

M3 CONDENSING WATER BOILER INSTALLATION & MAINTENANCE MANUAL MODELS (400, 500, 600, 650, 700, 750, 800) WB 130 A-CBM

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

IMPORTANT: THIS MANUAL CONTAINS INFORMATION REQUIRED FOR INSTALLATION, OPERATION AND MAINTENANCE OF THIS EQUIPMENT. READ AND FOLLOW THE INFORMATION IN THIS MANUAL AND ALL OTHER PROVIDED INSTRUCTIONS, LABELS AND MARKINGS BEFORE INSTALLING, OPERATING OR SERVICING THIS UNIT.



TO THE INSTALLER: After installation, these instructions must be given to the equipment user or left near the appliance.

SPECIAL INSTRUCTIONS TO THE OWNER: Retain this manual for future reference. These instructions contain important information that will help you in maintaining and operating this appliance.

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M3 CONDENSING WATER BOILER

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Warranty forms ship separately with each product.

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1 SAFETY CONSIDERATIONS

WARNING: If the information in the supplied manual(s) is not followed exactly, a fire, explosion or exposure to hazardous materials may result, causing property damage, personal injury or death.

AVERTISSEMENT. Assurez-vous de bien suivre les instructions données dans cette notice pour réduire au minimum le risque d'incendie ou d'explosion ou pour éviter tout dommage matériel, toute blessure ou la mort

FOR YOUR SAFETY

- **Do not** store or use gasoline or other flammable vapors or liquids in the vicinity of this or any other appliance.
- **Ne pas** entreposer ni utiliser d'essence ou ni d'autres vapeurs ou liquides inflammables à proximité de cet appareil ou de tout autre appareil.

WHAT TO DO IF YOU SMELL GAS

- **Do not** try to light any appliance.
- **Do not** touch any electric switch; do not use any phone in your building.
- **Immediately** call your gas supplier from a location away from your building and the smell of gas. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

QUE FAIRE SI VOUS SENTEZ UNE ODEUR DE GAZ:

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

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

L'installation et l'entretien doivent être assurés ou un service d'entretien qualifié ou par le fournisseur de gaz.

This product contains, or may come to contain materials that have been identified as carcinogenic, or possibly carcinogenic to humans. Before installing, servicing or removing this product, read and follow the supplied instructions

Clearance in accordance with the local installation codes and the requirements of the gas supplier.

Dégagement conforme aux codes d'installation locaux et aux exigences du fournisseur de gaz.

Should overheating occur or the gas supply fail to shut off, turn off the manual gas control valve to the appliance.

En cas de surchauffe ou si l'alimentation en gaz ne s'arrête pas, fermez manuellement le robinet d'arrêt de l'admission de gaz.

WARNING: Installation and service must be performed by a qualified installer, service agency or the gas supplier, who must read and follow the supplied instructions before installing, servicing or removing this appliance. Refer to the information contained in this manual. Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury, exposure to hazardous materials or death.

WARNING: Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the unit and to replace any part of the control system, all gas controls and all other items affecting safe appliance operation and which has been under water.

AVERTISSEMENT: N'utilisez pas cet appareil s'il a été plongé dans l'eau, même partiellement. Faites inspecter l'appareil par un technicien qualifié et remplacez toute partie du système de contrôle et toute commande qui ont été plongés dans l'eau.

WARNING: In an emergency shut the main gas supply valve to the appliance from a location safely away from the emergency. Failure to follow these instructions can cause property damage, personal injury, and exposure to hazardous materials or death.

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PRODUCT SAFETY INFORMATION REFRACTORY CERAMIC FIBER PRODUCT WITH CRYSTALLINE SILICA

WARNING: This product contains or may come to contain crystalline silica, which has been identified by the International Agency for Research on Cancer (IARC) as carcinogenic to humans. This product also contains refractory ceramic fibers, which have been identified by the IARC as possibly carcinogenic to humans. Avoid breathing fiber particulates and dust.

RISKS:

- Air borne fibrous insulation is a possible cancer hazard by inhalation.
- Airborne crystalline silica may cause silicosis (lung disease) by inhalation.
- May cause temporary irritation to eyes, skin, and respiratory tract.

PRECAUTIONARY MEASURES:

- Minimize airborne fibers with engineering controls.
- Use NIOSH/MSHA approved respirators as required (see MSDS).
- Wear long sleeved, loose-fitting clothing, eye protection and gloves.

FIRST AID MEASURES: (If any of the irritations listed persists, seek medical attention)

- Eyes: Flush with water.
- Skin: Wash with soap and warm water.
- Ingestion: Do not induce vomiting. Get medical attention if gastrointestinal symptoms develop.
- Inhalation: Remove to fresh clean air.

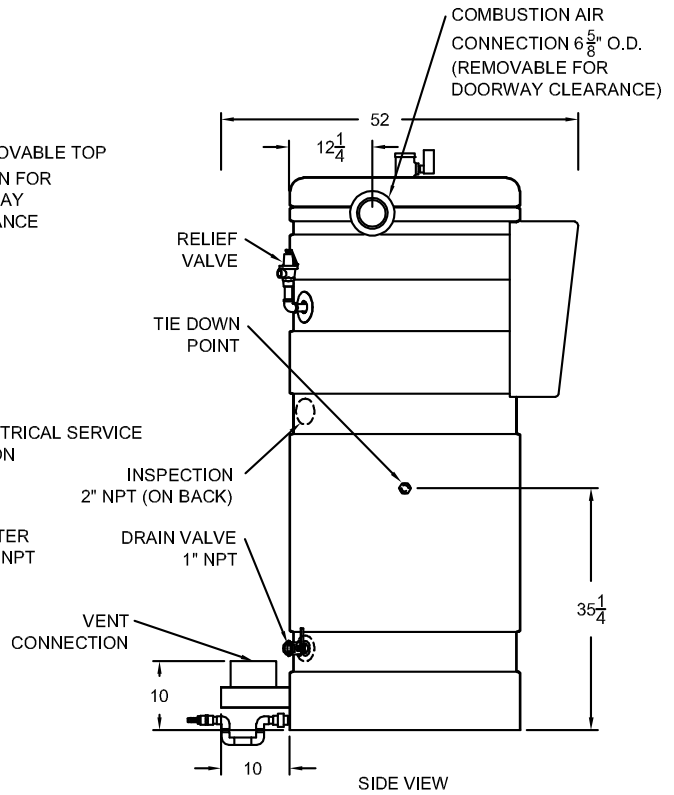
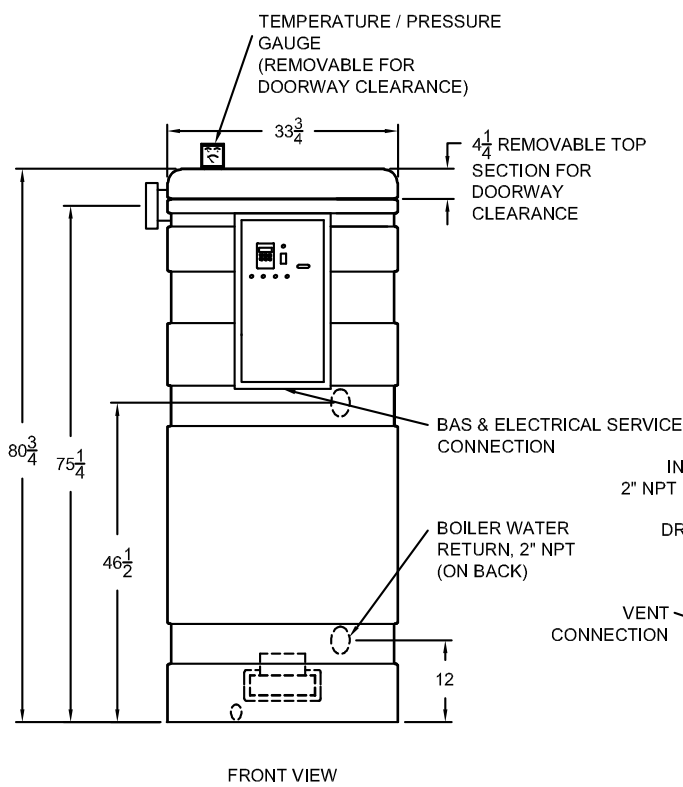
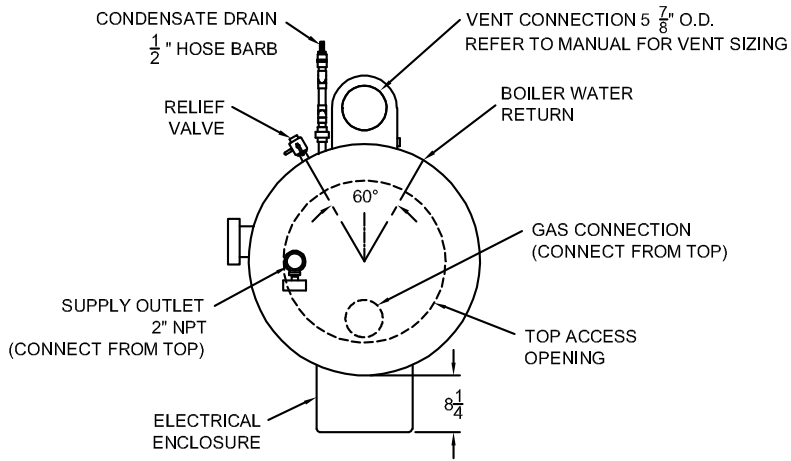
WARNING: If you are unfamiliar with the safe handling of refractory ceramic fiber products, or if you wish additional information prior to beginning any disassembly of the water heater or boiler that might expose refractory ceramic fiber materials, contact: Unifrax Corporation, 2351 Whirlpool Street, Niagara Falls, NY 14305-2413, 1-800-322-2293.

IDENTIFICATION OF REFRACTORY CERAMIC FIBER MATERIALS (RCF):

The burner assembly utilizes RCF material. (The RCF materials are located within the product and not generally exposed except during service, disassembly or assembly.)

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2 PRODUCT DESCRIPTION Component, Controls and Connection Locations (Locations May Vary)



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3 BOILER INSTALLATION

3.1 Checking Equipment Before You Install

- Inspect the unit completely upon receipt from the freight carrier before signing the bill of lading. Inspect the appliance and all accompanying parts for signs of impact or mishandling. Verify the total number of pieces shown on packing slips with those actually received. Contact the freight carrier immediately if any damage or shortage is detected.
- Check the data decal on the appliance. Be sure the electrical, water and gas supply is adequate for the installation.
- Carefully remove all side and top shipping supports and bracing. If possible, do not remove the wooden base/skid assembly until the product has been moved to its final location for installation and operation (see: Handling and Locating the Boiler).

3.2 Codes

The equipment must be installed in accordance with those installation regulations in force in the local area where the installation is to be made. Authorities having jurisdiction must be consulted before installation is made. In the absence of such requirements, the installation must be in accordance with the instructions in this manual, appliance markings, all supplemental instructions and in compliance with the latest edition of the National Fuel Gas Code, ANSI Z223.1/NFPA 54. Where required by the authority having jurisdiction, the installation must also conform to American Society of Mechanical Engineers "Safety Code for Controls and Safety Devices for Automatically Fired Boilers" (CSD-1). Where required by the Canadian authority having jurisdiction, the equipment must be installed in accordance with the latest edition of B149.1-10 Natural Gas and Propane Installation Code and applicable Provincial Regulations. All appliances conform to the current edition of the ASME Boiler and Pressure Vessel Code, Section IV.

3.3 Electrical Requirements

See appliance rating decal for electrical service requirements. The appliance must be electrically supplied and grounded in accordance with the requirements of the authority having jurisdiction or, in the absence of such requirements, with the latest edition of the National Electrical Code ANSI/NFPA No. 70. In Canada, the electrical service must conform to local electrical codes and/or CSA C22.1, Canadian Electrical Code, Part 1.

- All wiring between the unit and field installed devices must be made with type T copper wire.
- Line voltage wire exterior to the appliance must be enclosed in approved conduit or approved metal clad cable.
- To avoid serious damage, **DO NOT** energize the unit until the system and appliance is full of water.

Utiliser du fil de cuivre de la taille appropriée pour le service électrique entrant. Les dommages résultant de l'utilisation de fil d'aluminium seront exclus du champ d'application de la garantie de cet appareil.

