

INSTALLATION INSTRUCTIONS

Two-Stage, Direct Vent (Sealed Combustion) Forced Air

For Installation in:

- Manufactured Homes
- Modular Homes / Buildings
- Park Models, & Manufactured Buildings



⚠ CAUTION

HUD Manufactured Home Construction and Safety Standards (3280.714) prohibit the use of noncertified air conditioning or heat pump equipment with this furnace. It is strongly recommended that manufactured housing air conditioning components from Nortek Global HVAC be selected to provide a matched system specifically designed to meet these requirements.

The cutting, splicing or modifying of any internal electrical wiring may void product warranties and create a hazardous condition. Failure to comply with these standards could also provide inadequate heating or cooling performance and cause structural damage to a manufactured home.

Please contact your local distributor for help. A directory of Nortek Global HVAC factory authorized servicers is located in the furnace homeowner packet.

Reference: HUD Manufactured Home Construction and Safety Standards 3280.714.

⚠ WARNING

FIRE OR EXPLOSION HAZARD

- Failure to follow safety warnings exactly could result in serious injury or property damage.
- Installation and service must be performed by a qualified installer, service agency or the gas supplier.
- 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.
- Leave the building immediately.
- Immediately call your gas supplier from a neighbors phone. Follow the gas suppliers instructions.
- If you cannot reach your gas supplier, call the fire department.

⚠ AVERTISSEMENT

RISQUE D'INCENDIE OU D'EXPLOSION

- Le non-respect des avertissements de sécurité pourrait entraîner des blessures graves ou des dommages matériels.
- L'installation et l'entretien doivent être effectués par un installateur qualifié, un organisme de service ou le fournisseur de gaz.
- Ne pas entreposer ni utiliser de l'essence ni d'autres vapeurs ou liquides inflammables dans le voisinage de cet appareil, ni de tout autre appareil.

QUE FAIRE S'IL Y A UNE ODEUR DE GAZ

- Ne tenter d'allumer aucun appareil.
- Ne toucher à aucun interrupteur électrique; n'utiliser aucun téléphone dans le bâtiment.
- Évacuer l'immeuble immédiatement.
- Appeler immédiatement le fournisseur de gaz en employant le téléphone d'un voisin. Respecter les instructions du fournisseur de gaz.
- Si personne ne répond, appeler le service des incendies.

**DO NOT DESTROY. PLEASE READ CAREFULLY & KEEP IN A SAFE PLACE FOR FUTURE REFERENCE.
NE PAS DÉTRUIRE. VEUILLEZ LIRE ATTENTIVEMENT ET CONSERVER EN UN LIEU SÛR POUR RÉFÉRENCE ULTÉRIEURE.**

TABLE OF CONTENTS

IMPORTANT SAFETY INFORMATION.....	3	START-UP & ADJUSTMENTS.....	23
GENERAL INFORMATION.....	4	Pre-Start Check List	23
Requirements & Codes	4	Start-up Procedures	23
Clearances to Combustible Materials.....	5	Verifying & Adjusting Input Rate.....	23
Combustion Air Quality.....	5	Verifying & Adjusting Temperature Rise.....	24
Heating Load	5	Verifying Burner Operation.....	24
COMBUSTION AIR & VENTING REQUIREMENTS .	6	Verifying Operation of the Supply Air Limit Switch .	25
Important Information	7	OPERATING SEQUENCE	25
Category IV Appliances	7	Heating Cycle	25
Direct Vent Installation.....	7	Cooling Cycle	25
Vent Pipe Length & Diameter.....	7	Fan Mode	26
Vent Pipe Material.....	8	MAINTENANCE	26
Vent Pipe Installation	8	TROUBLESHOOTING.....	27
Outdoor Terminations - Horizontal Venting	8	FURNACE COMPONENTS	28
Outdoor Terminations - Vertical Venting	9	FIGURES & TABLES.....	29
Vent Freezing Protection.....	10	Figure 23. BW Series Dimensions	29
Existing Installations.....	10	Figure 24. BWT Series	
Ventilaire III or IV Air Quality Package	10	(w/ Top Return Air) Dimensions.....	30
CIRCULATING AIR REQUIREMENTS.....	11	Airflow Data	31
Plenums & Air Ducts.....	11	Table 6. Blower Performance - Front Return	31
Supply Air Connections	11	Table 7. Blower Performance - Top Return	32
Return Air Connections	11	Electrical Diagrams & Data.....	33
Closet & Alcove Installations	11	Table 8. Wire Length & Voltage Specifications .	33
Furnace Filter	12	Figure 25. Line Voltage Field Wiring	33
Dampers	12	Figure 26. MG2S Motor Control Board	33
FURNACE INSTALLATION.....	14	Figure 27. Two-Stage Furnace Control Board ..	33
About The Furnace.....	14	Figure 28. MG2S Wiring Diagram	34
Before You Install this Furnace	14	Gas Information	35
Locating the Unit.....	14	Table 9. Gas Flow Rates.....	35
Locating & Cutting Floor Openings	15	Table 10. Gas Pipe Capacities.....	35
Locating & Cutting Ceiling Openings	15	Table 11. Liquid Propane Conversion Chart.....	36
Installing Finger Tabbed Duct Connectors	15	Table 12. Natural Gas Heating Values.....	36
Narrow Duct Attachment - Option 1	16	Table 13. Orifices for Natural	
Narrow Duct Attachment - Option 2	16	Gas High Heating Value	36
Installing Screw-Down Duct Connectors	16	Table 14. High Altitude Deration Chart	
Round Duct Connector Installation.....	16	for Natural Gas - Low heating Value ...	36
Installing the Furnace	17	Venting Information	37
Condensate Drainage.....	17	Table 15. Vent Termination Clearances.....	37
GAS SUPPLY & PIPING.....	18	Figure 29. Horizontal / Vertical Venting &	
Leak Check.....	19	Clearances from Soffit.....	38
High Altitude Application.....	20	INSTALLATION CHECKLIST.....	40
Converting to LP/Propane Gas at Altitudes			
between 0 & 10,000 FT.	20		
ELECTRICAL WIRING	21		
Line Voltage Wiring	21		
Grounding.....	22		
Thermostat / Low Voltage Connections.....	22		
Single Stage AC & Single Stage Thermostat....	22		
Single Stage AC & Two Stage Thermostat	22		
Autostaging for Single Stage Thermostats	22		
Autostaging for Two-Stage Thermostats	22		
Fixed Speed Blower Applications.....	23		

IMPORTANT SAFETY INFORMATION

INSTALLER: Please read all instructions before servicing this equipment. Pay attention to all safety warnings and any other special notes highlighted in the manual. Safety markings are used frequently throughout this manual to designate a degree or level of seriousness and should not be ignored.

WARNING indicates a potentially hazardous situation that if not avoided, could result in personal injury or death.

CAUTION indicates a potentially hazardous situation that if not avoided, may result in minor or moderate injury or property damage.

- To minimize equipment failure or personal injury, it is essential that only qualified individuals install, service, or maintain this equipment. If you do not possess mechanical skills or tools, call your local dealer for assistance.
- Follow all precautions in the literature, on tags, and on labels provided with the equipment. Read and thoroughly understand the instructions provided with the equipment prior to performing the installation and operational checkout of the equipment.
- Use caution when handling this appliance or removing components. Personal injury can occur from sharp metal edges present in all sheet metal constructed equipment.
- Do not store any of the following on, or in contact with, the unit: Rags, brooms, vacuum cleaners, or other cleaning tools, spray or aerosol cans, soap powders, bleaches, waxes, cleaning compounds, plastics or plastic containers, paper bags or other paper products, gasoline, kerosene, cigarette lighter fluid, dry cleaning fluids, paint thinners, or other volatile fluids.
- Installation of equipment may require brazing operations. Installer must comply with safety codes and wear appropriate safety equipment (safety glasses, work gloves, fire extinguisher, etc.) when performing brazing operations.
- The installer should become familiar with the units wiring diagram before making any electrical connections to the unit. See the unit wiring label or [Figure 28 \(page 34\)](#).
- Always reinstall the doors on the indoor blower after servicing or cleaning/changing the filters. Do not operate the indoor blower without all doors and covers in place.

WARNING:

The safety information listed in this manual must be followed during the installation, service, and operation of this unit. Unqualified individuals should not attempt to interpret these instructions or install this equipment. Failure to follow safety recommendations could result in possible damage to the equipment, serious personal injury or death.

WARNING:

ELECTRICAL SHOCK, FIRE OR EXPLOSION HAZARD

Failure to follow safety warnings exactly could result in serious injury or property damage.

Improper servicing could result in dangerous operation, serious injury, death or property damage.

- **Before servicing, disconnect all electrical power to furnace.**
- **When servicing controls, label all wires prior to disconnecting. Reconnect wires correctly.**
- **Verify proper operation after servicing.**

WARNING:

FIRE OR EXPLOSION HAZARD

Failure to follow safety warnings exactly could result in serious injury or property damage.

Installation and service must be performed by a qualified installer, service agency or the gas supplier.

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.**
- **Leave the building immediately.**
- **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.**

WARNING:

Improper installation, service, adjustment, or maintenance may cause explosion, fire, electrical shock or other hazardous conditions which may result in personal injury or property damage. Unless otherwise noted in these instructions, only factory authorized kits or accessories may be used with this product.

GENERAL INFORMATION

Requirements & Codes

WARNING:

This unit must be installed in accordance with instructions outlined in this manual during the installation, service, and operation of this unit. Unqualified individuals should not attempt to interpret these instructions or install this equipment. Failure to follow safety recommendations could result in possible damage to the equipment, serious personal injury or death..

- The installer must comply with all local codes and regulations which govern the installation of this type of equipment. Local codes and regulations take precedence over any recommendations contained in these instructions. Consult local building codes and the National Electrical Code (NFPA 70) for special installation requirements.
 - All electrical wiring must be completed in accordance with local, state and national codes and regulations and with the National Electric Code (NFPA 70) or in Canada the Canadian Electric Code Part 1 CSA C.22.1.
 - This furnace must be installed in accordance with these instructions, all applicable local building codes and the current revision of the National Fuel Gas Code (NFPA54/ANSI Z223.1) or the Natural Gas and Propane Installation Code, CAN/CGA B149.1.
 - Use only with type of gas approved for this furnace. Refer to the furnace rating plate.
 - Install this furnace only in a location and position as specified on [page 5](#).
 - Provide adequate combustion and ventilation air to the furnace space as specified on [page 6](#).
 - Provide adequate clearances around the vent air intake terminal as specified in [Figure 1 \(page 9\)](#), [Figure 2 \(page 9\)](#), [Figure 3 \(page 9\)](#) & [Figure 4 \(page 9\)](#).
 - Combustion products must be discharged outdoors. Connect this furnace to an approved vent system only, as specified on [page 7](#), [page 8](#), [page 9](#), & [page 10](#).
 - Never test for gas leaks with an open flame. Use a commercially available soap solution to check all connections. See [page 19](#).
 - This furnace is designed to operate with a maximum external pressure rise of 0.3 inches of water column. Consult [Table 7, \(page 32\)](#) and the rating plate for the proper circulating air flow and temperature rise. It is important that the duct system be designed to provide the correct flow rates and external pressure rise. An improperly designed duct system can result in nuisance shutdowns, and comfort or noise issues.
 - This furnace must not be used for temporary heating of buildings or structures under construction.
- The Commonwealth of Massachusetts requires compliance with regulation 248 CMR 4.00 and 5.00 for installation of through-the-wall vented gas appliances as follows:
 1. For direct-vent appliances, mechanical-vent heating appliances or domestic hot water equipment, where the bottom of the vent terminal and the air intake is installed below four feet above grade the following requirements must be satisfied:
 - a.) A carbon monoxide (CO) detector and alarm shall be placed on each floor level where there are bedrooms. The detector shall comply with NFPA 720 (2005 Edition) and be mounted in the living area outside the bedroom(s).
 - b.) A (CO) detector shall be located in the room that houses the appliance or equipment and shall:
 - Be powered by the same electrical circuit as the appliance or equipment. Only one service switch shall power the appliance and the (CO) detector;
 - Have battery back-up power;
 - Meet ANSI/UL 2034 Standards and comply with NFPA 720 (2005 Edition); and Approved and listed by a Nationally Recognized Testing Laboratory as recognized under 527 CMR.
 - c.) A Product-approved vent terminal must be used, and if applicable, a product-approved air intake must be used. Installation shall be in strict compliance with the manufacturer's instructions. A copy of the installation instructions shall remain with the appliance or equipment at the completion of the installation.
 - d.) A metal or plastic identification plate shall be mounted at the exterior of the building, 4 feet directly above the location of vent terminal. The plate shall be of sufficient size, easily read from a distance of eight feet away, and read "Gas Vent Directly Below".
 2. For direct-vent appliances, mechanical vent heating appliances or domestic hot water equipment where the bottom of the vent terminal and the air intake is installed above four feet above grade the following requirements must be satisfied:
 - a.) A (CO) detector and alarm shall be placed on each floor level where there are bedrooms. The detector shall comply with NFPA 720 (2005 Edition) and be mounted in the living area outside the bedroom(s).
 - b.) The (CO) detector shall:
 - Be located in the room that houses the appliance or equipment;
 - Be hard-wired, battery powered or both.
 - Shall comply with NFPA 720 (2005 Edition).
 - c.) A product-approved vent terminal must be used, and if applicable, a product-approved air intake must be used. Installation shall be in strict compliance with the manufacturer's instructions. A copy of the installation instructions shall remain with the appliance or equipment at the completion of the installation.

Clearances to Combustible Materials

This furnace is Design Certified in the U.S. and Canada for the minimum clearances to combustible materials. **NOTE:** The furnace is listed for installation on combustible or non-combustible flooring. However, wood is the only combustible flooring allowed for installation. To obtain furnace base model number and specific clearance information, refer to the furnace rating plate, located inside of the furnace cabinet.

Access for positioning and servicing the unit must be considered when locating unit. The need to provide clearance for access to panels or doors may require clearance distances over and above the requirements. **Allow 18 inches minimum clearance from the front of the unit. However 36 inches is strongly recommended.** See [Table 1](#) for minimum clearance requirements.

INSTALLATION CLEARANCES		
	CLOSET	ALCOVE
Front *	1"	1"
Rear	0"	0"
Sides	0"	0"
Top	6"	6"
Duct w/in 3ft of furnace	1/4"	1/4"
Vent	0"	0"
Plenum Without Coil Box	1"	1"
Plenum With Coil Box	0"	0"
<p>NOTES:</p> <p><u>Alcove Installations</u> - Allow 18 in. minimum clearance from front of unit to nearest wall or partition for servicing.</p> <p><u>Closet installations</u> - Require a return air grill installed in the door or a partially louvered door across the opening for proper air circulation. For clearances 6" or greater, the closet must have an open free area of 235 in² minimum. For special clearances between 1" & 6", requirements are a louvered door with a minimum of 250 in² (1613 cm²) free area. For 1" clearance from furnace, use a fully louvered door with at least 400 in² of free airflow area. A fully louvered closet door is strongly recommended for all installation types.</p>		

Table 1. Minimum Clearance Requirements

The ductwork should be appropriately sized to the capacity of the furnace to ensure its proper airflow rating. For installations above 2,000 ft., the furnace should have a sea level input rating large enough that it will meet the heating load after deration for altitude.

Combustion Air Quality

⚠ CAUTION:

Combustion air must not be drawn from a corrosive atmosphere.

To maximize heat exchanger life, the combustion air must be free of chemicals that can form corrosive acidic compounds in the combustion gases. The required source of combustion air is to use outdoor air.

If outside air is used as return air to the furnace for ventilation or to improve indoor air quality, the system must be designed so that the return air is not less than 60° F (15° C) during operation. If a combination of indoor and outdoor air is used, the ducts and damper system must be designed so that the return air supply to the furnace is equal to the return air supply under normal, indoor return air applications.

Exposure to the following substances in the combustion air supply will result in safety and performance related problems. The list below contains examples of chemical containments found in a wide variety of common commercial household products:

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

Heating Load

This furnace should be sized to provide the design heating load requirement. Heating load estimates can be made using approved methods available from Air Conditioning Contractors of America (Manual J); American Society of Heating, Refrigerating, and Air Conditioning Engineers; or other approved engineering methods. **Excessive oversizing of the furnace could cause the furnace and/or vent to fail prematurely.**

COMBUSTION AIR & VENTING REQUIREMENTS

WARNING:

CARBON MONOXIDE POISONING HAZARD
Failure to follow the steps outlined below for each appliance connected to the venting system being placed into operation could result in carbon monoxide poisoning or death. The following steps shall be followed with each individual appliance connected to the venting system being placed in operation, while all other appliances connected to the venting system are not in operation:

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

AVERTISSEMENT:

RISQUE D'EMPOISONNEMENT AU MONOXYDE DE CARBONE

Le non-respect des consignes suivantes portant sur chacun des appareils raccordés au système d'évacuation mis en service pourrait entraîner l'empoisonnement au monoxyde de carbone ou la mort. Les consignes suivantes doivent être observées pour chaque appareil raccordé au système d'évacuation mis en service si les autres appareils raccordés au système ne sont pas en service:

1. Sceller toute ouverture non utilisée de la système d'évacuation;
2. S'assurer que la système d'évacuation présente des dimensions et une pente horizontale conformes à la norme ANSI Z223.1/NFPA 54, intitulée National Fuel Gas Code ou aux codes d'installation CSA-B149.1, ainsi qu'aux présentes instructions. S'assurer que la système d'évacuation n'est pas bloquée, restreinte, corrodée, qu'elle ne fuit pas et qu'elle ne présente aucun autre défaut potentiellement dangereux;
3. Dans la mesure du possible, fermer toutes les portes et fenêtres du bâtiment, et toutes les portes entre la pièce où se trouve l'appareil raccordé à la système d'évacuation et les autres pièces du bâtiment.
4. Fermer les registres des foyers;
5. Mettre en service les sècheuses et tout autre appareil qui n'est pas raccordé à la système d'évacuation. Faire fonctionner à régime maximal tout ventilateur d'évacuation, tel que les hottes de cuisinière et les ventilateurs de salles de bains. Ne pas mettre en service les ventilateurs d'été.
6. Respecter les instructions d'allumage. Mettre en service l'appareil à l'essai. Régler le thermostat de manière à ce que l'appareil fonctionne sans interruption;
7. Vérifier s'il y a débordement à l'orifice d'évacuation du coupe tirage des appareils dotés d'un coupe tirage 5 minutes après l'allumage du brûleur principal. Utiliser la flamme d'une allumette ou d'une chandelle.
8. Si l'on constate, au cours de l'un des essais qui précèdent, que l'évacuation est déficiente, corriger le système d'évacuation conformément à la norm ANSI Z223.1/NFPA 54, National Fuel Gas Code, et (ou) aux codes d'installation CSA B149.1.
9. Après avoir déterminé que tous les appareils raccordés à la système d'évacuation évacuent correctement tel que prescrit ci-dessus, rouvrir les portes et les fenêtres et remettre les ventilateurs d'évacuation, les registres de foyers et tout autre appareil fonctionnant au gaz à leur état de fonctionnement initial.

Important Information

WARNING:

Furnace installation using methods other than those described in the following sections must comply with the National Fuel Gas Code (NFGC) and all applicable local codes.

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 of flue products, including carbon monoxide.

WARNING:

This furnace must not be vented with other appliances, even if that appliance is of the condensing type. This includes water heaters of any efficiency. Common venting can result in severe corrosion of other appliances or their venting and can allow combustion gases to escape through such appliances or vents. Do not vent the furnace to a fireplace chimney or building chase.

