20	15	10	5	N/A	N/A	N/A
80,000 "C"	3	200	193	186	179	172	165	158	151
100,000	2 or 2 1/2	25	20	15	10	5	N/A	N/A	N/A
100,000	3	200	193	186	179	172	165	158	151
120,000	2 or 2 1/2	45	40	35	30	25	20	15	10
120,000	3	95	90	85	80	75	70	65	60

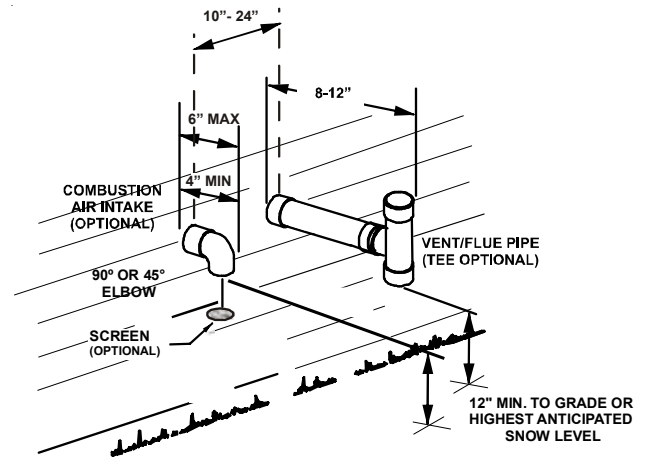
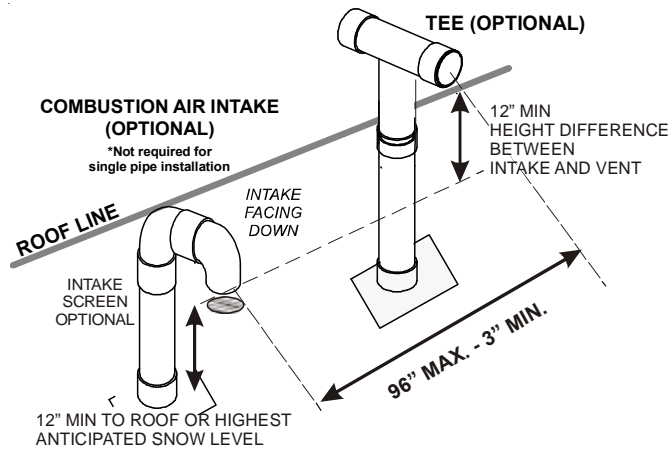
- 1) Maximum allowable limits listed on individual lengths for inlet and flue and NOT a combination.
- 2) Minimum requirement for each vent pipe is five (5) feet in length and one elbow/tee.
- 3) Tee used in the vent/flue termination must be included when determining the number of elbows in the piping 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. Long Sweep elbows should be considered equivalent to one 90 deg. elbow.
- 6) One 90° elbow should be secured to the combustion air intake connection.



90% Furnace Horizontal Termination (Single Pipe) Above Highest Anticipated Snow Level

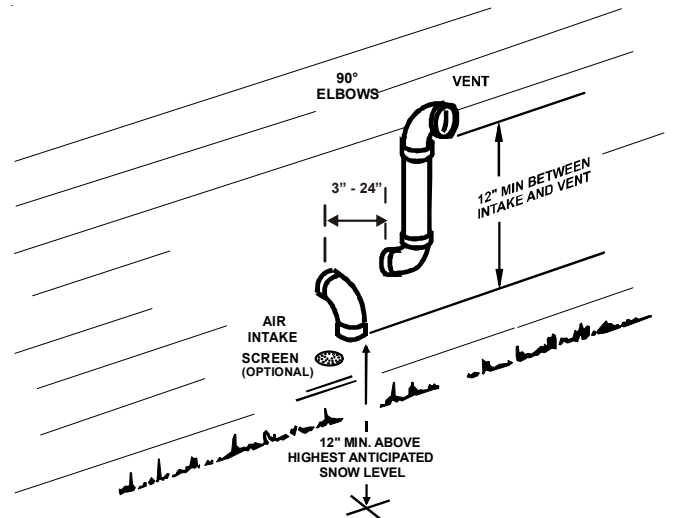
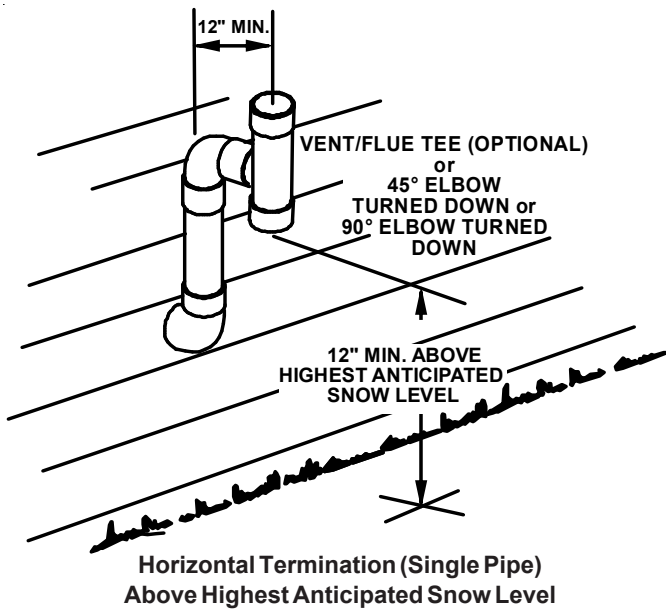
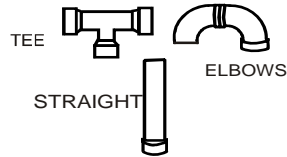
INSTALLATION CONSIDERATIONS

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

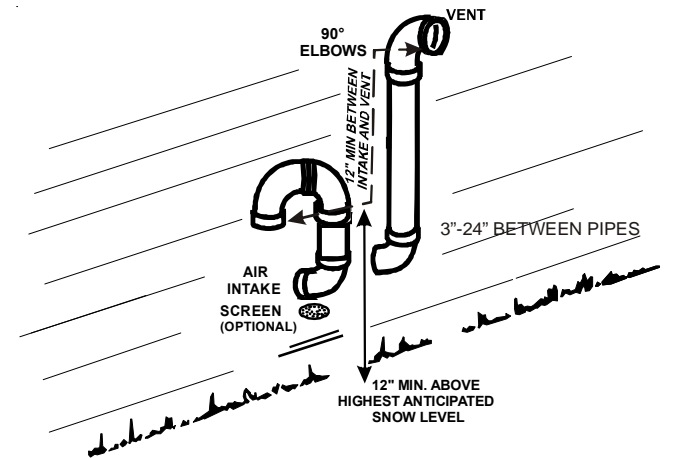


Standard Horizontal Terminations (Dual Pipe)

VENT PIPE TERMINATION OPTIONS



Alternate Horizontal Vent Termination (Dual Pipe)



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

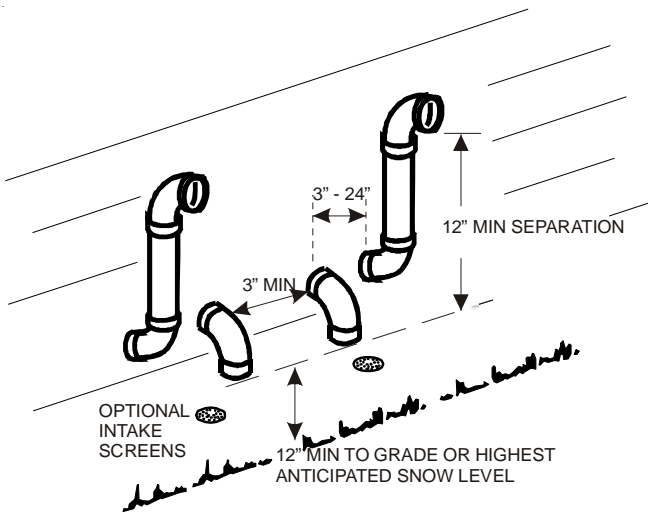
Alternate Vent Termination Above Anticipated Snow Level (Dual Pipe)

INSTALLATION CONSIDERATIONS

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

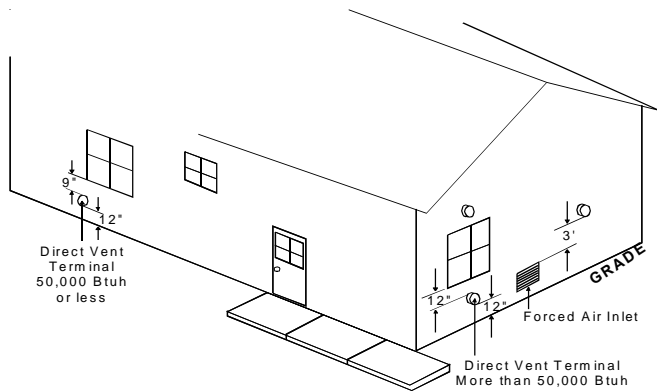
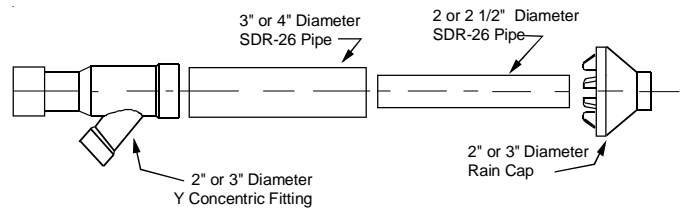


FIGURE 1

(DCVK) Vent Termination Clearances

- Do NOT terminate over public walkways. Avoid areas where condensate may cause problems such as above planters, patios, or adjacent to windows where steam may cause fogging.
- The vent termination shall be located at least 4' horizontally from any electric meter, gas meter, regulator and any relief equipment. These distances apply ONLY to U.S. Installations.
- The vent termination shall be located at least 3' above any forced air inlet located within 10'; and at least 10' from a combustion air intake of another appliance, except another direct vent furnace intake.
- In Canada, the Canadian Fuel Gas Code takes precedence over the preceding termination instructions.

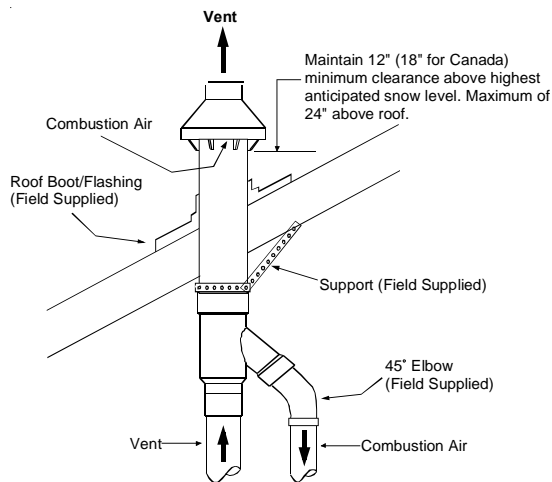


These kits are for vertical or horizontal termination of the combustion air inlet and the exhaust vent pipes on Category IV gas-fired condensing furnaces. The DCVK-30 (CVENT-3) kit can be used for 3" diameter pipe systems. The DCVK-20 (CVENT-2) kit can be used for the 2" diameter pipe system. Both the combustion air inlet and the exhaust vent pipes must attach to the termination kit. The termination kit must terminate outside the structure and must be installed per the instructions outlined below for vertical or horizontal termination. Vertical termination is preferred. Field supplied pipe and fittings are required to complete the installation.

- Determine the best location for the termination kit. Roof termination is preferred since it is less susceptible to damage, has reduced intake contaminants and less visible vent vapors. For side termination, consideration should be given to:
 - Possible damage from the vapors to plants/shurbs, other equipment and building materials
 - Possible damage to the terminal from foreign objects
 - Wind effects that may cause recirculation of flue products, debris or light snow
 - Visible vent vapors.

- The vent termination must be located at least 12" above ground or normally expected snow accumulation levels.

INSTALLATION CONSIDERATIONS



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 below. 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.

Condensate Drain Lines and 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.

WARNING

IN UPRIGHT UPFLOW INSTALLATIONS, THE DRAIN TRAP MUST BE MOUNTED ON THE OPPOSITE SIDE OF THE UNIT FROM THE JUNCTION BOX. THIS WILL REDUCE THE RISK OF WATER REACHING THE JUNCTION BOX IN THE EVENT OF A BLOCKED DRAIN CONDITION. FAILURE TO FOLLOW THESE INSTRUCTIONS CAN RESULT IN POSSIBLE PROPERTY DAMAGE, PERSONAL INJURY, OR DEATH DUE TO ELECTRICAL SHOCK.

- 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.

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.

HIGH ALTITUDE DERATE

When this furnace is installed at high altitude, the appropriate High Altitude orifice kit must be applied. This is required due to the natural reduction in the density of both the gas fuel and combustion air as altitude increases. The kit will provide the proper design certified input rate within the specified altitude range.

High altitude kits are purchased according to the installation altitude and usage of either natural or propane gas. Refer to the product Specification Sheet or Technical Manual for a tabular listing of appropriate altitude ranges and corresponding manufacturer's high altitude (Natural, Propane gas, and/or Pressure Switch) kits.

Do **not** derate the furnace by adjusting the manifold pressure to a lower pressure than specified on the furnace rating plate. The combination of the lower air density and a lower manifold pressure will prohibit the burner orifice from drawing the proper amount of air into the burner. This may cause incomplete combustion, flashback, and possible yellow tipping.

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/ft³ 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.

A different pressure switch may be required at high altitude regardless of the BTU/ft³ content of the fuel used. Refer to the product Specification Sheet or Technical Manual for a tabular listing of appropriate altitude ranges and corresponding manufacturer's pressure switch kits.

INSTALLATION CONSIDERATIONS

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 INSURE 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.

Refer to the specification sheet for the model you are servicing. Refer to the "propane gas and/or High Altitude Installations" section for details.

GAS VALVE

This unit is equipped with a 24 volt gas valve controlled during furnace operation by the integrated control module. As shipped, the valve is configured for natural gas. The valve is field convertible for use with propane gas by using the appropriate propane gas conversion kit. Taps for measuring the gas supply pressure and manifold pressure are provided on the valve.

NOTE: The gas supply pressure on White-Rodgers "G/J" model gas valve, can be checked with a gas pressure test kit (Part #0151K00000S) available through our authorized distributors.

The gas valve has a manual ON/OFF control located on the valve itself. This control may be set only to the "ON" or "OFF" position. Refer to the *Lighting Instructions Label* or the *"Putting the Furnace Into Operation"* section of this manual or the installation instructions for use of this control during start up and shut down periods.

GAS PIPING CONNECTIONS



CAUTION

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

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)

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

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 the following figures for typical gas line connections to the furnace.

1. Use black iron or steel pipe and fittings for the building piping.
2. Use pipe joint compound on male threads only. Pipe joint compound must be resistant to the action of the fuel used.
3. Use ground joint unions.
4. 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.
5. Install a 1/8" NPT pipe plug fitting, accessible for test gage connection, immediately upstream of the gas supply connection to the furnace.
6. Use two pipe wrenches when making 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.
7. 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.
8. Tighten all joints securely.

INSTALLATION CONSIDERATIONS

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

PROPANE GAS IS HEAVIER THAN AIR AND ANY LEAKING GAS CAN SETTLE IN ANY LOW AREAS OR CONFINED SPACES. TO PREVENT PROPERTY DAMAGE, PERSONAL INJURY, OR DEATH DUE TO FIRE OR EXPLOSION CAUSED BY A PROPANE GAS LEAK, INSTALL A GAS DETECTION WARNING DEVICE.

A gas detecting warning system is the only reliable way to detect a propane gas leak. Iron oxide (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, please refer to the warning on this page.