3.4 Handling and Locating the Boiler

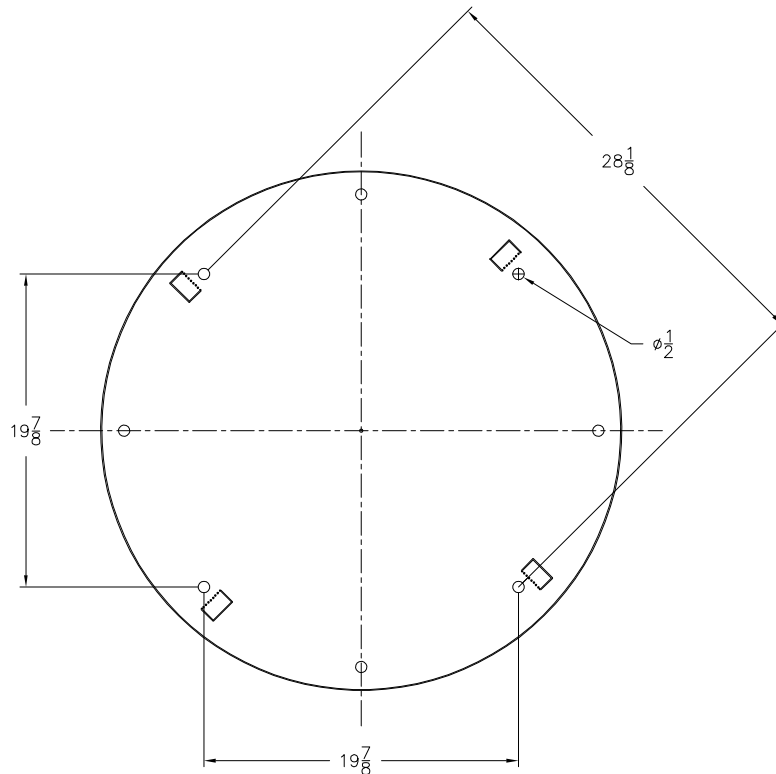
WARNING: Use industry standard safe rigging methods, such as strapping around the boiler base/skid assembly and using spreader bars, when attempting to lift or move this product. Failure to follow industry standard safe rigging methods can result in property damage, serious injury or death.

- 1 The boiler must be located indoors.
- 2 This boiler can be installed directly on a combustible floor.
- 3 Locate the boiler in an area that is not exposed to freezing temperatures.
4. This boiler must be installed on a level housekeeping pad at least 3" above the floor for proper condensate drainage and boiler operation.
5. Locate the boiler near a floor drain. Locate the unit so if the tank or water connections should leak, water damage will not occur to the adjacent area or to lower floors of the building. When such locations are unavoidable, install an adequately drained metal drain pan underneath the boiler. The manufacturer's warranty does not cover water damage.
6. Protect associated electrical components and electrical connections from water (dripping, spraying, rain, etc.) during appliance operation and service.
7. Locate the boiler where the vent and air intake piping, when installed, will remain within the maximum equivalent lengths allowed. See Venting.

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8. Use the following diagram to locate anchors or attachment points, when connecting the boiler to the floor. Typical concrete anchors: 5/16" x 1-3/4" double expansion shields.

Anchoring Attachment Points for Connection to Floor



3.5 Clearances To Combustible Surfaces

The minimum clearance to combustible material is 15" from the top, 24" from the front and zero clearance (0") from the sides and back of the boiler. The M3 can be installed directly on a combustible floor.

Distance minimale aux matériaux combustibles est égale à zéro (0 cm) sur les côtés et à l'arrière, avant les 61 cm, 38 cm de haut et peut être installé directement sur un plancher combustible.

3.6 Service Clearances

Additional clearance beyond the minimum required to combustible material should be considered to facilitate easy access for inspection and service of items such as the burner, gas controls and plumbing connections. Also allow sufficient space for installing and servicing building water, gas, vent, combustion air, electrical, pump and other auxiliary/optional equipment and connections.

3.7 Other Code and Regulatory Clearances and Requirements

Additional clearance beyond the minimum required to combustible materials and other requirements may be required to comply with local, state or national codes and regulations. It is to the responsibility of the installer to comply with these requirements. Examples of codes or regulations that may apply are the National Electric Code, State/Regional/National drain water and flue emissions regulations, the National Fuel Gas Code, Building Construction and Safety Codes, the Americans with Disabilities Act (ADA), "Safety Code for Controls and Safety Devices for Automatically Fired Boilers" (CSD-1) and other applicable Boiler Installation Code and Regulatory requirements.

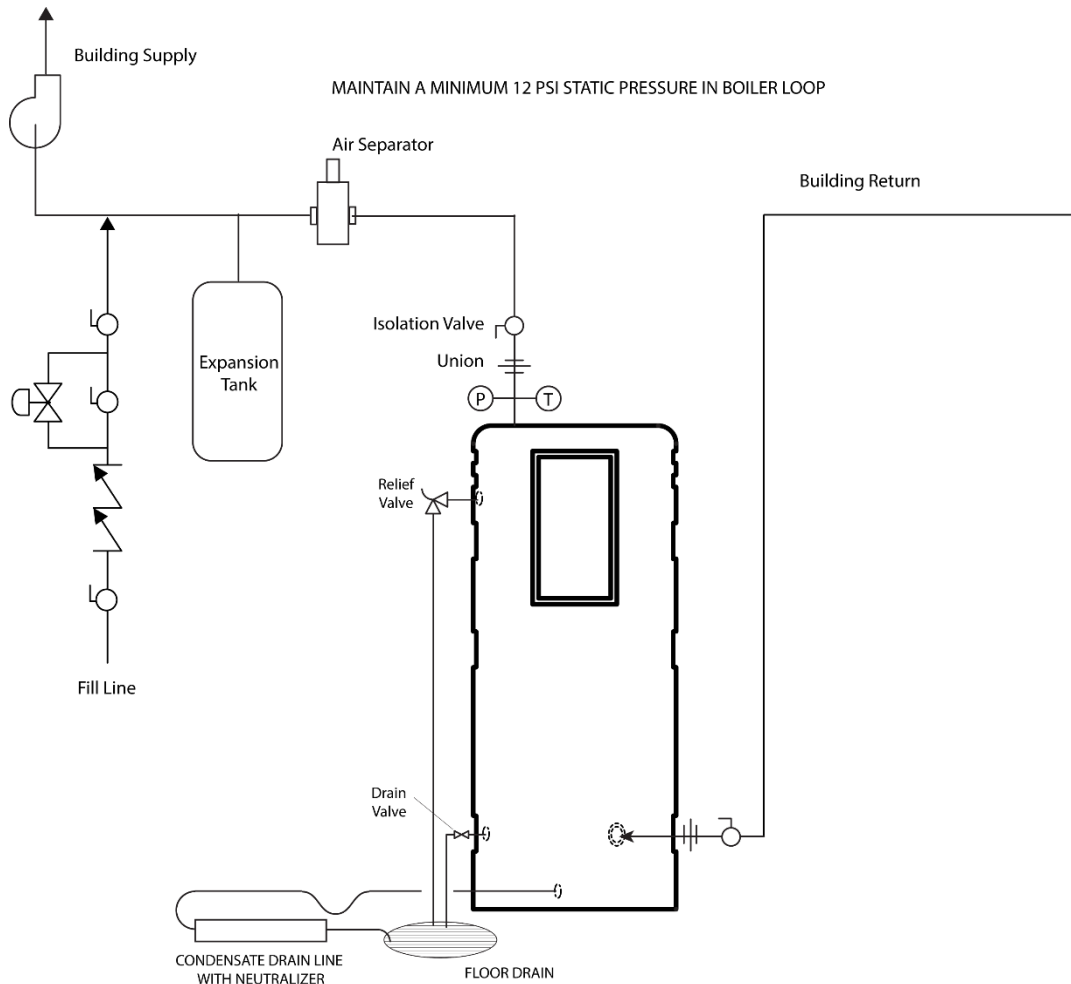
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4 GENERAL PIPING GUIDELINES

4.1 Supply and Return Connections

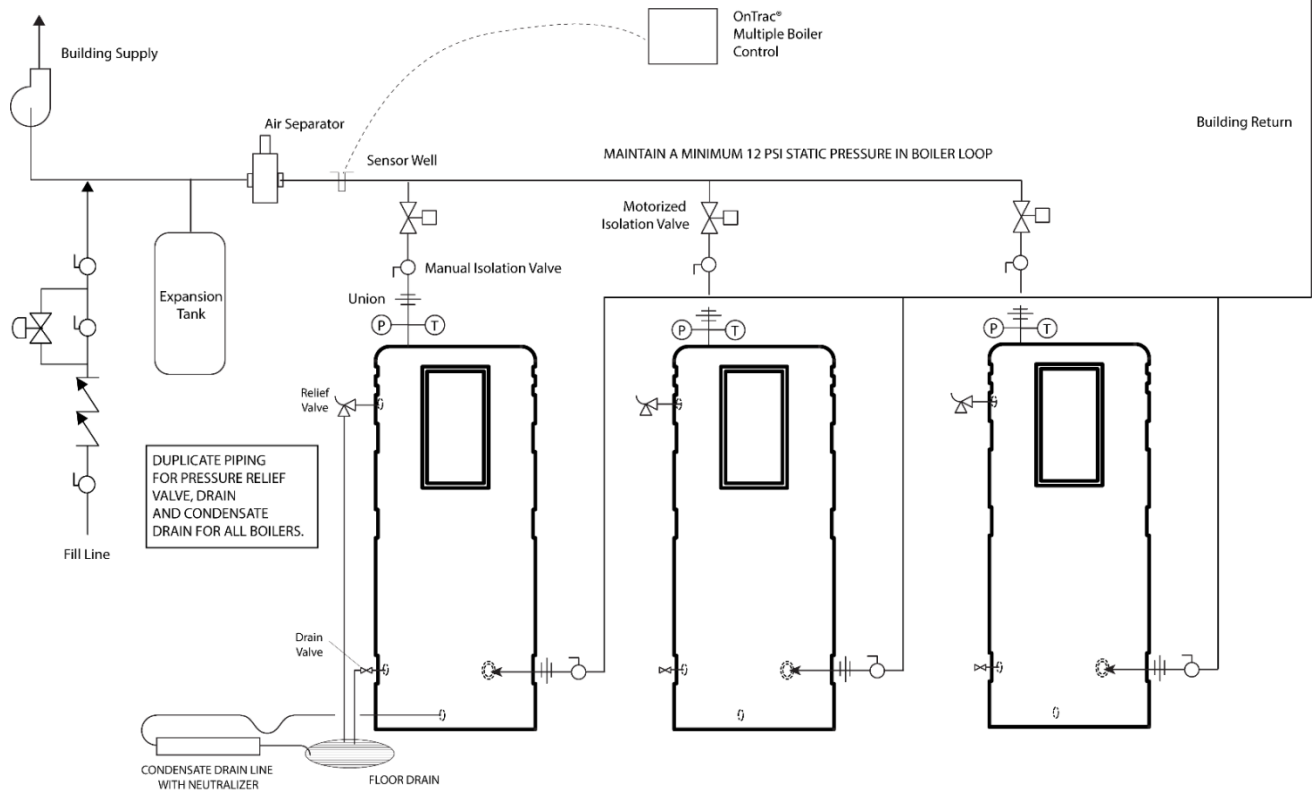
1. Connect the boiler system return piping (water to be heated) to the “Return” fitting located near the bottom and rear of the boiler.
2. Connect the system supply piping (hot water out of the unit) to the “Supply” fitting located and accessed at the top of the boiler.
3. Install shut-off valves and unions on the Return and Supply piping for servicing. Use caution when threading pipe nipples into tank connections to prevent cross threading, or over-tightening. Always use a back-up wrench on tank nipples when tightening unions, valves, etc.
4. Take those steps necessary to avoid the risk of boiler water freezing in the boiler or system piping (such as adding glycol (up to 50%), insulating pipes, heat trace, etc.).
5. Pipe the drain valve to a suitable open drain capable of receiving discharge temperatures up to 212°F.

IMPORTANT: Do not use the plumbing connected to the appliance as a ground for welding or any other purpose.

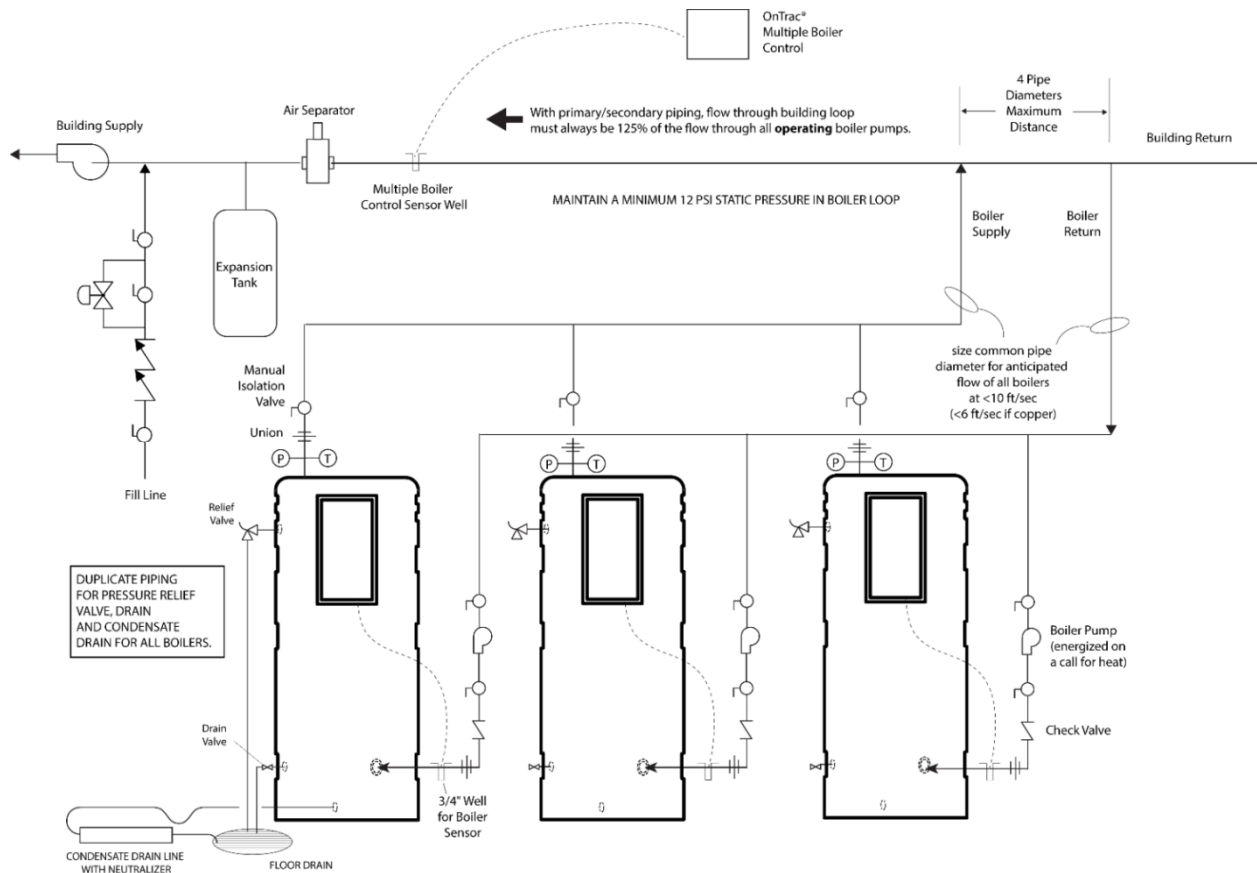


Example of a Single Boiler, Primary Only Installation

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Example of a Multi Boiler, Primary Only Installation