- This furnace must be vented in compliance with the current revision of the National Fuel Gas Code (ANSI-Z223.1/NFPA54). Instructions for determining the adequacy of combustion air for an installation can be found in the current revision of the NFGC (ANSI Z223.1 / NFPA54). **Consult local codes for special requirements.** These requirements are for US installations as found in the NFGC.
- The requirements in Canada (B149.1) are structured differently. In Canada, venting shall conform to the requirements of the current (CAN/CGA B149.1 or .2) installation codes. **Consult local codes for special requirements.**

Category IV Appliances

This furnace is classified as a Category IV appliance, which requires special venting materials and installation procedures. Category IV appliances operate with positive vent pressure and requires thoroughly sealed vent systems. They also produce liquid condensate, which is slightly acidic and can cause severe corrosion of ordinary venting materials. Furnace operation can be adversely affected by restrictive vent and combustion air piping.

Direct Vent Installation

This condensing furnace is certified for installation as a direct vent (2-pipe) appliance. Direct vent (2-pipe) furnaces draw combustion air directly from the outdoors and then vent the combustion products back outside, isolating the entire system from the indoor space. It is important to make sure that the whole system is sealed and clearances to combustibles are maintained regardless of the installation being in a confined or unconfined space. This section specifies installation requirements for direct vent (2-pipe) piping. [Table 2, \(page 8\)](#) contains the length of vent and combustion air piping for this type of installation.

Provisions must be made during the installation of this furnace that provide an adequate supply of fresh air for combustion and ventilation. The combustion air from the outside needs to be clear of chemicals that can cause corrosion. The inlet pipe should not be placed near corrosive chemicals such as those listed on [page 5](#).

Air openings on top of the furnace and openings in closet doors or walls must never be restricted. If the furnace is operated without adequate air for combustion, the flame roll-out switch will open, turning off the gas supply to the burners. **This safety device is a manually reset switch. DO NOT install jumper wires across these switches to defeat their function or reset a switch without identifying and correcting the fault condition.** If a switch must be replaced, use only the correct sized part specified in the Replacement Parts List provided online.

Vent Pipe Length & Diameter

For proper furnace operation, the combustion air and vent piping must not be excessively restrictive.

- The venting system should be designed to have the minimum number of elbows or turns.
- All horizontal runs must slope upwards from the furnace at 1/4 inch minimum per running foot of vent.
- Transition to the final vent diameter should be done as close to the furnace outlet as practical.
- Always use the same size or a larger pipe for combustion air that is used for the exhaust vent.

[Table 2, \(page 8\)](#) indicates the maximum allowable pipe length for a furnace of known input rate, when installed with piping of selected diameter and number of elbows. To use the table, the furnace input rate, the centerline length and the number of elbows on each pipe must be known.

When estimating the length of vent runs, consideration must be made to the effect of elbows and other fittings. This is conveniently handled using the idea of “equivalent length”. This means the fittings are assigned a linear length that accounts for the pressure drop they will cause. For example: a 3” diameter, long radius elbow is worth the equivalent of 3.5 feet of linear run.

The equivalent lengths of tees and various elbows are listed in [Table 2](#). Measure the linear length of your vent run and then add in the equivalent length of each fitting. The total length, including the equivalent fitting lengths, must be less than the maximum length specified in the table.

Condensing furnace combustion products have very little buoyancy, so [Table 2](#) is to be used without consideration of any vertical rise in the piping.

MAXIMUM DIRECT VENT, DUAL PIPE LENGTH (FT.)		
MG2S INPUTS (BTU)	INLET / OUTLET 2" DIAMETER	INLET / OUTLET 3" DIAMETER
45,000	30	60
60,000	30	60
72,000	30	60

†NOTES:

1. Subtract 2.5 ft. for each additional 2 inch long radius elbow, subtract 5ft for each additional 2" short radiious elbow, subtract 3.5 ft. for each additional 3 inch long radius elbow, and 7 ft. for each additional 3 inch short radius elbow.
2. Two 45 degree elbows are equivalent to one 90 degree elbow.
3. This table applies for elevations from sea level to 2,000 ft. For higher elevations, decrease pipe lengths by 8% per 1,000 ft of altitude.

Table 2. Vent Pipe Lengths

Vent Pipe Material

Vent and combustion air pipe and fittings must be one of the following materials in the list and must conform to the indicated ANSI/ASTM standards.

MATERIALS	STANDARDS
Schedule 40PVC	D1785
PVC-DWV	D2665
SDR-21 & SDR-26.....	D2241
ABS-DWV	D2661
Schedule 40 ABS	F628
Foam / Cellular Core PVC.....	F891
*PolyPro® by DuraVent	ULC-S636

When joining PVC to PVC, use cement that conforms to ASTM standard D2564. PVC primer must meet standard ASTM F656. When joining ABS to ABS, use cement that conforms to ASTM standard D2235. When joining PVC to ABS, use cement as specified in procedure from ASTM standard D3138.

In Canada, all plastic vent pipes and fittings including any cement, cleaners, or primers must be certified as a system to ULC S636. However this requirement does not apply to piping internal to the furnace.

Vent Pipe Installation

⚠ CAUTION:

Combustion air must not be drawn from a corrosive atmosphere.

This furnace has been certified for installation with zero clearance between vent piping and combustible surfaces. However, it is good practice to allow space for convenience in installation and service.

- In the absence of local codes, the location of any combustion air inlet relative to any vent terminal must be at least 8 inches. This includes installations involving more than one furnace.
- The quality of outdoor air must also be considered. Be sure that the combustion air intake is not located near a source of solvent fumes or other chemicals which can cause corrosion of the furnace combustion system. See [page 5](#) for a sample list of substances.

- Route piping as direct as possible between the furnace and the outdoors. Longer vent runs require larger diameters. Vent piping must be sloped upwards 1/4" per foot in the direction from the furnace to the terminal. This ensures that any condensate flows back to the condensate disposal system.
- The combustion air intake and the vent exhaust must be located in the same atmospheric pressure zone. This means both pipes must exit the building through the same portion of exterior wall or roof as shown in [Figure 1](#), [Figure 2](#), [Figure 4](#), and [Figure 29 \(page 38\)](#).
- Piping must be mechanically supported so that its weight does not bear on the furnace. Pipe supports must be installed a minimum of every five feet along the vent run to ensure no displacement after installation. Supports may be at shorter intervals if necessary to ensure that there are no sagging sections that can trap condensate. It is recommended to install couplings ([Figure 29](#)) along the vent pipe, on either side of the exterior wall. Couplings may be required by local code.
- If breakable connections are required in the combustion air inlet pipe (if present) and exhaust vent piping, then straight neoprene couplings with hose clamps can be used. These couplings can be ordered through your local furnace distributor. To install a coupling:

1. Slide the rubber coupling over the end of the pipe that is attached to the furnace and secure it with one of the hose clamps.
2. Slide the other end of the rubber coupling onto the other pipe from the vent.
3. Secure the coupling with the second hose clamp, ensuring that the connection is tight and leak free.

Outdoor Terminations - Horizontal Venting

- Vent and combustion air intake terminations shall be installed as shown in [Figure 1](#), [Figure 2](#), [Figure 3](#), and [Figure 4](#) in accordance with these instructions:
- Vent termination clearances must be consistent with the NFGC, ANSI 2223.1/NFPA 54 and/or the CSA B149.1, Natural Gas and Propane Installation Code. [Table 14, \(page 36\)](#) lists the necessary distances from the vent termination to windows and building air intakes.
- Vent and combustion air intake terminations must be located to ensure proper furnace operation and conformance to applicable codes. A vent terminal must be located at least 3 feet above any forced air inlet located within 10 feet. This does not apply to the combustion air inlet of a direct vent (two pipe) appliance. In Canada, CSA B149.1 takes precedence over these instructions. See [Table 15, \(page 37\)](#).
- All minimum clearances ([Figure 2 \(page 9\)](#)) must be maintained to protect building materials from degradation by flue gases.
- For optimal performance, vent the furnace through a wall that experiences the least exposure to winter winds.
- The vent termination shall be located at least 3 ft. horizontally from any electric meter, gas meter, regulator and any relief equipment. These distances apply ONLY to U.S. installations. In Canada, CSA B149.1 takes precedence over these instructions.

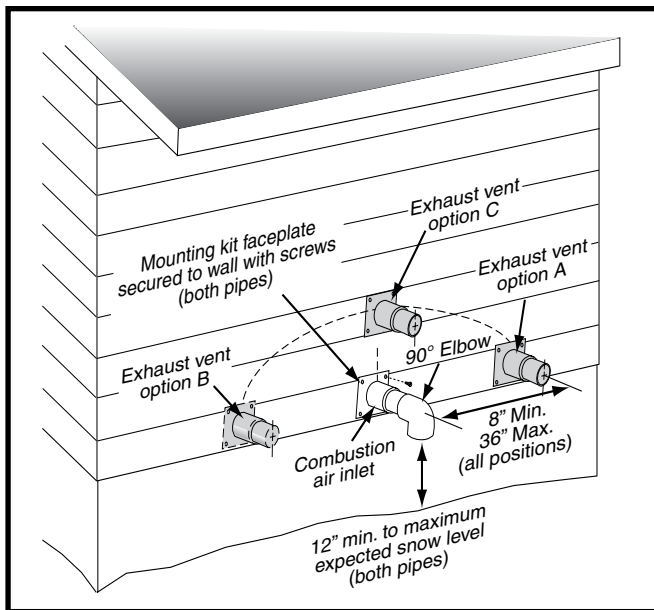


Figure 1. Inlet & Exhaust Pipe Clearances

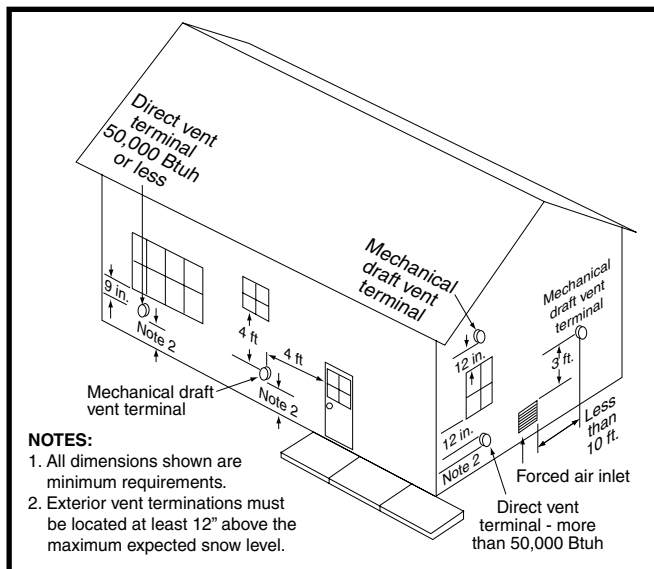


Figure 2. Vent Locations

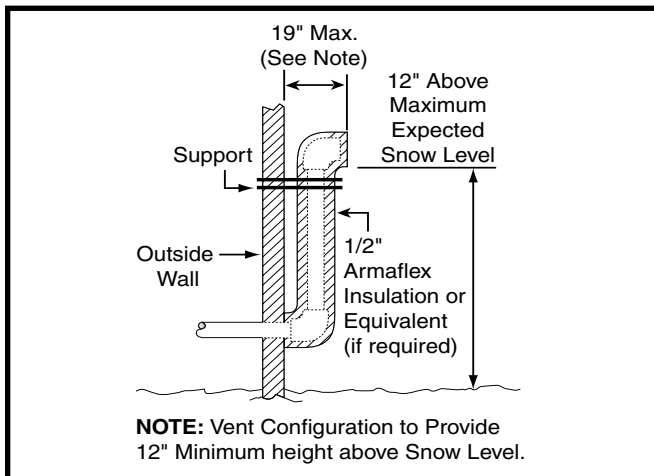


Figure 3. Alternate Horizontal Vent Installation

- Do not install the vent terminal such that exhaust is directed into window wells, stairwells, under decks or into alcoves or similar recessed areas, and do not terminate above any public walkways.
- If venting horizontally, side wall vent kits are available according to the pipe diameter size of the installation. Faceplate kits are also available for 3 inch horizontal venting. **Please follow the instructions provided with the kits.**
- Concentric vent kits are available for both 2" and 3" applications. Each size has one that meets UL 1738 and one that meets ULC S636. Refer to the technical sales literature for kit numbers.
- When the vent pipe must exit an exterior wall close to the grade or expected snow level where it is not possible to obtain clearances shown in Figure 1, a riser may be provided as shown in Figure 3. Insulation is required to prevent freezing of this section of pipe. See Table 3, (page 10) for vent freezing protection.

Outdoor Terminations - Vertical Venting

Termination spacing requirements from the roof and from each other are shown in Figure 4. The roof penetration must be properly flashed and waterproofed with a plumbing roof boot or equivalent flashing. Vent and combustion air piping may be installed in an existing chimney which is not in use provided that:

- Both the exhaust vent and air intake run the length of the chimney.
- The top of the chimney is sealed and weatherproofed.
- The termination clearances shown in Figure 4 are maintained.
- No other gas fired or fuel-burning equipment is vented through the chimney.

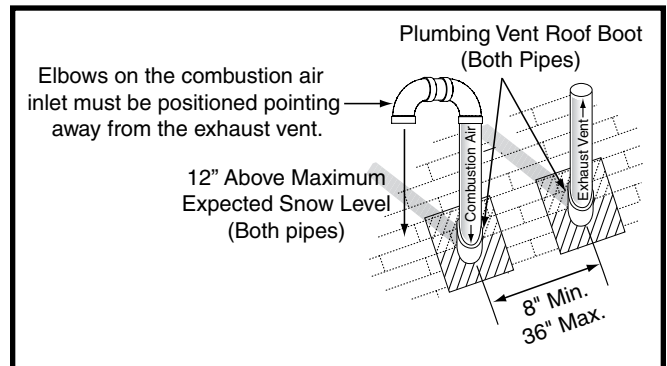


Figure 4. Vertical Vent Termination

Vent Freezing Protection

CAUTION:

When the vent pipe is exposed to temperatures below freezing (i.e., when it passes through unheated spaces, chimneys, etc.) the pipe must be insulated with 1/2 inch thick sponge rubber insulation, Armaflex-type insulation or equivalent. Insulating pipe is important to avoid condensate icing.

- Table 3 lists the maximum length of flue pipe that can travel through an unconditioned space or an exterior space. The total vent length must not exceed the lengths noted in the table. For Canadian installations, please refer to the Canadian Installation Code (CAN/CGA-B149.1 or 2) and/or local codes.
- For extremely cold climates or for conditions of short furnace cycles (i.e. set back thermostat conditions) the last 18 inches of vent pipe can be reduced. It is acceptable to reduce from 3" to 2-1/2" or, 3" to 2" if the total vent length is at least 15 feet in length, and the vent length is within the parameters specified in Table 2, (page 8). The restriction should be counted as 3 equivalent feet. Smaller vent pipes are less susceptible to freezing, but must not be excessively restrictive. .
- To prevent debris or creatures from entering the combustion system, a protective screen may be installed over the combustion air intake opening. The screens hole size must be large enough to prevent air restriction.

Winter Design Temperature	Maximum Flue Pipe Length (FEET) in Unconditioned & Exterior Spaces	
	Without Insulation	With Insulation*
20	45	60
0	20	60
-20	10	60

*NOTE: Insulation thickness greater than 3/8 inch, based on an R value of 3.5 (ft x F x hr) / (BTU x in.)

Table 3. Vent Protection

Existing Installations

When an existing furnace is removed from a vent system serving other appliances, the existing vent system may not be sized properly to vent the remaining appliances (example: water heater). An improperly sized venting system can result in the formation of condensate, leakage, or spillage. The existing vent system should be checked to make sure it is in compliance with NFGC and must be brought into compliance before installing the furnace.

NOTE: If replacing an existing furnace, it is possible you will encounter an existing plastic venting system that is subject to a Consumer Product Safety Commission recall. The pipes involved in the recall are High Temperature Plastic Vent (HTPV). **If your venting system contains these pipes DO NOT reuse this venting system!** This recall does not apply to other plastic vent pipes, such as white PVC or CPVC. Check for details on the CPSC website or call their toll-free number (800) 758-3688.

Ventilaire III or IV Air Quality Package

The Ventilaire air quality accessory packages are available to meet the ventilation requirements as outlined in H.U.D. Standard Part 3280.103 (b) (2). These packages introduce outdoor air into the living space during furnace blower operation. The VentilAire IV also serves to exhaust moist and/or hot air from the attic space. See Figure 5 for typical installation. Complete installation instructions are supplied with each air quality package.

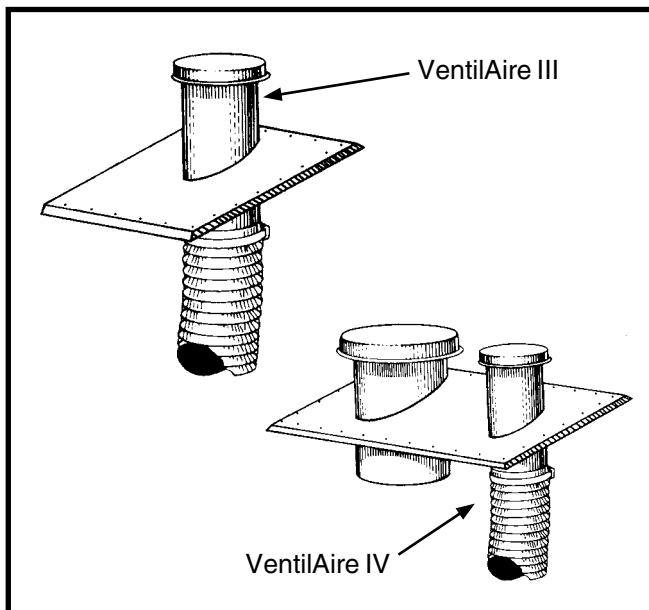


Figure 5. VentilAire III & IV

CIRCULATING AIR REQUIREMENTS

WARNING:

Do not allow combustion products to enter the circulating air supply. Failure to prevent the circulation of combustion products into the living space can create potentially hazardous conditions including carbon monoxide poisoning that could result in personal injury or death.

All supply ducts must be secured to the furnace with sheet metal screws and adequately sealed. When supply air is provided through the bottom of the unit, the joint between the furnace and the plenum must be air tight.

The surface that the furnace is mounted on must provide sound physical support of the furnace with no gaps, cracks or sagging between the furnace and the floor or platform.

Supply air ducts must not be connected to any other heat producing device such as a fireplace insert, stove, etc. This may result in fire, explosion, carbon monoxide poisoning, personal injury, or property damage.

Plenums & Air Ducts

This unit is designed only for use with a bottom supply duct and must be installed in accordance with the standards of the National Fire Protection Association Standard for Installation of Air Conditioning Systems (NFPA 90A), Standard for Installation of Residence Type Warm Air Heating and Air Conditioning Systems (NFPA 90B), and all applicable local codes. NFPA publications are available by writing to: National Fire Protection Association, Batterymarch Park, Quincy, ME 02269 or go to www.NFPA.org on the web.

- Design the air ducts according to methods described by the Air Conditioning Contractors of America (ACCA).
- Gas piping must not run in or through any of the air duct system.
- Air conditioning systems may require more duct register and open louver area to obtain necessary airflow.
- Noncombustible pans having one inch upturned flanges are located beneath openings in a floor return duct system.

Supply Air Connections

- For proper air distribution, the supply duct system must be designed so that the static pressure measured external to the furnace does not exceed the listed static pressure shown on the furnace rating plate. The supply air must be delivered to the heated space by duct(s) secured to the furnace casing, running full length and without interruption.
- Duct system must be designed so that no supply registers are located in duct system directly below the furnace.