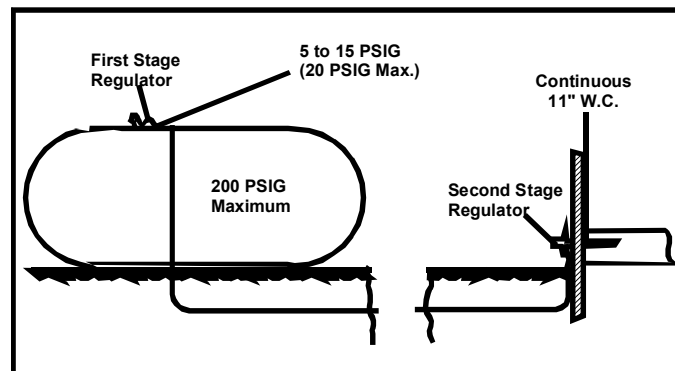
All propane gas equipment must conform to the safety standards of the National Board of Fire Underwriters, NBFU Manual 58.

For satisfactory operation, propane gas pressure must be 10 inch 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.
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.

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



Typical Propane Gas Installation

WARNING

IF THE GAS FURNACE IS INSTALLED IN A BASEMENT, AN EXCAVATED AREA OR A 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.

WARNING

AN UNDETECTED GAS LEAK WILL CREATE A DANGER OF EXPLOSION OR FIRE. IF THE PRESENCE OF GAS IS SUSPECTED, FOLLOW THE INSTRUCTIONS ON THE COVER OF THIS MANUAL. FAILURE TO DO SO COULD RESULT IN **SERIOUS PERSONAL INJURY OR DEATH.**

INSTALLATION CONSIDERATIONS

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.

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

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 Charts

When installing a propane storage tank, the contractor must consider proper tank sizing, safety, efficiency, ground characteristics and aesthetics. For a residential customer, the size may range from 100-1,000 gallons, depending on household use. Typically, a 500 gallon tank is ample for an average four-bedroom home. However, it is best to consult your local propane supplier to ensure the proper sizing for propane storage requirements. Determining the correct tank size for each household is a function of demand, economy, efficiency and convenience. It is a process that requires co-operation between the propane supplier and customer.

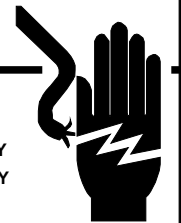
ELECTRICAL CONNECTIONS

WARNING

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

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.



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 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 N.E.C. 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.

INSTALLATION CONSIDERATIONS

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.

NOTE: Line polarity must be observed when making field connections.

⚠ WARNING

IN 90% FURNACE UPRIGHT UPFLOW INSTALLATIONS, THE DRAIN TRAP MUST BE MOUNTED ON THE OPPOSITE SIDE OF THE UNIT FROM THE JUNCTION BOX. THIS WILL REDUCE THE RISK OF WATER REACHING THE JUNCTION BOX IN THE EVENT OF A BLOCKED DRAIN CONDITION.

Connect hot, neutral, and ground wires as shown in the wiring diagram located on the unit's blower door. Line polarity must be observed when making field connections. Line voltage connections can be made through either the right or left side panel.

⚠ CAUTION

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

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

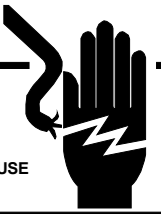
⚠ WARNING

TO AVOID THE RISK OF ELECTRICAL SHOCK, INJURY, 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.

115 VOLT LINE CONNECTION OF ACCESSORIES (ELECTRONIC AIR CLEANER)

⚠ 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.



ACCESSORY LOAD SPECIFICATIONS	
Electronic Air Cleaner	1.0 Amp maximum at 120 VAC
Humidifier	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.

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 control module electronic air cleaner terminals (EAC) are energized with 115 volts whenever the circulator blower is energized.

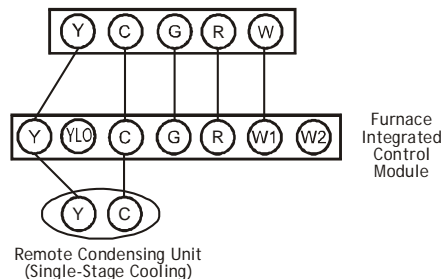
24 VOLT THERMOSTAT WIRING

NOTE: Low voltage connections can be made through either the right or left side panel. Wire routing must not interfere with circulator blower operation, filter removal, or routine maintenance.

A 40 V.A. transformer and an integrated electronic control are built into the furnace to allow use with most cooling equipment. Consult the wiring diagram, located in the Technical Manual or on the blower door for further details of 115 Volt and 24 Volt wiring.

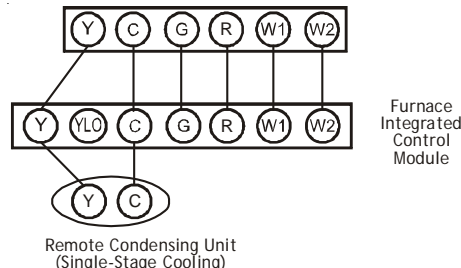
THERMOSTAT WIRING

The *MEC96 furnace has W1 & W2 terminals for connection of a two stage heating thermostat. If desired, a thermostat with only one stage of heat may be used. As shipped, the furnace S1-1 switch is OFF; S1-2 switch is ON. This is the correct position to use a single stage heating thermostat with auto timing transition to high fire.



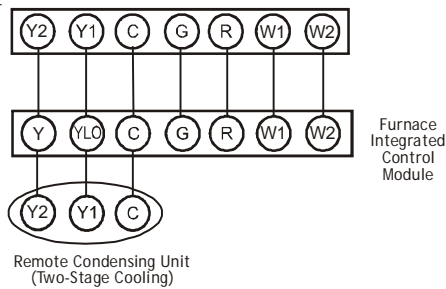
Thermostat - Single -Stage Heating with Single-Stage Cooling

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

INSTALLATION CONSIDERATIONS



Thermostat - Two-Stage Heating with Two-Stage Cooling
Thermostat Wiring Diagrams

SINGLE-STAGE HEATING THERMOSTAT APPLICATION

A single-stage thermostat with only one heating stage may be used to control this furnace. The application of a single-stage thermostat offers a *timed* transition from low to high fire. The furnace will run on low stage for a fixed period of time before stepping up to high stage to satisfy the thermostat's call for heat. The delay period prior to stepping up can be set at either a fixed 10 or 20 minute time delay or a load based variable time between 1 and 12 minutes (AUTO mode). If the AUTO mode is selected, the control averages the cycle times of the previous three cycles and uses the average to determine the time to transition from low stage to high stage.

Staging DIP Switches

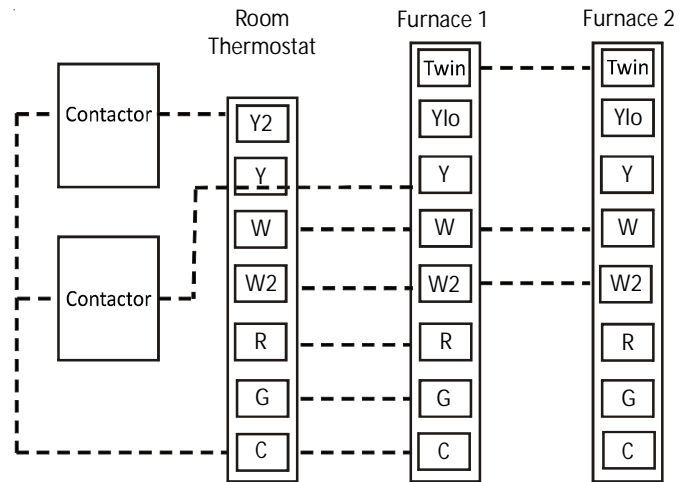
DIP Switch	S1-1	S1-2	Heat Staging
	OFF	OFF	2 Stage Stat*
	ON	OFF	10 min delay
(factory setting)	OFF	ON	AUTO
	ON	ON	20 min delay

* no high fire without W2 call

TWINNING

Using the "TWIN" terminals and proper wiring enables two *MEC96 furnaces of the same model and size to be twinned. Twinning allows simultaneous operation of two furnaces and forces the indoor blower motors of each furnace to operate synchronously into a common duct system. Using the twinning function will require only field installed wiring with no external kits or parts.

The staging DIP switches and speed tap DIP switches must be set the same on both furnaces.



CIRCULATOR BLOWER SPEED ADJUSTMENT

WARNING

HIGH VOLTAGE
DISCONNECT ALL POWER BEFORE CHANGING SPEED TAPS.
MULTIPLE POWER SOURCES MAY BE PRESENT. FAILURE TO DO SO MAY CAUSE PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.

This furnace is equipped with a multi-speed ECM motor. Two wiring harnesses connect the motor to the integrated control board and furnace power supply. The line voltage (115 VAC) power supply to the motor is constant and not switched by the control board. Motor operation is also dependent on a 24 VDC signal on one of the four speed taps on the motor. The airflow tables for heating and cooling speeds show the relationship between airflow (CFM) and external static pressure for each size furnace.

WARNING

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

Circulator Blower Speed Facts

1. Motor speed Tap wiring must remain in factory position on the control board and motor.
2. There are 4 speed Tap wires to the motor T1, T2, T3, T4.
3. There are 5 speeds available, depending on DIP switch settings and found in air flow table for each size furnace.
4. T1 terminal is always energized for Low Heat / Constant Fan speed.
5. T2 terminal is always energized for High Heat speed.
6. T3 terminal is always energized in Low Cooling.
7. T4 terminal is always energized in High Cooling.

SYSTEM OPERATION

8. Heating input (W1/ W2) always has priority over all other thermostat input.
9. Cooling input (YLo/ Y) has priority over continuous fan input.
10. Continuous fan input (G) has lowest priority.

***The blower speed wiring connections must remain in factory position.**

1. Refer to the air flow table for your specific model furnace
2. If a cooling or heat pump condensing unit is being used in conjunction with this furnace, the three DIP switches in S2 are used to select the proper cooling speeds to match the outdoor unit size. Typical CFM requirements are 400 CFM / Ton.

1. Turn OFF power to the furnace.
2. Select the heating and cooling blower speeds that match the installation requirements from the airflow table in this manual or the Service Manual, If factory cooling speeds do not match the installation requirements, the dip switch settings must be changed from factory position
3. Turn ON power to furnace.
4. Verify proper temperature rise in heat modes and CFM in cooling modes

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.

CIRCULATING AIR AND FILTERS DUCTWORK - AIR FLOW

Duct systems and register sizes must be properly designed for the C.F.M. and external static pressure rating of the furnace. Ductwork should be designed in accordance with the recommended methods of "Air Conditioning Contractors of America" manual D.

A duct system should be installed 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 return air filter is not supplied with the furnace. The installer must supply a means of filtering all of the return air. Filter(s) shall comply with UL900 or CAN/ULC-S111 Standards. If the furnace is installed without filters, the warranty will be voided.

Upflow furnaces with air delivery of less than 1800 CFM:

Use one side return or one bottom return ductwork connection.

Upflow furnaces with air delivery of 1800 CFM or higher:

Use two side returns or one side return and one bottom return connection.

Guide dimples locate the side and bottom return cutout locations. Use a straight edge to scribe lines connecting the dimples. Cut out the opening on these lines. An undersized opening will cause reduced airflow. For bottom return connection, remove the bottom of the cabinet before setting the furnace on the raised platform or return air duct.

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.*** Supply and return connections to the furnace may be made with flexible joints to reduce noise transmission, if desired. If a central return is used, a connecting duct must be installed between the unit and the utility room wall so the blower will not interfere with combustion air or draft. The room, closet, or alcove must not be used as a return air chamber.

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

SYSTEM OPERATION

DIP SWITCH SETTING															
*MEC960302BN			0.1		0.2		0.3		0.4		0.5		0.6	0.7	0.8
			CFM	Rise	CFM	Rise	CFM	Rise	CFM	Rise	CFM	Rise	CFM	CFM	CFM
FACTORY SETTING	All DIP Switch Positions	G	870		658		548		469		413		349	293	N/A
	All DIP Switch Positions	W1	870	21	658	28	548	34	469	40	413	45	349	293	N/A
	All DIP Switch Positions	W2	885	30	821	32	755	35	684	39	621	43	557	508	461
	OFF OFF OFF	Ylo	874		697		612		533		470		414	361	303
		Y	1146		1097		1049		1002		941		895	846	787
	ON OFF OFF	Ylo	874		697		612		533		470		414	361	303
		Y	928		868		810		743		670		614	560	505
	ON ON OFF	Ylo	928		868		810		743		670		614	560	505
		Y	1146		1097		1049		1002		941		895	846	787
	OFF ON OFF	Ylo	928		868		810		743		670		614	560	505
		Y	870		658		548		469		413		349	293	N/A
	OFF OFF ON	Ylo	928		868		810		743		670		614	560	505
		Y	885		821		755		684		621		557	508	461
	OFF ON ON	Ylo	874		697		612		533		470		414	361	303
		Y	1146		1097		1049		1002		941		895	846	787
	ON OFF ON	Ylo	885		821		755		684		621		557	508	461
		Y	1146		1097		1049		1002		941		895	846	787
	ON ON ON	Ylo	885		821		755		684		621		557	508	461
		Y	874		697		612		533		470		414	361	303

DIP SWITCH SETTING															
*MEC960402BN			0.1		0.2		0.3		0.4		0.5		0.6	0.7	0.8
			CFM	Rise	CFM	Rise	CFM	Rise	CFM	Rise	CFM	Rise	CFM	CFM	CFM
FACTORY SETTING	All DIP Switch Positions	G	847		694		611		535		471		415	357	313
	All DIP Switch Positions	W1	847	29	694	36	611	41	535	47	471	53	415	357	313
	All DIP Switch Positions	W2	989	36	932	38	882	40	819	43	773	46	695	650	586
	OFF OFF OFF	Ylo	856		667		546		466		413		357	302	N/A
		Y	1143		1095		1046		996		946		890	834	778
	ON OFF OFF	Ylo	856		667		546		466		413		357	302	N/A
		Y	960		898		840		780		711		659	596	547
	ON ON OFF	Ylo	960		898		840		780		711		659	596	547
		Y	1143		1095		1046		996		946		890	834	778
	OFF ON OFF	Ylo	960		898		840		780		711		659	596	547
		Y	847		694		611		535		471		415	357	313
	OFF OFF ON	Ylo	960		898		840		780		711		659	596	547
		Y	989		932		882		819		773		695	650	586
	OFF ON ON	Ylo	856		667		546		466		413		357	302	N/A
		Y	1143		1095		1046		996		946		890	834	778
	ON OFF ON	Ylo	989		932		882		819		773		695	650	586
		Y	1143		1095		1046		996		946		890	834	778
	ON ON ON	Ylo	989		932		882		819		773		695	650	586
		Y	856		667		546		466		413		357	302	N/A

SYSTEM OPERATION

DIP SWITCH SETTING															
*MEC960603BN			0.1		0.2		0.3		0.4		0.5		0.6	0.7	0.8
FACTORY SETTING	All DIP Switch Positions	G	CFM	Rise	CFM	Rise	CFM	Rise	CFM	Rise	CFM	Rise	CFM	CFM	CFM
	All DIP Switch Positions	W1	894	42	846	44	780	48	720	52	660	57	603	554	505
	All DIP Switch Positions	W2	1328	40	1287	41	1249	43	1215	44	1170	46	1131	1085	1046
	OFF OFF OFF	Ylo	782		629		547		469		396		333	N/A	N/A
	Y	1236		1189		1149		1101		1066		1017	969	928	
ON OFF OFF	Ylo	782		629		547		469		396		333	N/A	N/A	
	Y	1149		1104		1057		1017		963		918	865	822	
ON ON OFF	Ylo	1149		1104		1057		1017		963		918	865	822	
	Y	1236		1189		1149		1101		1066		1017	969	928	
OFF ON OFF	Ylo	1149		1104		1057		1017		963		918	865	822	
	Y	894		846		780		720		660		603	554	505	
OFF OFF ON	Ylo	1149		1104		1057		1017		963		918	865	822	
	Y	1328		1287		1249		1215		1170		1131	1085	1046	
OFF ON ON	Ylo	782		629		547		469		396		333	N/A	N/A	
	Y	1236		1189		1149		1101		1066		1017	969	928	
ON OFF ON	Ylo	1328		1287		1249		1215		1170		1131	1085	1046	
	Y	1236		1189		1149		1101		1066		1017	969	928	
ON ON ON	Ylo	1328		1287		1249		1215		1170		1131	1085	1046	
	Y	782		629		547		469		396		333	N/A	N/A	