Example of a Multi Boiler, Primary/Secondary Only Installation

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4.2 Sensor Locations and Thermal Well

The boiler uses an operating sensor and a monitoring sensor. One sensor is located in the thermal well in the upper portion of the boiler water tank. A second sensor for use external to the boiler is coiled and located in the control enclosure along with the Sensor Thermal Well. The Sensor Thermal Well can be installed in the piping going to or from the boiler, based on application. As shipped, the sensor located in the upper portion of the boiler is used as the operator and is connected to P1 (see wiring diagram) and the 25 foot long sensor coiled in the control enclosure is used as the monitor and is connected to P2 (see wiring diagram). The operating sensor location is based on the boiler application. The operating and monitoring sensor wiring to the TempTrac control can be swapped to make the 25 foot long monitoring sensor serve as a remote operating sensor.

Multiple boiler installations or adding outdoor reset requires a communication-based (non-analog) BMS such as an Ontrac[®] control.

IMPORTANT: See boiler application guidelines regarding placement of multi sensor well, as well as sensor configuration and Ontrac operation.

4.3 Filling the Boiler

1. Fill the system with water. To be sure that the unit is not “air bound,” open the relief valve. Leave the valve open until a steady flow of water is observed. Close the valve and complete filling the system.
2. In hard water areas, fill water should receive water treatment to reduce the introduction of minerals into the system. Excessive buildup of minerals in the heat exchanger can cause a non-warrantable failure.
3. Make sure there are no system leaks. DO NOT use petroleum based stop-leak products. All system leaks must be repaired. The constant addition of make-up water to a closed loop boiler system can cause minerals to collect in the heat exchanger. Excessive buildup of minerals in the heat exchanger can cause a non-warrantable failure.
4. For systems requiring freeze protection, use only hydronic system antifreeze with a maximum concentration of 50%. Follow the glycol manufacturer’s instructions. DO NOT use undiluted or automotive type antifreeze.

4.4 Building Return Temperature

Condensing boilers like the M3 utilize colder building return water to increase boiler efficiency and lower flue gas temperatures to allow the use of plastic vent pipe like PVC. Higher building return water temperatures can result in higher vent temperatures that exceed the temperature limits for plastic venting systems.

See Section 8 “Venting” for the maximum building return water temperatures allowed for the selected venting system material to be installed.

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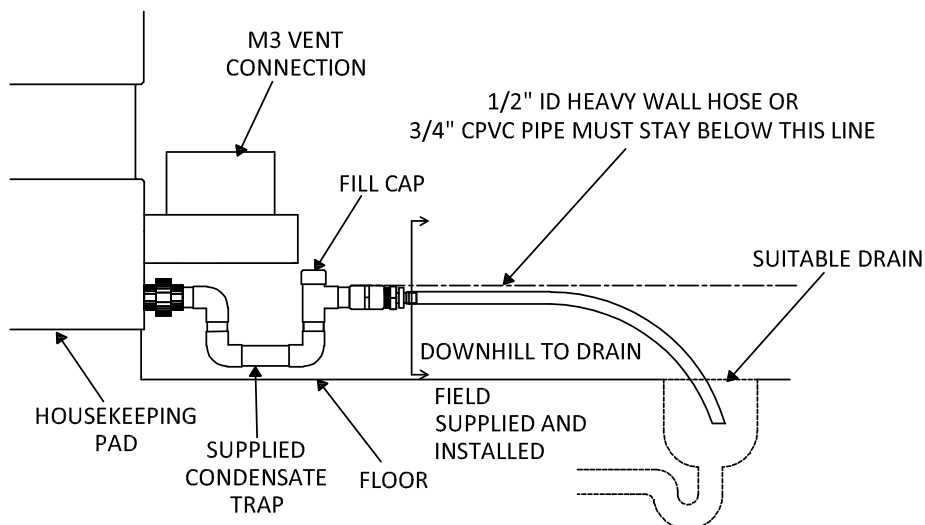
5 CONDENSATE DRAIN, TRAP & DISPOSAL

The M3 boiler produces a significant amount of condensate. The condensate drain is under slightly positive flue pressure; therefore the 3/4" CPVC condensate trap supplied with the product must always be used. This trap is sized and designed to create a liquid barrier to prevent flue gases from escaping through the condensate drain into the installed space. Prior to startup or after extended periods of non-use, manually fill the trap with water before operating the boiler.

WARNING: The trap included with this unit must be installed and maintained as described in these instructions and must be included as part of the condensate piping system. This trap is required to keep hazardous products of combustion from continually entering the installed space where the condensate piping terminates. Failure to properly install this trap can cause, personal injury, exposure to hazardous materials or death.

1. Attach the supplied 3/4" CPVC condensate trap to the mating CPVC union connection on the boiler condensate drain pipe located near the flue outlet. The trap must be rotated so the offset in the pipe aims down toward the floor. Do not rotate the offset toward the ceiling. Do not use tools to tighten the CPVC union. Hand tighten the CPVC union to seat the internal gasket.
2. Do not combine condensate drains from multiple condensing appliances into a single drain line. Route each drain line into a drain suitable for condensate and make certain the end of the drain lines are not submerged or otherwise blocked.
3. All condensate plumbing must be protected from freezing. Do not locate the condensate piping such that an ice dam of frozen condensate can block condensate from leaving the outlet.
4. The condensate is only slightly acidic (3-5 PH), however, local codes may require it to be neutralized prior to entering the drainage system. An optional, field installed, Condensate Neutralization System is available from the factory.
5. Connect a condensate drain line or the Riverside Hydronics® Condensate Neutralization System to the barbed hose connection, sized for 1/2" ID heavy wall Vinyl tubing rated for 170°F or higher, located at the end of the condensate trap. All piping from the condensate trap to the suitable drain must remain below the highest point (top of the condensate outlet pipe) on the properly attached condensate trap.

Condensate Trap without Optional Condensate Neutralizer



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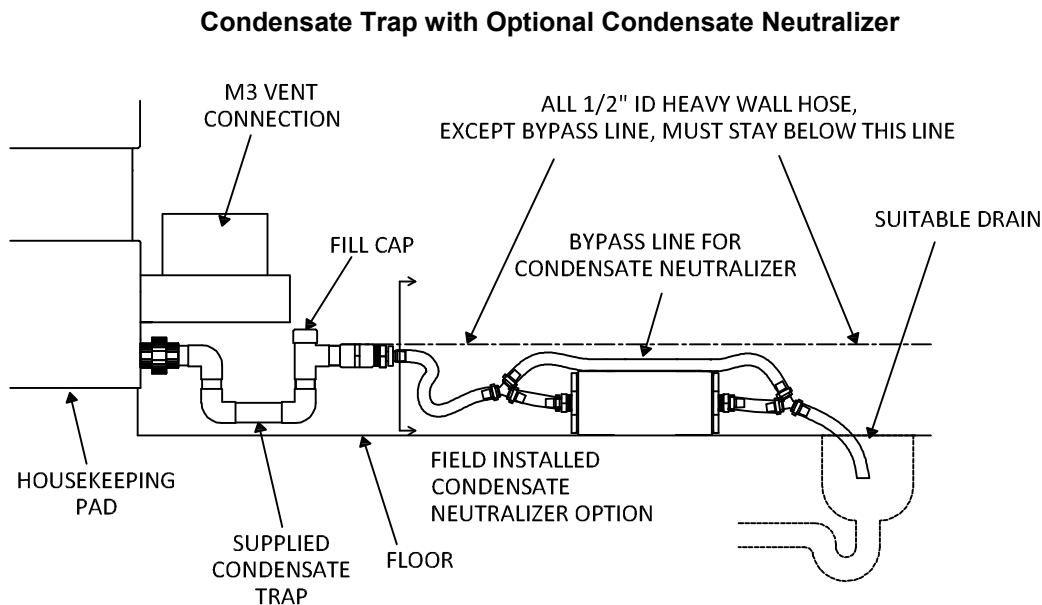
5.1 Condensate Neutralization System (optional)

Condensate is only slightly acidic (3-5 PH), however this slight acidity can be neutralized by routing it through an optional Condensate Neutralization System. Some "authorities having jurisdiction" require such neutralization before condensate disposal through a suitable drain. Condensate is neutralized while slowly flowing through a container filled with renewable crushed limestone. The condensate neutralizer reduces or avoids the need for separate chemical treatment or dilution using substantial quantities of tap water. Contact your local Riverside Hydronics® representative to obtain a Condensate Neutralization System and follow the instructions included for assembly and connection.

Condensate Neutralization Systems (CNS) Installation Requirements:

1. Follow the steps 1 through 6 in the Condensate Drain, Trap & Disposal section above.
2. The Condensate Neutralization System (CNS) must be mounted horizontally and level, with the mounting strap legs on the floor.
3. Locate the CNS in a convenient place between the condensate outlet and a suitable drain and where the 3" threaded end cap can be removed to recharge the Neutralizer with crushed limestone.
 - a. The CNS must be located such that condensate will flow downhill from the condensate trap outlet to the inlet on one end of the CNS and downhill from the other end of the CNS to the drain. If this continuous downhill flow is not maintained, the trap will not properly operate and condensate could back up into the boiler.
 - b. Follow the instructions included in the Condensate Neutralization System for connecting the supplied 1/2" Vinyl tubing.
4. Keep the Condensate Neutralization System closed at all times, except when the appliance is turned off for maintenance to recharge the condensate neutralizer with limestone.

WARNING: Keep the Condensate Neutralization System closed at all times the appliance is operating. The system must remain closed to prevent hazardous products combustion from continually enter the room. Failure to keep the Condensate Neutralization System closed during appliance operation can cause property damage, personal injury, exposure to hazardous materials or death.



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6 GAS SUPPLY AND PIPING

Verify the type of gas specified on rating plate is supplied to the unit. This unit is orificed for operation up to 2000 feet altitude. Appliance Btu/h input derates 4% per 1000 feet elevation above sea level. Consult Factory for installations above 2000 feet elevation.

6.1 Gas Train and Controls Certification

NOTE: The gas train and controls assembly provided on this unit have been tested under the applicable Nationally Recognized Standard to comply with safety and performance criteria such as ignition, combustion and safety shutdown operation.

6.2 Gas Control Trains

All models include the following gas control train components: manual shutoff valve, two safety shutoff valves, zero governor type regulator, manual test valve and manifold pressure taps. These components may be separate or combined in a common housing.

WARNING: Do not adjust or remove any screws or bolts on gas train control components which are secured with a red or blue sealing compound. In addition to voiding warranties and certification listings, such adjustment or disassembly can cause improper operation which could result in property damage, personal injury or death.

6.3 Inlet Pressure

Measure at the inlet pressure tap located at the main gas cock. The inlet pressure must remain within the minimum and maximum values while the unit is at rest and while the unit is operating at maximum firing rate.

INLET PRESSURE	NAT. GAS	Propane
Maximum Static Pressure (Inches-Water Column)	14"	14"
Minimum Flow Pressure (Inches-Water Column)	3.5"	8"

6.4 Manifold Pressure

Measure at the pressure tap located downstream side of the manual valve closest to the burner. The rated manifold pressure appears on the product data label located near the front of the appliance.

6.5 Gas Piping Size

Do not use the gas pipe connection size to determine the gas supply piping. Designing and sizing a gas supply piping system requires consideration of many factors and must be done by a gas supply piping expert. Always follow NFPA 54 National Fuel Gas Code for gas pipe sizing and gas pipe system design. The following charts provide examples of some of the information used by the gas supply piping expert to determine proper pipe sizes.