Return Air Connections

- Front return furnaces are factory configured for the return air to flow through the front louvered door. The return air may also be attached to either side of the furnace cabinet using a field installed kit. The location and size of the side and top return air connections are shown in [Figure 23 \(page 29\)](#) & [Figure 24 \(page 30\)](#). The filter size for the side return air is 20" x 20" x 1".
- Top return furnaces are factory configured for the return air to enter the top of the furnace. See [Figure 24 \(page 30\)](#).
NOTE: For top return installations, an external or in-wall filter mount can be used. The factory installed filter should be removed and the return duct should be sized to provide adequate airflow.
- For floor return systems, the manufactured housing manufacturer or installer shall affix a prominent marking on or near the appliance where it is easily read when the closet door is open. The marking shall read:

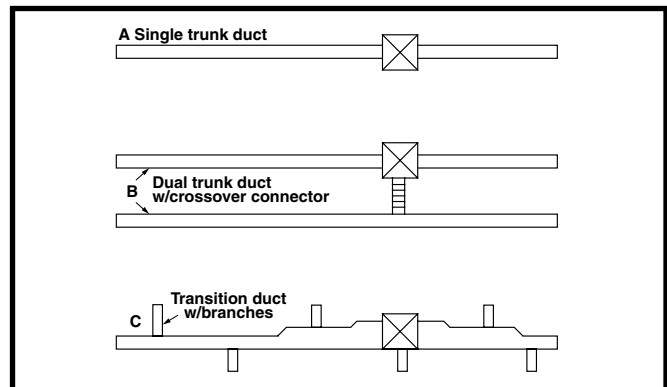


Figure 6. Typical Supply Duct Systems

CAUTION, HAZARD OF ASPHYXIATION. DO NOT COVER OR RESTRICT FLOOR RETURN AIR OPENING.

- Return air openings should not be located to draw air directly from a bathroom.
- Materials located in the return duct system shall have a flame spread classification of 200 or less.
- The total free area of the openings in the floor or the ceiling registers serving the return air duct system must not be not less than 352 in² (2,270 cm²).

Closet & Alcove Installations

WARNING:

Failure to comply with the the following instructions may result in fire, asphyxiation or carbon monoxide poisoning.

For proper air circulation, closet installations require a return air grill installed in the door or side wall that exchanges with the living area of the home. A partially louvered door may also be used across the opening. Grilles placed in a side wall require a 6" clearance from the wall to the furnace so that the air may enter the front grille of the furnace. All return air systems, including the floor and ceiling systems, must meet the following conditions:

- The return air opening, regardless of its location in the closet, must not be smaller than size specified on unit data label. If located in the floor, the opening must be provided with a means of preventing its inadvertent closure by flat object(s) placed over the opening.
- The cross-sectional area of the return duct system (in floor or ceiling) leading into the closet must not be less than 235 in² (1,516 cm²).

CAUTION:

HAZARD OF ASPHYXIATION: Negative pressure inside the closet, with closet door closed and the furnace blower operating on high speed, shall be no more negative than minus 0.05 inch water column.

- Test the negative pressure in the closet with the air-circulating fan operating at high speed and the closet closed. The negative pressure in the closet must not be less than minus 0.05 inches water column with the closet door closed and the fan operating at high speed. The negative pressure is to be no more negative than minus 0.05" water column as this indicates a dirty filter or a restricted return air system.
- For closet installation with less than 6" front clearance, but not less than 1", a louvered door must be used having a minimum 250 in² (1,613 cm²) free area opening directly in line with openings in the furnace door. For 1" clearance from furnace, use a fully louvered door with at least 400 in² (2,580 cm²) of free airflow area.

Furnace Filter

WARNING:

Never operate the furnace without a filter in place. Accumulating dust in the return air can build up on internal components, resulting in loss of efficiency, equipment damage, and possible fire.

- Front return furnaces are supplied with a single reusable air filter when shipped from the factory. Accessing the filter does not require tools and can be easily removed from the inside of the access door. The filter is secured to the door with a retaining bracket.
- Top return furnaces are shipped with a non-reusable single 18"x18"x1" air filter from the factory. Accessing the filter does not require tools and can be easily

removed from inside the blower compartment. The filter is secured with a U-shaped retaining bracket. It is recommended that the filter be cleaned or replaced monthly. Newly built or recently renovated homes may require more frequent changing until the construction dust has minimized.

1. Slide the standard 18"x18"x1" filter into the space between the combustion air pipe and the blower assembly. See [Figure 7 \(page 13\)](#). **NOTE:** Make sure the airflow arrows on the filter point towards the blower assembly.
 2. Push the filter to the rear of the furnace cabinet and angle it up over the blower. Make sure the filter is pushed back as far as possible.
 3. Position the filter retainer under the filter and insert the stepped ends into the 0.25 holes in the rear of the furnace. **NOTE:** The stepped ends should be facing upwards in the holes.
 4. Evenly align the filter over the opening in the top of the furnace cabinet and position the other end of filter retainer up over the flange in the furnace's top panel. **NOTE:** To properly secure the filter, make sure the filter retainer is properly positioned in the top panel of the furnace. There should be no visible air gaps. The retainer may slide left or right slightly, but must not have any movement between the front and rear. See [Figure 7](#).
- Replacement filters are available at most local retailers. Inspect filters frequently and replace when necessary with filter of same dimensional size. Filters designed to remove smaller particles such as pollen, may require additional maintenance.

Dampers

An automated shut off damper is required when the home is air conditioned by a self-contained unit. A damper is required to prevent chilled air from flowing over the furnace heat exchanger. This damper is designed to fit in the feeder duct cavity, directly under the furnace. For proper installation, refer to the instructions provided with the damper. See replacement parts list provided online.

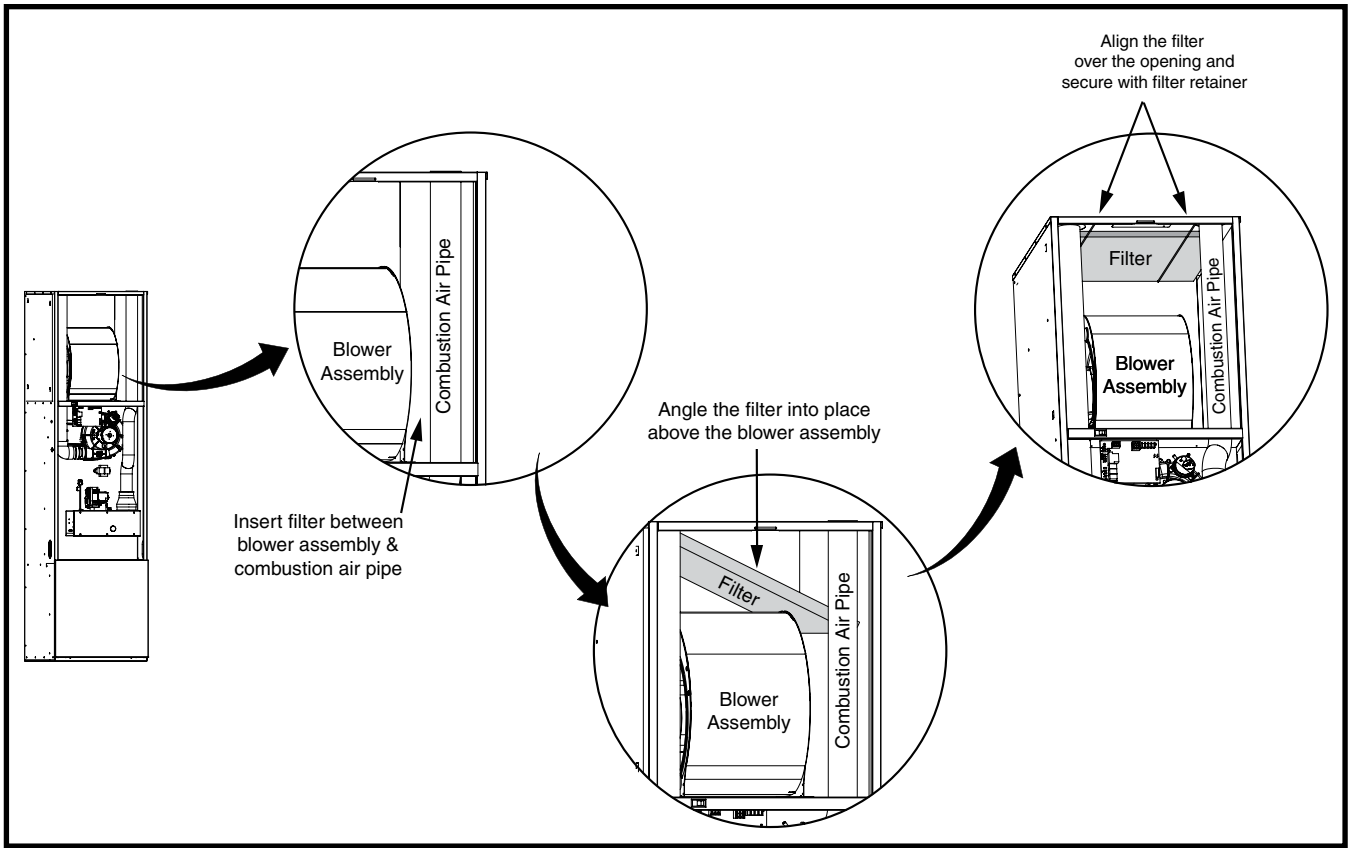


Figure 7. Filter Installation

FURNACE INSTALLATION

NOTE: These Installation procedures are suggested for typical furnace installations. Since each installation is different, the sequence of instructions may differ from the actual installation. Only qualified HVAC technicians should install this furnace.

The installer must be familiar with and comply with all codes and regulations applicable to the installation of these heating appliances and related equipment. In the absence of local codes, the installation must be in accordance with the current provisions of one or more of the following standards.

- Federal Manufactured Home Constructions & Safety Standard (H.U.D. Title 24, Part 3280.707[a][2])
- American National Standard (ANSI-119.2/NFPA-501C) for all recreational vehicle installations.
- American National Standard (ANSI-Z223.1/NFPA-54) and/or CAN/CSA B149 for all gas-fired furnace models.
- American National Standard (ANSI-Z95.1/NFPA-31) and/or CSA B139 for all oil-fired furnace models.
- American National Standard (NFPA-70) and/or CSA 22.1 Canadian Electric Code Part 1 for all electrical field wiring.
- Units have been researched under standards UL 307A & B, UL727-1999, ANSI Z21.47b/CSA 2.3b-2008, and CSA B140.10.

About The Furnace

The MG2S furnace is designed only for indoor installations and can be readily connected to the high static duct system of a home. Units are approved for single/multistory residential or mobile/modular/manufactured structures in freestanding/closet/alcove downflow only configurations.

This appliance will provide many years of safe and dependable comfort, providing it is properly installed and maintained. Abuse, improper use, and/or improper maintenance can shorten the life of the appliance and create unsafe hazards. Please read all instructions before installing the unit.

Approved installation, operation, and maintenance of this appliance must be in accordance with the listed specifications contained in these instructions and other documents supplied with the furnace and/or optional air conditioning equipment. Unless it is noted differently in this manual, only use factory authorized kits and accessories on this appliance. Refer to local authorities having jurisdiction for further information.

Before You Install this Furnace

- ✓ This equipment is securely packaged at the time of shipment and upon arrival should be carefully inspected for damage prior to installing the equipment at the job site. Claims for damage (apparent or concealed) should be filed immediately with the carrier.
- ✓ Check the electrical supply and verify the power supply is adequate for unit operation. The system must be wired and provided with circuit protection in accordance with local building codes. If there is any question concerning the power supply, contact the local power company.

- ✓ Verify the air delivery of the furnace is adequate to handle the static pressure drop of the coil, filter, and duct work.

Locating the Unit

- The dimensions of the room or alcove must be able to accommodate the overall size of the unit and required clearances to combustible materials listed in [Table 1, \(page 5\)](#). Access for positioning and servicing must also be considered when locating the unit. To determine the required clearances needed for installation and combustible materials, refer to [Figure 23 \(page 29\)](#) & [Figure 24 \(page 30\)](#) for overall dimensions.
- The furnace must be installed on a solid surface and must be level front-to-back and side-to-side at installation. The surface that the furnace is mounted on must provide sound physical support of the unit.
- The furnace should be installed as close to the center of the air distribution system as possible and attached to a properly installed duct system. **Do not use the back of the furnace for return air.** See [page 11](#) for circulating requirements.
- The furnace must be installed so that all electrical components are protected from water.
- The plenum attached to the A/C coil box and ductwork within 3 ft. of the furnace must be installed so that surfaces are at least 1/4" from combustible construction.
- When installed in a residential garage, the furnace must be positioned so the burners and the source of the ignition are located no less than 18 inches above the floor and protected from physical damage by vehicles.
- This furnace is certified for use on wood flooring or supports, but must not be installed directly on carpeting, tile, or any combustible material other than wood flooring. **NOTE:** The furnace may be installed on combustible flooring when installed on a manufacturer's approved duct connector ([Figure 8](#)). This factory supplied accessory must be installed in the floor cavity and attached to the supply air duct before the downflow furnace is installed.
- The furnace must be installed upstream from a refrigeration system.

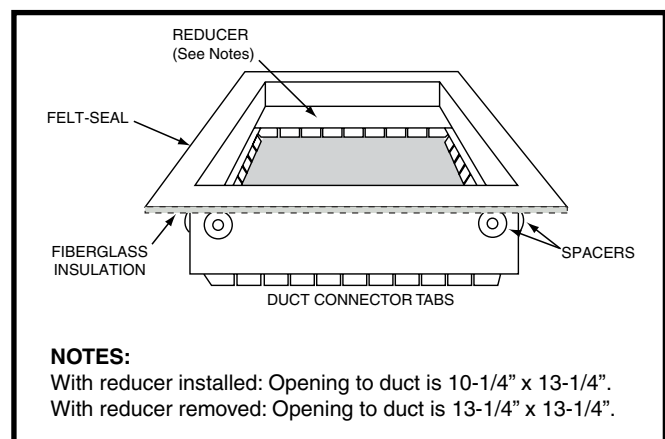
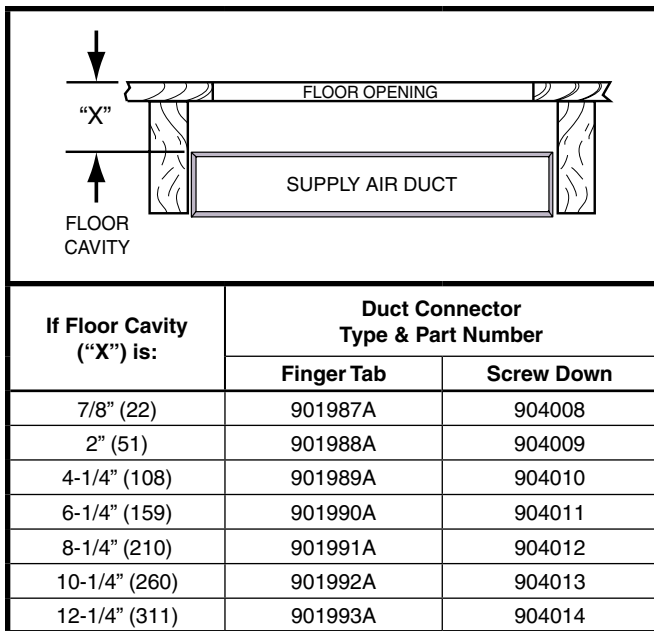


Figure 8. Duct Connector



NOTE: Dimensions shown as Inches (Millimeter)

Table 4. Duct Connector Sizes

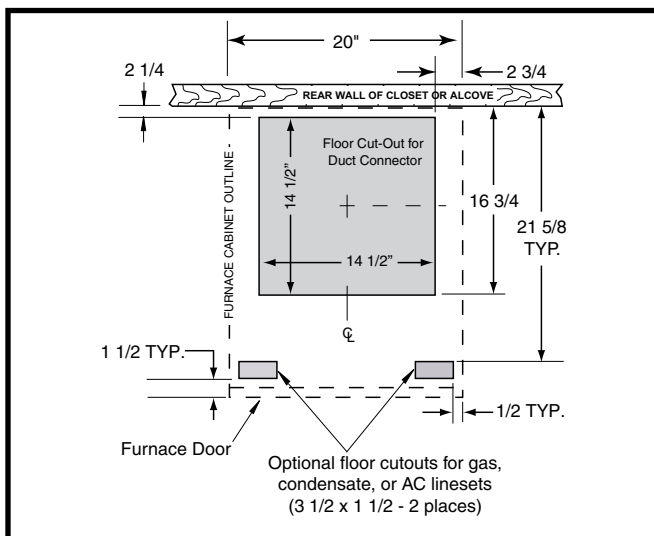


Figure 9. Floor Cutout Dimensions

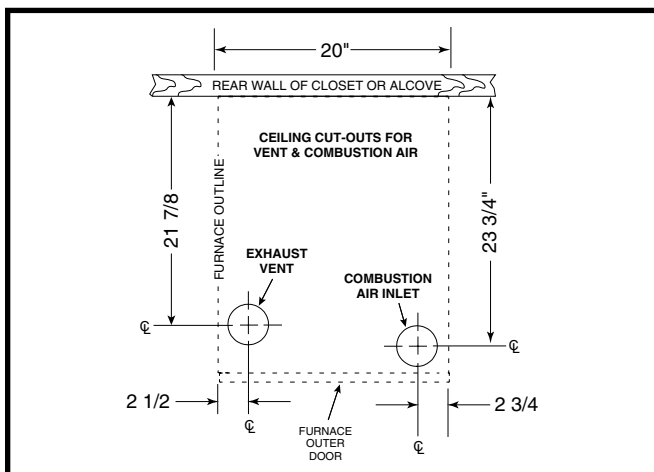


Figure 10. Ceiling Cut-Out Dimensions

Locating & Cutting Floor Openings

IMPORTANT NOTE: Cut-outs in the floor, must be carefully located to avoid misalignment of the furnace.

1. Measure from the rear wall or alcove and mark the centerline of the cut-out on the floor. Using the centerline as a starting point, draw the rest of the duct cut-out to the dimensions shown in Figure 9.
2. Cut out the floor opening to within 1" of the actual cutout drawn.
3. Measure from the top of the floor down to the top of the supply air duct to obtain the depth of the floor cavity. **NOTE:** The depth of the floor cavity shown as "X" in Table 4 will determine the correct duct connector.
4. Determine which duct connector to use from the table.
6. Measure and drill gas hole and cut out for cooling coil (if applicable).

Locating & Cutting Ceiling Openings

IMPORTANT NOTE: Cut-outs in the ceiling and roof must be carefully located to avoid misalignment of the furnace, combustion air piping, and vent piping. See Figure 10.

1. Measure from the rear wall or alcove and mark the centerlines of both cut-outs in the ceiling.
2. Using the centerlines as a starting point, draw the rest of the cut-outs to the dimensions shown in Figure 10.
3. Cut out the ceiling openings.

Installing Finger Tabbed Duct Connectors

The standard duct connector is designed for use on ducts 12" in width. However ducts narrower than 12" may not allow sufficient clearances for this type of installation. For an alternate installation method, see Narrow Duct Attachment - Option 1 or Option 2 on page 16.

1. Center the duct connector in the floor opening with bottom tabs resting on top of the supply air duct.
2. Mark the cut-out area on the supply air duct by tracing around the connector tabs of the duct connector. See Figure 11 (page 16).
3. Remove the duct connector and cut out the marked area of the supply air duct 1/16" larger the actual cutout drawn.
4. Install the duct connector back in the floor opening with the bottom tabs extending into the supply air duct.
5. Install the mounting plate (Figure 11) under the back side of the duct connector. Align the screw holes in both components.
6. Secure the duct connector and the mounting plate to the wood floor with appropriate size screws.
7. Bend the connector tabs on the bottom of the duct connector upwards and as tight as possible against the supply air duct. See Figure 11.
8. Seal all connections with industrial grade sealing tape or liquid sealant. **NOTE:** Requirements for sealing ductwork vary from region to region. Consult with local codes for requirements specific to your area.