DIP SWITCH SETTING															
*MEC960803BN			0.1		0.2		0.3		0.4		0.5		0.6	0.7	0.8
FACTORY SETTING	All DIP Switch Positions	G	CFM	Rise	CFM	Rise	CFM	Rise	CFM	Rise	CFM	Rise	CFM	CFM	CFM
	All DIP Switch Positions	W1	1221	41	1172	42	1128	44	1087	46	1049	47	1005	959	922
	All DIP Switch Positions	W2	1311	54	1293	55	1249	57	1203	59	1172	61	1122	1088	1041
	OFF OFF OFF	Ylo	750		644		569		507		442		388	328	N/A
	Y	1111		1068		1025		984		941		885	N/A	801	
ON OFF OFF	Ylo	750		644		569		507		442		388	328	N/A	
	Y	894		842		784		726		682		618	562	519	
ON ON OFF	Ylo	894		842		784		726		682		618	562	519	
	Y	1111		1068		1025		984		941		885	N/A	801	
OFF ON OFF	Ylo	894		842		784		726		682		618	562	519	
	Y	1221		1172		1128		1087		1049		1005	959	922	
OFF OFF ON	Ylo	894		842		784		726		682		618	562	519	
	Y	1311		1293		1249		1203		1172		1122	1088	1041	
OFF ON ON	Ylo	750		644		569		507		442		388	328	N/A	
	Y	1111		1068		1025		984		941		885	N/A	801	
ON OFF ON	Ylo	1311		1293		1249		1203		1172		1122	1088	1041	
	Y	1111		1068		1025		984		941		885	N/A	801	
ON ON ON	Ylo	1311		1293		1249		1203		1172		1122	1088	1041	
	Y	750		644		569		507		442		388	328	N/A	

SYSTEM OPERATION

		DIP SWITCH SETTING														
		*MEC961004CN		0.1		0.2		0.3		0.4		0.5		0.6	0.7	0.8
			CFM	Rise	CFM	Rise	CFM	Rise	CFM	Rise	CFM	Rise	CFM	CFM	CFM	
FACTORY SETTING	All DIP Switch Positions	G	1522		1464		1402		1338		1280		1230	1167	1101	
	All DIP Switch Positions	W1	1522	41	1464	43	1402	44	1338	47	1280	49	1230	1167	1101	
	All DIP Switch Positions	W2	1861	48	1803	49	1749	51	1698	52	1653	54	1594	1549	1504	
	OFF OFF OFF	Ylo	1004		890		805		710		620		553	474	406	
		Y	1772		1713		1662		1609		1540		1498	1452	1399	
	ON OFF OFF	Ylo	1004		890		805		710		620		553	474	406	
		Y	1312		1235		1170		1101		1037		962	880	820	
	ON ON OFF	Ylo	1312		1235		1170		1101		1037		962	880	820	
		Y	1772		1713		1662		1609		1540		1498	1452	1399	
	OFF ON OFF	Ylo	1312		1235		1170		1101		1037		962	880	820	
		Y	1522		1464		1402		1338		1280		1230	1167	1101	
	OFF OFF ON	Ylo	1312		1235		1170		1101		1037		962	880	820	
		Y	1861		1803		1749		1698		1653		1594	1549	1504	
	OFF ON ON	Ylo	1004		890		805		710		620		553	474	406	
		Y	1772		1713		1662		1609		1540		1498	1452	1399	
	ON OFF ON	Ylo	1861		1803		1749		1698		1653		1594	1549	1504	
		Y	1772		1713		1662		1609		1540		1498	1452	1399	
	ON ON ON	Ylo	1861		1803		1749		1698		1653		1594	1549	1504	
		Y	1004		890		805		710		620		553	474	406	

		DIP SWITCH SETTING														
		*MEC961205DN		0.1		0.2		0.3		0.4		0.5		0.6	0.7	0.8
			CFM	Rise	CFM	Rise	CFM	Rise	CFM	Rise	CFM	Rise	CFM	CFM	CFM	
FACTORY SETTING	All DIP Switch Positions	G	1796		1753		1697		1645		1589		1536	1478	1425	
	All DIP Switch Positions	W1	1796	42	1753	43	1697	44	1645	45	1589	47	1536	1478	1425	
	All DIP Switch Positions	W2	2211	48	2162	49	2122	50	2076	51	2029	53	1986	1984	1942	
	OFF OFF OFF	Ylo	1106		1017		946		855		764		681	605	N/A	
		Y	1683		1628		1565		1511		1445		1387	1340	1276	
	ON OFF OFF	Ylo	1106		1017		946		855		764		681	605	N/A	
		Y	1399		1327		1259		1185		1118		1051	980	913	
	ON ON OFF	Ylo	1399		1327		1259		1185		1118		1051	980	913	
		Y	1683		1628		1565		1511		1445		1387	1340	1276	
	OFF ON OFF	Ylo	1399		1327		1259		1185		1118		1051	980	913	
		Y	1796		1753		1697		1645		1589		1536	1478	1425	
	OFF OFF ON	Ylo	1399		1327		1259		1185		1118		1051	980	913	
		Y	2211		2162		2122		2076		2029		1986	1984	1942	
	OFF ON ON	Ylo	1106		1017		946		855		764		681	605	N/A	
		Y	1683		1628		1565		1511		1445		1387	1340	1276	
	ON OFF ON	Ylo	2211		2162		2122		2076		2029		1986	1984	1942	
		Y	1683		1628		1565		1511		1445		1387	1340	1276	
	ON ON ON	Ylo	2211		2162		2122		2076		2029		1986	1984	1942	
		Y	1106		1017		946		855		764		681	605	N/A	

SYSTEM OPERATION

UPRIGHT FILTER INSTALLATIONS

Depending on the installation and/or customer preference, differing filter arrangements can be applied. Filters can be installed in the central return register and a side panel external filter rack kit (upflow filter kit # EFR02 As an alternative a media air filter or electronic air cleaner can be used as the requested filter. Refer to the following minimum filter requirement charts for determination of the minimum filter area to ensure proper unit performance. The following figures show possible filter locations.

Refer to Minimum Filter Area tables to determine filter area requirement. **NOTE:** Filters can also be installed elsewhere in the duct system such as a central return.

Horizontal Installations

Filter(s) must be installed external to the furnace casing for horizontal installations. For most installations it is preferable to use a central return with filters installed in the duct behind the return air grill. In this way filter replacement is relatively simple by merely removing the grille, rather than going into the attic or crawl space.

ADDITIONAL FILTERING ACCESSORIES

External Filter Rack Kit (EFR02)

The external filter rack kit is intended to provide a location external to the furnace casing, for installation of a permanent filter on upflow model furnaces. The rack is designed to mount over the indoor blower compartment area of either side panel, and provide filter retention as well as a location for attaching return air ductwork.

Electronic Air Cleaner (ASAS and GSAS) or Media Air Cleaner (AMU and GMU)

The electronic air cleaner and media air cleaner are multi-positional high efficiency air filtration devices that can be installed in any position, except with the access door facing down. The best location for the air cleaner is in the return air duct next to the blower compartment. Before installing the air cleaner, consider the application. The electronic air cleaner must be readily accessible for periodic inspection and cleaning of the pre-filters and electronic cells while the media air cleaner must be readily accessible for periodic inspection and replacement of the Media Air Cleaner (AMU and GMU) filter cartridge (3 per carton) M0-1056, M1-1056, M2-1056, M8-1056, to maintain maximum efficiency and trouble-free operation. Carbon Filters 1156-3 and 1856-3 (set of 3) are also available. See Product Catalog for exact filter for your model. A full line of air filtration and indoor air quality products are available and can be seen at www.goodmanmfg.com.

SEQUENCE OF OPERATION

POWERUP:

- When power is supplied, the control will energize the Red LED, microcomputer runs its self-check routine.

- The control will check the status of the gas valve circuitry.
- Line polarity is checked.
- The control then enters standby waiting for a call for heat or cool.
- The Furnace status LED will display a slow green flash signaling standby mode

HEAT MODE:

Call For 1st Stage Heat

- On a call for first stage heat, the thermostat contacts close signaling the control module.
- The microcomputer runs its self-check routine.
- The Amber LED will display a slow flash signaling normal heat operation.
- The control module checks the high limit (and/or auxiliary limit) switch(es) for normally closed contacts.
- The control checks the low pressure switch for a shorted condition.
- The gas valve relay status is checked for proper operation. Once the low pressure switch is detected open, the inducer blower is energized at high speed and the humidifier is enabled.
- The low pressure switch is checked for closure.
- Once the low pressure switch is closed, the pre-purge period begins. The inducer will be energized at high speed for the pre-purge period.
- Following the completion of pre-purge, the inducer switches to low speed and the igniter warm up period begins.
- After completion of the igniter warm up period:
 - Trial for ignition begins.
 - The first stage of the gas valve is energized.
- The igniter is de-energized when flame is sensed or at the conclusion of the ignition activation period (IAP), whichever comes first.
- When flame is sensed, the delay to heat on period begins timing.
- Retry counter is zeroed, if after 10 seconds the flame is sensed:
 - Control enters normal operating loop where all inputs are continuously checked.
- After the delay to heat on period, the circulator fan is energized at the low heat speed.
- The air cleaner will be energized with the circulator.
- If the call for heat is lost while the control is in the trial for ignition period without flame being detected, the control will turn off the gas valve and igniter. The control then enters the post-purge routine. The post-purge time will be increased to 60 seconds. After completing the post-purge, the control resumes normal operation.

SYSTEM OPERATION

CALL FOR 2ND STAGE AFTER FIRST STAGE:

- The inducer motor is enabled at high speed.
- The pressure switches are checked for closure. Closure of the second stage pressure switch will energize the high fire stage of the gas valve.
- The high speed circulator output is energized.
- **NOTE:** A call for 2nd stage without a call for 1st stage will be ignored, and a three amber flash code will be displayed on the LED. This error code will only be stored in memory once during a single power cycle.

2ND STAGE SATISFIED, FIRST STAGE STILL CALLED:

- When the second stage of the thermostat is satisfied, the inducer blower is reduced to low speed which de-energizes the second stage of the gas valve.
- After the high heat off delay expires, the circulator is reduced to low heat speed.

SIMULTANEOUS CALL FOR LOW AND HIGH HEAT

A call for both stages of heat will establish low fire before going to high fire

Operation Using a Single Stage Heating Thermostat

Using a single stage thermostat, the options for high fire delay are: 10 minutes; 20 minutes; or auto

- The automatic second stage logic is a method of energizing the second stage valve based on the recent average of the heating duty cycle. During a typical heating day there will be at least one call for heat within a 3 hour period, and usually much more often. During this mode the low to high stage delay is determined by using the average calculated duty cycle from the table below. Once the specified delay time has expired the second stage valve will be energized
- On the heating cycle following a period of 3 hours (or greater) in which there is no call for heat, the second stage valve will energize based on the average calculated duty cycle prior to the three hour no call for heat. If the average calculated duty cycle is less than 50%, then the low to high stage delay will be determined from the table below. In this case, an assumption is made that the outside temperature is fairly mild and the long time between calls for heat was due to a low thermal loss in the building. Going quickly to second stage heat is not required in this instance.

- If the average calculated duty cycle is 50% or greater, then the heating cycle will be treated as if high stage is needed and the transition from low to high stage delay will happen quickly. In this case an assumption is made that the outside temperature is cold and that the thermostat is likely coming out of setback. Since assumptions are being made during this heating cycle the duty cycle for this heat cycle will not be used in the average calculated duty cycle formula for future heating cycles.
- The duty cycle is calculated every cycle and used during the next cycle. The equation for the duty cycle is calculated as follows: $\text{Duty Cycle} = (\text{Time the appropriate stage is ON}) / (\text{Time of the complete cycle})$.
- The average calculated duty cycle is determined by averaging the previous average calculated duty cycle with the duty cycle from the previous cycle. This places a large emphasis on the previous cycle but allows a large variation in any one duty cycle to be averaged out after just a few complete heating cycles.
- If there is no load activity for 24 hours or more then set the Duty Cycle = 100%
- The initial default average calculated duty cycle = 50%

Duty Cycle %	Valve Output	Demand
0-38	1 st Stage, 12 minute 2 nd Stage	Light
38-50	1 st Stage, 10 minute 2 nd Stage	Light to Average
50-62	1 st Stage, 7 minute 2 nd Stage	Average
62-75	1 st Stage, 5 minute 2 nd Stage	Average to Heavy
75-88	1 st Stage, 3 minute 2 nd Stage	Heavy
88-100	1 st Stage, 1 minute 2 nd Stage	Heavy

	Position	Purpose	Silkscreen	Function		
				90 seconds	OFF	OFF
S1	3-4	Heat OFF Delay	3,4	120 seconds	Off	On
				150 seconds	On *	Off *
				180 seconds	ON	ON

Heat Mode Blower Off Delay Timing

SYSTEM OPERATION

COOLING MODE:

LOW STAGE COOLING MODE SEQUENCE:

- On a call for lo cool, the Ylo and G thermostat contacts close signaling the control module.
- The LED will display a "GREEN"1 flash
- The compressor and condenser fan are energized. The compressor is connected to the Ylo terminal of the control module.
- The circulator fan is energized at lo cool speed after a cool on delay. The electronic air cleaner will also be energized.
- After the thermostat is satisfied, the compressor is de-energized
- Following the 60 second Cool Mode Fan Off Delay period, the cool circulator and air cleaner relay are de-energized.
- When the call for "Ylo"and "G"are presented simultaneously, the control will honor the Cool On delay and keep the circulator de-energized. After the Cool On delay, the circulator fan and air cleaner relays are energized. The circulator fan is energized at the cool speed. If a call for "G"is present prior to a call for "Ylo", the circulator will remain at the FAN circulator speed during the Cool On delay.

SINGLE COOLING STAGE THERMOSTAT OR 2ND STAGE COOLING MODE SEQUENCE.

- On a call for cool, the Y and G thermostat contacts close signaling the control module.
- The LED will display a "GREEN"2 flash
- The compressor and condenser fan are energized. The compressor is connected to the Y terminal of the control module.
- The circulator fan is energized at cool speed after a cool on delay. The electronic air cleaner will also be energized.
- After the thermostat is satisfied, the compressor is de-energized and the Cool Mode FanOff Delay period begins.
- Following the 60 second Cool Mode Fan Off Delay period, the cool circulator and air cleaner relay are de-energized

MANUAL FAN ON:

- On a call for Fan, the G thermostat contacts close signaling the control module.
- The LED will display a solid "GREEN"
- When a call for G is received, the control will energize the circulator in low heat speed after the fan on delay time expires. The electronic air cleaner will also be energized at this time.
- When the thermostat fan switch is moved to the ON position, the circulator blower is energized at low heat speed and the electronic air cleaner is also energized
- When the thermostat fan switch is moved back to the AUTO position, the circulator fan and air cleaner relay are de-energized and the control awaits a thermostat call for heat or cool.
- Exception: During the Cool "On"delay, the control will not respond to the fan input. If the fan was called prior to the call for cool, the circulator will remain energized during the Cool "On"delay.
- If the fan is called prior to a call for heat, the circulator will remain energized during the entire call for heat sequence.