Use the values in the following table to add the equivalent straight pipe for each elbow or tee to obtain the total distance from the meter:

CONVERT FITTINGS TO EQUIVALENT STRAIGHT PIPE*								
Diameter Fitting (inches)	¾"	1"	1¼"	1½"	2"	3"	4"	5"
Equivalent Length of Straight Pipe (feet)	2'	2'	3'	4'	5'	10'	14'	20'

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Use the following table to determine the possible pipe size based on distance from gas meter for a Single Unit Installation using Schedule 40 Metallic Gas Pipe.*

SINGLE UNIT INSTALLATION – POSSIBLE SCHEDULE 40 METALLIC GAS PIPE SIZE*							
Distance from meter in equivalent feet of schedule 40 metallic gas pipe.* Based on inlet pressure less than 2 psi, specific gravity of 0.60 and a pressure drop of 0.5 in. w.c.							
MODEL	0' - 10'	11' - 25'	26' - 50'	51' - 100'	101' - 200'	201' - 300'	301' - 500'
400	1"	1"	1-1/4"	1-1/4"	1-1/2"	2"	2"
500	1"	1-1/4"	1-1/4"	1-1/2"	2"	2"	2-1/2"
600	1"	1-1/4"	1-1/2"	1-1/2"	2"	2"	2-1/2"
650	1"	1-1/4"	1-1/2"	1-1/2"	2"	2"	2-1/2"
700	1-1/4"	1-1/4"	1-1/2"	2"	2"	2-1/2"	2-1/2"
750	1-1/4"	1-1/4"	1-1/2"	2"	2"	2-1/2"	2-1/2"
800	1-1/4"	1-1/4"	1-1/2"	2"	2-1/2"	2-1/2"	3"

*See NFPA 54 National Fuel Gas Code for actual pipe size selection and for sizing Propane gas piping

MULTIPLE UNIT INSTALLATIONS SCHEDULE 40 METALLIC GAS PIPE SIZE CHART*														
Maximum Capacity of Pipe in Thousands of BTU's per hour for gas pressures of 14 Inches Water Column (0.5 PSIG) or less and a pressure drop of 0.05 Inch Water Column (Based on NAT GAS, 1025BTU's per Cubic Foot of Gas and 0.60 Specific Gravity).*														
Nominal Iron Pipe Size, Inches	Length of Pipe in Straight Feet													
	10	20	30	40	50	60	70	80	90	100	125	150	175	200
3/4	369	256	205	174	155	141	128	121	113	106	95	86	79	74
1	697	477	384	328	292	267	246	256	210	200	179	164	49	138
1 1/4	1400	974	789	677	595	543	502	472	441	410	369	333	308	287
1 1/2	2150	1500	1210	1020	923	830	769	707	666	636	564	513	472	441
2	4100	2820	2260	1950	1720	1560	1440	1330	1250	1180	1100	974	871	820
2 1/2	6460	4460	3610	3100	2720	2460	2310	2100	2000	1900	1700	1540	1400	1300
3	11200	7900	6400	5400	4870	4410	4000	3800	3540	3300	3000	2720	2500	2340
4	23500	16100	13100	11100	10000	9000	8300	7690	7380	6870	6150	5640	5130	4720

*See NFPA 54 National Fuel Gas Code for actual pipe size selection and for sizing Propane gas piping

6.6 Appliance Isolation During Gas Supply Piping Pressure Test

1. The appliance and its provided manual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of 1/2 PSI (3.5 kPa).
2. The appliance must be isolated from the gas supply piping system by closing its individual manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 PSI (3.5 kPa).
3. The appliance and its gas connection must be leak-tested before placing it in operation.

6.7 Gas Connection

1. Safe operation of unit requires adequate gas supply with the required static and dynamic (flow) pressures. Actual piping selection depends on many variables that must be carefully considered by the gas piping system designer.
2. Do not select gas pipe sizes based only on the supplied tables. These tables are for use by the gas piping system designer as a reference in checking pipe size selections.
3. Gas pipe size may be larger than boiler connection.
4. Installation of a union is suggested for ease of service.

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5. Install a manual main gas shutoff valve on the gas supply piping connected to the appliance to isolate the burner and gas train from the main supply gas in compliance with NFPA 54 National Fuel Gas Code and most local Codes.
6. The gas system installer must clearly identify the emergency shut-off device.
7. A sediment trap (drip leg) MUST be provided in the inlet of the gas connection to the unit.
8. The combination gas valves and/or gas regulators incorporate either an internal vent limiter or an externally mounted vent limiting orifice and 1/4" aluminum tube located in a "T" attached to the regulator vent port. Venting to outdoors is not required. Never remove, cut, splice or alter the flexible tubing attached directly to the regulator vent port or to a vent limiting fitting attached externally to the regulator, as this will cause unreliable ignition and can cause improper operation.

Although not required, a connection to the open end of the 1/4" aluminum tube can be made and routed to the outdoors. No other connection point is allowed. Do not remove the aluminum tubing and connect directly to the "T", as damage to the required vent limiter and improper gas control could result.

7 COMBUSTION AND VENTILATION AIR

Provisions for adequate combustion and ventilation air to the mechanical room must be in accordance with Section "Air for Combustion and Ventilation" in the latest edition of the NFPA 54 National Fuel Gas Code, ANSI Z223.1 and/or CAN/CSA B149, Installation Codes or applicable provisions of the local building codes. Any method addressed in NFPA 54 National Fuel Gas Code section "Air for Combustion and Ventilation is acceptable and several are outlined below.

7.1 Equipment Located In Confined Spaces

Equipment located in confined spaces requires two openings, one commencing within 12" (30.5 cm) from the top of the enclosure/room and one commencing within 12" from bottom of the enclosure/room to assure adequate combustion air and proper ventilation. The total input of all gas utilization equipment installed in the room must be used to determine the required minimum air volume needed for combustion, ventilation and dilution of flue gasses. Also consider makeup air requirements from other equipment within the mechanical room or other rooms that are pressure connected with the mechanical room. Some examples of other makeup air requirements are from kitchen exhaust hoods, clothes dryers, powered exhaust fans, etc.

- **All Air From Outdoors:**

Each opening requires a minimum free area of 1 square inch per 4000 Btu/hr of the total input rating of all appliances in the enclosure, if directly communicating with the outdoors or communicating to the outdoors through vertical ducts.

Each opening requires a minimum free area of 1 square inch per 2000 Btu/hr of the total input rating of all appliances in the enclosure, if communicating with the outdoors through horizontal ducts.

- **All Air From Inside The Building:**

Follow the requirements of NFPA 54 National Fuel Gas Code, ANSI Z223.1 section "Indoor Combustion Air."

- **Combination Of Air From The Indoors And From The Outdoors:**

Follow the requirements of NFPA National Fuel Gas Code, ANSI Z223.1 section "Combination Indoor and Outdoor Combustion Air."

- **From Outdoors Through One Opening:**

Follow the requirements of NFPA National Fuel Gas Code, ANSI Z223.1 section "One Permanent Opening Method."

NOTE: This unit may be installed with a remote air intake system which uses a make-up air duct to draw combustion air directly from outdoors.

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WARNING: Adequate clean combustion air must be provided to the appliance. The appliance must never operate under a negative pressure. Particular care must be taken when exhaust fans, compressors, air handling units, etc. may rob air from the appliance. The combustion air supply must be completely free of any chemicals or fumes, which may be corrosive to the appliance. Some common chemical fumes to avoid are fluorocarbons and other halogenated compounds, most commonly present as refrigerants or solvents, such as Freon, trichloroethylene, perchlorethylene, chlorine, etc. These chemicals, when in contact with the equipment or when burned, form acids which quickly attack the tubes, flue collector, stack and other appliance and auxiliary equipment. Failure to provide adequate clean combustion air or operating under negative pressure can cause premature, unwarranted product failure or unsafe operation producing carbon monoxide that could escape into the building. Exposure to carbon monoxide can lead to personal injury or death.

7.2 Maximum Allowed Remote Combustion Air Inlet Length (Equivalent Length)

A vertical or horizontal remote air inlet system can be connected to this appliance without modification. The maximum length of field supplied single wall pipe, such as PVC or galvanized ventilation pipe, is shown in the chart below titled Maximum Air Inlet Duct Equivalent Length. Use metal tape or RTV sealant to seal each pipe joint.

Maximum Air Inlet Duct Equivalent Length				
Duct Size	4" (Model 400 Only)	4" (Model 500 Only)	6" Duct (All Models)	8" Duct (All Models)
Max Equivalent Length	100 eq. feet	60 eq. feet	150 eq. feet	200 eq. feet

To determine the maximum straight length of duct allowed, use the Duct Fitting Equivalent Length chart below to find the total equivalent length for all duct fittings in your combustion air system. Then subtract this number of feet from the total equivalent length allowed in Maximum Air Inlet Duct Equivalent Length chart above. The sum of this calculation is the maximum length of straight duct allowed. If a longer length is required, repeat the calculation using a larger duct size. No additional deduction is required for the addition of the duct system terminal.

Duct Fitting Equivalent Length			
Duct Pipe:	4" Duct	6" Duct	8" Duct
90° Elbow	22 feet	16 feet	11 feet
90° Long Radius Elbow	12 feet	10 feet	6 feet
45° Elbow	12 feet	10 feet	6 feet

The following remote air duct information is provided for use in design calculations, if needed.

Remote Air Duct Specifications	
Input MBtu/h	Required Air (SCFM)
399	87
500	108
600	130
650	141
700	152
750	163
800	173

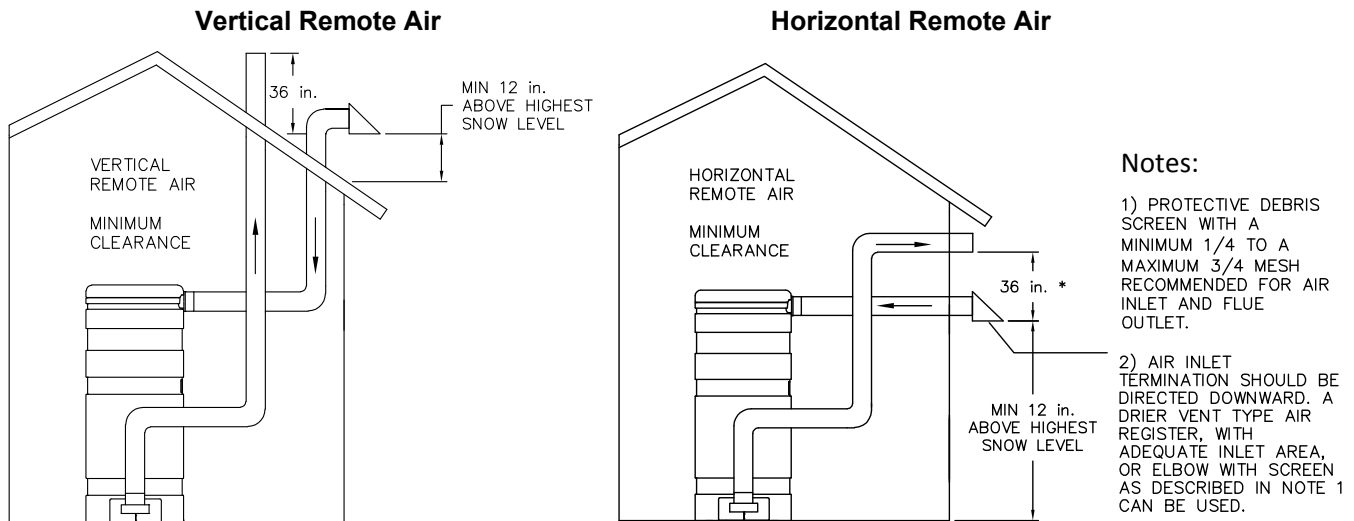
7.3 Remote Combustion Air Cap

A suitable remote air termination must be used to prevent water, debris, animals or obstructing material from entering the remote air supply.

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7.4 Vertical or Horizontal Remote Air Duct Termination

- Air inlet must be located no less than 3 feet (0.91m) below the exhaust terminal if they are within 10 feet (3.05 m) of each other, unless the flue outlet terminates with a straight discharge. If the flue outlet terminates with a straight discharge, the air inlet can be located no less than 18 inches (0.46m) below the exhaust terminal.
- If terminating through the roof, the air inlet must terminate at least 12 inches (0.3 m) above roof level and at least 12 inches (0.3 m) above snow levels.
- If terminating through a sidewall, the air inlet must terminate at least 12 inches (0.3 m) above grade and/or at least 12 inches (0.3 m) above possible snow levels.



- Notes:**
- 1) PROTECTIVE DEBRIS SCREEN WITH A MINIMUM 1/4 TO A MAXIMUM 3/4 MESH RECOMMENDED FOR AIR INLET AND FLUE OUTLET.
 - 2) AIR INLET TERMINATION SHOULD BE DIRECTED DOWNWARD. A DRIER VENT TYPE AIR REGISTER, WITH ADEQUATE INLET AREA, OR ELBOW WITH SCREEN AS DESCRIBED IN NOTE 1 CAN BE USED.

* When flue outlet is terminated with a straight discharge, separation of terminations must be a minimum of 18".

7.5 Combining Remote Air Ducting

Each boiler MUST have separate intake piping, unless the air inlet piping, exhaust duct and other system considerations have been fully evaluated and a combined duct system designed by one of the duct design firms identified at www.RiversideHydronics.com/vent-design.html. Before operation of a combined remote air ducting system, all of the duct design firm's system installation and operation requirements must be in place, their instructions followed and the system must be properly maintained.

WARNING: Do not combine remote air ducting of multiple appliances into a single remote air duct unless the combined remote air ducting system has been evaluated and designed by a specified duct design firm and the combined remote air duct system is installed, operated and maintained following instructions from that firm. Combining remote air ducting without following these requirements can result in failure of the boiler and venting system and/or exposure to carbon monoxide and can result in property damage, personal injury or death.