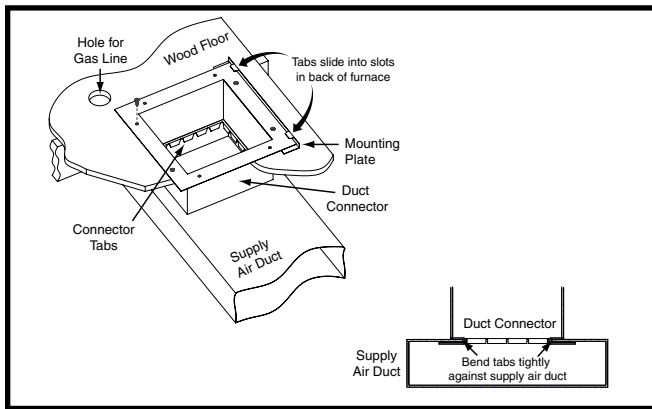


Figure 11. Finger Tabbed Duct Connector

Narrow Duct Attachment - Option 1

This alternate attachment method may be used to install a furnace duct connector to narrow metal ductwork if insufficient clearances prevent the bending of the duct connector tabs at the side of the duct.

1. Select Option A or Option B in [Figure 12](#) and cut the top of the supply air duct. Remove metal flaps from the duct (shaded area) if Option A is selected.
2. Fold the duct flaps up to form an opening for the duct connector (applies to Options A or B).
3. Install the duct connector with the bottom tabs extending into the supply air duct.
4. Bend the tabs on the bottom of the duct connector upwards and as tight as possible against the removed ends of the supply air duct.
5. Form the duct flaps up against the side of the duct connector as tight as possible. See [Figure 12](#).
6. Secure the duct connector flaps to the supply air duct with staples (3 minimum) or if a 2x block/joist is not provided, use sheet metal screws (2 minimum).

NOTE: The duct connector tabs may be attached to the air duct with sheet metal screws or other suitable fasteners as long as the duct connector and the air duct are securely attached.

7. Seal all connections with industrial grade sealing tape or liquid sealant.

NOTE: Requirements for sealing ductwork vary from region to region. Consult with local codes for requirements specific to your area.

Narrow Duct Attachment - Option 2

This alternate attachment method may be used to install a furnace duct connector to narrow metal ductwork if insufficient clearances prevent the bending of the duct connector tabs at the side of the duct.

1. Cut and remove the top of the supply air duct as shown in [Figure 13](#).
2. Install the duct connector with the bottom tabs extending into the supply air duct.
3. Bend the tabs on the bottom of the duct connector upwards and as tight as possible against the supply air duct ([Figure 13](#)).
4. Secure the duct connector tabs to the supply air duct with staples (3 minimum) or sheet metal screws (2 minimum).

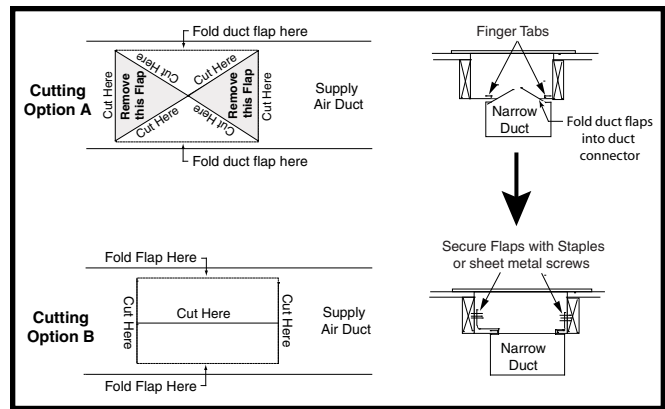


Figure 12. Narrow Air Ducts - Option 1

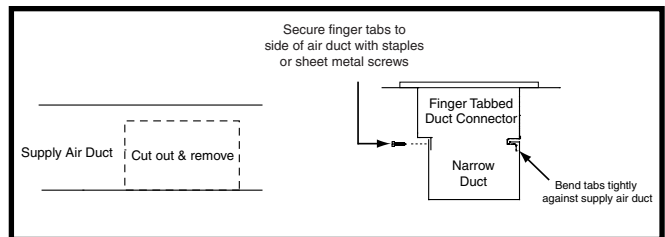


Figure 13. Narrow Ducts - Option 2

Installing Screw-Down Duct Connectors

1. Apply a bead of caulking, mastic, or other approved sealant around bottom side of 1/2" flange and restrictor plate (when applicable). See [Figure 14](#)
2. Locate the screw down duct connector over the duct and carefully lower it into place.
3. Secure the duct connector to the floor using flat head screws or nails. **NOTE:** Make sure the duct connector flanges stay in contact with the duct.
4. Secure the plenum to the duct using sheet metal screws making sure a tight seal is made between the duct and the duct connector. **NOTE:** Additional screws may be added if required.
5. Cut away along edge of flange allowing the center to drop into the duct. **NOTE:** Remove section of duct with caution, as edges will be sharp.

Round Duct Connector Installation

1. Install and center the duct connector in the floor opening.
2. Install the mounting plate ([Figure 15 \(page 17\)](#)) under the back side of the duct connector. **NOTE:** Make sure the screw holes are aligned in both components.
3. Using appropriate size screws, secure the duct connector and the mounting plate to the wood floor.
4. Connect the round supply duct to the underside of the duct connector and secure them with field supplied sheet metal screws or appropriate clamps.
5. Seal all connections with industrial grade sealing tape or liquid sealant as required.

NOTE: Requirements for sealing ductwork vary from region to region. Consult with local codes for requirements specific to your area.

Installing the Furnace

Sides and back of the furnace may be enclosed by wall framing such as in a closet or alcove. The dimensions of the room or alcove must be able to accommodate the overall size of the furnace and the installation clearances outlined on [page 5](#) and [Figure 1](#), [Figure 2](#), [Figure 3](#), & [Figure 4](#). The furnace shall be appropriately connected to the supply and return air distribution system as shown in [Figure 23](#) ([page 29](#)) & [Figure 24](#) ([page 30](#)).

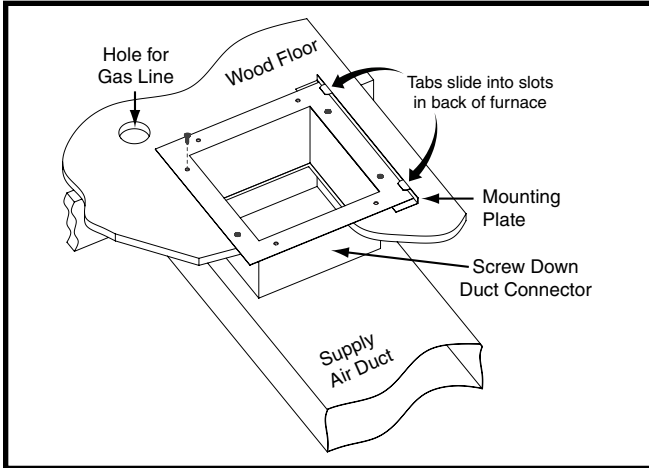


Figure 14. Screw-Down Duct Connector

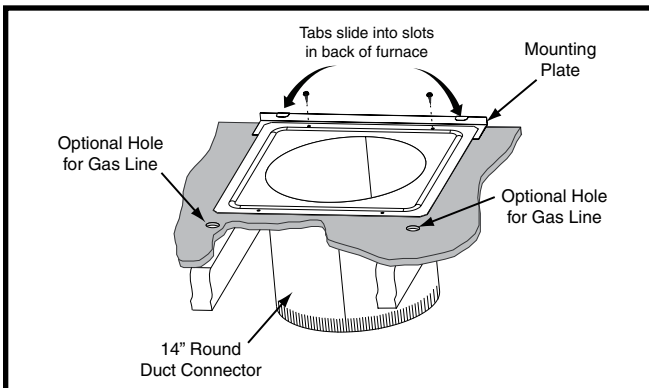


Figure 15. Round Duct Connector

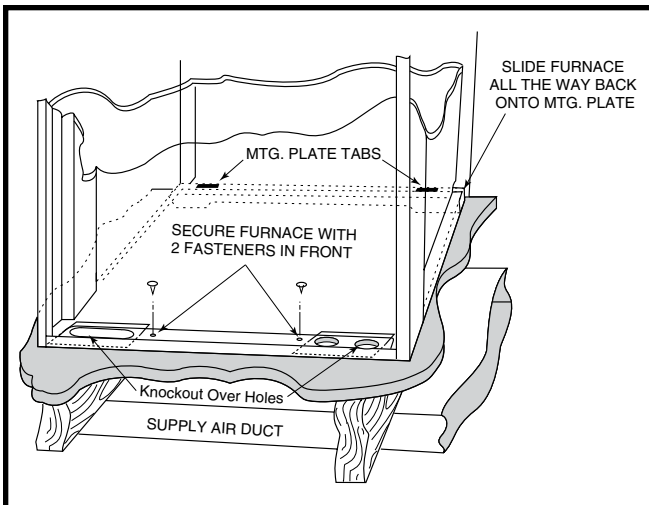


Figure 16. Cabinet Furnace on Supply Air Duct

1. Remove furnace outer door(s) and bottom fuel line knockout.
2. Place furnace onto duct connector and center with floor opening.
3. Slide onto mounting plate. (Bottom rear slots on furnace should engage with mounting plate tabs.)
4. Secure front with one (1) fastener at each corner. See [Figure 16](#).

NOTE: Additional fasteners may be used at rear, sides or through door frame, as desired, to secure furnace to closet or alcove framing.

Condensate Drainage

! WARNING:

The condensate produced by the furnace must be drained. Do not connect a water supply to the drainage hose of the furnace.

! CAUTION:

Do not install additional traps in the condensate drain.

- If the furnace is installed in an area where temperatures fall below freezing, special precautions must be made for insulating condensate drain lines that drain to the outdoors. If condensate freezes in the lines, this will cause improper operation or damage to the furnace. It is recommended that all drain lines on the outside of the residence be wrapped with an industry approved insulation or material allowed by local code.
- Before routing the drain tube out of the furnace, loosen the tube clamp and turn the tube so the preset 90° turn faces the intended direction of exit from the cabinet. Do not route the drain tube without rotating the tube first. This will kink the tube and prevent condensate from draining.
- Care should be taken to route the drain line away from the burner box. Drain lines resting on the burner box can become kinked or collapsed due to the heat from the burner box.
- The condensate drain may exit through the left or right slots in the bottom of the furnace. See [Figure 17](#) ([page 18](#)). Make sure the flexible drain hose is not kinked.
- The condensate should drain from the plastic collector box as droplets or a small stream. If you notice the furnace has operated for more than 5 minutes without draining or the status lights on the control board indicate an open pressure switch as listed in [Table 5](#), ([page 27](#)), follow the steps below.

1. Remove the collector box soft tube (Figure 17) and verify the exit from the collector box is clear of any debris or obstructions.
2. Replace this tube and verify the fit to the header spout is airtight. Air will be drawn into the header if this connection is not tight.
3. Check other tube connections along the drain system. Verify that all are airtight.

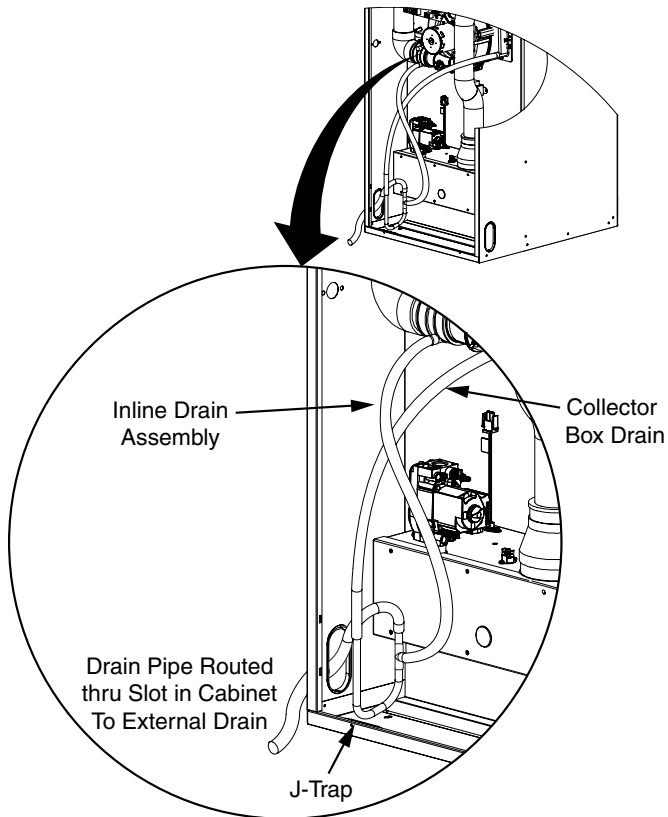


Figure 17. Condensate Drainage

GAS SUPPLY & PIPING

⚠ WARNING:

FIRE OR EXPLOSION HAZARD

- Failure to follow safety warnings exactly could result in serious injury or property damage.
- Installation and service must be performed by a qualified installer, service agency or the gas supplier.
- 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.
- Leave the building immediately.
- 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.

⚠ AVERTISSEMENT :

RISQUE D'INCENDIE OU D'EXPLOSION

- Le non-respect des avertissements de sécurité pourrait entraîner des blessures graves ou des dommages matériels.
- L'installation et l'entretien doivent être effectués par un installateur qualifié, un organisme de service ou le fournisseur de gaz.
- Ne pas entreposer ni utiliser de l'essence ni d'autres vapeurs ou liquides inflammables dans le voisinage de cet appareil, ni de tout autre appareil.

QUE FAIRE S'IL Y A UNE ODEUR DE GAZ

- Ne tentez pas d'allumer quelque appareil que ce soit.
- Ne touchez à aucun interrupteur électrique; n'utilisez pas de téléphone dans votre immeuble.
- Évacuer l'immeuble immédiatement.
- Appelez immédiatement votre fournisseur de gaz à l'aide du téléphone d'un voisin. Suivez les directives données par le fournisseur de gaz.
- Si vous ne pouvez pas joindre le fournisseur de gaz, appelez les pompiers.

- All gas piping must be installed in compliance with local codes and utility regulations. In the absence of local codes the gas line installation must comply with the latest edition of the Federal Manufactured Home Construction & Safety Standard (H.U.D. Title 24, Part 3280.707[a][2]), National Fuel Gas Code (ANSI Z223.1) or (CAN/CGA B149.1 or .2) Installation Codes.
- Some local regulations require the installation of a manual main shut-off valve and ground joint union external to the furnace as shown in Figure 18. The shut-off valve should be readily accessible for service and/or emergency use. Consult the local utility or gas supplier for additional requirements regarding placement of the manual main gas shut-off.
- Per ANSI 21.47, A 1/8-inch NPT plugged tapping, accessible for test gauge connection, must be installed immediately upstream of the gas supply connection to the furnace external to the cabinet. If local codes allow the use of a flexible gas appliance connector, always use a new listed connector. Do not use a connector that has previously serviced another gas appliance.
- Gas piping must never run in or through air ducts, chimneys, gas vents, or elevator shafts.
- Compounds used on threaded joints of gas piping must be resistant to the actions of LP propane gas.
- The main gas valve and main power disconnect to the furnace must be properly labeled by the installer in case emergency shutdown is required.
- Flexible gas connectors are not recommended for this type of furnace but may be used if allowed by local jurisdiction. Only new flexible connectors may be used. Do not use a connector which has previously serviced another gas appliance.
- A drip leg should be installed in the vertical pipe run to the unit if not entering the furnace through the floor.

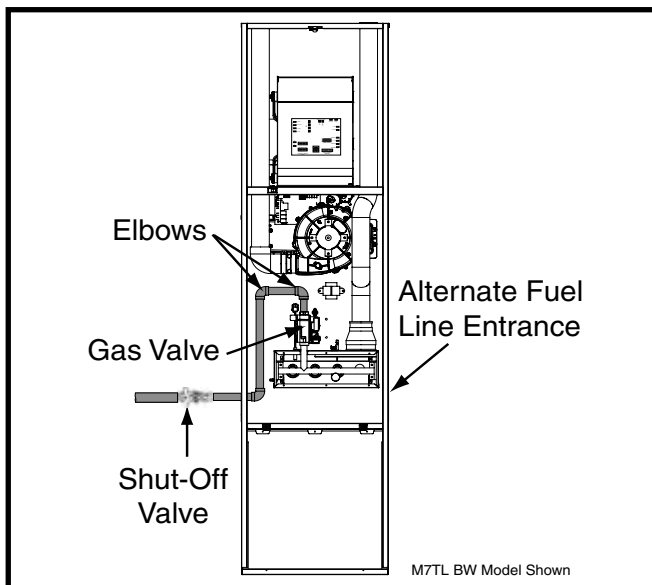


Figure 18. Typical Gas Connections

Table 10, (page 35) lists gas flow capacities for standard pipe sizes as a function of length in typical applications based on nominal pressure drop in the line.

The furnace is installed with a bottom gas entry. When connecting the gas supply, provide clearance between the gas supply line and the entry hole in the furnace casing to avoid unwanted noise and/or damage to the furnace. Typical gas hookups are shown in Figure 18.

Leak Check

⚠ WARNING:

FIRE OR EXPLOSION HAZARD
Failure to follow safety warnings exactly could result in serious injury or property damage.

Never test for gas leaks with an open flame. Use a commercially available soap solution made specifically for the detection of leaks to check all connections. A fire or explosion may result causing property damage, personal injury or loss of life.

⚠ AVERTISSEMENT :

RISQUE D'INDENNIE OU D'EXPLOSION
Le non-respect des avertissements de sécurité pourrait entraîner des blessures graves, la mort ou des dommages matériels.

Ne jamais utiliser une flamme nue pour vérifier la présence de fuites de gaz. Pour la vérification de tous les joints, utiliser plutôt une solution savonneuse commerciale fabriquée spécifiquement pour la détection des fuites de gaz. Un incendie ou une explosion peut entraîner des dommages matériels, des blessures ou la mort.

After the gas piping to the furnace is complete, all connections must be tested for gas leaks. This includes pipe connections at the main gas valve, emergency shutoff valve and flexible gas connectors (if applicable). The soap and water solution can be applied on each joint or union using a small paintbrush. If any bubbling is observed, the connection is not sealed adequately and must be retightened. Repeat the tightening and soap check process until bubbling ceases.

IMPORTANT NOTE

When pressure testing gas supply lines at pressures greater than 1/2 psig (14 inch W.C.), the gas supply piping system must be disconnected from the furnace to prevent damage to the gas control valve. If the test pressure is less than or equal to 1/2 psig (14 inch W.C.), close the manual shut-off valve.

High Altitude Application

High altitude conversion with this furnace depends on the installation altitude and the heating value of the gas. Installation of this furnace at altitudes above 2,000 feet shall be in accordance with local codes, or in the absence of local codes, the National Fuel Gas Code, ANSI Z223.1/NFPA 54 or National Standard of Canada, Natural Gas & Propane Installation Code CGA B149.1. Please consult your local code authority.

The installer must indicate the furnace has been converted to high altitude. This may be accomplished by marking the rating plate with a permanent marker.

WARNING:

The reduction of input rating necessary for high altitude installation may only be accomplished with factory supplied orifices. Do not attempt to drill out orifices in the field. Improperly drilled orifices may cause fire, explosion, carbon monoxide poisoning, personal injury or death.

The furnaces are shipped from the factory with orifices and gas regulator settings for natural gas operation at sea level altitudes. At 2000 feet, the NFGC requires that this appliance be derated 4% for each 1000 feet of altitude. For example, the input needs to be reduced 8% at 2,000 feet, 12% at 3,000 feet, etc. This deration is in reference to the input rate and gas heating value at sea level.

To derate the furnace requires knowing the heating value of the gas at the installation site. Heating values at particular job sites vary for two reasons:

1. The chemical mixture of the gas varies across regions and is expressed as the sea level heating value.
2. The heating value varies by altitude. For this reason, especially in high altitude areas, the local gas utility specifies the heating value at the residence's gas meter as the local value.