ACCESSORIES

GME95 & AMEH96 FURNACE ACCESSORIES

MODEL NUMBER	EFR02	AFE18-60A	AMU / GMU	ASAS / GSAS	0170K00000S	0170K00001S
Description	EFR External Filter Rack	Dual Fuel Kit	Media Air Cleaners	Electronic Air Cleaner	Concentric Side Wall Flush Mount Vent Kit (3")	Concentric Side Wall Flush Mount Vent Kit (2")
*MEC960302BNAA	•	•	•	•	•	•
*MEC960402BNAA	•	•	•	•	•	•
*MEC960603BNAA	•	•	•	•	•	•
*MEC960803BNAA	•	•	•	•	•	•
*MEC961004CNAA	•	•	•	•	•	•
*MEC961205DNAA	•	•	•	•	•	

MODEL NUMBER	DCVK-2 (CVENT-2)	DCVK-30 (CVENT-3)	LPM08	LPLP03	RF000142	FTK04
Description	Concentric Vent Kit (2")	Concentric Vent Kit (3")	Propane Gas Conversion Kit	LP Low Pressure Shut Of Kit	Vent Drain Coupling	Twinning Kit
*MEC960302BNAA	•	•	•	•	•	•
*MEC960402BNAA	•	•	•	•	•	•
*MEC960603BNAA	•	•	•	•	•	•
*MEC960803BNAA	•	•	•	•	•	•
*MEC961004CNAA	•	•	•	•	•	•
*MEC961205DNAA		•	•	•	•	•

Approved Accessory for this model

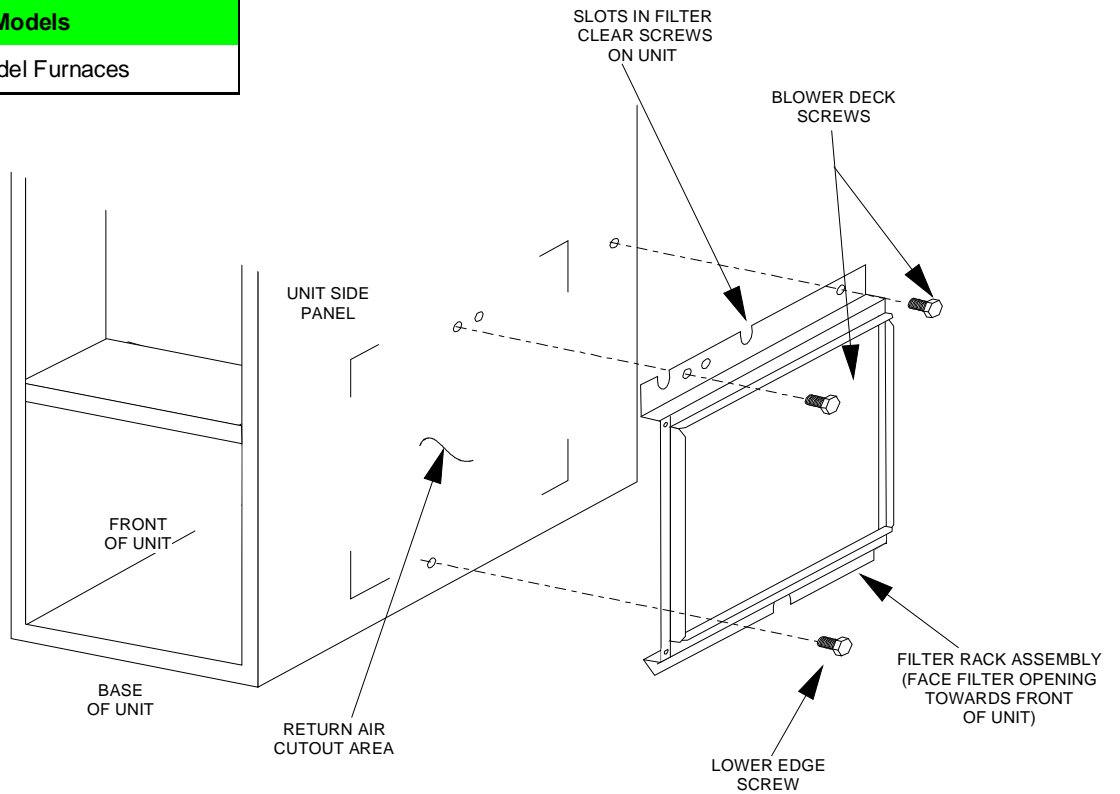
Not Approved for this model

- (2) W/R & HW 2 stg valve
- (4) 7,000 - 11,000 ft altitude
- (5) 7,000 - 9,000 ft altitude
- (6) 9,001 - 11,000 ft altitude

ACCESSORIES

EXTERNAL FILTER RACK KIT (EFR02)

EFR01 EXTERNAL FILTER RACK KIT
Used on Models
90% Upflow Model Furnaces



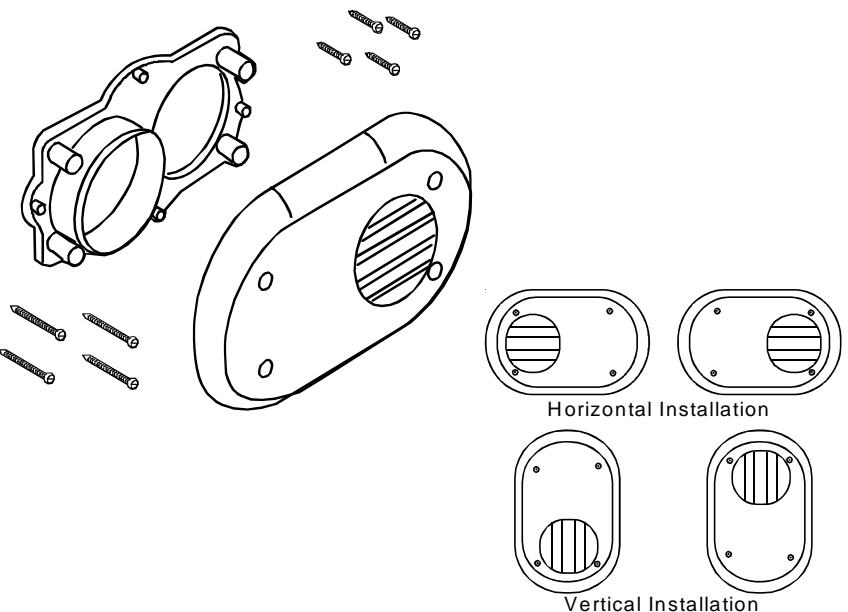
SIDE WALL VENT KIT (0170K00000S/0170K00001S)

Description

This side wall only vent kit #0170K00000S is to be used with 2" - 3" vent systems. The #0170K00001S is a side wall vent kit that is to be used with 2" vent systems ONLY. 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).



ACCESSORIES

CONCENTRIC VENT CONVERSION KIT

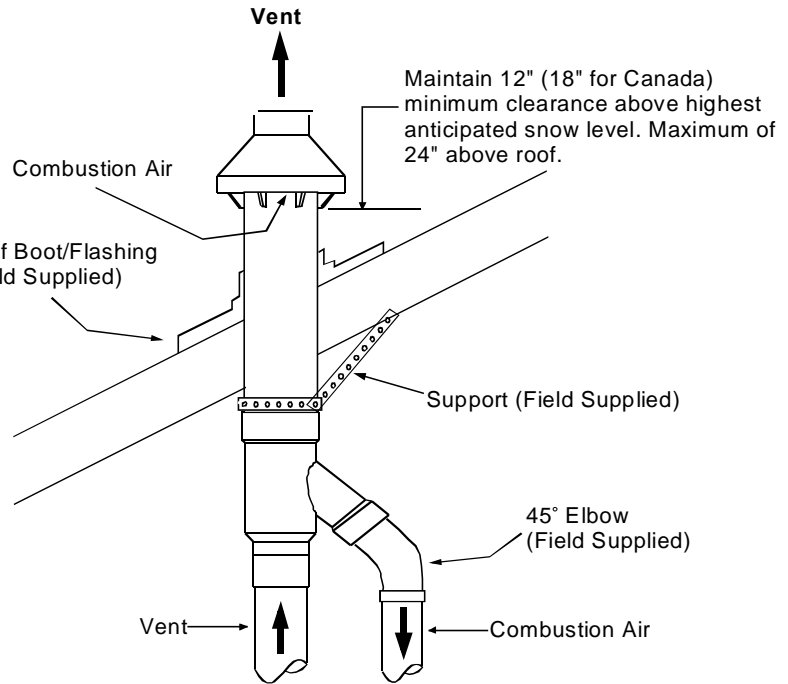
(DCVK-20 ♦ DCVK-30)

(CVENT-2) (CVENT-3)

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

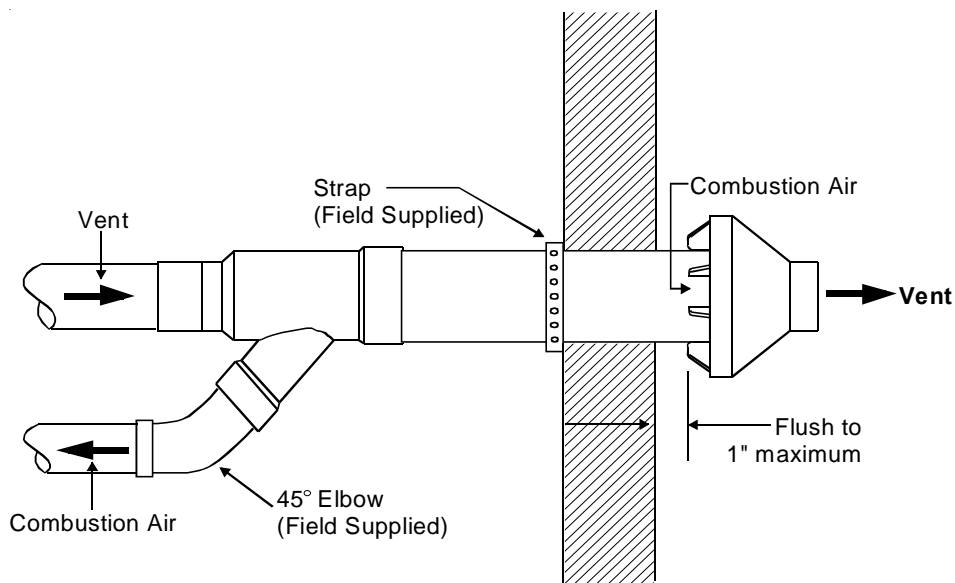
This concentric vent kit allows for vertical or horizontal vent termination. The illustrations give a brief view of the kit and its application.

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

(Vertical Installation)



DCVK

(Horizontal Installation)

ACCESSORY WIRING DIAGRAMS

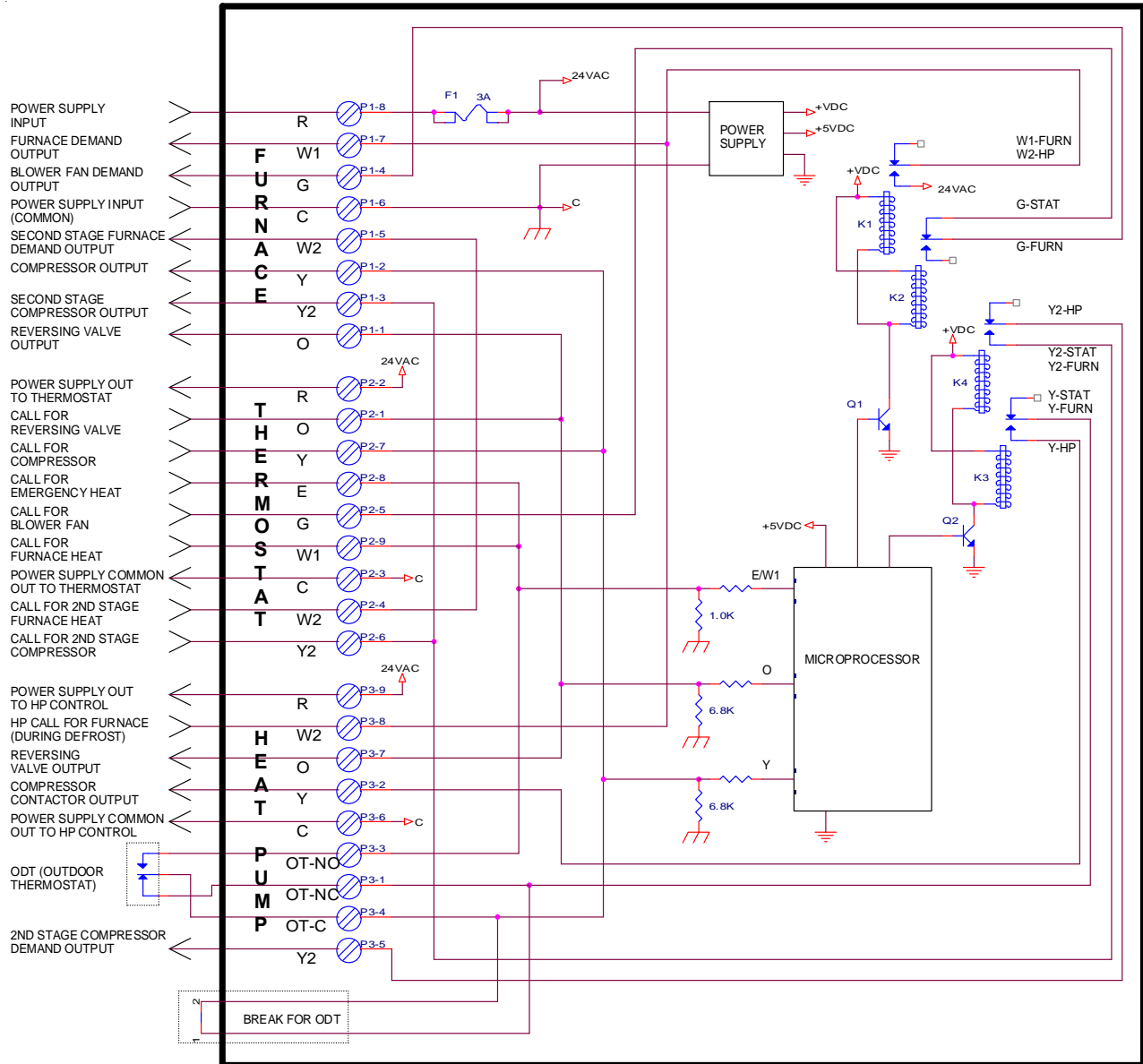


WARNING

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.



ALL FUEL SYSTEM CONTROL BOARD - AFE1860A



ALL FUEL SYSTEM CONTROL BOARD - AFE18-60A

This wiring diagram is for reference only. Not all wiring is as shown above.

Refer to the appropriate wiring diagram for the unit being serviced.