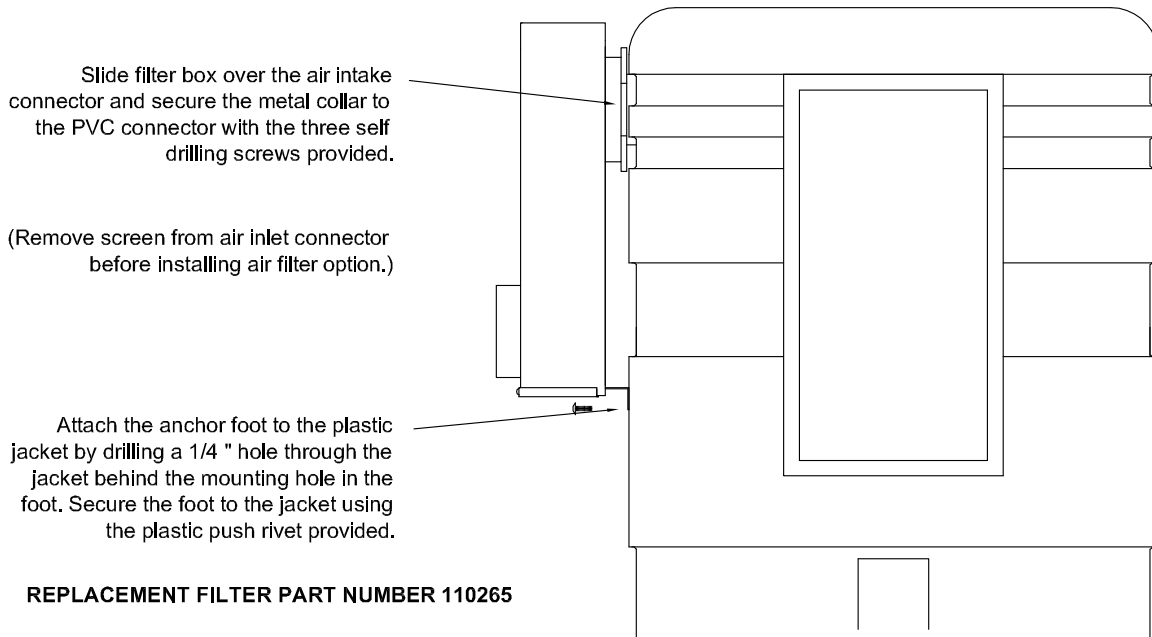
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7.6 Optional Filter Box for Dusty or Dirty Combustion Air

The field installed optional air inlet filter box must be attached to the combustion air inlet on any appliance located where it is exposed to dusty, dirty or lint filled combustion air. Replace the filter on a 3 to 6 month schedule, or more often, based on severity of contamination. Inadequate combustion air or non-combustible particulate matter such as dust, dirt, dryer lint, concrete dust, dry wall dust or the like can be drawn in with combustion air and block burner ports. This can cause unreliable operation and non-warrantable failures. When the optional field installed filter box is required, do not operate the appliance without a suitable filter. See the following illustration for filter and filter box kit part numbers and installation instructions.

FILTER BOX INSTALLATION

KIT PART NUMBER 125810



REPLACEMENT FILTER PART NUMBER 110265

NOTE: Can Use Any Standard Capacity, MERV 7 Pleated Air Filter - 12 X 24 X 1

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8 VENTING

All M3 models use the positive pressure generated by the burner system blower to push combustion products out of the vent. Since the vent system is under positive pressure and must be capable of containing condensate, it must be constructed using schedule 40 solid PVC or CPVC pipe or using a Polypropylene or Stainless Steel venting system (single or double wall) listed by ETL, UL, ULC or CSA for Category IV positive pressure gas appliance venting. Do not use ABS pipe and do not use PVC or CPVC pipe with cell/foam type construction (such as “CellCore”) or other non-solid PVC or CPVC plastic pipe.

Chaudières M3 sont conçus pour fonctionner avec le PVC, CPVC ou en polypropylène ou simple ou double paroi en acier inoxydable système indiqué par ETL, UL, ULC ou CSA pour la catégorie IV pression positive appareil à gaz évacuation de ventilation. Ne sélectionnez pas la taille du tuyau de ventilation basée uniquement sur le diamètre raccord de l'appareil.

WARNING: Use only solid PVC or CPVC pipe or use a Polypropylene or Stainless Steel venting (single or double wall) system listed by a nationally recognized testing laboratory for Category IV positive pressure gas appliance venting. Use of ABS pipe, or use of PVC or CPVC pipe with cell/foam type construction or use of use of venting materials other than specified in these instructions can result in failure of the venting system and/or exposure to carbon monoxide or other toxic fumes, which can result in property damage, personal injury or death.

8.1 Vent Material Selection

Condensing boilers like the M3 utilize colder building return water to increase boiler efficiency and lower flue gas temperatures. Higher building return water temperatures result in higher flue gas temperatures, requiring higher temperature rated venting system materials. For proper operation, the vent system material selected and installed must be adequate for the maximum building return water temperature. Once the vent material has been selected, follow all of the requirements in Section 8.2 Vent Installation – General and all of the requirements for the selected vent material located in either Section 8.3 PVC Vent Installation or Section 8.4 CPVC Vent installation or Section 8.5 Polypropylene or Stainless Steel Vent Installation.

VENTING MATERIAL SELECTION BASED ON BUILDING RETURN WATER TEMPERATURE		
Vent System Material Specified**	Maximum Return Water Temperature (Maximum allowed by boiler Vent Safety Switch)	Other Allowed Vent System Materials**
PVC	Up to and including 100°F (37°C)	CPVC, Polypropylene* or Stainless Steel*
CPVC or Polypropylene*	Up to and including 140°F (60°C)	CPVC, Polypropylene* or Stainless Steel*
Stainless Steel*	Return temperatures greater than 140°F (60°C)	Stainless Steel*

* Polypropylene and Stainless Steel venting systems must be ETL, UL, ULC or CSA listed as Category IV

** The Vent Safety Switch is set to protect the vent system material specified when ordering the boiler. Higher temperature rated vent materials can be used, but the maximum allowed return water temperature for the vent material specified is unchanged, unless the Vent Safety Switch is revised and new markings are applied by a factory authorized service agency.

NOTE: The M3 boiler ships with a Vent Safety Switch that will keep the boiler from operating with a flue gas temperature that exceeds the maximum allowable temperature of the vent material originally specified for use with the boiler.

If the boiler is installed with a vent material suitable for operation with flue gas temperatures that exceed the original vent material specified and if a higher maximum boiler return water temperature is needed, the vent safety switch must be changed by a factory authorized service agency to allow the boiler to operate with the higher flue gas temperatures resulting from the higher maximum boiler return water temperature. Markings will also be affixed to the boiler stating that vent materials with lower temperature ratings must not be used.

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8.2 Vent Installation – General

The M3 boiler can be vented either vertically, through a ceiling or roof, or horizontally through a wall. The M3 boiler is a Category IV positive pressure gas appliance, so venting and can be routed to the outdoors in any direction from the vent connection of the boiler, except down. Unless the list vent system manufacturer states otherwise, the vent must be installed and supported at least every four feet to slope downward toward the boiler vent connection with at least ¼ inch drop per linear foot of horizontal vent run, to allow proper drainage of accumulated condensation. All penetrations through walls and roofs must be weather and gas tight, such that rain and products of combustion cannot pass from outdoors back indoors.

WARNING: Do not connect this appliance to an existing or traditional gas vent or chimney, do not use a barometric damper in the vent and do not combine the vent with any other appliance, except as provided in the section titled “Combining Category IV Vents.” Such venting could result in failure of the venting system and/or exposure to carbon monoxide which can result in property damage, personal injury or death.

8.2.1 Maximum Vent Length (Equivalent Length)

The maximum length of field supplied Category IV vent is shown in the chart below:

Maximum Vent Length in Equivalent Feet			
Vent Size	4" (Use only on Models 400, 500)	6" Vent (All Models)	8" Vent (All Models)
Max Equivalent Length	100 eq. feet	150 eq. feet	200 eq. feet

Vent pipe fittings reduce the maximum allowable vent length. For listed Polypropylene or Stainless Steel Category IV venting systems use the vent manufacturer’s equivalent length deduction for all elbows, terminations, etc. For PVC and CPVC vents, or if the information is not readily available from the vent manufacturer, use the Vent Pipe Fitting Equivalent Length chart below to find the total equivalent length for all vent fittings in your combustion air system. Then subtract this number of feet from the total equivalent length allowed in Maximum Vent Length in Equivalent Feet chart above. The sum of this calculation is the maximum length of straight vent allowed. If a longer length is required, repeat the calculation using a larger vent size. When using this chart, no additional deduction is required for the addition of the vent system terminal.

Vent Pipe Fitting Equivalent Length						
Vent Pipe:	PP * 4" Vent	Other ** 4" Vent	PP * 6" Vent	Other ** 6" Vent	PP * 8" Vent	Other ** 8" Vent
90° Elbow	22 feet	22 feet	22 feet	16 feet	18 feet	11 feet
90° Long Radius Elbow	12 feet	12 feet	14 feet	10 feet	8 feet	6 feet
45° Elbow	12 feet	12 feet	14 feet	10 feet	8 feet	6 feet

* PP = polypropylene

** Other = PVC, CPVC or Stainless Steel

The following vent information is provided for use in design calculations, if needed.

Venting Specifications		
Input MBtu/h	Combustion Air Volume (cfm)	Max Vent Press. " W.C.
399	135	0.5
500	170	0.5
600	205	0.5
650	221	0.5
700	239	0.5
750	255	0.5
800	273	0.5

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8.2.2 Vertical or Horizontal Vent Termination:

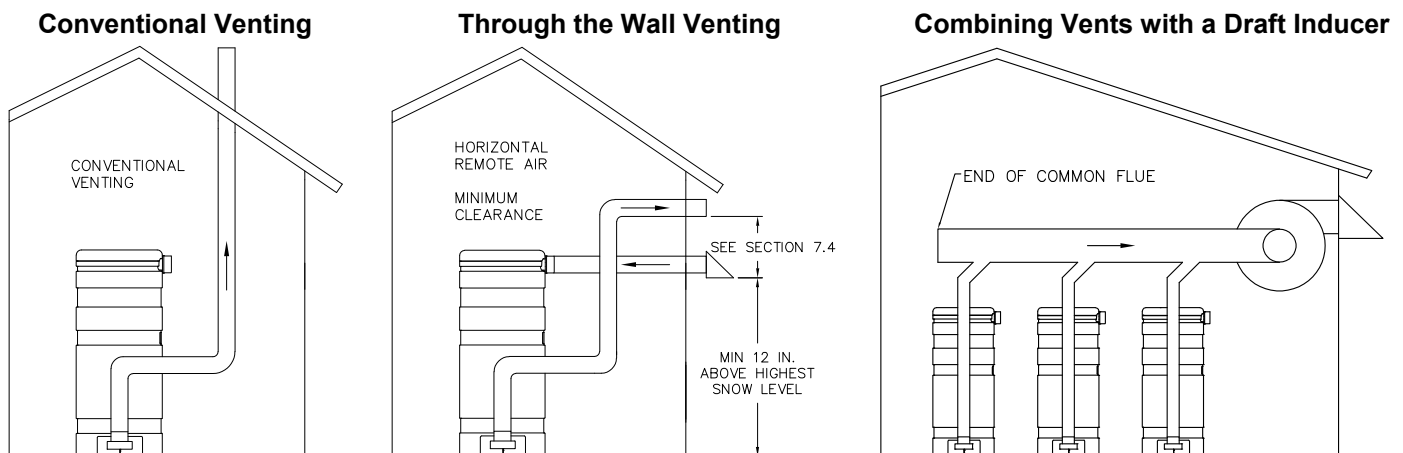
1. The vent terminal must have a minimum clearance of 4 feet (1.22 m) horizontally from, and in no case be located above or below, unless a 4 foot (1.22 m) horizontal distance is maintained from electric meters, gas meters, regulators and relief equipment.
2. The vent cap must terminate at least 3 feet (0.91 m) above any forced air inlet within 10 feet (3.05 m).
3. The vent shall terminate at least 4 feet (1.22 m) below, 4 feet (1.22 m) horizontally from or 1 foot (0.3 m) above any door, window or building air inlet to the building.
4. The vent system shall terminate at least 1 foot (0.3 m) above grade and at least 1 foot (0.3m) above possible snow accumulation levels and shall terminate at least 7 feet (2.13 m) above grade when located adjacent to public walkways or gathering areas.
5. To avoid a blocked flue condition, keep the vent cap clear of snow, ice, leaves, debris, etc.
6. The vent must not exit over a public walkway, near soffit vents or crawl space vents or other areas where condensate or vapor could create a nuisance or hazard or cause property or could be detrimental to the operation of regulators, relief valves or other equipment.
7. A horizontal vent must extend one foot beyond the wall.
8. A horizontal vent terminal must not be installed closer than 3 feet (0.91m) from an inside corner of an L-shaped structure.
9. A vertical vent must exhaust outside the building at least 3 feet (0.91m) above the point of the exit and at least 2 feet (0.61 m) above the highest point of the roof within a 10-foot (3.05 m) radius of the termination.
10. A vertical termination less than 10 feet (0.91 m) from a parapet wall must be a minimum of 2 feet (0.61 m) higher than the parapet wall.