For added flexibility, two tables have been provided for natural gas installations with high or low heating values at sea level. [Table 13](#) & [Table 14](#), (page 36) contain the manifold pressure and orifice sizes to use at various altitudes. [Table 13](#) (HIGH) is for natural gas installations with a heating value of more than 1,000 Btu per cubic foot and [Table 14](#) (LOW) is for less than 1,000 Btu per cubic foot. To determine which table to use:

1. Consult the local utility for the local heating value at your installation site.
2. From [Table 12](#), (page 36), find your local heating value as supplied by the utility company. Follow down the column and stop at your altitude level.
3. If your sea level heating value is HIGH, use [Table 13](#) or if it's LOW, use [Table 14](#). See example above.

After changing the orifices, it is required that you measure the gas input rate. This may be accomplished in the usual way, by clocking the gas meter and using the local gas heating value. See Verifying & Adjusting the Input Rate section on [page 23](#).

EXAMPLE

Elevation: 5,000 feet
Type of Gas: Natural Gas
Local Heating Value of Gas: 750

From [Table 11](#), find 750 and follow down the column, stop at the 5,000 feet row. The heating value listed is LOW. [Table 14](#) will be used to determine orifice size and manifold pressure.

IMPORTANT NOTE:

Observe the action of the burners to make sure there is no yellowing, lifting or flashback of the flame.

Converting to LP/Propane Gas at Altitudes between 0 & 10,000 FT.

Converting two-stage furnaces to LP/Propane requires the replacement of the burner orifices and converting the regulator to LP. All furnace models need to be derated when converted to LP. See [Table 11](#), (page 36).

WARNING:

The furnace was shipped from the factory equipped to operate on natural gas. Conversion to LP / Propane gas must be performed by qualified service personnel using a factory supplied conversion kit. Failure to use the proper conversion kit can cause fire, explosion, property damage, carbon monoxide poisoning, personal injury, or death.

WARNING:

Shut off the gas supply at the manual gas shutoff valve, before disconnecting the electrical power. A fire or explosion may result causing property damage, personal injury or loss of life. Failure to follow the safety warnings exactly could result in serious injury, death or property damage.

WARNING:

To avoid electric shock, personal injury, or death, turn off the electric power at the disconnect or the main service panel before making any electrical connections.

⚠ WARNING:

The reduction of input rating necessary for high altitude installation may only be accomplished with factory supplied orifices. Do not attempt to drill out orifices in the field. Improperly drilled orifices may cause fire, explosion, carbon monoxide poisoning, personal injury or death.

Generally, conversion requires the replacement of the burner orifices and the spring & stem assembly in the pressure regulator. In the U.S., if the installation is above 2,000 ft., refer to [Table 11, \(page 36\)](#) to determine the correct orifice size and regulator pressure. See example below.

Conversion to LP / Propane is detailed in the installation instructions provided with the conversion kit. The conversion instructions for US installations are only to be used to convert natural gas furnaces to LP/Propane gas in the United States. For installations in Canada, the Canadian conversion instructions must be used. **Please follow the instructions provided with the kit.**

When conversion is complete, verify the manifold pressure and input rate are correct as listed in the Tables.

EXAMPLE

Elevation: 5,000 feet
Type of Gas:..... Propane Gas
Input BTU of Furnace:..... 60,000

From [Table 11](#), find 60,000 Btuh and follow across the row to the 5,000 FT column. The manifold pressure listed is 4.2 for Low and 10.0 for High. The listed orifice size is 56.

ELECTRICAL WIRING

⚠ WARNING:

ELECTRICAL SHOCK, FIRE OR EXPLOSION HAZARD

Failure to follow safety warnings exactly could result in serious injury or property damage.

Improper servicing could result in dangerous operation, serious injury, death or property damage.

- Before servicing, disconnect all electrical power to furnace.
- When servicing controls, label all wires prior to disconnecting. Reconnect wires correctly.
- Verify proper operation after servicing.

⚠ AVERTISSEMENT :

RISQUE DE DÉCHARGE ÉLECTRIQUE, D'INCENDIE OU D'EXPLOSION

Le non-respect des avertissements de sécurité pourrait entraîner des blessures graves ou des dommages matériels.

Un entretien inapproprié peut provoquer un fonctionnement dangereux, des blessures graves, la mort ou des dommages matériels.

- Avant toute intervention, couper l'alimentation électrique du générateur d'air chaud.
- Pour l'entretien des commandes, étiqueter tous les fils avant de les débrancher. Rebrancher les fils correctement.
- Vérifier le bon fonctionnement après l'intervention.

Line Voltage Wiring

- Electrical connections must be in compliance with all applicable local codes with the current revision of the National Electric Code (NFPA 70).
- For Canadian installations the electrical connections and grounding shall comply with the current Canadian Electrical Code (CSA C22.1 and/or local codes).
- It is recommended that the line voltage (115 VAC) to the furnace be supplied from a dedicated branch circuit containing the correct fuse or circuit breaker for the furnace as listed in [Table 8, \(page 33\)](#).

IMPORTANT NOTES:

If replacing any of the original wires supplied with the furnace, the replacement wire must be copper wiring and have a temperature rating of at least 105°F (40°C). For electrical specifications, refer to the furnace nameplate or [Table 8](#).

Proper line voltage polarity must be maintained in order for the control system to operate correctly. Verify the incoming neutral line is connected to the

white wire and the incoming HOT line is connected to the black wire. The furnace will not operate unless the polarity and ground are properly connected as shown in [Figure 25 \(page 33\)](#).

Grounding

WARNING:

To minimize personal injury, the furnace cabinet must have an uninterrupted or unbroken electrical ground. The controls used in this furnace require an earth ground to operate properly. Acceptable methods include electrical wire or conduit approved for ground service. Do not use gas piping as an electrical ground!

Thermostat / Low Voltage Connections

- The furnace is designed to be controlled by a 24 VAC thermostat. The thermostat's wiring must comply with the current provisions of the NEC (NFPA 70) and with applicable local codes having jurisdiction.
- The thermostat must be installed according to the instructions supplied by the thermostat manufacturer. Low voltage connections (24 VAC) from the thermostat are wired to the terminal strip on the integrated control in the furnace. For heating applications, [Figure 19](#) & [Figure 20 \(page 23\)](#) show how to properly connect single stage and two-stage thermostats. Recommended minimum wire gauge for thermostat wiring is shown in [Table 8, \(page 33\)](#).
- The thermostat should be mounted about 5 feet above the floor on an inside wall. DO NOT install the thermostat on an outside wall or any other location where its operation may be adversely affected by radiant heat from fireplaces, sunlight, or lighting fixtures, and convective heat from warm air registers or electrical appliances. Refer to the thermostat manufacturer's instruction sheet for detailed mounting information.

Single Stage AC & Single Stage Thermostat

This option does not use the full two-stage control capability of the furnace, but the possibility of timed autostaging is available. See also Autostaging for Single Stage Thermostats.

- Connect the thermostat's **W** output to the furnace control boards **W1** terminal. This allows the furnace to always run in low output mode. See [\(Figure 19\)](#)
- Always connect the thermostat **C** & **R** to the furnace control board **C** & **R**.
- For cooling, connect the thermostats **Y** signal to the furnace control board **Y / Y2** terminal.
- Field supplied wires should also connect **Y / Y2** & **C** to the outdoor unit's **Y** & **C** terminals.

Single Stage AC & Two Stage Thermostat

This option uses the full two stage heating capability of the furnace with a single stage outdoor unit. See [Figure 20](#).

- Connect the thermostat's **W1** & **W2** outputs to the furnace control board's **W1** & **W2** terminals.
- Always connect the thermostat **C** & **R** to the furnace control board **C** & **R**
- For cooling, connect the thermostats **Y** signal to the furnace control board **Y / Y2** terminal.
- Field supplied wires should also connect **Y / Y2** & **C** to the outdoor unit's **Y** & **C** terminals.

Autostaging for Single Stage Thermostats

The Autostaging feature makes it possible to use a single stage thermostat and still receive some of the benefits of 2-stage furnace operation. If Autostage is enabled, the furnace will drop to **LOW** fire after initially starting in **HIGH** fire. After a period of 10 minutes, the furnace will then stage up to **HIGH** fire, until the heating load is met. See [Figure 19 \(page 23\)](#) and the Low Voltage Connection section.

The autostaging option is selected using the autostage jumper located near the thermostat terminal block. See [Figure 27 \(page 33\)](#). When the autostage jumper is moved from **OFF** to **ON**, the following occurs during a call for heat:

Setting the Autostage jumper in the **ON** position signals the control to utilize a 10 minute delay between **LOW** fire and **HIGH** fire when a call for heat is supplied via 24V signal to **W1**.

NOTE: If the autostage jumper is in the **ON** position and a **W1** demand is present when power is applied to the furnace, the first heat cycle will run in second stage heat with no autostaging. After the first cycle, the furnace will resume normal autostaging operation.

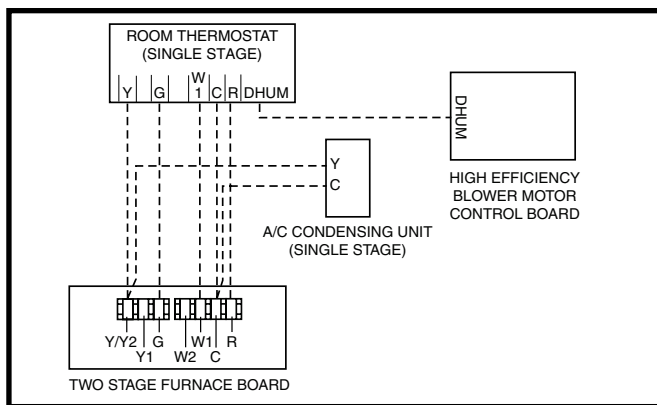


Figure 19. Wiring Configuration 1

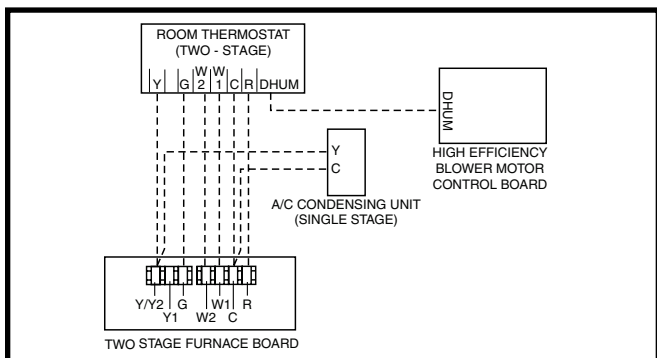


Figure 20. Wiring Configuration 2

Autostaging for Two-Stage Thermostats

The Autostage setting on the furnace control board (Figure 27 (page 33)) is disabled when shipped from the factory. This feature will be not used when paired with a two-stage thermostat. The autostage jumper setting (P7) must be kept on **OFF** to allow the thermostat to adjust stages.

CAUTION:

The terminal marked “Y1_IN” on the variable speed motor control board is not an output to drive the outdoor unit. **DO NOT** connect Y1_IN on the motor control board to the outdoor unit.

Fixed Speed Blower Applications

The fixed speed motor control board (Figure 26 (page 33)) contains a set of dip switches for setting the blower speed. Use pins 1 to 4 to set the blower speed for heating and pins 5 to 8 to set the speed for cooling. To determine the appropriate switch settings for your installation, see Table 6 (page 31) and Table 7 (page 32).

For thermostats with a dehumidifier output, use a field supplied wire to connect the thermostat’s dehumidifier output to the terminal marked **DEHUM**. The thermostat should be set so that the **DEHUM** output should be high (positive) when dehumidification is needed.

START-UP & ADJUSTMENTS

Pre-Start Check List

- ✓ Verify the polarity of the connections are correct, the line voltage power leads are securely connected and the furnace is properly grounded.
- ✓ Verify that all needed thermostat wires are securely connected to the correct leads on the terminal strip of the circuit board. See Figure 19 & Figure 20.
- ✓ Verify the gas line service pressure does not exceed 10.0 inches of water column, and is not less than 4.5 inches W.C. for natural gas. For LP gas the line service pressure must not exceed 14 in. W.C., and must not be less than 11.0 in. W.C.
- ✓ Verify the roll-out and manual reset switch is closed. If necessary, press the button to reset the switch. **DO NOT install a jumper wire across a switch to defeat its function. If a switch reopens on start-up, DO NOT reset the switch without identifying and correcting the fault condition.**
- ✓ Verify the blower door is in place, closing the door switch in the line voltage circuit.
- ✓ Verify the gas line has been purged and all connections are leak free.

Start-up Procedures

Do not perform these steps until all of the checks in the previous steps have been completed:

1. Set the thermostat to the lowest setting.
2. Turn off all electrical power to the furnace.
3. Follow the Operating Instructions on the label attached to the furnace.
4. Set the thermostat above room temperature and verify the Operating Sequence. See page 25.
5. After 5 minutes of operation, set the thermostat below room temperature and verify steps 9 - 10 of the Operating Sequence.

Verifying & Adjusting Input Rate

The input rate must be verified for each installation to prevent over-firing of the furnace. **NOTE:** The input rate must not exceed the rate shown on the furnace rating plate. At altitudes above 2,000 feet, it must not exceed that on the rating plate less 4% for each 1,000 feet. To determine the exact input rate, perform the following procedures:

1. Shut off all other gas fired appliances.
2. Start the furnace and run it for at least 3 minutes.
3. Measure the time (in seconds) required for the gas meter to complete one revolution.
4. Convert the time per revolution to cubic feet of gas per hour using Table 9, (page 35).
5. Multiply the gas flow rate in cubic ft per hr by the heating value of the gas in Btu per cubic ft to obtain the input rate in Btuh. See example.

Example:

- Time for 1 revolution of a gas meter with a 1 cubic ft dial = 40 seconds.
- From Table 9 read 90 cubic ft gas per hr.
- Local heating value of the gas (obtained from gas supplier) = 1,040 Btu per cubic ft.
- Input rate = 1,040 x 90 = 93,600 Btuh.

6. The manifold pressure must be set to the appropriate value for each installation by a qualified installer, service agency or the gas supplier.

⚠ WARNING:

Do not attempt to drill the gas orifices. Use only factory supplied orifices. Improperly drilled orifices may cause fire, explosion, carbon monoxide poisoning, personal injury or death.

- a.) Obtain the manifold pressure setting required for this installation by referring to [Table 11](#) for Propane or [Table 13](#) or [Table 14, \(page 36\)](#) for Natural Gas.
- b.) Remove the regulator capscrew from the INLET side of the regulator. See [Figure 21](#).
- c.) Slowly turn the adjustment screw inside the regulator to obtain the appropriate manifold pressure.

NOTE: Turning the screw clockwise increases the pressure and turning the screw counter-clockwise decreases the pressure. To prevent backing the screw all the way out from the valve, turn the screw slowly.

- d.) Replace and tighten the regulator capscrew over the adjustment screw.

Verifying & Adjusting Temperature Rise

After installation of the furnace, confirm the temperature rise of the furnace is within the limits specified on the rating plate. Any temperature rise outside the specified limits could result in premature failure of the heat exchanger.

For typical duct systems, the temperature rise will fall within the limits specified on the rating plate with the blower speed at the factory recommended setting. If the measured temperature rise is outside the specified limits, it may be necessary to change the speed of the blower.

NOTE: Lowering the blower speed will increase the temperature rise and a higher blower speed will decrease the temperature rise.

The furnace is equipped with a multi-speed motor. Heating and cooling speed selection is made by moving the switches on the blower control in the box in front of the blower.

1. Place thermometers in the return and supply air stream as close to the furnace as possible.

IMPORTANT: The thermometer on the supply air side must be shielded from direct radiation from the heat exchanger to avoid false readings.

2. Consult [Table 7, \(page 32\)](#) and the rating plate for the proper circulating air flow and temperature rise.

NOTE: This furnace is designed to operate with a maximum external pressure rise of 0.3 inches of water column. It is important that the duct system be designed to provide the correct flow rates and external pressure rise. An improperly designed duct system can result in nuisance shutdowns, and comfort or noise issues.

3. Adjust all registers and duct dampers to the desired position and run the furnace for 10 to 15 minutes before taking any temperature readings. The temperature rise is the difference between the supply and return air temperatures.

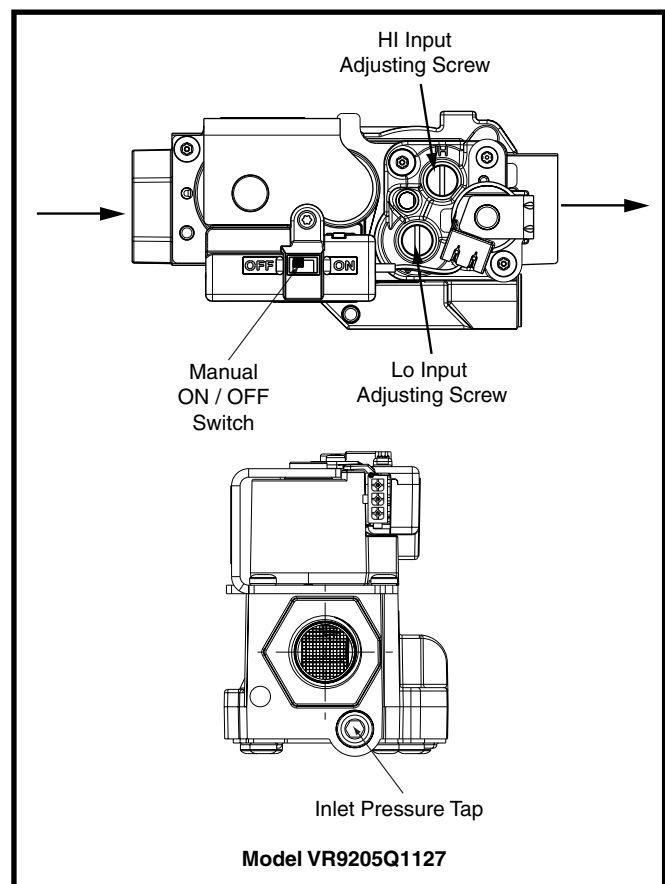
NOTE: The settings in [Table 6](#) refer to the small white switches on the red HEAT / COOL switch socket on the motor control board. The switches are set by the factory for good performance in a typical installation. If needed, the switches can be changed to ON or OFF by sliding them with a small screwdriver. See [Figure 26 \(page 33\)](#).

Verifying Burner Operation

⚠ CAUTION:

The door over the burners may only be open for inspection purposes only. The door must be installed during unattended operation.

1. Set the thermostat above room temperature and observe the ignition sequence. **NOTE:** The burner flame should carry over immediately between all burners without lifting off, curling, or floating. The flames should be blue, without yellow tips.



2. After validating the flame, change thermostat setting to below room temperature.
3. Verify the burner flame is completely extinguished.
4. Replace the burner compartment door.

Verifying Operation of the Supply Air Limit Switch

NOTE: A properly functioning limit switch should turn off the gas valve when the return is blocked (time depends on how well the return air is blocked). The circulating air and combustion blowers should continue to run when the limit switch opens.

1. Verify the blower door is securely mounted in place and that there is power to the furnace.
2. Block the return airflow to the furnace by installing a close-off plate in place of or upstream of the filter(s).
3. Set the thermostat above room temperature and observe the Operating Sequence.
4. Remove the close-off immediately after the limit switch opens. If the furnace continues to operate with no return air, set the thermostat below room temperature, shut off power to the furnace, and replace the limit switch.

OPERATING SEQUENCE

The operating sequences for the heating, cooling, and fan modes are described below. Refer to the field and furnace wiring diagrams: [Figure 25 \(page 33\)](#) and [Figure 28 \(page 34\)](#).