(For use with Heat Pumps in conjunction with 80% or 90% Single-Stage or Two-Stage Furnaces)

SERVICING

SERVICE NUMBERS

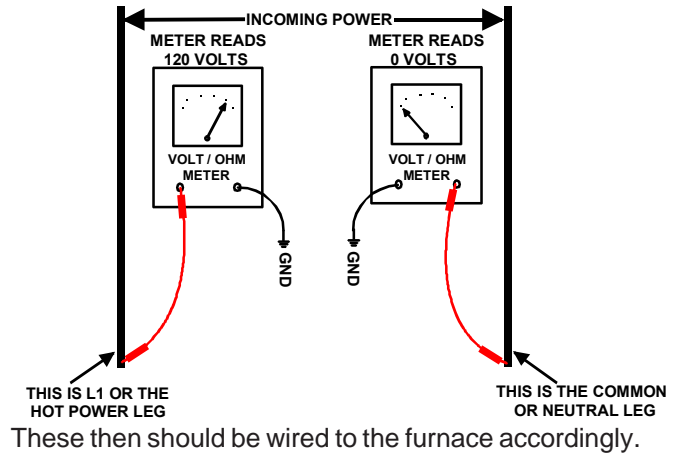
S-1	CHECKING VOLTAGE	45
S-2	CHECKING WIRING	45
S-3A	THERMOSTAT AND WIRING	45
S-3B	HEATING ANTICIPATOR	45
S-4	CHECKING TRANSFORMER AND CONTROL CIRCUIT	46
S-16A	CHECKING AIR CIRCULATOR BLOWER MOTOR (EEM)	46
S-200	CHECKING DUCT STATIC	46
S-201	CHECKING TEMPERATURE RISE	45
S-300	CHECKING PRIMARY LIMIT CONTROL	45
S-301	CHECKING AUXILIARY LIMIT CONTROL	48
S-302	CHECKING FLAME ROLLOUT CONTROL	50
S-303	INDUCED DRAFT BLOWER MOTOR	50
S-304	CHECKING GAS VALVE (REDUNDANT)	50
S-305	CHECKING MAIN BURNERS	51
S-306	CHECKING ORIFICES	51
S-307	CHECKING GAS PRESSURE	51
S-308	CHECKING HOT SURFACE IGNITOR	54
S-309	CHECKING FOR FLASHBACK	54
S-310	CHECKING PRESSURE CONTROL	54
S-311	HIGH ALTITUDE APPLICATION (USA)	55
S-312	CHECKING FOR DELAYED IGNITION	55
S-313	CHECKING INTEGRATED IGNITION CONTROL BOARDS	55
S-314	CHECKING FLAME SENSOR	56

SERVICING

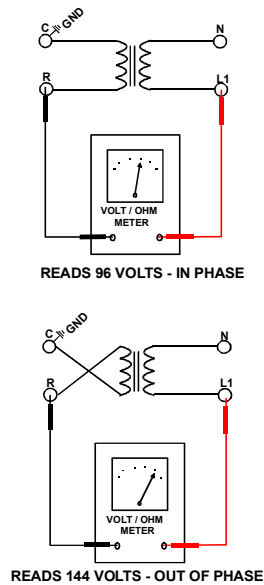
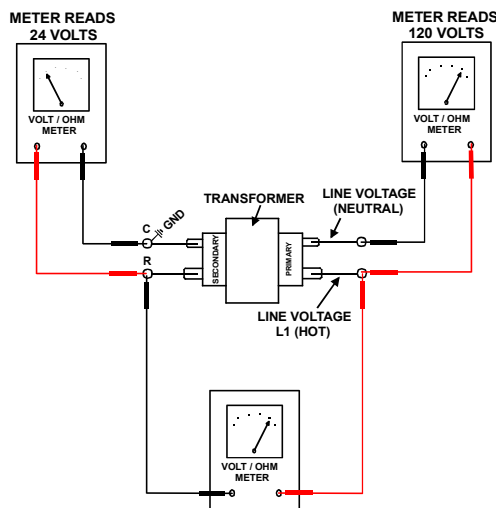
As more and more electronic's are introduced to the Heating Trade, Polarization of incoming power and phasing of primary to secondary voltage on transformers becomes more important.

Polarization has been apparent in the Appliance industry since the introduction of the three prong plug, however, the Heating Industry does not use a plug for incoming power, but is hard wired.

Some of the electronic boards being used today, with flame rectification, will not function properly and/or at all without polarization of incoming power. Some also require phasing between the primary and secondary sides of step-down transformers.

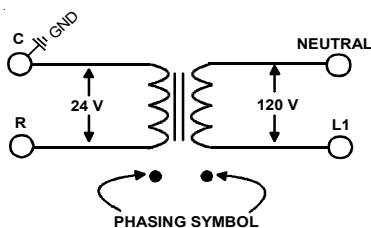


CHECKING FOR PHASING - PRIMARY TO SECONDARY OF UNMARKED TRANSFORMERS*



If meter reads approximately 96 volts - the primary to secondary are in phase - if reads approximately 144 volts out of phase - reverse low voltage wires.

***NOTE:** For flame rectification the common side of the secondary voltage (24 V) is cabinet grounded. If you were to bench test a transformer the primary neutral and secondary common must be connected together for testing purposes.

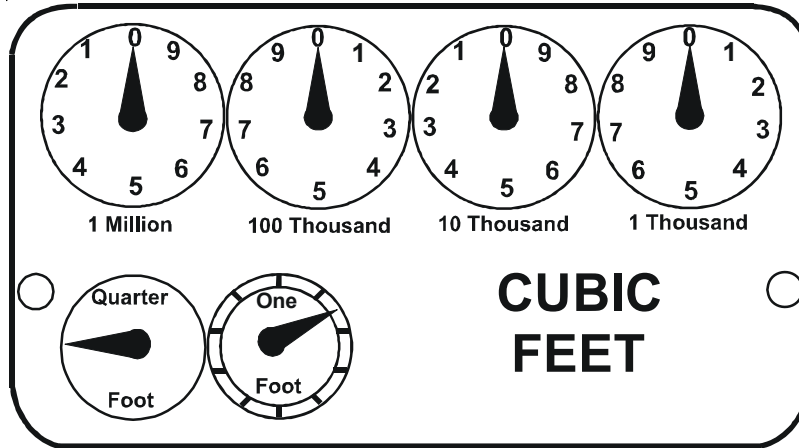


Some transformers will display phasing symbols as shown in the illustration to the left to assist in determining proper transformer phasing.

Checking for polarization and phasing should become a habit in servicing. Let's start now.

NOTE: Newer integrated ignition controls have a diagnostic flash code for reversed polarity (Refer to *Troubleshooting-Diagnostic Chart* for LED Codes).

SERVICING



GAS RATE -- CUBIC FEET PER HOUR											
Seconds for One Revolution	Size of Test Dial					Seconds for One Revolution	Size of Test Dial				
	1/4 cu/ft	1/2 cu/ft	1 cu/ft	2 cu/ft	5 cu/ft		1/4 cu/ft	1/2 cu/ft	1 cu/ft	2 cu/ft	5 cu/ft
10	90	180	360	720	1800	36	25	50	100	200	500
11	82	164	327	655	1636	37	--	--	97	195	486
12	75	150	300	600	1500	38	23	47	95	189	474
13	69	138	277	555	1385	39	--	--	92	185	462
14	64	129	257	514	1286	40	22	45	90	180	450
15	60	120	240	480	1200	41	--	--	--	176	439
16	56	113	225	450	1125	42	21	43	86	172	429
17	53	106	212	424	1059	43	--	--	--	167	419
18	50	100	200	400	1000	44	--	41	82	164	409
19	47	95	189	379	947	45	20	40	80	160	400
20	45	90	180	360	900	46	--	--	78	157	391
21	43	86	171	343	857	47	19	38	76	153	383
22	41	82	164	327	818	48	--	--	75	150	375
23	39	78	157	313	783	49	--	--	--	147	367
24	37	75	150	300	750	50	18	36	72	144	360
25	36	72	144	288	720	51	--	--	--	141	355
26	34	69	138	277	692	52	--	--	69	138	346
27	33	67	133	265	667	53	17	34	--	136	340
28	32	64	129	257	643	54	--	--	67	133	333
29	31	62	124	248	621	55	--	--	--	131	327
30	30	60	120	240	600	56	16	32	64	129	321
31	--	--	116	232	581	57	--	--	--	126	316
32	28	56	113	225	563	58	--	31	62	124	310
33	--	--	109	218	545	59	--	--	--	122	305
34	26	53	106	212	529	60	15	30	60	120	300
35	--	--	103	206	514						

SERVICING

Service Problem		No Heat		Unsatisfactory Heat				Test Method Remedy	See Service Procedure Reference			
POSSIBLE CAUSE DOTS IN ANALYSIS GUIDE INDICATE "POSSIBLE CAUSE"	SYMPTOM	System Will Not Start	Burner Won't Ignite	Burner Ignites-Locks Out	Burner Shuts Off prior to T' Stat being Satisfied	Short Cycles	Long Cycles			Soot and /or Fumes	Too Much Heat	Not Enough Heat
		Power Failure		●								
Blown Fuse		●									Test Voltage	S-4
Loose Connection		●									Check Wiring	S-2
Shorted or Broken Wires		●									Check Wiring	S-3A
No Low Voltage		●									Check Transformer	S-4
Faulty Thermostat		●				●	●		●	●	Check Thermostat	S-3A
Faulty Transformer		●									Check Transformer	S-4
Poor or High Resistance Ground				●							Measure Ground Resistance	S-17B
Improper Heat Anticipator Setting						●	●		●	●	Adjust Heat Anticipator Setting	S-3B
Improper Thermostat Location						●	●		●	●	Relocate Thermostat	S-316
Faulty Limit or Roll Out Switch			●		●						Test Control	S-300 / S-302
Faulty Flame Sensor				●							Test Flame Sensor	S-314
Faulty Ignition Control		●	●	●							Test Control	S-313
Gas Valve or Gas Supply Shut Off			●								Turn Valves to On Position	S-317
Faulty Induced Draft Blower			●					●			Test Induced Draft Motor	S-303
Faulty Blower Motor (PSC)			●		●						Test Blower Motor (PSC)	S-16A,B,C
Broken or Shorted Ignitor			●								Test Ignitor	S-308
Dirty Flame Sensor, Low UA				●							Clean Flame Sensor	S-314
Stuck Gas Valve			●					●	●		Replace Gas Valve	S-304
Faulty Gas Valve			●					●	●		Replace Gas Valve	S-304
Open Auxiliary Limit			●		●						Reset Control	S-301
Improper Air Flow or Distribution					●					●	Check Duct Static	S-200
Cycling on Limit					●	●				●	Check Controls & Temperature Rise	S-201 / S-300
Delayed Ignition								●			Test for Delayed Ignition	S-312
Flashback								●			Test for Flashback	S-309 / S-311
Orifice Size								●	●	●	Check Orifices	S-306 / S-311
Gas Pressure			●					●	●	●	Check Gas Pressure	S-307
Cracked Heat Exchanger								●			Check Burner Flames	S-305
Furnace Undersized						●				●	Replace with Proper Size Furnace	S-318
Furnace Oversized						●					Replace with Proper Size Furnace	S-318
Faulty Pressure Switch			●	●	●						Test Pressure Switch	S-310
Blocked or Restricted Flue								●			Check Flue/Drawdown Pressure	S-310
Open Roll Out Switch			●	●							Test Flame Roll Out Control	S-302
Bouncing On Pressure Switch				●							Test Negative Pressure	S-310

TROUBLESHOOTING

Symptoms	Green LED Code	Amber LED Code	Red LED Code	Fault Description	Check	Cautions
•Furnace fails to operate •Control board LED is off	•None	•None	•None	•Defective disconnect switch •defective door switch • No 115 volt power •No 24 volt power	•Determine cause and restore proper high and low volt power supply	•Confirm electrically safe condition before proceeding with repairs
•Furnace is waiting for a call	•Solid ON	•None	•None	•Furnace is not receiving a call	•None Required	•Confirm electrically safe condition before proceeding with work
•Furnace fan only is running	•Rapid Flash	•None	•None	•Furnace is receiving a call for fan (24 volts on G terminal	•None Required	•Confirm electrically safe condition before proceeding with work
•Normal operation with low stage call for cooling (Ylo & G)	•One repeating flash	•None	•None	•Normal operation with low stage call for cooling (Ylo & G)	•None Required	•Confirm electrically safe condition before proceeding with work
•Normal operation with high or single stage call for cooling (Y & G)	•Two repeating flashes	•None	•None	•Normal operation with high or single stage call for cooling (Y & G)	•None Required	•Confirm electrically safe condition before proceeding with work
•Normal operation with low stage call for heat (W1)	•None	•One repeating flash	•None	•Normal operation with low stage call for heat (W1)	•None Required	•Confirm electrically safe condition before proceeding with work
•Normal operation with high or single stage call for heat	•None	•Two repeating flashes	•None	•Normal operation with high or single stage call for heat	•None Required	•Confirm electrically safe condition before proceeding with work
•Furnace does not operate, three Amber flashes on control board	•None	•Three repeating flashes	•None	•W2 call present without W1	•Faulty thermostat or thermostat wiring or improperly connected thermostat wires	•Confirm electrically safe condition before proceeding with repairs
•Furnace does not operate, four Amber flashes on control board	•None	•Four repeating flashes	•None	•Ylo or Y call present without G	•Faulty thermostat or thermostat wiring or improperly connected thermostat wires	•Confirm electrically safe condition before proceeding with repairs
•Furnace does not operate, rapid Amber flashes on control board	•None	•Rapid	•None	•Low flame sense current	•Dirty / coated flame rod, poor flame, improper gas pressure, poor flame sense wire or connections	•Clean flame rod with steel wool. Confirm electrically safe condition before proceeding with repairs
•Furnace does not operate, one Red flash on control board	•None	•None	•One repeating flash	•Flame sensed when no flame should be present	•Gas valve stuck open, improper wiring to gas valve, shorted flame rod or wire	•Confirm electrical and gas safe conditions before proceeding with repairs
•Furnace does not operate, two Red flashes on control board, possible inducer operation	•None	•None	•Two repeating flashes	•Pressure switch stuck closed	•Faulty pressure switch, pressure switch wires shorted, control board inducer relay stuck closed	•Confirm electrically safe condition before proceeding with repairs
•Furnace does not operate, three Red flashes on control board	•None	•None	•Three repeating flashes	•Low fire pressure switch stuck open	•Faulty pressure switch, pressure switch or tubing or wiring / connection, control board inducer relay failed, vent pipe restriction / excessive elbows or length	•Confirm electrically safe condition before proceeding with repairs

TROUBLESHOOTING

Symptoms	Green LED Code	Amber LED Code	Red LED Code	Fault Description	Check	Cautions
•Furnace does not operate, four Red flashes on control board	•None	•None	•Four repeating flashes	•Open limit circuit, main limit, aux limit, or roll out switch	•Temperature rise, duct static, gas pressure, burner alignment, orifice plate position, wiring to all limits	•Confirm electrically safe condition before proceeding with repairs
•Furnace does not operate, five Red flashes on control board	•None	•None	•Five repeating flashes	•Limit & rollout circuit open for 15 minutes. Open control board fuse or rollout switch	•Control board fuse, Temperature rise, duct static, gas pressure, burner alignment, orifice plate position, wiring to all limits	•Confirm electrically safe condition before proceeding with repairs
•Furnace does not operate, six Red flashes on control board	•None	•None	•Six repeating flashes	•Pressure switch cycling lockout, pressure switch has opened 5 times in the same heating cycle	•Excessive venting restriction, leaking pressure switch tubing	•Confirm electrically safe condition before proceeding with repairs
•Furnace does not operate, seven Red flashes on control board	•None	•None	•Seven repeating flashes	•Lockout - excessive retries from flame not being proven during trial for ignition	•Gas pressure, gas valve, front cover pressure switch, flame rod	•Confirm electrical and gas safe conditions before proceeding with repairs
•Furnace does not operate, eight Red flashes on control board	•None	•None	•Eight repeating flashes	• Lockout - excessive recycles from flame proving being lost after being proven	•Gas pressure, gas valve, front cover pressure switch, flame rod	•Confirm electrical and gas safe conditions before proceeding with repairs
•Furnace does not operate, nine Red flashes on control board	•None	•None	•Nine repeating flashes	•Improper grounding or reverse polarity	•115 volt hot & neutral supply to furnace reversed, hot wire (door switch & L1 on control board) must read 115 volts to ground & neutral. Neutral wire should measure 0 volts to ground	•Confirm electrically safe condition before proceeding with repairs
•Furnace does not operate, ten Red flashes on control board	•None	•None	•Ten repeating flashes	•Gas valve current detected with no call for heat	•Verify gas valve is not receiving voltage from an electrical short. If valve wiring is correct replace control board	•Confirm electrical and gas safe conditions before proceeding with repairs
•Furnace does not operate, eleven Red flashes on control board, inducer running	•None	•None	•Eleven repeating flashes	•Open limit switch circuit for more than 5 minutes	•Re-set main power and check indoor blower operation	•Confirm electrically safe condition before proceeding with repairs
•Furnace does not operate, twelve Red flashes on control board	•None	•None	•Twelve repeating flashes	•Control board igniter relay not energizing igniter	•Replace control board	•Confirm electrically safe condition before proceeding with repairs
•Furnace does not operate, control board Red LED on solid	•None	•None	•Solid ON	•Control board internal fault	•Replace control board	•Confirm electrically safe condition before proceeding with repairs
•Furnace does not operate, control board Red LED rapid flash	•None	•None	•Rapid Flash	•Twinning error	•Correct twinning wiring	•Confirm electrically safe condition before proceeding with repairs
•Furnace does not operate, control board Red LED with three double flashes	•None	•None	•Three double flashes	•Second stage pressure switch stuck open	•Verify pressure switch function & tubing, verify inducer operating and pulling enough vacuum to engage switch	•Confirm electrically safe condition before proceeding with repairs

Green LED Flash	Amber LED Flash	Red LED Flash	Error/Condition
		1	Flame sensed when no flame should be present
		2	Pressure Switch Stuck Closed/ Inducer Error
		3	1st-stage Pressure Switch Stuck Open/ Inducer Error
		4	Open limit switch
		5	Open Rollout/Open Fuse Detect
		6	Pressure switch cycle lockout
		7	External lockout (retries)
		8	External lockout (recycles)
		9	Grounding or Reversed polarity
		10	Gas flow with no call for heat
		11	Limit switch open – blower failure
		12	Ignitor Relay Failure
		Solid	Internal, GV Error, Micro, and Frequency Check
		Rapid	Twinning error
		3 double	2nd-stage Pressure Switch Stuck Open/ Inducer Error
	1		Normal Operation with call for first stage heat (W1)
	2		Normal Operation with call for second stage heat (W2)
	3		W2 present with no W1
	4		Y present with no G call, Y1 present with no G call.
	Rapid		Low flame sense current
Solid			Standby
Rapid			Normal Operation with call for fan (G)
1			Normal Operation with call for Low stage cool (Ylo + G)
2			Normal Operation with call for High stage cool/or single stage cooling. (Y + G)

DIAGNOSTIC CHART

Refer to the *Troubleshooting Chart* in the back of this manual for assistance in determining the source of unit operational problems.