8.2.3 Combining Category IV Vents

Combined M3 Category IV gas vent systems must incorporate an Exhausto, Tjernlund or US Draft variable speed, modulating, mechanical draft inducer capable of maintaining the appropriate negative draft at the end of the common flue, to assure that all boilers in the combined vent system operate with a negative draft. **Do not exceed negative 0.25" W.C.** See the "Combining Vents with a Draft Inducer" illustration below.

Combining the exhaust vents of multiple M3 condensing boilers into a common, unpowered or "gravity" vent is never recommended (i.e. venting as Category II). M3 boilers are too efficient and their flue products are too cold to generate the natural buoyancy required for such combined vent systems to function reliably and safely.

WARNING: Do not connect multiple boilers vents into a single unpowered or fixed speed powered vent. This could cause unsafe operation and the potential for poisonous carbon monoxide to enter occupied areas. Such improper installation can cause property damage, personal injury, exposure to hazardous materials or death.



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8.2.4 Connecting to an Existing Vent System

Do not connect the M3 to an existing vent system, until it has been confirmed the existing vent system complies with all requirements for a new vent system. A venting system in full compliance with the instructions provided in this manual is required for safe and reliable operation of the M3. Do not connect the M3 to a masonry chimney.

WARNING: Before operating the appliance connected to an existing vent system, confirm the vent system complies with all guidance and requirements for a new vent system specified in this manual. Failure to confirm the existing vent system complies can result in unsafe operation and the potential for poisonous carbon monoxide to enter occupied areas and can cause property damage, personal injury, exposure to hazardous materials or death.

8.3 PVC Vent Installation

Follow the instructions below for installing schedule 40 solid PVC venting.

The stainless steel vent connection located near the rear of the boiler is 5-7/8" O.D., to accept 6 inch I.D. schedule 40 PVC pipe. After installing a short length of 6 inch PVC pipe to the vent connection, an increasing or reducing fitting can be connected to adapt to a larger or smaller vent systems (See Section 8.2.1 Maximum Vent Length (Equivalent Lengths)).

1. Read and follow the information, instructions and warnings in "VENTING" section.
2. Do not insulate the plastic vent pipe.
3. Design the vent pipe route so that normal expansion (pipe getting longer) and contraction (pipe getting shorter), due to on and off temperatures, does not bind or put stress on cemented pipe fittings.
4. A length of 6" schedule 40 PVC pipe must always be the first venting material attached to the M3, when using PVC venting.
5. Dry-fit the length of 6" PVC pipe onto the M3 vent connector. Then remove the pipe and apply a liberal coating of room temperature vulcanizing (RTV) adhesive to the outside of the vent connector and to the inside of the plastic pipe. Before the RTV sets, slide the pipe over the vent connector while rotating approximately 1/8 of a turn. Inspect and apply additional RTV to the joints, if needed to provide a sound air and water tight seal.
6. Drill a pilot hole through the PVC pipe and into the center of the stainless steel vent connector flange in three equally spaced locations around the pipe. Drive stainless steel sheet metal screws through the pilot holes to attach and firmly hold the plastic pipe onto the vent connector flange.
7. Clean and deburr all solid PVC pipe ends, then trial assemble the entire vent system vent before joining with cement. Mark the pipe and fittings to identify their locations, then disassemble. Reassemble the vent system using fresh PVC cement to connect the PVC pipe. If both solid PVC and solid CPVC pipe are used in the same vent system, all joints between the two types of pipe must be made with fresh cement suitable for both materials. Follow the cement manufacturer's instructions for making sound air and water tight joints.
8. Vent support – The PVC vent system must be supported at intervals no greater than four feet, to prevent sagging, distortion and stress on pipe fittings. Vertical pipe must also be supported to avoid stress on all cemented pipe fittings and to prevent putting excessive weight on the appliance vent connection.
9. The vent pipe must be sealed at the point where it passes through a wall or roof, to prevent rain, insects or flue products from entering the living space or interior of the building.
10. For proper vent operation and to protect the gas vent from wind and weather, attach a UL listed vent termination to the outdoor end of the vent or otherwise provide suitable termination to prevent wind, water, debris or animals from obstructing or entering the vent. Testing for leaks – Once the vent system is installed, it must be checked to confirm all joints in the vent system are air and water tight. After the vent is assembled, close the end of the vent with a taped plastic bag or some other temporary closure. With the gas supply turned off, energize the M3 combustion blower to apply air pressure to the vent system. Spray each joint and vent connection with commercially available leak detection liquid to confirm no air is escaping from any point. Repair any leaks and retest. After testing is complete, de-energize the combustion blower, wipe clean the leak detection liquid and REMOVE the temporary vent closure.
11. Do not use a barometric damper with the M3 venting system. Barometric dampers are designed for use with certain Category I negative pressure vent systems. The M3 Category IV vent system operates with positive vent pressure and will not operate safely with a barometric damper.

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8.4 CPVC Vent Installation

Follow the instructions below for installing schedule 40 solid CPVC venting

The stainless steel vent connection located near the rear of the boiler is 5-7/8" O.D., to accept 6 inch I.D. schedule 40 CPVC pipe. After installing a short length of 6 inch CPVC pipe to the vent connection, an increasing or reducing fitting can be connected to adapt to a larger or smaller vent systems (See Section 8.2.1 Maximum Vent Length (Equivalent Lengths)).

1. Read and follow the information, instructions and warnings in "VENTING" section.
2. Do not insulate the plastic vent pipe.
3. Design the vent pipe route so that normal expansion (pipe getting longer) and contraction (pipe getting shorter), due to on and off temperatures, does not bind or put stress on cemented pipe fittings.
4. A length of 6" schedule 40 CPVC pipe must always be the first venting material attached to the M3 when using CPVC venting. Do not use PVC pipe or other PVC components in a CPVC vent installation.
5. Dry-fit the length of 6" CPVC pipe onto the M3 vent connector. Then remove the pipe and apply a liberal coating of room temperature vulcanizing (RTV) adhesive to the outside of the vent connector and to the inside of the plastic pipe. Before the RTV sets, slide the pipe over the vent connector while rotating approximately 1/8 of a turn. Inspect and apply additional RTV to the joints, if needed to provide a sound air and water tight seal.
6. Drill a pilot hole through the CPVC pipe and into the center of the stainless steel vent connector flange in three equally spaced locations around the pipe. Drive stainless steel sheet metal screws through the pilot holes to attach and firmly hold the plastic pipe onto the vent connector flange.
7. Clean and deburr all solid CPVC pipe ends, then trial assemble the entire vent system vent before joining with cement. Mark the pipe and fittings to identify their locations, then disassemble. Reassemble the vent system using fresh CPVC cement to connect the CPVC pipe. Follow the cement manufacturer's instructions for making sound air and water tight joints.
8. Vent support – The CPVC vent system must be supported at intervals no greater than four feet, to prevent sagging, distortion and stress on pipe fittings. Vertical pipe must also be supported to avoid stress on all cemented pipe fittings and to prevent putting excessive weight on the appliance vent connection.
9. The vent pipe must be sealed at the point where it passes through a wall or roof, to prevent rain, insects or flue products from entering the living space or interior of the building.
10. For proper vent operation and to protect the gas vent from wind and weather, attach a UL listed vent termination to the outdoor end of the vent or otherwise provide suitable termination to prevent wind, water, debris or animals from obstructing or entering the vent. Testing for leaks – Once the vent system is installed, it must be checked to confirm all joints in the vent system are air and water tight. After the vent is assembled, close the end of the vent with a taped plastic bag or some other temporary closure. With the gas supply turned off, energize the M3 combustion blower to apply air pressure to the vent system. Spray each joint and vent connection with commercially available leak detection liquid to confirm no air is escaping from any point. Repair any leaks and retest. After testing is complete, de-energize the combustion blower, wipe clean the leak detection liquid and REMOVE the temporary vent closure.
11. Do not use a barometric damper with the M3 venting system. Barometric dampers are designed for use with certain Category I negative pressure vent systems. The M3 Category IV vent system operates with positive vent pressure and will not operate safely with a barometric damper.

8.5 Polypropylene or Stainless Steel Vent Installation

Follow the instructions below for installing an ETL, UL, ULC or CSA listed Category IV Polypropylene or Stainless Steel venting system.

The stainless steel vent connection located near the rear of the boiler is 5-7/8" O.D., to accept the venting system adapter available from the manufacturer of the listed Polypropylene or Stainless Steel venting system. After installing the adapter to the M3 vent connection, the vent size can be increased or reduced using vent system parts available from the manufacturer of the listed vent system. (See Section 8.2.1 Maximum Vent Length (Equivalent Lengths)).

1. Read and follow the information, instructions and warnings in "VENTING" section.
2. Obtain the correct adapter from the manufacturer of the listed Polypropylene or Stainless Steel venting system being installed to attach and seal their venting system to the M3 5-7/8 inch vent connection outlet. Attach the adapter to the M3 vent connection following the instructions provided by the adapter's manufacturer.

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3. Follow the ETL, UL, ULC or CSA listed Polypropylene or listed single or double wall Stainless Steel, Category 4 positive pressure gas appliance vent system manufacturer's instructions for installing, sealing, supporting and terminating their vent system. Do not insulate plastic vent pipe.
4. Support the venting system following the venting system manufacturer's installation instructions. The vertical pipe must be supported to prevent putting excessive weight on the appliance vent connection.
5. Seal the vent pipe at the point where it passes through a wall or roof following the venting system manufacturer's installation instructions.
6. For proper vent operation and to protect the gas vent from wind and weather, attach vent system's termination (cap) following the listed venting system manufacturer's installation instructions.
7. Test the completed venting system for leaks following the venting system manufacturer's installation instructions.
8. Do not use a barometric damper with the M3 venting system. Barometric dampers are designed for use with certain Category I negative pressure vent systems. The M3 Category IV vent system operates with positive vent pressure and will not operate safely with a barometric damper.

9 OPERATING AND SAFETY CONTROLS

9.1 Pressure Relief Valve(s)

A Pressure Relief Valve(s) sized in accordance with the ASME Boiler and Pressure Vessel Code, Section IV is installed in the boiler.

WARNING: Secure the relief valve discharge pipe to a suitable floor drain such that very hot water does not openly splash during a significant relief valve discharge. If the relief valve discharge pipe is not routed and secured to a suitable drain, hot water discharge can result in property damage, scalding and personal injury or death.

WARNING: Do not plug the relief valve(s), use discharge piping smaller than the relief valve opening or install a reducing coupling, valve or other restriction in the relief valve discharge line. Failure to comply with these relief valves and discharge piping requirements can prevent the relief valve from providing its intended pressure protection, which can result in a sudden loss of pressure containment that can cause property damage, exposure to hazardous materials, personal injury or death.

- Follow the relief valve manufacturer's installation and operating instructions and all local regional and national codes applicable to relief valve installation and discharge piping.
- The relief valve discharge pipe must not be smaller than the relief valve opening and must be secured to prevent it from lifting out of the drain under discharge pressure and must be routed to allow complete drainage of the valve and piping.
- Do not plug the relief valve(s) or install a reducing coupling, valve or other restriction in the relief valve discharge line(s), as this will eliminate the critical water pressure protection it provides.
- Thermal Expansion - A relief valve that periodically discharges may result from thermal expansion. To control these periodic discharges, the boiler system must be provided with means to control expansion. Contact a boiler professional to resolve this situation.

9.2 Electronic Low Water Cut-Off

When the water level is above the electrode position in the tank, the reset pushbutton will energize the control (LED will be lit). The control remains energized until the water level drops below the electrode position (LED will not be lit). Unless otherwise specified, there is a three-second time delay on decreasing level. Water level must be below tank probe location for full three seconds before control de-energizes. The Electronic Low Water Cut-Off is located in the top head of the boiler.

IMPORTANT: Probe Sensitivity = 26K ohms (most water/glycol mixtures up to 50% concentration may be used).

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WARNING: Turn off all electrical service to the appliance when accessing the limit or other controls located inside the control cabinet or inside the burner vestibule inside the top of the appliance. Close and fasten the control cabinet and burner vestibule cover before restoring electrical service to the appliance. The cabinet and burner vestibule contain High Voltage wiring and terminals. If the electrical service is not turned off and these terminals are touched, a dangerous shock causing property damage, personal injury or death could occur.

Coupez l'alimentation avant intervention sur l'appareil.

9.3 Operating Temperature Control

An adjustable digital operating control is located in the front control panel. To adjust the setpoint, push the **SET** key. The upper display will show "St1", while the lower display shows its value. Push the **SET** key again to modify St1. The value of St1 will flash in the lower display. Adjust the set point by pushing the **UP** or **DOWN** keys. Push the **SET** key again to confirm the value. To exit, press **SET + UP** or wait 15 seconds without pressing any key. For more information, see "TempTrac Electronic Control Panel", Section 10.1 in this manual.

Suivez les instructions dans le manuel d'installation pour modifier la température de l'eau de la chaudière.