Heating Cycle

1. The thermostat calls for heat by energizing the **W1** terminal with 24VAC.
2. The control checks to see the pressure switch is open. If the switch is closed, the furnace will shut down for 5 minutes before retrying.
3. If the pressure switch is open, the control energizes the inducer motor and waits for the pressure switch to close. The pressure switch must close within 12 seconds.
4. The control runs the inducer for a 30 second pre-purge time.
5. The control energizes the igniter output for the appropriate adaptive warm-up time limit.
6. The furnace always ignites the burners in **high** fire. If the call for heat is for **low** rate, the furnace will move down to **low** fire after the flames stabilize.
7. If the flame is proved and ignites the gas, the control de-energizes the igniter. The gas valve and inducer remains energized. The control goes to blower on delay.
8. The control energizes the blower on the selected HEAT speed 22 seconds after the gas valve opened. The gas valve and inducer remain energized.
9. If there is a call for **high** fire, the gas valve moves to the **high** fire position and the blower speeds are increased. The furnace will remain in **high** fire until the demand for heat is satisfied.
10. If autostaging is enabled (single stage thermostat) the demand for heat has lasted more than the selected time, the furnace automatically moves up to **high** fire. Autostage time is ON (10 minutes) or OFF, depending on the Jumper (**P7**) setting on the furnace control board.
11. When the thermostat demand for heat is satisfied, the control de-energizes the gas valve. The inducer output remains on for a 30 second post-purge period.
12. The circulating air blower will continue to run for the selected Blower Off Delay (**P5**). This may be 60, 90, or 120 seconds depending on the jumper setting on the furnace control board.

Cooling Cycle

1. The thermostat calls for cooling by energizing the **Y / Y2 or Y1** terminal with 24VAC.
2. The control energizes the blower in the cooling speed and sends 24VAC to the contactor in the condensing unit.
3. When the thermostat removes the call for cooling, the contactor in the outdoor condensing unit is de-energized and the control continues to run the fan for a period of 60 seconds.

Fan Mode

- When the thermostat energizes the **G** terminal for continuous fan (without calling for heat or cooling), the blower will operate at 50% of the selected high cooling speed for continuous fan operation.
- If a call for cooling occurs during continuous fan, the blower will switch over to the selected COOL speed.
- If the W terminal receives a call for heat during continuous fan, the blower will de energize.
- A call for fan is ignored while in lockout.

MAINTENANCE

WARNING:

ELECTRICAL SHOCK, FIRE OR EXPLOSION HAZARD

Failure to follow safety warnings exactly could result in serious injury or property damage.

Improper servicing could result in dangerous operation, serious injury, death or property damage.

- **Before servicing, disconnect all electrical power to furnace.**
- **When servicing controls, label all wires prior to disconnecting. Reconnect wires correctly.**
- **Verify proper operation after servicing.**

AVERTISSEMENT :

RISQUE DE DÉCHARGE ÉLECTRIQUE, D'INCENDIE OU D'EXPLOSION

Le non-respect des avertissements de sécurité pourrait entraîner des blessures graves ou des dommages matériels.

Un entretien inapproprié peut provoquer un fonctionnement dangereux, des blessures graves, la mort ou des dommages matériels.

- **Avant toute intervention, couper l'alimentation électrique du générateur d'air chaud.**
- **Pour l'entretien des commandes, étiqueter tous les fils avant de les débrancher. Rebrancher les fils correctement.**
- **Vérifier le bon fonctionnement après l'intervention.**

Proper maintenance is most important to achieve the best performance from a furnace. Follow these instructions for years of safe, trouble free operation.

- These maintenance instructions are primarily intended to assist qualified technicians experienced in the proper maintenance and operation of this appliance.
- Always close the door on the furnace after servicing or cleaning/changing the filters. **Do not operate the furnace without the door closed.**

- Verify the thermostat is properly installed and will not be affected by drafts or heat from lamps or other appliances.
- To achieve the best performance and minimize equipment failure it is recommended that a yearly maintenance checkup be performed. At a minimum, this check should include the following items:

Air Filter(s) - An air filter is supplied with the BW series furnace as shipped from the factory. Filters should be changed or cleaned monthly during the heating season. Newly built or renovated homes may require more frequent changing until the construction dust has minimized.

WARNING:

Never operate the furnace without a filter in place. Dust and lint can build up on internal components, resulting in loss of efficiency, equipment damage, and possible fire.

Filters designed to remove smaller particles such as pollen, may require additional maintenance.

Blower Compartment - Dirt and lint can create excessive loads on the motor resulting in higher than normal operating temperatures and shortened service life. It is recommended that the blower compartment be cleaned of dirt or lint that may have accumulated in the compartment or on the blower and motor as part of the annual inspection.

Cleaning of Burners - If the burners must be cleaned, follow steps 1-12. For component locations see [Figure 22 \(page 28\)](#).

1. Shut off gas supply to the furnace at the meter or at a manual valve in the supply piping.
2. Turn off all power to the furnace and set the thermostat to it's lowest setting.
3. Move the manual ON/OFF switch to the OFF position. See [Figure 21 \(page 24\)](#).
4. Disconnect the wires from the gas valve, igniter, flame sensor, and flame rollout switch.

CAUTION:

To prevent damage to the unit or internal components, it is recommended that two wrenches be used when loosening or tightening nuts. Do not over tighten!

5. Using two wrenches, separate the ground-joint union in the gas supply piping at the furnace.
6. Remove the piping between the gas valve and the ground-joint union. (If applicable).
7. Remove all screws securing the burner box door.
8. Remove all screws securing the manifold assembly to the burner box.
9. Remove all screws from the corners of the box and carefully remove the burner assembly from the furnace. **IMPORTANT: DO NOT damage the igniter while removing the burner assembly.**

10. Inspect the burners for accumulated dust or debris. If necessary carefully clean them with a soft wire brush and a vacuum cleaner. **IMPORTANT: DO NOT damage the igniter while cleaning the burner assembly.**
11. Replace all the parts in reverse order that they were removed.
12. Follow the lighting instructions found on the furnace door to return the furnace to operation. Verify proper operation after servicing.

Vent System

WARNING:

Holes in the vent pipe or heat exchanger can cause combustion products to enter the home. Replace the vent pipe or heat exchanger if leaks are found. Failure to prevent the circulation of combustion products into the living space can create potentially hazardous conditions including carbon monoxide poisoning that could result in personal injury or death.

TROUBLESHOOTING

Check the inlet pipe (if applicable) and outlet pipe to ensure they are not blocked by debris. Any damaged section of vent pipe must be replaced, and any obstruction or blockage must be removed prior to operating the furnace.

Heat Exchanger & Burner Maintenance - The furnace should operate for many years without soot buildup in the flue passageways, however, the flue, vent system, and burners should be inspected and cleaned (if required) by a qualified service technician annually to ensure continued safe operation. Pay attention to any deterioration from corrosion or other sources.

Lubrication - The bearings in the blower motor and inducer blower used in these furnaces are pre-lubricated and sealed by the manufacturer. No further oiling of the bearings is required for the life of the motor.

If the furnace fails to operate check the following:

- Is the thermostat operating properly?
- Are the blower compartment door(s) in place?
- Is the furnace disconnect closed?
- Has the circuit breaker tripped or the control board fuse burned open?
- Is the gas turned on?
- Are any manual reset switches open?
- Is the filter dirty or plugged?
- Is the flame sensor coated? (Remove and clean with steel wool. **(Do not use emery cloth or sandpaper!)**)
- Is there blockage in the condensate drain switch? Also verify that there is no double trapping of condensate.
- Is the secondary heat exchanger free of debris and clogs?

- Is evaporator coil clean and free of debris (If applicable).
- Are all the LED's on the furnace control board constantly ON? If not, refer to Table 5 below or the wiring diagram (Figure 28, page 33) to determine fault condition.

IMPORTANT NOTE: The furnace will lock out after 5 failed attempts for ignition and will try again every hour if the call for heat remains.

- If the inducer blower is operating, and items above have been verified, check the blower limit switch and reset if necessary. For component locations see [Figure 22 \(page 28\)](#).
- If the furnace operates when the Blower Limit Switch is reset, contact a qualified service technician to identify and repair the problem.
- If the furnace still doesn't operate, check the flame roll-out switch and reset if necessary.
- If the furnace operates when the flame rollout switch is reset, contact a qualified service technician to identify and repair the problem.

Furnace Control Board		
Diagnostic Description	Green LED	Red LED
Control Fault (No Power)	Off	Off
L1/Neutral Polarity Fault	Flash	Flash
1 Hour Lockout	Alternating Flash	
Normal Operation	On	On
Pressure Switch Closed Fault	On	Flash
Pressure Switch Open Fault	Flash	On
Open Limit Switch Fault	Flash	Off
Motor Fault	On	Off
Diagnostic Description	Yellow LED	
Low Flame Sensor Signal	Continuous Flash	
Flame Present	On	

Motor Control Board (Variable Speed)		
DIAGNOSTIC DESCRIPTION	Green LED	Red LED
Control Fault (No Power)	Off	Off
Normal Operation	On	On
Motor Fault	On	Flash
Communications Fault	Flash	Flash

Table 5. Control Board Fault Conditions

FURNACE COMPONENTS

The descriptions below are various functional components that affect the operation and shutting down of this furnace. Some of these components and their locations are shown in [Figure 22](#). If any component of the furnace must be replaced, use only factory authorized replacement parts specified in the Replacement Parts List provided online.

Blower Limit Switch: Prevents operation when blower is not operational.

Flame Sensor: Verifies when a flame has carried over from the igniter to the opposite end burner. If no flame is detected, the furnace will shut down within 4 seconds.

Flame Roll-Out Switch: Verifies that the burner flames are drawn into the heat exchanger tubes. If the burner flames are not properly drawn into the heat exchanger, the flame roll-out switch will close the gas valve and initiate the shutdown cycle.

Gas Valve: Controls the flow of gas to the burners. When the gas valve is energized it automatically opens and regulates the gas pressure in the manifold.

Inducer Assembly: Vents products of combustion to the outside.

Pressure Switch: Verifies that the inducer is drawing the combustion gases through the heat exchanger. The pressure switch prevents furnace operation with excessive flue/condensate blockage or improper inducer operation.

Main Air Limit Switch: Prevents the air temperature leaving the furnace from exceeding the maximum allowable outlet air temperature.