External Lockout

- A control lockout resulting from an external fault sensed by the control, such as an unsuccessful recycle or retry period, or a limit trip. Once in External Lockout, the control will shut down for a period of one hour before attempting another trial for ignition.

Internal Lockout

- A failure internal to the control board.

FAULT RECALL

Retrieving Fault Codes

To retrieve fault codes, push and release the “LAST ERROR” button for more than 1/5 second and less than 5 seconds (the LED will indicate this period by solid GREEN for 1/5 second to 5 seconds). The LED will flash up to five stored fault codes, beginning with the most recent. If there are no fault codes in memory, the LED will flash two green flashes. The control will flash the most recent error first and the oldest error last. If multiple faults exist there will be 2 seconds between codes. Solid LED error codes will not be displayed.

Fault Code Reset

To clear the fault code memory, push and hold the “LAST ERROR” button for more than 5 seconds and less than 10 seconds (the LED will indicate this period by RAPID GREEN FLASH for 5 seconds to 10 seconds). The LED will flash three green flashes when the memory has been cleared.

The ignition control is equipped with a momentary push button switch that can be used to display on the diagnostic LED the last five faults detected by the control. The control must be in Standby Mode (no thermostat inputs) to use the feature.

Depress the push button switch for approximately 2 seconds. Release the switch when the LED is turned off. The diagnostic LED will then display the flash codes associated with the last five detected faults. The order of display is the most recent fault to the least recent fault.



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 one flash diagnostic LED code. If the furnace is in “lockout”, it 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 for 1 - 20 seconds.
3. Manual thermostat cycle. Lower the thermostat so that there is no longer a call for heat then reset to previous setting. Interrupt thermostat signal to the furnace for 1 - 20 seconds.

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 cover from the Junction Box and gain access to incoming power lines.

With Power ON:

 WARNING
LINE VOLTAGE NOW PRESENT

2. Using a voltmeter, measure the voltage across the hot and neutral connections.

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

3. No reading - indicates open wiring, open fuse, no power, or faulty Door Interlock Switch from unit to fused disconnect service. Repair as needed.
4. With ample voltage at line voltage connectors, energize the furnace blower motor by jumpering terminals R to G on the integrated ignition control.
5. With the blower motor in operation, the voltage should be 115 volts \pm 10 percent.
6. 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.
7. After completing check and/or repair, replace Junction Box cover and reinstall the service panel doors.
8. 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 (or W1 and W2 for two-stage models) on the integrated ignition control.

With Power On (and Door Interlock Switch closed):

 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
 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.

S-3B HEATING ANTICIPATOR



The heating anticipator on older thermostats 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. Modern thermostats do not have this type of heat anticipator. Many have a selector switch to adjust the number of cycles per hour.

SERVICING

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.

 WARNING
LINE VOLTAGE NOW PRESENT

 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.	

S-16A CHECKING AIR CIRCULATOR BLOWER MOTOR (MULTI-SPEED ECM MOTOR)

 WARNING
DISCONNECT ALL POWER BEFORE SERVICING.

1. Remove blower compartment door to gain access to the circulator blower motor and integrated ignition control.
2. Check for any obstruction that would keep the fan wheel / fan motor from turning.
3. Check wiring, the motor has two wiring harnesses, a main harness and a control harness. The main pin harness has:

White neutral wire connected to the Neutral terminal on the control board.

Black wire connected to the CIRC H terminal on the control board.

Red wire connected to the COM terminal, which is a female spade connection next to the T1 – T4 wires on the control board.

Green ground wire connected to cabinet ground

The control harness has:

Blue wire connected to T1 on the control board.

Red wire connected to T2 on the control board.

Orange wire connected to T3 on the control board.

Black wire connected to T4 on the control board.

The multi-speed ECM motor requires a line voltage power supply (black connected to CIRC H and white connected to neutral on the control board) as well as a signal on one of the speed taps (T1-T4).

The speed tap voltage is D.C. and can vary depending on S2 DIP switch selection. The voltage reading from any one of the speed taps is referenced between the female COM terminal next to the speed taps on the control board. From COM to T1 or T2, 6-7 VDC when energized. From COM to T3, 13-14 VDC when energized. From COM to T4, 6-7 or 13-14 VDC depending on S2 settings.

S-200 CHECKING DUCT STATIC

The maximum and minimum allowable external static pressures are found in the specification section. These tables also show the amount of air being delivered at a given static by a given motor speed or pulley adjustment.

The furnace motor cannot deliver proper air quantities (CFM) against statics other than those listed.

Too great of an external static pressure will result in insufficient air that can cause excessive temperature rise, resulting in limit tripping, etc. Whereas not enough static may result in motor overloading.

SERVICING

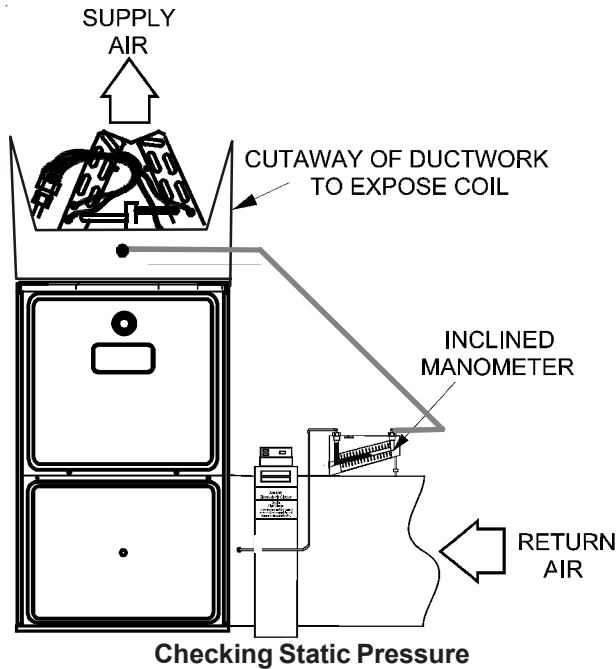
To determine proper air movement, proceed as follows:

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. Add the two (2) readings together for total external static pressure.

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 these components, as shown in the following drawing.

4. Consult proper tables for the quantity of air.

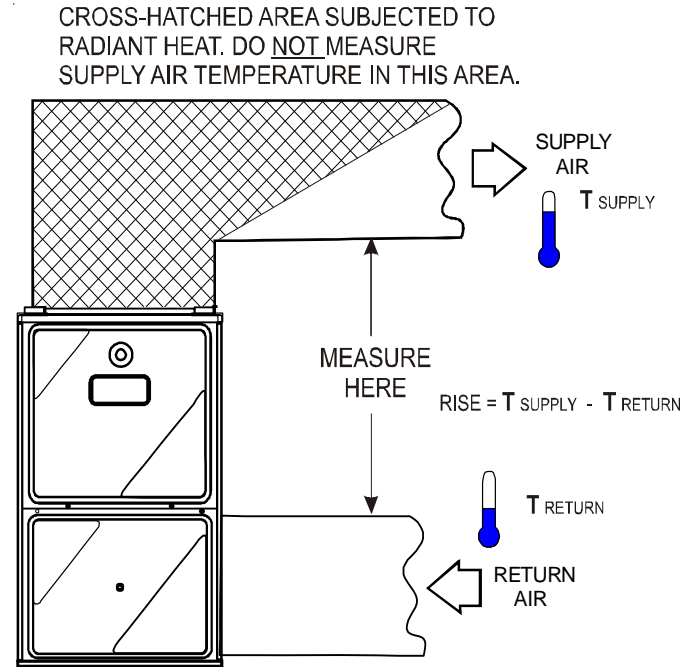
If the total external static pressure exceeds the minimum or maximum allowable statics, check for closed dampers, registers, undersized and/or oversized poorly laid out duct work.



S-201 CHECKING TEMPERATURE RISE

The more air (CFM) being delivered through a given furnace, the less the rise will be; so the less air (CFM) being delivered, the greater the rise. The temperature rise should be adjusted in accordance to a given furnace specifications and its external static pressure. 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 blower performance specification section. Determine and adjust temperature rise as follows:

1. Operate furnace with burners firing for approximately ten minutes. Check BTU input to furnace - do not exceed input rating stamped on rating plate. 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.



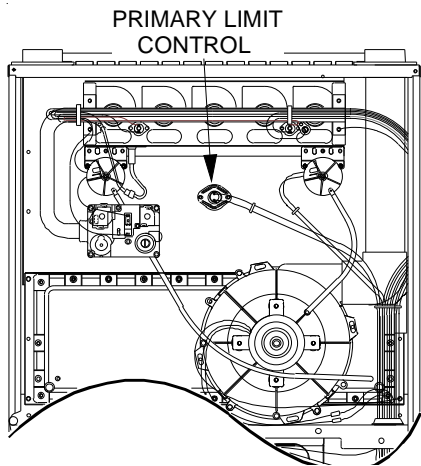
Checking Temperature Rise

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 *Circulator Blower Speed* section in the Product Design section of this manual for speed changing details. Temperature rise is related to the BTUH output of the furnace and the amount of air (CFM) circulated over the heat exchanger. Measure motor current draw to determine that the motor is not overloaded during adjustments.

S-300 CHECKING PRIMARY LIMIT CONTROL

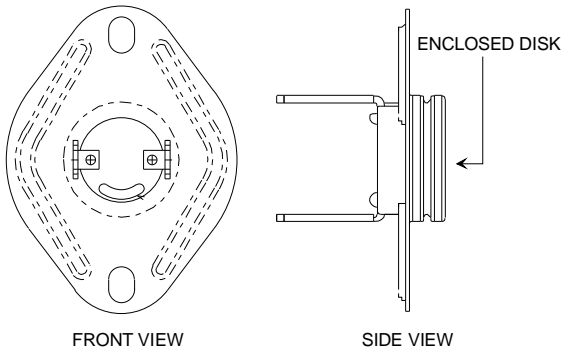
All primary limit controls are nonadjustable, automatic reset, bi-metal type limit control. Refer to the following drawing for the location of the primary limit.

SERVICING



**Primary Limit Control Location
(90% Upflow Furnace Shown)**

The following drawing illustrates the style of limit switches used on the 90% furnaces.



**Primary Limit Control Style
(90% Furnaces)**

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 burner compartment door to gain access to the primary limit.
2. Remove low voltage wires at limit control terminals.
3. With an ohmmeter, test between these two terminals as shown in the following drawing. The ohmmeter should read continuous unless heat exchanger temperature is above limit control setting. If not as above, replace the control.

LIMIT FAULT CODES

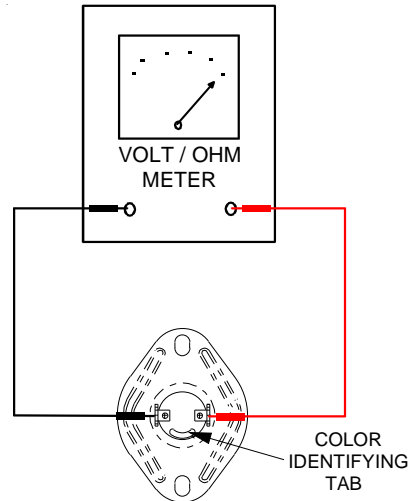
If the control detects the high limit circuit open, the RED LED will flash FOUR times and energize the inducer and indoor blower.

If the limit circuit opens five times within a single call for heat, the furnace will go into lockout for one hour. The RED LED will display a FOUR flash code during this time. The control board can be reset by cycling 115 volt power to the furnace.

If the limit circuit opens and does not close within five minutes, the control assumes the blower has failed the RED LED will flash ELEVEN times.

If the limit circuit opens and does not close within fifteen minutes, the control assumes the manual rollout or fuse has opened and the RED LED will flash FIVE times. The control will enter a one hour lockout and the inducer will run continuously.

In an open limit condition the red LED will flash as described above but the error code will not be stored in memory until the limit resets or until 15 minutes has elapsed. So if the limit resets in less than 5 minutes a four flash code will be stored. If the limit resets in more than 5 but less than 15 minutes, an eleven flash code will be stored. If the limit is still open after 15 minutes, a five flash code will be stored.



Testing Primary Limit Control

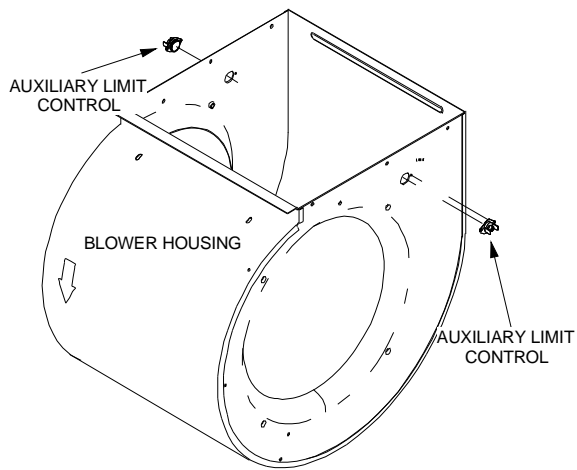
4. After completing check and/or replacement of primary limit control, reinstall burner compartment door.
5. Turn on electrical power and verify proper unit operation.