9.4 High Water Temperature Limit Controls

The boiler is equipped with two temperature limit controls. One is an automatic reset limit control with a maximum set point of 200°F and one is a manual reset high limit control with a maximum set point of 210°F. Either of these limit controls will turn off the burner when the water temperature in the tank exceeds the set point of the control. These controls are located inside the burner vestibule and are accessed from the top of the M3. The manual reset high limit control is reset by pressing the limit reset button accessible through a hole in the metal cover on top of the appliance. Pressing the reset on the high limit control will not cause the control to reset until the water temperature has dropped below the set point of the manual reset high limit control.

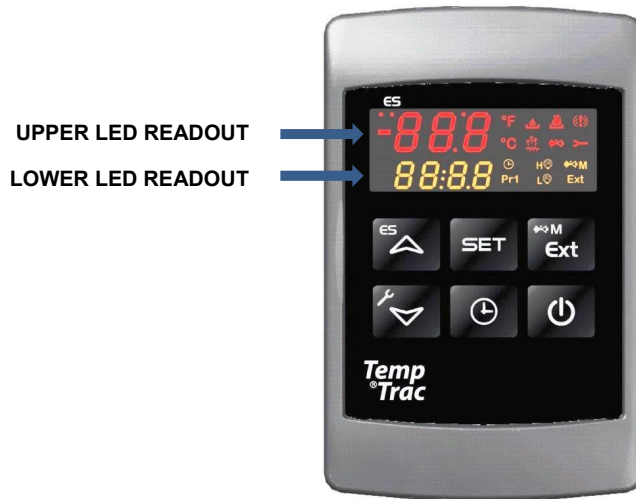
WARNING: Turn off all electrical service to the appliance when accessing the limit or high limit controls located inside the burner vestibule and close and fasten the burner vestibule cover before restoring electrical service to the appliance. The burner vestibule contains High Voltage wiring and terminals. If the electrical service is not turned off and these terminals are touched, a dangerous shock could occur, causing personal injury or death.

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10 TEMPTRAC™ Electronic Controller Panel

10.1 Principle Of Operation

The boiler operates to satisfy the setpoint of the TempTrac digital control whose operating sensor is located near the top of the boiler tank, or in the return line of a Hydronic system, depending on the application. Demand (flow) will typically create a drop in temperature, thus activating the boiler to add heat to the hot water supply. This setpoint is the desired boiler water temperature to maintain, as measured at the operating sensor location.



10.2 Upper LED Readout

The upper readout is normally configured to display the monitoring probe (TP2) temperature reading. This readout can display additional information by pushing the EXT button to cycle through the following items:

- The temperature reading from (probe TP3), which is located in the vent connection and monitors the flue gas temperature (if equipped).
- The modulating range of the burner, indicated by 0 to 100%.
- The temperature difference between TP1 and TP2.

All of the display information described above is available for monitoring through the optional MODBUS RTU interface.

10.3 Lower LED Readout

The lower readout is normally configured to display the control sensor (TP1) temperature reading.

10.4 Control Buttons

SET	Displays and modifies the temperature set points. In programming mode, it selects a parameter or confirms an operation.
UP	Displays and modifies the energy saving (Night Time setback) settings. In programming mode, it browses the parameter codes or increases a displayed value.
DOWN	Displays the working hours of the load relays. In programming mode, it browses the parameter codes or decreases a displayed value.
CLOCK	Changes lower display from the stored water temperature to current time and day.
EXT	Changes upper display to show the temperature at Probe TP1, TP2 or TP3, the percent of the modulating range or the temperature at Probe TP1 minus the temperature at Probe TP2.
ON/OFF	Switches the control ON or OFF.

(See TempTrac User Manual 34-80 for full description)

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10.5 To View the Setpoint

- Push and release the **SET** key to see the set point value.
- To return to normal display, press **SET + UP** or wait 15 seconds without pressing any key.

10.6 To Change the Setpoint

- Push the **SET** key. The upper display will show the “St1” parameter name, while the lower display will show its value.
- Use the **UP** or **DOWN** key to cycle through the parameter names.
- Push the **SET** key to modify a parameter value. The value starts flashing in the lower display.
- To change it push the **UP** or **DOWN** keys. Push the **SET** key again to confirm the value and pass to the setting of next set point.
- Repeat this process as needed to change other parameters.
- **To Exit:** press **SET + UP** or wait 15 seconds without pressing any key.

NOTE: Each point has a time out of 15 seconds. If any key is pushed within 15 seconds the controller exits the set points programming procedure.

NOTE: The set value is stored even when the procedure is exited by waiting for the time-out to expire.

10.7 To Lock and Unlock the Keyboard

- Push and hold the **UP + DOWN** keys for more than three seconds.
- The “**PoF**” message will be displayed and the keyboard is locked. At this point it is only possible to view the set point.
- Push and hold the **UP + DOWN** keys again for more than three seconds to unlock the keyboard.
- The “**Pon**” message will display.



10.8 To Change Other Parameters

- Push the **SET and DOWN** arrow simultaneously for 3 seconds.
- Select the required parameter. The name of the parameter is on the upper display; its value is on the lower display.
- Press the **SET** key: the value of the parameter will start blinking.
- Use **UP** or **DOWN** to change the value.
- Press **SET** to store the new value and move to the following parameter.
- **To Exit:** Press **SET + UP** or wait 15s without pressing a key.

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10.9 LED Display Alarm Messages

Alarm messages are displayed in the upper LED readout and alternate with the default display. An alarm LED ICONs also illuminated.

ALARM MESSAGE	CAUSE	RESULTS OF ALARM CONDITION	RECOMMENDED ACTION
"P1"	TP1 probe failure	Return temperature sensor is not connected or is reading incorrectly. Call for heat and burner modulation output signal will revert to low fire.	Check wiring and sensor Terminals 14 & 17
"P2"	TP2 probe failure	Temperature sensor is not connected or is reading incorrectly.	Check wiring and sensor Terminals 15 & 17
"P3"	TP3 probe failure	Temperature sensor is not connected or is reading incorrectly or flue gas temperature protection is disabled.	Check wiring and sensor Terminals 16 & 17
"HA"	High temperature limit setpoint exceeded	Audible alarm sounds, operation continues.	Manual reset required
"LA"	Low temperature alarm	Audible alarm sounds, operation continues.	
AL1	Digital input 1 is activated.	Unit de-energized after timer delay. Audible alarm sounds.	Manually reset required
AL2	Digital input 2 is activated. This alarm indication is dedicated to the Alarm On Any Failure feature of this product.	Unit de-energized after timer delay. Audible alarm sounds. Alarm contacts close for remote indication of alarm. Internal alarm register will communicate an alarm condition through the Modbus RTU communication link.	Manually reset required
AL3	Digital input 3 is activated.	Unit de-energized after timer delay. Audible alarm sounds.	
Mn1	Maintenance alarm for output 1	Buzzer sounds, operation continues	Check wiring and sensor
Mn2	Maintenance alarm for output 2	Buzzer sounds, operation continues	Check wiring and sensor
Mn3	Maintenance alarm for output 3	Buzzer sounds, operation continues	Check wiring and sensor
"rtc"	The real time clock has lost its setting	Energy saving function disabled	Reprogram clock
CONTROL MESSAGE	CAUSE	RESULTS OF CONTROL CONDITION	NOTES
 On	A call-for-heat condition	The burner operating sequence should begin.	If the burner does not operate, check safety devices or Remote Proving Interlock
 Flashing	The remote enable/disable has been triggered	The small flame icon will flash indicating the standby state	The R1-R2 terminals have been opened by the remote master control. The boiler will remain in standby.

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11 REMOTE CONNECTIONS – TERMINAL STRIP

11.1 Making BMS/BAS remote connections for analog and binary (on/off) signals

A terminal strip for the remote connection is located behind the bottom control panel door and is accessed removing the four thumb screws a lifting the hinged door.

WARNING: Turn off all electrical service to the appliance when accessing the remote connection terminal strip located inside the bottom control panel door and close and fasten bottom control panel door before restoring electrical service to the appliance. The control panel contains High Voltage wiring and terminals. If the electrical service is not turned off and these terminals are touched, a dangerous shock could occur, causing personal injury or death.

Coupez l'alimentation avant intervention sur l'appareil.

1. **If BMS/BAS provides remote on/off control directly to each boiler but allows boiler to control modulation on its own:**
 - Remove the jumper connecting terminals R1 and R2.
 - Connect the BMS output leads for the enable/disable function to terminals R1 and R2.
 - Leave all other wires in their initial positions.
2. **BAS connection over network with MODBUS RTU protocol (requires option ALMMB)**
 - An optional serial connection cable (part no. 106624) enables the TempTrac to communicate via Modbus RTU to a Building Automation System or to the OnTrac® multiple boiler control. Connections are made using shielded, twisted pair wiring in a daisy chain arrangement.

3. BAS Protocol Gateways

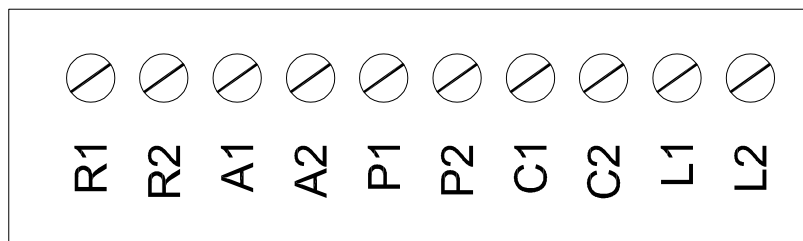
When communicating over a network connection, the standard protocol of the TempTrac control is Modbus RTU. The standard protocol between the OnTrac and the BAS is Modbus TCP/IP. A gateway will be required to communicate with the BAS if it uses a different protocol. Riverside Hydronics® offers pre-mapped gateways that support BACnet MSTP, BACnet IP, Lonworks or Johnson Controls N2. Consult factory for other protocols. **(For a general overview of the application of this gateway, refer to Setup Manual #34-525.)**

These third-party supplied gateways are custom-programmed components that must be sourced through Riverside Hydronics®.

IMPORTANT: Do not use single strand bell wire for remote field connections to terminals R1-R2 and C1-C2. Use only multi-strand copper wire. See table below for wire length and gauge:

Wire Gauge	18 GA	16GA	14 GA	12 GA
Maximum Length	30 FT	50 FT	75 FT	100 FT

11.2 Terminal Functions - The following describes the functions of each of these terminals and the proper method for interfacing with an Energy Management System:



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L1-L2: Used for incoming 120VAC power supply connection. Terminal **L1** is the HOT terminal and **L2** is NEUTRAL. See the product catalog or specification document for circuit ampacity rating.

R1-R2: Used to activate / de-activate boiler from remote master control. When switching this low current circuit, a relay with gold plated contacts or the use of two relay contacts in parallel must be used. Terminals are wired to a relay in a remote Energy Management System. When the relay closes, the circuit from R1 to R2 is completed and appliance controls are enabled. This appliance ships from factory with a jumper between terminals Remove jumper when connecting to a remote controller. The indication of this function is described in section **10.8 LED Display Alarm Messages**.

A1-A2: Used to activate a remote alarm, signaling shutdown of combustion control. Provides a maximum 3 amp relay contact closure when the flame safeguard terminates combustion due to a tripped safety interlock (i.e.: air proving switch, high limit switch or flame sensor, etc.).

P1-P2: Provides a low amperage dry contact to control remote equipment (i.e. mechanical room air louvers, draft inducer or power vent, etc.). Do not directly energize pumps or motors through these terminals. If operation or repositioning of the remote equipment is required for safe operation of the appliance, the remote equipment must send a return proving signal to terminals C1-C2, via its proving switch, to confirm proper operation or repositioning to enable the appliance to energize.

C1-C2: Used for proving operation of remote equipment. Terminals are wired to a proving switch on a remote device such as an isolation valve, primary pump, a power venter, louvers, or a combination of these in series. When all remote proving switches close, the circuit from C1 to C2 is completed and the appliance controls are enabled. This appliance ships from the factory with a jumper between terminals C1 and C2 that must be removed when a proving switch is connected.

11.3 Connecting Isolation Valves

Motorized isolation valves can be controlled by the building automation system or through an OnTrac[®] boiler management system. If an OnTrac[®] boiler management system is used, the motorized isolation valve must be energized by a field provided isolation relay connected to the low amperage terminals (CIRCULATOR 1-2) located on the terminal strip shown in the pictorial drawing in section 16.3 "Component Wiring and Conduit Routing Details." Do not energize an isolation valve connected directly to these low amperage terminals. These terminals are not for use with a circulator pump.

12 SEQUENCE OF OPERATION

1. Incoming 120VAC

- a. Full time power to the Fuse.
- b. Full time power to the Main Control Switch.

2. Power On - When the main control switch is turned on:

- a. 120V is applied to the step-down transformer (24V).
- b. 120V is applied to the L.W.C.O. terminal L1 (if used).
- c. 120V is applied to the Fenwal Flame Ignition Control.
- d. 24V is applied to the TempTrac operating temperature control terminal L1.
- e. Full time power to the Variable Frequency Drive.

3. Control Device Pre-check – Power flows through the following control devices before reaching call-for-heat control. The following devices are listed in circuit order:

- a. The Electronic Low Water Cut-Off control when installed is the first device in the control circuit.
- b. The High Gas Pressure and Low Gas Pressure Switch are energized and their monitored pressures are proved.
- c. The High Temperature Limits are energized.
- d. Terminals P1-P2 terminals close to activate a pump, if used, or to activate any connected remote devices.
- e. The circuit between Terminals C1-C2 is closed by the jumper or by any connected remote proving switches, enabling the boiler to continue the sequence of operation (C1-C2, see Section 11.2).
- f. Isolation valve terminals are energized.