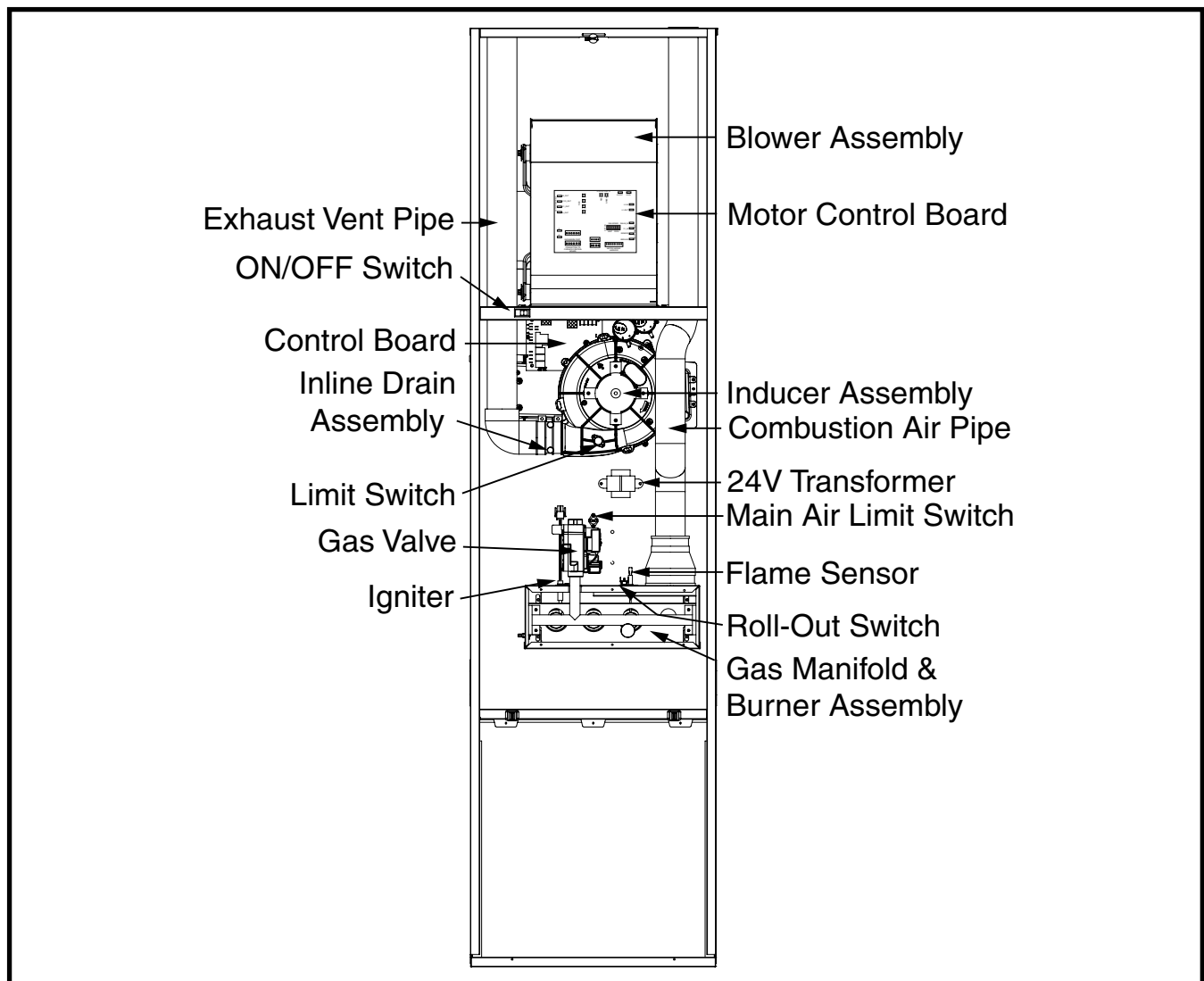


Figure 22. Furnace Components

FIGURES & TABLES

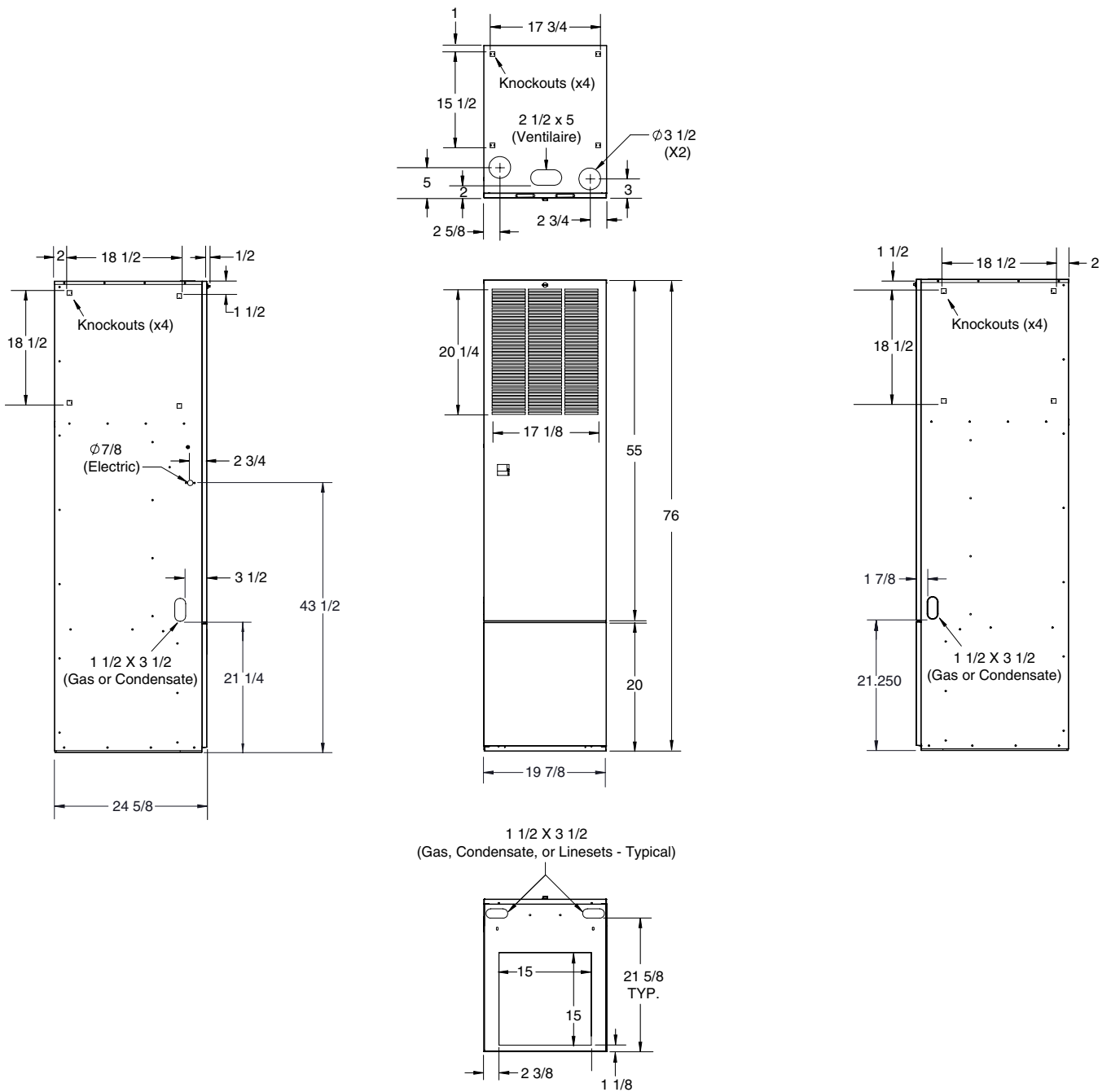


Figure 23. Front Return Model Dimensions

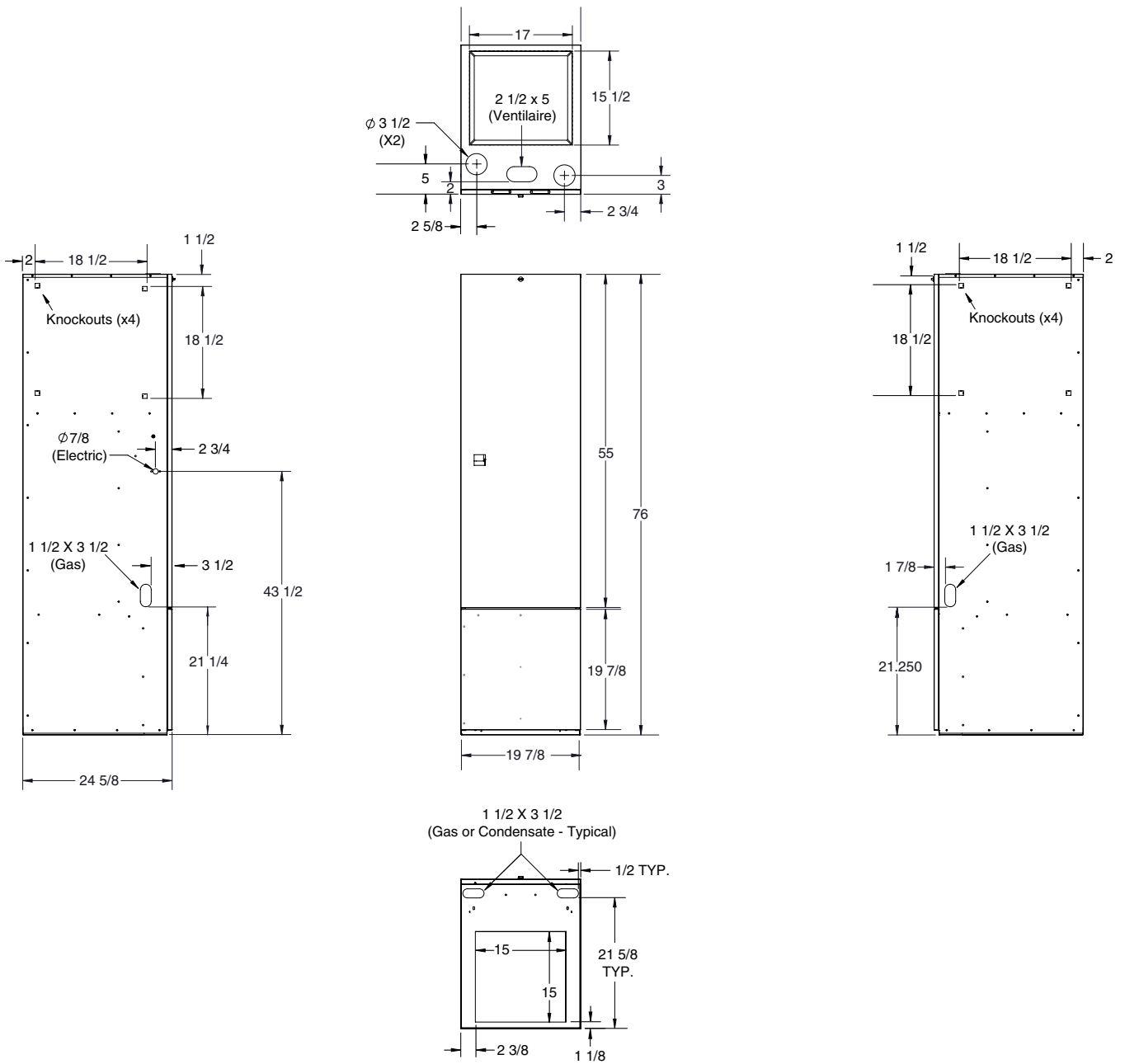


Figure 24. Top Return Model Dimensions

Airflow Data

MODEL NUMBER	MOTOR SWITCH SETTINGS (0 =OFF,1 =ON)				COOLING				HEATING							
					EXTERNAL STATIC PRESSURE (IN.W.C.)				EXTERNAL STATIC PRESSURE (IN.W.C.)							
	1/5	2/6	3/7	4/8	0.2	0.3	0.4	0.5	0.2		0.3		0.4		0.5	
					CFM	CFM	CFM	CFM	CFM	RISE	CFM	RISE	CFM	RISE	CFM	RISE
MG2S-045F*	0	0	0	0	913	868	841	795	913	44	868	46	841	48	795	50
	1	0	0	0	965	944	886	848	965	41	944	42	886	45	848	47
	0	1	0	0	1037	1000	973	933	1037	39	1000	40	973	41	933	43
	1	1	0	0	1112	1079	1047	1012	1112	36	1079	37	1047	38	1012	40
	0	0	1	0	1185	1155	1118	1082	1185	34	1155	35	1118	36	1082	37
	1	0	1	0	1256	1216	1180	1151	1256	32	1216	33	1180	34	1151	35
	0	1	1	0	1289	1258	1222	1186	1289	31	1258	32	1222	33	1186	34
	1	1	1	0	1354	1319	1283	1247	1354	30	1319	30	1283	31	1247	32
	0	0	0	1	1396	1366	1331	1299								
	1	0	0	1	1442	1411	1379	1351								
	0	1	0	1	1485	1451	1421	1388								
	1	1	0	1	1510	1473	1446	1416								
	0	0	1	1	1550	1517	1494	1460								
	1	0	1	1	1588	1561	1530	1503								
0	1	1	1	1635	1606	1582	1554									
1	1	1	1	1646	1612	1582	1550									
MG2S-060F*	0	0	0	0	913	868	841	795	913	58	868	61	841	63	795	67
	1	0	0	0	965	944	886	848	965	55	944	56	886	60	848	63
	0	1	0	0	1037	1000	973	933	1037	51	1000	53	973	55	933	57
	1	1	0	0	1112	1079	1047	1012	1112	48	1079	49	1047	51	1012	53
	0	0	1	0	1185	1155	1118	1082	1185	45	1155	46	1118	48	1082	49
	1	0	1	0	1256	1216	1180	1151	1256	42	1216	44	1180	45	1151	46
	0	1	1	0	1289	1258	1222	1186	1289	41	1258	42	1222	44	1186	45
	1	1	1	0	1354	1319	1283	1247	1354	39	1319	40	1283	42	1247	43
	0	0	0	1	1396	1366	1331	1299								
	1	0	0	1	1442	1411	1379	1351								
	0	1	0	1	1485	1451	1421	1388								
	1	1	0	1	1510	1473	1446	1416								
	0	0	1	1	1550	1517	1494	1460								
	1	0	1	1	1588	1561	1530	1503								
0	1	1	1	1635	1606	1582	1554									
1	1	1	1	1646	1612	1582	1550									
MG2S-072F	0	0	0	0	923	884	843	798	923	69	884	72	843	76	798	80
	1	0	0	0	964	922	886	843	964	66	922	69	886	72	843	76
	0	1	0	0	1052	1017	977	938	1052	61	1017	63	977	66	938	68
	1	1	0	0	1117	1088	1049	1017	1117	57	1088	59	1049	61	1017	63
	0	0	1	0	1196	1163	1131	1092	1196	54	1163	55	1131	57	1092	59
	1	0	1	0	1258	1219	1190	1151	1258	51	1219	53	1190	54	1151	56
	0	1	1	0	1283	1248	1213	1177	1283	50	1248	51	1213	53	1177	54
	1	1	1	0	1335	1299	1268	1234	1335	48	1299	49	1268	50	1234	52
	0	0	0	1	1389	1356	1322	1292	1389	46	1356	47	1322	48	1292	50
	1	0	0	1	1442	1406	1374	1340	1442	44	1406	46	1374	47	1340	48
	0	1	0	1	1480	1446	1415	1382	1480	43	1446	44	1415	45	1382	46
	1	1	0	1	1506	1475	1442	1410	1506	42	1475	43	1442	44	1410	45
	0	0	1	1	1542	1507	1474	1443	1542	42	1507	42	1474	43	1443	44
	1	0	1	1	1583	1554	1518	1488	1583	40	1554	41	1518	42	1488	43
0	1	1	1	1630	1601	1563	1530	1630	39	1601	40	1563	41	1530	42	
1	1	1	1	1633	1599	1564	1529									

NOTE: Blower speeds highlighted in gray do not meet government mandated efficiency requirements and are not available for use in heating mode.

Table 6. Blower Performance - Front Return

MODEL NUMBER	MOTOR SWITCH SETTINGS (0 =OFF,1 =ON)				COOLING				HEATING							
					EXTERNAL STATIC PRESSURE (IN.W.C.)				EXTERNAL STATIC PRESSURE (IN.W.C.)							
					0.2	0.3	0.4	0.5	0.2		0.3		0.4		0.5	
	1/5	2/6	3/7	4/8	CFM	CFM	CFM	CFM	CFM	RISE	CFM	RISE	CFM	RISE	CFM	RISE
MG2S-045T*	0	0	0	0	872	831	797	745	872	46	831	48	797	50	745	54
	1	0	0	0	924	888	855	809	924	43	888	45	855	47	809	49
	0	1	0	0	1005	969	939	899	1005	40	969	41	939	43	899	44
	1	1	0	0	1076	1043	1014	972	1076	37	1043	38	1014	39	972	41
	0	0	1	0	1155	1122	1078	1046	1155	35	1122	36	1078	37	1046	38
	1	0	1	0	1220	1187	1158	1126	1220	33	1187	34	1158	35	1126	36
	0	1	1	0	1269	1230	1199	1164								
	1	1	1	0	1321	1290	1251	1218								
	0	0	0	1	1399	1360	1325	1293								
	1	0	0	1	1448	1423	1382	1347								
	0	1	0	1	1495	1463	1427	1390								
	1	1	0	1	1531	1490	1457	1424								
	0	0	1	1	1564	1534	1501	1464								
	1	0	1	1	1611	1576	1543	1510								
0	1	1	1	1645	1609	1583	1547									
1	1	1	1	1683	1653	1624	1594									
MG2S-060T*	0	0	0	0	872	831	797	745	872	61	831	64	797	67	745	72
	1	0	0	0	924	888	855	809	924	58	888	60	855	62	809	66
	0	1	0	0	1005	969	939	899	1005	53	969	55	939	57	899	59
	1	1	0	0	1076	1043	1014	972	1076	50	1043	51	1014	53	972	55
	0	0	1	0	1155	1122	1078	1046	1155	46	1122	48	1078	49	1046	51
	1	0	1	0	1220	1187	1158	1126	1220	44	1187	45	1158	46	1126	47
	0	1	1	0	1269	1230	1199	1164								
	1	1	1	0	1321	1290	1251	1218								
	0	0	0	1	1399	1360	1325	1293								
	1	0	0	1	1448	1423	1382	1347								
	0	1	0	1	1495	1463	1427	1390								
	1	1	0	1	1531	1490	1457	1424								
	0	0	1	1	1564	1534	1501	1464								
	1	0	1	1	1611	1576	1543	1510								
0	1	1	1	1645	1609	1583	1547									
1	1	1	1	1683	1653	1624	1594									
MG2S-072T	0	0	0	0	885	848	804	764	885	72	848	75	804	80	764	84
	1	0	0	0	944	901	862	816	944	68	901	71	862	74	816	78
	0	1	0	0	1020	976	940	906	1020	63	976	66	940	68	906	71
	1	1	0	0	1087	1055	1019	985	1087	59	1055	61	1019	63	985	65
	0	0	1	0	1161	1132	1089	1060	1161	55	1132	57	1089	59	1060	60
	1	0	1	0	1225	1195	1164	1137	1225	52	1195	54	1164	55	1137	56
	0	1	1	0	1265	1239	1204	1175	1265	51	1239	52	1204	53	1175	54
	1	1	1	0	1330	1299	1265	1228	1330	48	1299	49	1265	51	1228	52
	0	0	0	1	1388	1353	1320	1289								
	1	0	0	1	1447	1413	1382	1346								
	0	1	0	1	1489	1454	1423	1388								
	1	1	0	1	1513	1484	1452	1420								
	0	0	1	1	1556	1523	1492	1459								
	1	0	1	1	1599	1566	1534	1502								
0	1	1	1	1639	1609	1578	1547									
1	1	1	1	1670	1651	1613	1583									

NOTE: Blower speeds highlighted in gray do not meet government mandated efficiency requirements and are not available for use in heating mode.

Table 7. Blower Performance - Top Return

Electrical Diagrams & Data

Furnace Model Number MG2S-	Furnace Input (Btuh)	Cabinet Width (in.)	Nominal Electrical Supply	Maximum Operating Voltage	Minimum Operating Voltage	Maximum Furnace Amperes	Minimum Wire Gauge	Maximum Fuse or Circuit Breaker Amps*
045A	45,000	19 7/8	115-60-1	127	103	8.8	14	15
060A	60,000	19 7/8	115-60-1	127	103	8.8	14	15
072A	72,000	19 7/8	115-60-1	127	103	8.8	14	15

NOTE: Minimum wire gauge and maximum fuse/circuit breaker amperage are based on MCA¹ and MOP² calculations. This furnace is approved for installation with a 15 or 20 amp fuse/circuit breaker however wiring sizing must adhere to current version of the NEC and/or applicable local codes depending upon the overcurrent protection.

Thermostat Wire Gauge	Recommended Thermostat Wire Length	
	2 - wire - Heating	4 or 5 wire - Cooling
24	55 ft.	25 ft.
22	90 ft.	45 ft.
20	140 ft.	70 ft.
18	225 ft.	110 ft.

* Time-delay fuses or circuit breakers are required.

Table 8. Wire Length & Voltage Specifications

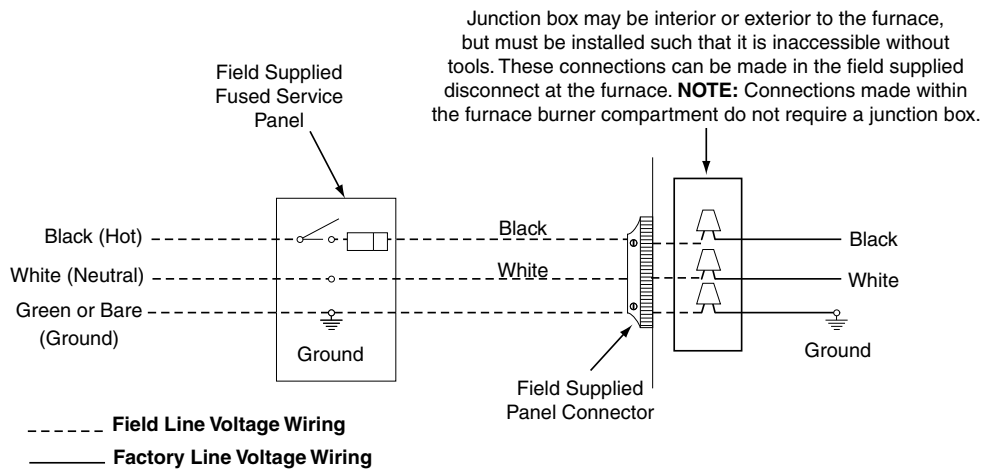


Figure 25. Line Voltage Field Wiring

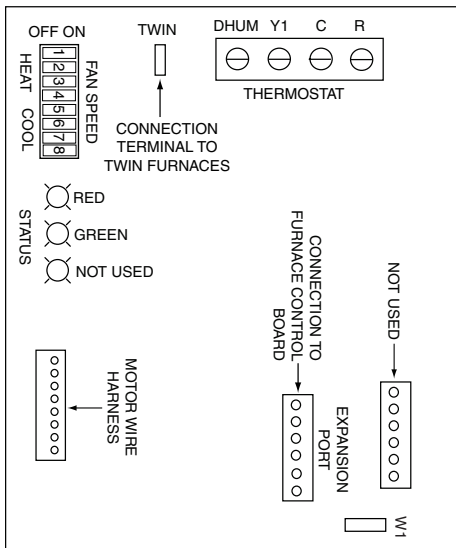


Figure 26. MG2S Motor Control Board

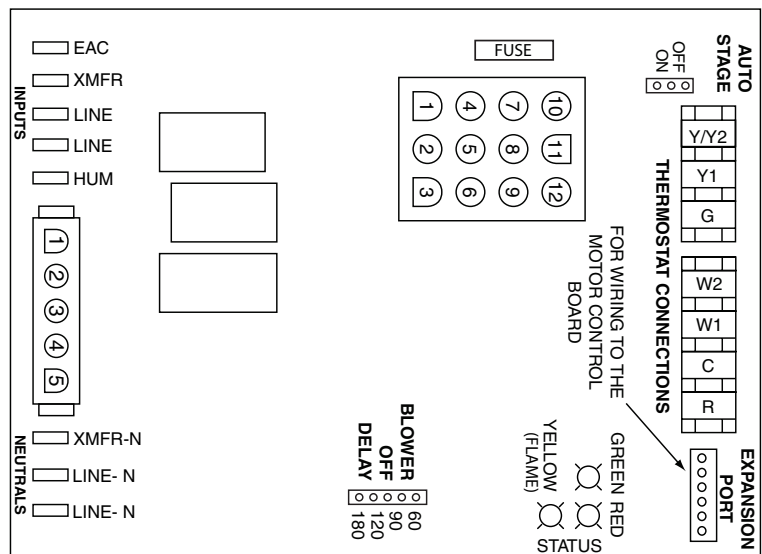


Figure 27. Two-Stage Furnace Control Board

WIRING DIAGRAM

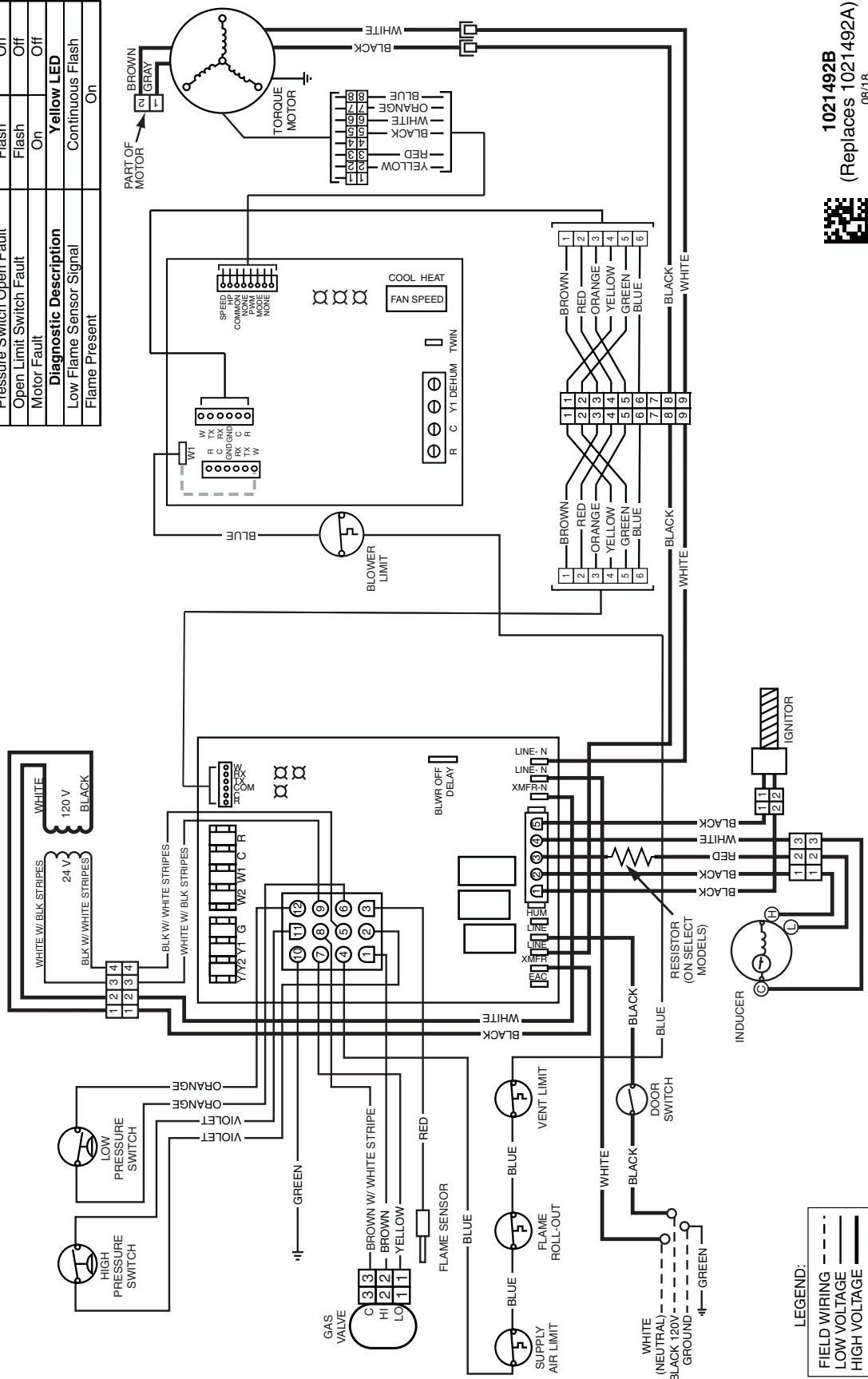
For 96% 2-Stage Fixed Speed Downflow Furnaces

Refer to the Installation Instructions provided with the kit for the proper heating and cooling speeds for your application. This wiring diagram shows connections and termination required for the blower kit only. Use in addition to the wiring diagram for the furnace.

If any of the original wire as supplied with the furnace must be replaced, it must be replaced with wiring material having a temperature rating of at least 105° C.

Use copper conductors only.