S-301 CHECKING AUXILIARY LIMIT CONTROL

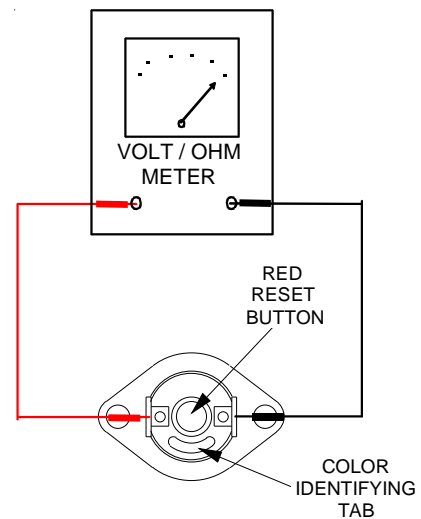
The auxiliary limit control is designed to prevent furnace operation in case of main blower failure in horizontal installations. It may also open if the power supply is interrupted while the furnace is firing.

The auxiliary limit control is suitable for both horizontal right and horizontal left installations. Regardless of airflow direction, it does not need to be relocated. The (2) two auxiliary limits are located on the blower housing (one on each side), as shown in the following illustration.



SERVICING




Auxiliary Limit Control Location



Testing Auxiliary Limit Control

 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.	

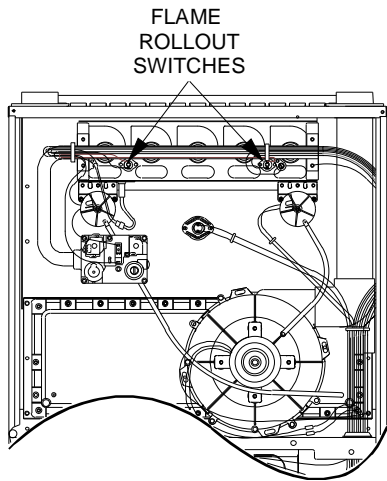
 WARNING
TO AVOID POSSIBLE FIRE, ONLY RESET THE AUXILIARY LIMIT CONTROL ONCE. IF IT SHOULD OPEN A SECOND TIME, A QUALIFIED SERVICER MUST DETERMINE WHY THE AUXILIARY LIMIT OPENED BEFORE RESETTING AGAIN.

1. Remove blower compartment door to gain access to the auxiliary.
2. Remove the wires from the auxiliary limit control terminals.
3. Using an ohmmeter, test for continuity across the two terminals.

SERVICING

302 CHECKING FLAME ROLLOUT CONTROL

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



**Flame Rollout Switch Location
(90% Upflow Furnace Shown)**



The control is designed to open should a flame roll out occur. An over firing condition or flame impingement on the heat shield may also cause the control to open. If the rollout control opens, the air circulation blower will run continuously.

 WARNING
LINE VOLTAGE NOW PRESENT

1. Remove the burner compartment door to gain access to the rollout switch(es) mounted to burner bracket.
2. Reset the manual roll out switch
3. Remove wires from roll out switch
4. Using an ohmmeter, check for continuity across the switch.
5. If the switch will not close after manually resetting, it must be replaced.
6. Measure the voltage between each side of the rollout control and ground during the ignition attempt. If a roll out switch has tripped, it is important to find out why. Possible causes could be flame impingement, orifice plate out of position, burners with excessive cross-over slot dimension, over-firing, improper orifices, improper gas pressure, air leaking from around the heat exchanger into the burner compartment, air leaking through the heat exchanger itself.

7. After check and/or replacement of rollout switch, reinstall burner compartment door and verify proper unit operation.

S-303 INDUCED DRAFT BLOWER Motor

 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 the induced draft blower motor.
2. Disconnect the motor wire leads from its connection point at the induced draft motor.
3. Using a ohmmeter, test for continuity between each of the motor leads.
4. Touch one probe of the ohmmeter to the motor frame (ground) and the other probe in turn to each lead.
If the windings do not test continuous or a reading is obtained to ground, replace the motor.
5. If the windings have a continuity reading, reconnect wires. Turn power on to the furnace and turn the thermostat on in the heating mode. Check voltage for 115V at the induced draft motor terminals during the trial for ignition. If you have 115V and the motor does not run, replace the induced draft motor.
6. After completing check and/or replacement of induced draft motor, reinstall burner compartment door.
7. Turn on electrical power and verify proper unit operation.

S-304 CHECKING GAS VALVE (Redundant)

A combination redundant operator type gas valve which provides all manual and automatic control functions required for gas fired heating equipment is used.

The valve provides control of main burner gas flow, pressure regulation, and 100 percent safety shut-off.

SERVICING

WARNING

DISCONNECT ALL POWER BEFORE SERVICING

Two stage gas valves always require 24 volts between common and low fire (main coil) to open. Also, the furnace front cover pressure switch is wired in series with the low (main) solenoid of the gas valve. In the event of a non functioning gas valve, always check the front cover pressure switch. Also see section S-307 on Checking Gas Pressure and section S-310 on Checking Pressure Switches

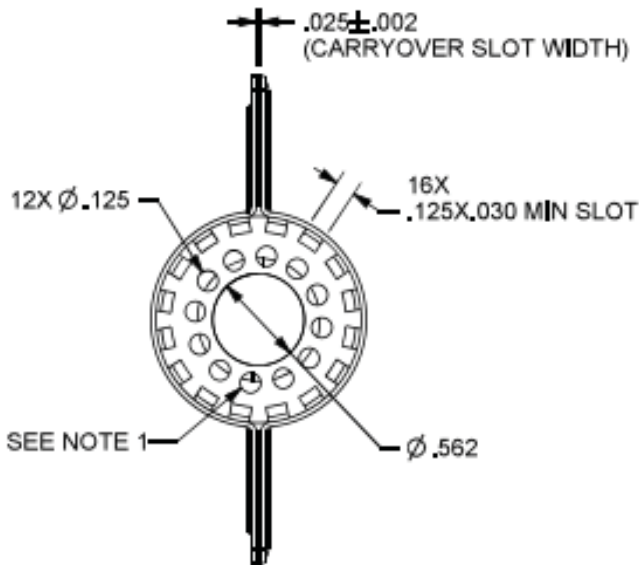
S-305 CHECKING MAIN BURNERS

BURNERS

Burners have been redesigned for 34.5" chassis furnaces. Overall length and width dimensions remain the same as 40" model burners. The burners used 34.5" models have burner head insert with larger diameter center hole and a larger number of surrounding holes.

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.



34.5" Burner

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, burner cross-over slots should not be altered in size.

S-306 CHECKING ORIFICES

*MEC96 model furnaces have factory installed #45 natural gas orifices (except *MEC96030 which has #50).

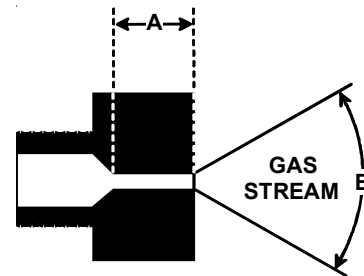
The only time resizing is required is when a reduction in firing rate is required for an increase in altitude or a furnace is being converted for use with LP gas.

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. This will change the angle or deflection of the vacuum effect or entraining of primary air, which will make it difficult to adjust the flame properly. This same problem can occur if an orifice spud of a different length is substituted.

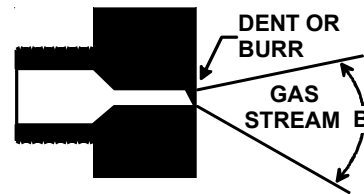
WARNING

DISCONNECT ALL GAS AND ELECTRICAL POWER SUPPLY.

1. Check orifice visually for distortion and/or burrs.
2. Check orifice size with orifice sizing drills.



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.

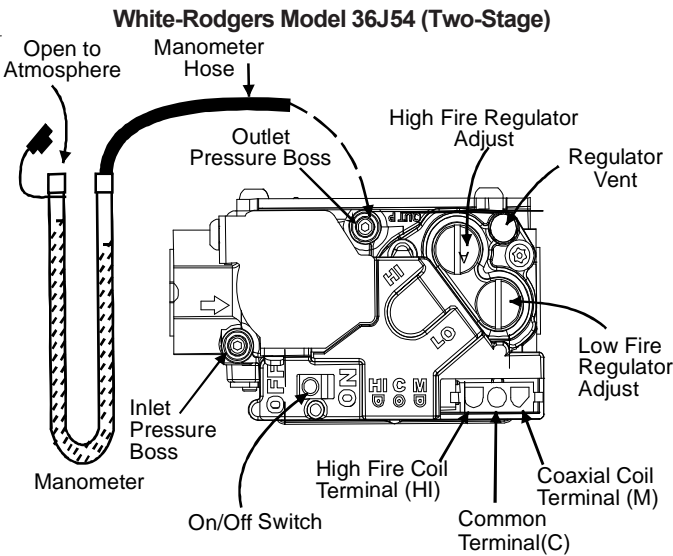
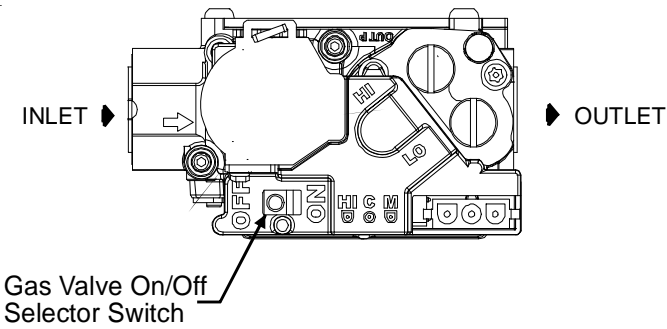
S-307 CHECKING GAS PRESSURE

Gas Supply Pressure Measurement

GAS PRESSURE TEST

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.

SERVICING



White-Rodgers Model 36J54 Connected to Manometer

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 tap or the gas piping drip leg. See White-Rodgers 36J54 gas valve figure for location of inlet pressure tap.

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.

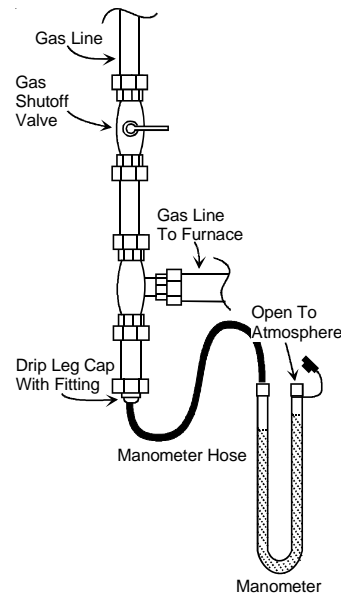
- NOTE:** If measuring gas pressure at the drip leg, a field-supplied hose barb fitting must be installed prior to making the hose connection. If using the inlet pressure tap on the White-Rodgers 36J54 gas valve, then use the 36G/J Valve Pressure Check Kit, Part No. 0151K00000S.
3. Turn ON the gas supply 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 *Inlet Gas Supply Pressure* table.

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.

GAS MANIFOLD PRESSURE MEASUREMENT AND ADJUSTMENT

Only small variations in gas pressure should be made by adjusting the gas valve pressure regulator. The manifold pressure must be measured with the burners operating. To measure and adjust the manifold pressure, use the following procedure.



Measuring Inlet Gas Pressure (Alt. Method)

CAUTION

TO PREVENT UNRELIABLE OPERATION OR EQUIPMENT DAMAGE, THE GAS MANIFOLD PRESSURE MUST BE AS SPECIFIED ON THE UNIT RATING PLATE. ONLY MINOR ADJUSTMENTS SHOULD BE MADE BY ADJUSTING THE GAS VALVE PRESSURE REGULATOR.

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:
White-Rodgers 36J54 valve: Back outlet pressure test screw (inlet/outlet pressure tap) out one turn (counter-clockwise, not more than one turn).
4. Attach a hose and manometer to the outlet pressure tap (White-Rodgers valve).
5. Turn ON the gas supply.

SERVICING

6. Turn on power and close thermostat "R" and "W1" contacts to provide a call for low stage heat.
7. Measure the gas manifold pressure with burners firing. Adjust manifold pressure using the *Manifold Gas Pressure* table shown below.
8. Remove regulator cover screw from the low (LO) outlet pressure regulator adjust tower and turn screw clockwise to increase pressure or counterclockwise to decrease pressure. Replace regulator cover screw.
9. Close thermostat "R", "W1" and "W2" contacts to provide a call for high stage heat.
10. Remove regulator cover screw from the high (HI) outlet pressure regulator adjust tower and turn screw clockwise to increase pressure or counterclockwise to decrease pressure. Replace regulator cover screw.
11. Turn off all electrical power and gas supply to the system.
12. Remove the manometer hose from the hose barb fitting or outlet pressure tap.
13. Replace outlet pressure tap:

White-Rodgers 36J54 valve: Turn outlet pressure test screw in to seal pressure port (clockwise, 7 in-lb minimum).
14. Turn on electrical power and gas supply to the system.
15. Close thermostat contacts "R" and "W1/W2" to energize the valve.

Manifold Gas Pressure			
Gas		Range	Nominal
Natural	Low Stage	1.6 - 2.2" w.c.	1.9" w.c.
	High Stage	3.2 - 3.8" w.c.	3.5" w.c.
Propane	Low Stage	5.7 - 6.3" w.c.	6.0" w.c.
	High Stage	9.7 - 10.3" w.c.	10.0" w.c.

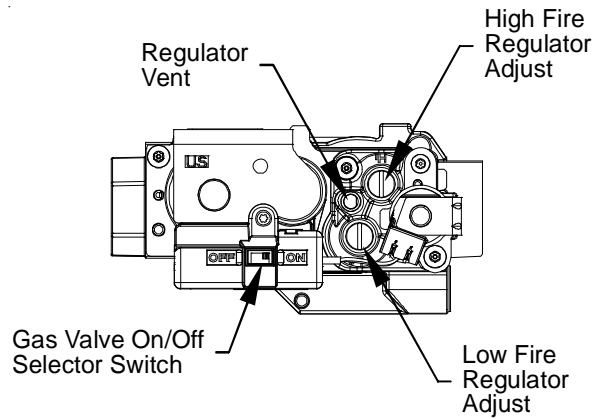
Using a leak detection solution or soap suds, check for leaks at outlet pressure tap plug (Honeywell valve) or screw (White-Rodgers valve). Bubbles forming indicate a leak. SHUT OFF GAS AND REPAIR ALL LEAKS IMMEDIATELY!

NOTE: For gas to gas conversion, consult your dealer for appropriate conversion.



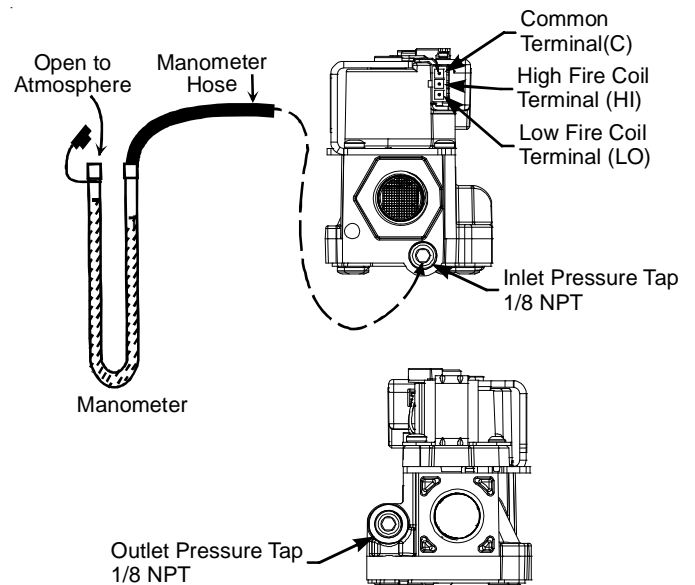
CAUTION

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.



Honeywell Model VR9205 (Two-Stage)

Measuring Gas Pressure: Two-Stage Valves Cont'd




Honeywell Model VR9205 Connected to Manometer

1. Remove regulator cover screw from the low (LO) outlet pressure regulator adjust tower and turn screw clockwise to increase pressure or counterclockwise to decrease pressure. Replace regulator cover screw.
 - a. Close thermostat "R" and "W" contacts to provide a call for heat.
 - b. Remove regulator cover screw from the high (HI) outlet pressure regulator adjust tower and turn screw clockwise to increase pressure or counterclockwise to decrease pressure. Replace regulator cover screw.
 - c. Turn off all electrical power and gas supply to the system.
 - d. Remove the manometer hose from the outlet pressure boss.