FAULT CONDITIONS		
Diagnostic Description	Green LED	Red LED
Control Fault (No Power)	Off	Off
L1/Neutral Polarity Fault	Flash	Flash
1 Hour Lockout	Alternating Flash	Flash
Normal Operation	On	On
Pressure Switch Closed Fault	On	Flash
Pressure Switch Open Fault	Flash	On
Open Limit Switch Fault	Flash	Off
Motor Fault	On	Off
Diagnostic Description		
Low Flame Sensor Signal	Continuous Flash	Yellow LED
Flame Present	On	On



1021492B
(Replaces 1021492A)
08/18

Figure 28. MG2S Wiring Diagram

Gas Information

GAS FLOW RATES (Cubic Feet Per Hour)			
TIME FOR ONE REVOLUTION (SECONDS)	CUBIC FEET PER REVOLUTION OF GAS METER		
	1	5	10
10	360	1,800	3,600
12	300	1,500	3,000
14	257	1,286	2,571
16	225	1,125	2,250
18	200	1,000	2,000
20	180	900	1,800
22	164	818	1,636
24	150	750	1,500
26	138	692	1,385
28	129	643	1,286
30	120	600	1,200
32	113	563	1,125
34	106	529	1,059
36	100	500	1,000
38	95	474	947
40	90	450	900
42	86	429	857
44	82	409	818
46	78	391	783
48	75	375	750
50	72	360	720
52	69	346	692
54	67	333	667
56	64	321	643
58	62	310	621
60	60	300	600
62	58	290	581
64	56	281	563

GAS FLOW RATES (Cubic Feet Per Hour)			
TIME FOR ONE REVOLUTION (SECONDS)	CUBIC FEET PER REVOLUTION OF GAS METER		
	1	5	10
66	55	273	545
68	53	265	529
70	51	257	514
72	50	250	500
74	49	243	486
76	47	237	474
78	46	231	462
80	45	225	450
82	44	220	439
84	43	214	429
86	42	209	419
88	41	205	409
90	40	200	400
92	39	196	391
94	38	191	383
96	38	188	375
98	37	184	367
100	36	180	360
102	35	176	353
104	35	173	346
106	34	170	340
108	33	167	333
110	33	164	327
112	32	161	321
114	32	158	316
116	31	155	310
118	31	153	305
120	30	150	300

Table 9. Gas Flow Rates

CAPACITY OF BLACK IRON GAS PIPE (CU. FT. PER HOUR) FOR NATURAL GAS (SPECIFIC GRAVITY - 0.60)								
Nominal Pipe Diameter (IN.)	Length of Pipe Run (Feet)							
	10	20	30	40	50	60	70	80
1/2	130	90	75	65	55	50	45	40
3/4	280	190	150	130	115	105	95	90
1	520	350	285	245	215	195	180	170
1 1/4	1,050	730	590	500	440	400	370	350
1 1/2	1,600	1,100	890	760	670	610		

$$\text{Cubic Feet Per Hour Required} = \frac{\text{Input To Furnace (Btu/hr)}}{\text{Heating Value of Gas (Btu/Cu. Ft.)}}$$

NOTE: The cubic feet per hour listed above must be greater than the cubic feet per hour of gas flow required by the furnace. To determine the cubic feet per hour of gas flow required by the furnace, divide the input rate of the furnace by the heating value (from gas supplier) of the gas.

Table 10. Gas Pipe Capacities

INPUT (BTU)	ALTITUDE ABOVE SEA LEVEL																		
	0 to 1,999 FT				2,000 to 2,999 FT			3,000 to 4,999 FT			5,000 to 5,999 FT			6,000 to 7,999 FT			8,000 to 10,000 FT		
	ORIFICE SIZE	MANIFOLD PRESSURE		ORIFICE SIZE	MANIFOLD PRESSURE		ORIFICE SIZE	MANIFOLD PRESSURE		ORIFICE SIZE	MANIFOLD PRESSURE		ORIFICE SIZE	MANIFOLD PRESSURE		ORIFICE SIZE	MANIFOLD PRESSURE		
		LOW	HIGH		LOW	HIGH		LOW	HIGH		LOW	HIGH		LOW	HIGH		LOW	HIGH	
39,000	1.1mm	4.2	10.0	1.1mm	3.8	9.0	1.1mm	3.6	8.5	#59	4.2	10.0	#59	3.8	9.0	#59	3.6	8.5	
57,000	1.25mm	4.2	10.0	1.25mm	3.8	9.0	1.25mm	3.6	8.5	1.1mm	4.2	10.0	1.1mm	3.8	9.0	1.1mm	3.6	8.5	
63,000	1.2mm	4.2	10.0	1.2mm	3.8	9.0	1.2mm	3.6	8.5	1.1mm	4.2	10.0	1.1mm	3.8	9.0	1.1mm	3.6	8.5	

Table 11. Liquid Propane Conversion Chart

LOCAL HEATING VALUES FOR NATURAL GAS										
ALTITUDE ABOVE SEA LEVEL	BTU PER CUBIC FOOT									
	650	700	750	800	850	900	950	1,000	1,050	
2,000 FT	LOW	LOW	LOW	LOW	LOW	LOW	HIGH	HIGH	HIGH	
3,000 FT	LOW	LOW	LOW	LOW	LOW	LOW	HIGH	HIGH	HIGH	
4,000 FT	LOW	LOW	LOW	LOW	LOW	HIGH	HIGH	HIGH	HIGH	
5,000 FT	LOW	LOW	LOW	LOW	LOW	HIGH	HIGH	HIGH	HIGH	
6,000 FT	LOW	LOW	LOW	LOW	HIGH	HIGH	HIGH	HIGH	HIGH	
7,000 FT	LOW	LOW	LOW	LOW	HIGH	HIGH	HIGH	HIGH	HIGH	
8,000 FT	LOW	LOW	LOW	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	
9,000 FT	LOW	LOW	LOW	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	
10,000 FT	LOW	LOW	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	

Table 12. Natural Gas Heating Values

NATURAL GAS with HIGH HEATING VALUE							
ALTITUDE ABOVE SEA LEVEL.	O.S & M.P.	INPUT (BTU)					
		45000		60000		72000	
		LOW	HIGH	LOW	HIGH	LOW	HIGH
0 FT to 1,999 FT	O.S.	49		45		47	
	M.P.	1.7	3.5	1.7	3.5	1.7	3.5
2,000 FT to 2,999 FT	O.S.	49		45		47	
	M.P.	1.7	2.9	1.7	3.3	1.7	3.2
3,000 FT to 3,999 FT	O.S.	49		45		47	
	M.P.	1.7	2.8	1.7	3.1	1.7	3
4,000 FT to 4,999 FT	O.S.	49		45		47	
	M.P.	1.7	2.6	1.7	2.9	1.7	2.8
5,000 FT to 5,999 FT	O.S.	49		45		47	
	M.P.	1.7	2.5	1.7	2.8	1.7	2.7
6,000 FT to 6,999 FT	O.S.	51		48		49	
	M.P.	1.7	3.3	1.7	3.5	1.7	3.5
7,000 FT to 7,999 FT	O.S.	51		48		49	
	M.P.	1.7	3	1.7	3.3	1.7	3.3
8,000 FT to 8,999 FT	O.S.	51		48		49	
	M.P.	1.7	2.8	1.7	3	1.7	3
9,000 FT to 9,999 FT	O.S.	51		48		49	
	M.P.	1.7	2.6	1.7	2.8	1.7	2.8

NOTE: O.S.=Orifice Size, M.P. = Manifold Pressure

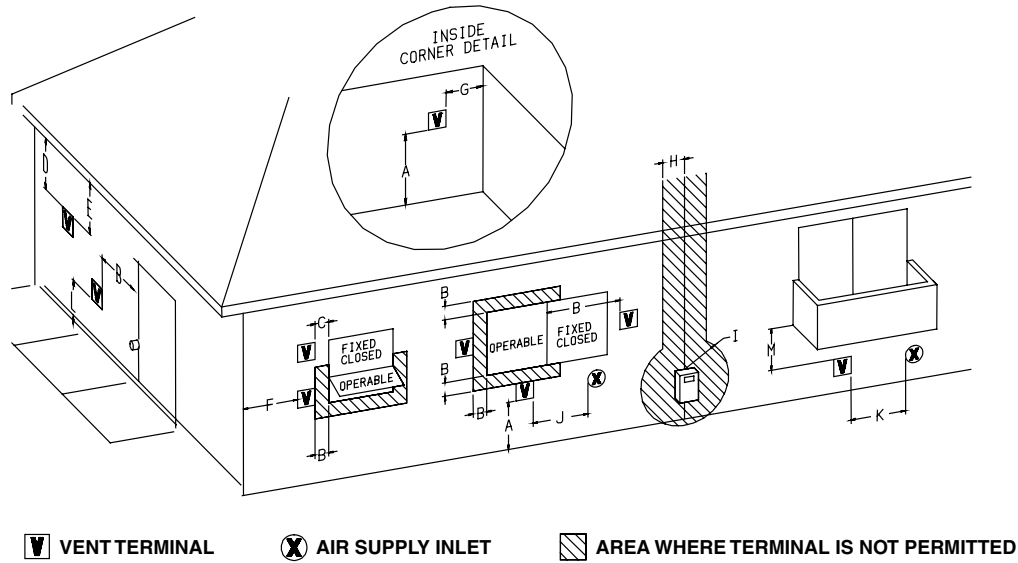
Table 13. Orifices for Natural Gas High Heating Value

NATURAL GAS with LOW HEATING VALUE							
ALTITUDE ABOVE SEA LEVEL	O.S & M.P.	INPUT (BTU)					
		45000		60000		72000	
		LOW	HIGH	LOW	HIGH	LOW	HIGH
0 FT to 1,999 FT	O.S.	49		45		47	
	M.P.	1.7	3.5	1.7	3.5	1.7	3.5
2,000 FT to 2,999 FT	O.S.	49		45		47	
	M.P.	1.7	3.5	1.7	3.5	1.7	3.5
3,000 FT to 3,999 FT	O.S.	49		45		47	
	M.P.	1.7	3.1	1.7	3.4	1.7	3.3
4,000 FT to 4,999 FT	O.S.	49		45		47	
	M.P.	1.7	2.9	1.7	3.2	1.7	3.1
5,000 FT to 5,999 FT	O.S.	49		45		47	
	M.P.	1.7	2.7	1.7	3.1	1.7	2.9
6,000 FT to 6,999 FT	O.S.	49		45		47	
	M.P.	1.7	2.6	1.7	2.9	1.7	2.8
7,000 FT to 7,999 FT	O.S.	51		48		49	
	M.P.	1.7	3.5	1.7	3.5	1.7	3.4
8,000 FT to 8,999 FT	O.S.	51		48		49	
	M.P.	1.7	3.1	1.7	3.3	1.7	3.2
9,000 FT to 9,999 FT	O.S.	51		48		49	
	M.P.	1.7	2.9	1.7	3.1	1.7	2.9

NOTE: O.S.=Orifice Size, M.P. = Manifold Pressure

Table 14. High Altitude Deration Chart for Natural Gas - Low heating Value

Venting Information



Clearance Location	CANADIAN INSTALLATIONS ^a	US INSTALLATIONS ^b		
	Direct Vent (2-pipe) & Conventional Vent (1-pipe) Furnaces	Direct Vent (2-pipe) Furnaces	Conventional Vent (1-pipe) Furnaces	
A	Clearance above grade, veranda, porch, deck, balcony, or maximum expected snow level.	12 inches (30cm)	12 inches (30cm)	12 inches (30cm)
B	Clearance to window or door that may be opened.	6 inches (15cm) for appliances < 10,000 Btuh (3kW) 12 inches (30cm) for appliances 10,000 Btuh - 100,000 Btuh (30kW) 36 inches (91cm) for appliances > 100,000 Btuh (30Kw)	6 inches (15cm) for appliances < 10,000 Btuh (3kW) 9 inches (23cm) for appliances 10,000 Btuh - 50,000 Btuh (30kW) 12 inches (30cm) for appliances > 50,000 Btuh (30Kw)	4 ft. (1.2m) below or to side of opening; 1 ft. (300mm) above opening
C	Clearance to permanently closed window	12 inches (30cm) suggested or as needed to avoid condensation on glass.	12 inches (30cm) suggested or as needed to avoid condensation on glass.	
D	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 feet (61cm) from the center line of the terminal.	Clearance must be greater than the depth of the soffit unless it complies with Figure 30 (page 38)	Clearance must be greater than the depth of the soffit unless it complies with Figure 30 (page 38)	
E	Clearance to unventilated soffit.	Clearance must be greater than the depth of the soffit unless it complies with Figure 30 (page 38)	Clearance must be greater than the depth of the soffit unless it complies with Figure 30 (page 38)	
F	Clearance to outside corner.	All Clearances in this Figure apply on both walls	All Clearances in this Figure apply on both walls	
G	Clearance to inside corner.	All Clearances in this Figure apply on both walls	All Clearances in this Figure apply on both walls	
H	Clearance to each side of center line extended above meter/regulator assembly.	3 feet (91cm) within a height 15 feet above the meter/regulator assembly	3 feet (91cm) within a height of 15 feet	
I	Clearance to service regulator vent outlet.	3 feet (91cm)	3 feet (91cm) in any direction	
J	Clearance to non-mechanical air supply inlet to building or the combustion air inlet to any other appliance.	6 inches (15cm) for appliances < 10,000 Btuh (3kW) 12 inches (30cm) for appliances 10,000 Btuh - 100,000 Btuh (30kW) 36 inches (91cm) for appliances > 100,000 Btuh (30Kw)	6 inches (15cm) for appliances < 10,000 Btuh (3kW) 9 inches (23cm) for appliances 10,000 Btuh - 50,000 Btuh (30kW) 12 inches (30cm) for appliances > 50,000 Btuh (30Kw)	4 ft. (1.2m) below or to side of opening; 1 ft. (300mm) above opening
K	Clearance to mechanical air supply inlet.	6 feet (1.83m)	3 feet (91cm) above if within 10 feet (3m) horizontally	3 ft. (91cm) above if within 10 feet (3m) horizontally
L	Clearance above paved sidewalk or driveway located on public property.	7 feet (2.13m) ^c	7 feet (2.13m) ^c	7 ft. (2.13m)
M	Clearance under open veranda, porch, deck, or balcony.	12 inches (30cm) ^d	12 inches (30cm) ^d	12 inches (30cm) ^d

NOTES:

a = In accordance with the current CSA B149.1 Natural Gas and Propane Installation Guide Code

b = In accordance with the current ANSI Z223.1 / NFPA 54 Natural Fuel Gas Code

c = A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.

d = Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor.

Table 15. Vent Termination Clearances

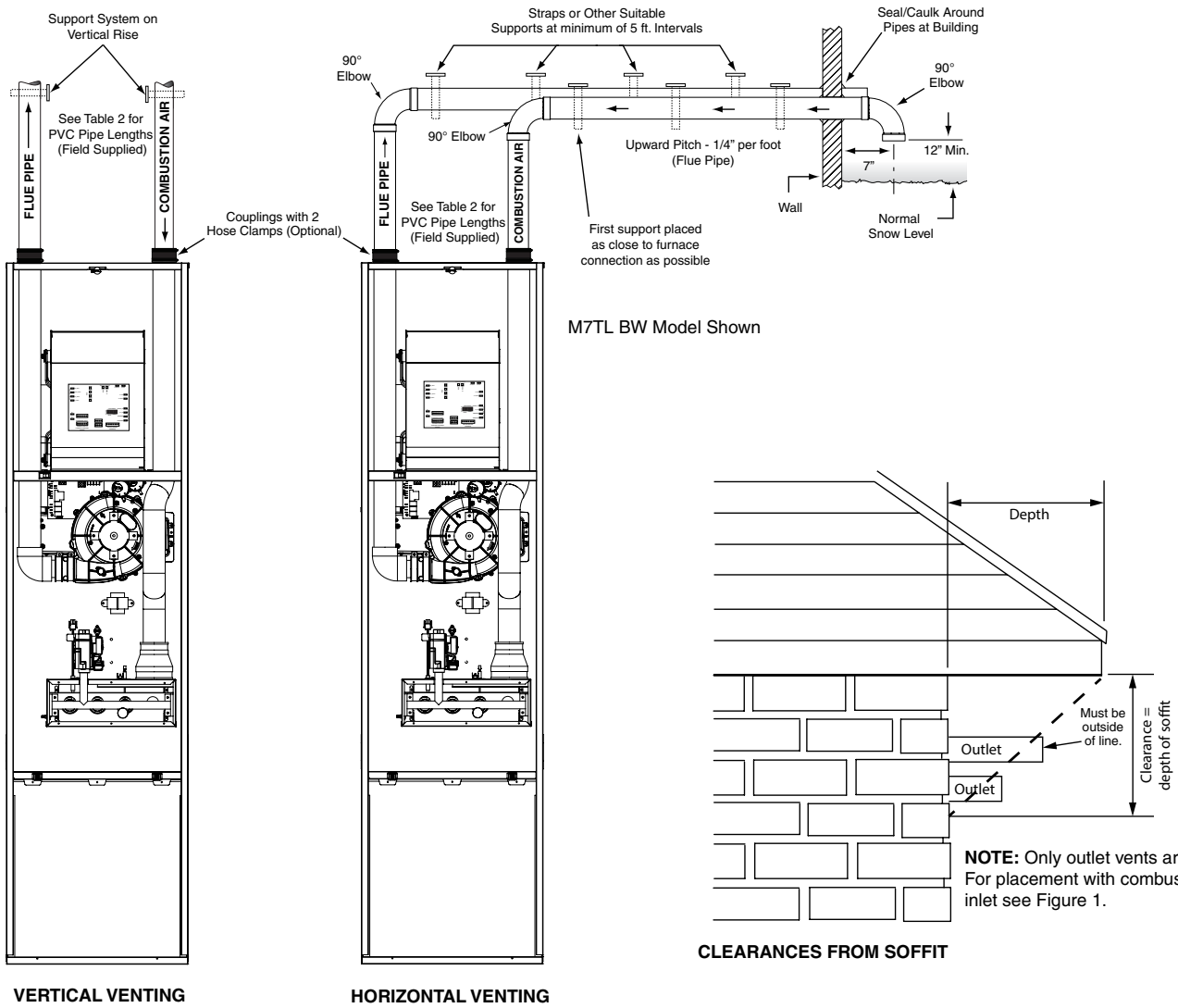


Figure 29. Horizontal / Vertical Venting & Clearances from Soffit

INSTALLATION CHECKLIST

ATTENTION INSTALLERS:

It is your responsibility to know this product better than your customer. This includes being able to install the product according to strict safety guidelines and instructing the customer on how to operate and maintain the equipment for the life of the product. Safety should always be the deciding factor when installing this product and using common sense plays an important role as well. Pay attention to all safety warnings and any other special notes highlighted in the manual. Improper installation of the furnace or failure to follow safety warnings could result in serious injury, death, or property damage.

These instructions are primarily intended to assist qualified individuals experienced in the proper installation of this appliance. Some local codes require licensed installation/service personnel for this type of equipment. Please read all instructions carefully before starting the installation. Return these instructions to the customer's package for future reference.

INSTALLER NAME:

CITY:	STATE:
-------	--------

INSTALLATION ADDRESS:

CITY:	STATE:
-------	--------

UNIT MODEL #

UNIT SERIAL #

Minimum clearances per Table 1, (page 5) ?	YES	NO
Has the owner's information been reviewed with the homeowner?	YES	NO
Has the literature package been left near the furnace?	YES	NO

ELECTRICAL SYSTEM

Electrical connections tight?	YES	NO
Line voltage polarity correct?	YES	NO
Supply Voltage	VOLTS:	
Has the thermostat been calibrated?	YES	NO
Is the thermostat level?	YES	NO
Is the heat anticipator setting correct?	YES	NO

GAS SYSTEM

Gas Type: (circle one)	Natural Gas	Propane
Gas pipe connections leak tested?	YES	NO
Gas Line Pressure	(in - W.C.)	
Installation Altitude	(FT.)	
Deration Percentage	(%)	
Furnace Input	(Btuh)	
Supply Air Temperature	(° F)	
Return Air Temperature	(° F)	
Temperature Rise	(° F)	

COMBUSTION AIR & VENTING SYSTEM

Is there adequate fresh air supply for combustion and ventilation?	YES	NO
Vent free from restrictions?	YES	NO
Filter(s) secured in place?	YES	NO
Filter(s) clean?	YES	NO
Flue connections tight?	YES	NO
Is there proper draft?	YES	NO