SERVICING


- e. 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.

 **WARNING**


HIGH VOLTAGE
DISCONNECT **ALL** ELECTRICAL POWER AND SHUT OFF GAS SUPPLY BEFORE SERVICING OR INSTALLING.


2. Turn on gas to furnace and check for leaks. If leaks are found, repair and then reinstall burner compartment door.
3. Turn on electrical power and verify proper unit operation. Make sure furnace operates at the proper manifold pressure at both high and low stage outputs.

Manifold Gas Pressure			
Gas	Rate	Range	Nominal
Natural Gas	High Stage	3.2 to 3.8" w.c.	3.5" w.c.
	Low Stage	1.6 to 2.2" w.c.	1.9" w.c.

 **WARNING**

HIGH VOLTAGE
DISCONNECT **ALL** ELECTRICAL POWER AND SHUT OFF GAS SUPPLY BEFORE SERVICING OR INSTALLING THIS UNIT.
MULTIPLE POWER SOURCES MAY BE PRESENT. FAILURE TO DO SO MAY CAUSE PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.



 **WARNING**

HIGH VOLTAGE
DISCONNECT **ALL** ELECTRICAL POWER AND SHUT OFF GAS SUPPLY BEFORE SERVICING OR INSTALLING.

Manifold Gas Pressure			
Gas	Rate	Range	Nominal
Propane Gas	High Stage	9.7 to 10.3" w.c.	10.0" w.c.
	Low Stage	5.7 to 6.3" w.c.	6.0" w.c.

S-308 CHECKING HOT SURFACE IGNITOR

120V Silicon Nitride Igniter - *MEC96 furnaces use a 120V silicon nitride igniter for ignition. The normal operating temperature is approximately 2156°F - 2678°F. At room temperature the igniter ohm reading should be from 37-68 ohms.

7. Place unit in heating cycle, measure current draw of ignitor during preheat cycle.

The steady state current at 120V is 0.37 to 0.68 amps.

8. After checking and/or replacing of hot surface ignitor, re-install burner compartment door and verify proper unit operation.

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 SWITCH

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. In addition to the inducer pressure switch, this furnace has a "front cover pressure switch" wired in series with the gas valve. This pressure switch keeps the gas valve from opening in the event of condensate backing up in the secondary heat exchanger. This could occur from improperly connected drains or a plugged drain tube.

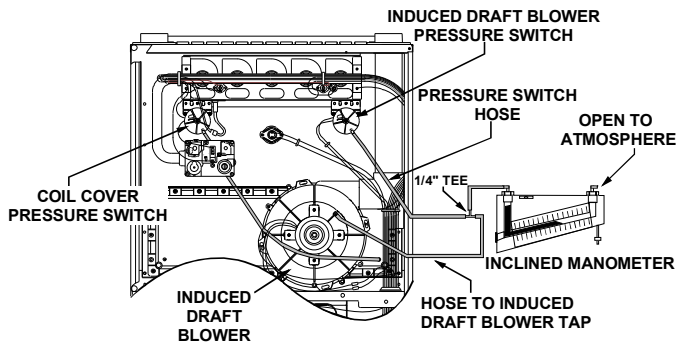
 **WARNING**

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. Remove the pressure control hose from the control and interconnect with an inclined manometer as shown in the following figures.
4. With an ohm meter connected across the pressure switch terminals; with the inducer running the switch should close and the ohm meter should show a complete circuit across the pressure switch. If the switch is not closed, compare the negative pressure to the closing point specified for the particular switch. Either the switch is defective or the inducer / venting system is inadequate.

SERVICING



**Blower Pressure Switch
Negative Pressure Measurement**

S-311 HIGH ALTITUDE APPLICATION (USA)

The furnace as shipped requires no change to run between 0 - 7500 feet. Do not attempt to increase the firing rate by changing orifices or increasing the manifold pressure below 7500 feet. This can cause poor combustion and equipment failure. High altitude installations above 7500 feet may require both a pressure switch and an orifice change. These changes are necessary to compensate for the natural reduction in the density of both the gas and the combustion air at higher altitude.

For installations above 7500 feet, please refer to your distributor for required kit(s). Contact the distributor for a tabular listing of appropriate manufacturer's kits for propane gas and/or high altitude installations. 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.

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 on the BTU/ft³ 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.

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.

Furnace design makes this extremely unlikely unless safety controls have been by-passed or tampered with. Never by-pass or alter furnace controls.

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 2 ohms.

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

WARNING

LINE VOLTAGE NOW PRESENT

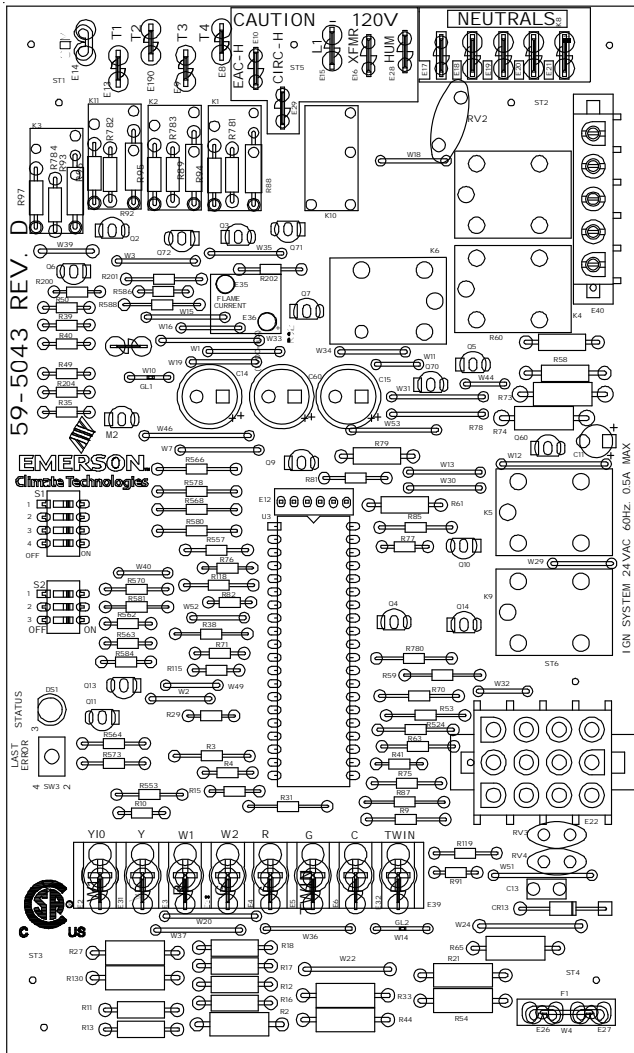
These tests must be completed within a given time frame due to the operation of the ignition control.

The ignition control is capable of diagnosing many furnace failures to help in troubleshooting. The trial for ignition period is 4 seconds.

Goodman® Brand and Amana® Brand Two-Stage (*MEC96)

1. Check for 120 volts from Line 1 (Hot) to Line 2 (Neutral) at the ignition control. No voltage, check the door switch connections and wire harness for continuity.
2. Check for 24 volts from W to C terminal on the ignition control. No voltage. Check transformer, room thermostat, and wiring.
If you have 24 volts coming off the transformer but receive approximately 13 volts on the terminal board between (C) and (R), check for blown fuse.
3. Check 120 volt outputs on the 5 pin harness.
Pin 1 = HSI Hot
Pin 2 = Inducer High
Pin 3 = Inducer Low
Pin 4 = Inducer N
Pin 5 = HSI N

SERVICING



PCBBF133 Control Board

4. After the ignitor warmup time, begin checking for 24 volts to the gas valve. Voltage will be present for four seconds only if proof of flame has been established.
5. If proof of flame was established voltage will be provided to the air circulation blower following the heat on delay period.

S-314 CHECKING FLAME SENSOR

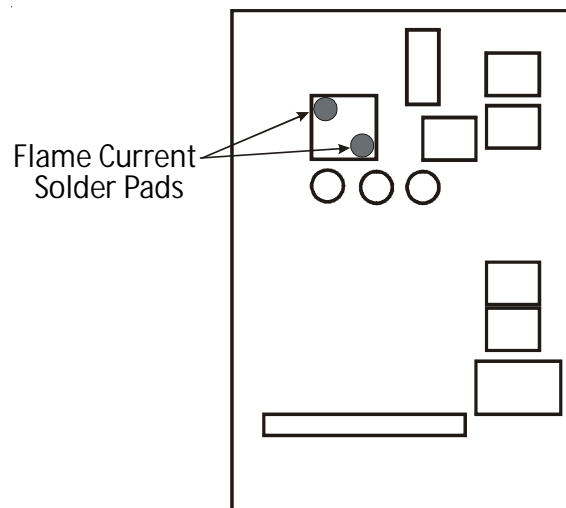
A flame sensing device is used in conjunction with the ignition control module to prove combustion. If proof of flame is not present the control will de-energize the gas valve and "retry" for ignition or lockout.

! 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 current can be measured in two ways:

1. Putting a D.C. microamp meter in series with the flame rod
 2. Putting a D.C. volt meter across the two solder pads in the flame current section of the control board.
- 1 D.C. volt = 1 microamp.





! WARNING



LINE VOLTAGE NOW PRESENT


3. As soon as flame is established a micro-amp reading should be evident once proof of flame (micro-amp reading) is established, the hot surface ignitor will be de-energized.
4. The Integrated Ignition controls will have 1 to 4 micro-amps. If the micro-amp reading is less than the minimum specified, check for high resistance wiring connections, sensor to burner gap, dirty flame sensor, or poor grounding.
5. If absolutely no reading, check for continuity on all components and if good - replace ignition control module.

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.

MAINTENANCE

 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.	

 WARNING	
HIGH VOLTAGE DISCONNECT ALL POWER BEFORE SERVICING, REMOVING THE FILTER OR PREFORING ANY OTHER MAINTENEACE. MULTIPLE POWER SOURCES MAY BE PRESENT. FAILURE TO DO SO MAY CAUSE PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.	

 CAUTION
IF YOU MUST HANDLE THE ITNITOR, HANDLE WITH CARE. TOUCHING THE IGNITOR BODY WITH BARE FINGERS, ROUGH HANDLING, OR VIBRATION COULD RESULT IN EARLY IGNITOR FAILURE. ONLY A QUALIFIED SERVICER SHOULD EVER HANDLE THE IGNITOR.

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. It is the owner's responsibility to keep air filters clean. When replacing a filter, it must be replaced with a filter of the same type and size.

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.
- Combustion air intake pipe system (where applicable). Check for blockage and/or leakage. Check the outside termination and the connection at the furnace.
- Heat exchanger. Check for corrosion and/or buildup within the heat exchanger passageways.
- Burners. Check for proper ignition, burner flame, and flame sense.
- 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.

Filter Removal

Depending on the installation, differing filter arrangements can be applied. Filters can be installed in the central return register, the bottom of the blower compartment (upflow only). A media air filter or electronic air cleaner can be used as an alternate filter. The filter sizes given in the *Product Design* section of this manual or the product *Specification Sheet* must be followed to ensure proper unit performance. Refer to the following information for removal and installation of filters.

FILTER REMOVAL PROCEDURE

Media Air Filter or Electronic Air Cleaner Removal

Follow the manufacturer's directions for service.

Horizontal Unit Filter Removal

Filters in horizontal installations are located in the central return register.

INDUCED DRAFT AND CIRCULATION BLOWERS

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

AIR FILTER

 WARNING
NEVER OPERATE FURNACE WIHTOUT A FILTER INSTALLED AS DUST AND LINT WILL BUILD UP ON INTERNAL PARTS RESULTING IN LOSS OF EFFICIENCY, EQUIPMENT DAMAMGE, AND POSSIBLE FIRE.

Filters must be used with this furnace. Filters do not ship with these furnaces but must be provided by the installer for proper furnace operation.

Remember that dirty filters are the most common cause of inadequate heating or cooling performance.

MAINTENANCE


CONDENSATE DRAINAGE SYSTEM (QUALIFIED SERVICER ONLY)

The drain tubes, standpipe, and field supplied drain line must be checked annually and cleaned as often as necessary to ensure proper condensate drainage.


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 sensing signal. If this occurs, a qualified servicer must carefully clean the flame sensor with steel wool. After cleaning, the flame sensor output should be as listed on the specification sheet.

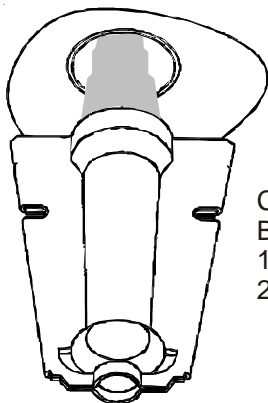
BURNERS

 **WARNING**

HIGH VOLTAGE
ELECTRICAL COMPONENTS ARE CONTAINED IN BOTH COMPARTMENTS. TO AVOID ELECTRICAL SHOCK, INJURY OR DEATH, DO NOT REMOVE ANY INTERNAL COMPARTMENT COVERS OR ATTEMPT ANY ADJUSTMENT. CONTACT A QUALIFIED SERVICE AGENT AT ONCE IF AN ABNORMAL FLAME APPEARANCE SHOULD DEVELOP.



Periodically during the heating season make a visual check of the burner flames. Turn the furnace on at the thermostat. Wait a few minutes since any dislodged dust will alter the normal flame appearance. Flames should be stable, quiet, soft and blue with slightly orange tips. They should not be yellow. They should extend directly outward from the burner ports without curling downward, floating or lifting off the ports.



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

Burner Flame

TEST EQUIPMENT

Proper test equipment for accurate diagnosis is as essential as regular hand tools.

The following is a must for every service technician and service shop.

1. Dial type thermometers or thermocouple meter (optional) - to measure dry bulb temperature.
2. Amprobe - to measure amperage and voltage.

3. Volt-Ohm Meter - testing continuity, capacitors, and motor windings.
4. Inclined Manometer - to measure static pressure, pressure drop across coils, filters, and draft.
5. Water Manometer (12") - to test gas inlet and manifold pressure.

Other recording type instruments can be essential in solving abnormal problems, however, in many instances they may be rented from local sources.

Proper equipment promotes faster, more efficient service and accurate repairs resulting in fewer call backs.

HEATING PERFORMANCE TEST

Before attempting to diagnose an operating fault, run a heating performance test and apply the results to the *Service Problem Analysis Guide*.

To conduct a heating performance test, the BTU input to the furnace must be calculated.

After the heating cycle has been in operation for at least fifteen minutes and with all other gas appliances turned off, the gas meter should be clocked.

To find the BTU input, multiply the number of cubic feet of gas consumed per hour by the heating value of the gas being used. (The calorific value of the gas being used is found by contacting your local utility.)

EXAMPLE: It is found by the gas meter, that it takes forty (40) seconds for the hand on the cubic foot dial to make one complete revolution, with all appliances off, except the furnace. Take this information and locate it on the gas rate chart. Observe the forty (40) seconds, locate and read across to the one (1) cubic foot dial column. There we find the number 90, which shows that ninety (90) cubic feet of gas will be consumed in one (1) hour.

Let's assume the local gas utility has stated that the calorific value of the gas is 1,025 BTU per cubic foot.

Multiplying the ninety (90) cubic feet by 1,025 BTU per cubic foot gives us an input of 92,250 BTUH.

Checking the BTU input on the rating plate of the furnace being tested.

EXAMPLE:

INPUT: 92,000 BTU/HR

OUTPUT CAP: 84,000

Should the figure you calculated not fall within five (5) percent of the nameplate rating of the unit, adjust the gas valve pressure regulator or resize orifices.