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4. **Call For Heat** - If the TempTrac operating control senses a call-for-heat condition and the previous safety devices are energized the following sequence will begin:
 - a. The enable contacts for the VFD are energized for the modulating burner models or the blower contacts close for the fixed input burner models.
 - b. The Airflow-Proving Switch then proves the operation of the burner blower.
 - c. The thermostat contact on the Fenwal Flame Ignition Control is energized.
5. **Heat-Up** - Following the pre-purge delay, the hot surface igniter will be energized:
 - a. The flame control will send 120V to the hot surface igniter for 20 seconds.
6. **Ignition** - When dwell time is completed a 4-second Trial for Ignition (TFI) period is initiated:
 - a. The Delay-On (Low Fire Hold) Relay and the Gas Safety Valves are energized.
 - b. During TFI the flame safeguard control will monitor the flame using flame rectification through the hot surface igniter.
 - c. If the flame control senses the presence of flame before the end of the TFI period, the igniter will be de-energized and the flame control will continue to monitor the flame, through the igniter, until the operating thermostat ends the call for heat condition.
7. **Modulation Release** - Once the Delay-On (Low Fire Hold) relay has timed out, the TempTrac will regulate the speed of the blower through the VFD.
 - a. The TempTrac will continue to monitor the water temperature in the boiler.
 - b. When the setpoint temperature is reached, the call-for-heat signal to the flame safeguard control is discontinued. When the call for heat condition ends, the gas valve will close and the burner will end operation.
 - c. The VFD will ramp the blower speed down and stop after 10 seconds.
 - d. As the water temperature in the loop drops below setpoint, the TempTrac will sense this condition and begin the call-for-heat sequence again.

8. Loss of Flame Signal

If the hot surface igniter fails to sense flame during an attempt to light the burner (trial for ignition), the ignition control will lockout. However, if the hot surface igniter fails to sense the flame at any time during normal burner operation (flame failure), the gas valve will be closed and another call for-for-heat sequence will be initiated to attempt to relight the burner. If this attempt to relight the burner and sense flame fails (single retry), the ignition control will shut-down and lockout. The blower will complete post-purge operation to exhaust any remaining combustion products until the call for heat ends.

9. Alarm on Any Failure

- a. When any safety device or remote proving interlock prevents the burner from firing within the allotted time period once the call-for-heat is initiated (approx. 7 minutes), the TempTrac will initiate an alarm notification. This notification is indicated in the following ways:
 - A flashing alarm message “AL2” is displayed on the TempTrac screen.
 - A high pitch beeping audible alarm.
 - The dry contacts at terminals A1 & A2 will close. 3 amp max load.
 - The alarm register, accessible through the Modbus RTU communication option, shows alarm.
- b. To reset the TempTrac once the alarm is activated, attempt to determine the safety device which caused the condition and correct the condition. Once the condition is corrected, the TempTrac can be reset by pressing any button. If the lockout is caused by the ignition control, power must be re-cycled in order to reset the ignition module.
- c. See the troubleshooting guide, Section 15 of this manual, for more details.

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13 INITIAL STARTUP

13.1 Initial Startup Requirements

Installation must be complete prior to the required factory authorized initial startup. The factory authorized startup must be complete prior to placing the boiler into service. Starting the boiler without proper piping, combustion air, venting or electrical connections or control settings can be dangerous and may void the product warranty. The following startup instructions must be followed precisely in order to achieve safe and efficient operation to assure trouble-free service life.

WARNING: Proper startup must be made by a qualified installer or service agency, who must read and follow the supplied instructions and appliance markings. Failure to complete proper startup before use, tampering with controls or not following all instructions and markings may damage this equipment, void the warranty and may result in property damage, personal injury or death.

A Start-up Form is included with each product and must be completed by the qualified installer or service agency conducting the startup and must be returned to the manufacturer to register the warranty. Copies are available at www.riversidehydronics.com.

WARNING: Turn off all power to the boiler when servicing or accessing the blower drive. The blower drive still has power when appliance switch is off. Failure to turn off all power to the boiler can cause personal injury, property damage or death.

13.2 Tools and Instrumentation Required

- Stack Temperature Gauge
- Stack Draft Gauge
- Electronic Combustion Analyzer
- Two U-tube Manometers or pressure gauges
- AC/DC Multi-meter (with 20,000 OHM/Volt rating)
- Amp Meter
- Normal Hand Tools

13.3 Resources

- Product Installation & Maintenance Manuals
- Start-up Report with instructions
- Local, State, & Federal Codes
- Toll Free 24-Hour Technical Support: 1-800-433-5654

13.4 On Site Considerations

- Electrical Supply in accordance with Nameplate Rating
- Uncontaminated Combustion Air
- Adequate Fuel Supply
- Treated Water Supply (Boilers)

13.5 Startup Procedure

1. Carefully study the burner start-up information included in this manual.
2. Fill system tank with water:
 - a. Close the drain valve
 - b. Open the pressure relief valve or other air vent valve (if equipped) located above the tank to permit the air in the system to escape.
 - c. Open the makeup water fill valve.
 - d. Close the pressure relief valve or other air vent valve opened in step b, when water starts for flow from the valve.
 - e. If venting through the pressure relief valve was used when filling the boiler, ensure the relief valve has been returned to the proper operating condition prior to start-up

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3. Be sure all connections into the tank are tight, as leaks at tank fittings will damage the insulation.
4. **CAUTION:** Conduct the following gas train leakage test before start-up, at annual intervals and prior to investigating the cause of any reported occurrences of delayed ignition.
 - a. Using an appropriate bubble detection solution, thoroughly coat all gas train pipe connections. If any bubbles are detected, the leaking connection must be tightened, recoated, and rechecked to assure stoppage of the leak.
 - b. Attach a manometer to measure the gas pressure at the manual gas shutoff valve located just upstream of the gas train. Adjust gas train inlet pressure to the specified value (e.g. 14" W.C.), and tightly close the gas train manual shutoff valve closest to the burner.
 - c. Reattach the manometer to the gas train manual shutoff valve at the burner and record the measured gas pressure in inches of water column (W.C.). Measure gas pressure again after 15 minutes. If gas pressure has increased 0.5" W.C. or more, the gas leak must be isolated to one or more of the operating gas valves. (For example, a solenoid actuated gas shutoff valve.) After any leaking valve is replaced, the reassembled gas train must be leak tested again before start-up is attempted.
5. Open the hinged, top enclosure panel cover on the appliance to expose control circuit. A wiring diagram is attached to the back of this panel.
6. Visually check that all components are intact and no damage has occurred during transit.
7. Check all connections within the control cabinet. A loose connection could cause intermittent shutdowns.
8. The burner uses use a hot surface igniter (HSI) as the ignition source. The gas control system may use a single gas pressure regulator and valves, valve regulator combinations or multiple gas trains.
9. Connect a test meter to the ignition control to read the flame current in microamps.

NOTE: Some flame controls read the flame signal in micro amps and some in volts DC.

CAUTION: Be sure the tank is filled with water. Dry firing can cause unwarranted damage to the appliance.

10. Check the inlet gas pressure before start-up, using a manometer or a 0 to 28" W.C. pressure gauge for inlet gas pressure. (This is the pressure measured before all components in the gas train.) This manometer must stay connected throughout the testing, as the inlet pressure must be monitored during the firing of the burner. Record static pressure; it must not exceed 14" W.C. Pressures above this could cause damage to the diaphragm in the gas valve or pressure regulator. The inlet gas pressure must not fall below 3.5" W.C.
11. Connect a second manometer to the manifold test port at the shutoff valve closest to the burner.
12. **Turn-off main gas shutoff valve.**
13. **Disable or jumper out any BMS/BAS control interface to allow independent setup and adjustment of each boiler.**
14. Turn unit on using the rocker switch on the front of the control enclosure. When the burner fails to light, the flame control will lockout.


The burner combustion must be checked during startup using a combustion analyzer to verify it is operating in accordance with the requirements of 13.5.24 "Burner Combustion Adjustment" during startup, at both Low and High Fire. Start the burner in Low Fire operation by setting the TempTrac Control for manual modulation output:

- Push and hold the **EXT** key for more than 3 seconds. The ***M** LED switches ON and the **PS4** parameter is displayed in the upper display, while the **PAS** label is shown in the lower display.
- Release the key, and insert the password: **3-2-1**. The value of the modulation parameter PS4 will be displayed in the lower display. **(nu)** stands for Not Used. Return to this condition for automatic operation.
- To adjust modulation manually, push the **SET** key, the value starts flashing. Then use **UP** or **DOWN** keys to modify it. **100 = High Fire; 0 = Low Fire.**
- To exit, press **SET + UP** or wait 30s without pressing any key.

NOTE: After a modification, it will be possible to enter the Modulation output setting without entering the password for 10min. After this time you will be asked for the password again.

15. **Turn-on main gas shutoff valve.**

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16. If the TempTrac operating control switch is closed (indicated by the  icon), the burner blower should come on and pre-purge begins.
17. If nothing happens, check for a safety device lockout. Some safety devices such as the Low Water Cut-off, Gas Pressure Switches and the High Temperature limit will require manual reset after lockout and therefore can be easily identified.
18. When the blower motor starts, the Flame Ignition Control will not be energized until positive air flow is established and the Remote Proving Interlock, when used, has closed. If the Flame Ignition Control does not energize, see the troubleshooting guide for help.
19. The Air Proving Switch can be easily identified by checking for 120V on both sides of the switch.
20. If the amber colored call-for-heat indicating light is not illuminated, it is likely that the Remote proving interlock is open. Check remote device.
21. After the pre-purge, the flame control energizes the HSI for the heat up period, approximately 20 seconds. At the end of that period the gas valve is opened for approximately 4 seconds. After the burner lights and the primary safety control senses a flame, the burner will remain on until the call for heat is satisfied or operation is interrupted by a safety device.
22. If the burner fails to light, the flame control will lockout. When lockout occurs, cycle the main power switch to reset the flame ignition control before the alarm-on-any-failure occurs. When the burner fails to ignite, the most common cause at startup is air in the gas supply. This can usually be corrected with multiple cycles or bleeding the line manually. If the burner lights but blows out, ensure that the burner firing rate is locked in low fire and check for improper combustion or weak flame signal as a possible cause.
23. Once the main burner flame is established the firing rate will be controlled by the TempTrac control.
24. Burner Combustion Adjustment

CAUTION: Use a combustion analyzer to adjust combustion. Do not attempt to adjust the burner by sound or sight. With the burner firing, insert the combustion analyzer probe in the flue vent approximately two feet from the appliance. All models are adjusted as follows:

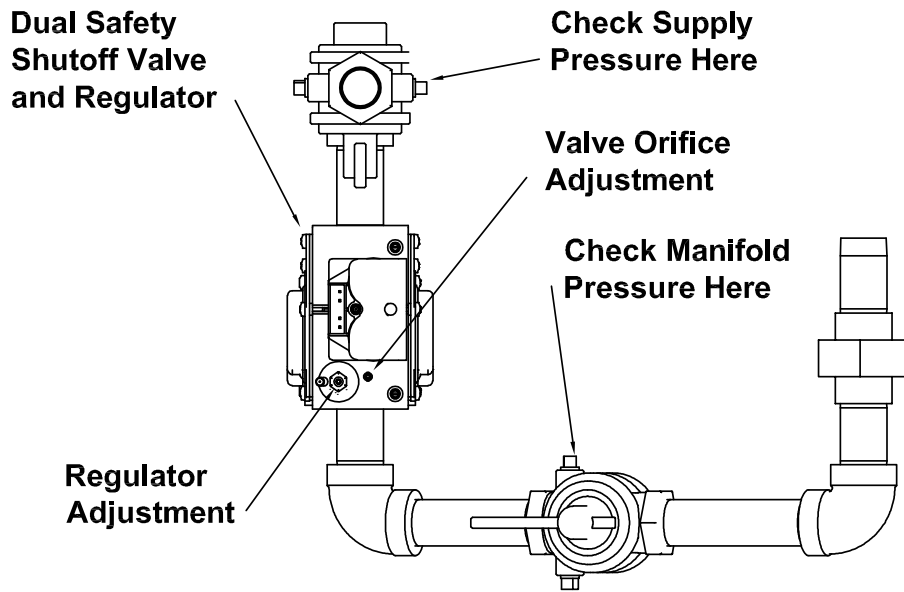
With the burner firing and adjusted to Low Fire, adjust the regulator screw clockwise (counter clockwise for the 400, requires Allen wrench) to increase gas flow or counter clockwise to decrease flow. The desired CO₂ in the combustion products must be between 8.5 and 9.5% for natural gas, 9.5% to 10.5% for LP gas. Do not attempt to adjust combustion based on manifold pressure alone. Manifold pressure should only be used as a reference point. It should not be necessary to adjust the regulator for these models. **See Gas Train Illustrations for details.**

- a. Once the desired combustion is achieved at Low Fire, raise the burner firing rate to High Fire. Adjust the valve orifice clockwise to reduce the flow of gas and counter-clockwise to increase the flow of gas in order to maintain the desired CO₂ in the combustion products between 8.5 and 9.5% for natural gas, 9.5% to 10.5% for LP gas.
- b. When High Fire combustion has been reached and combustion is within the proper range, return to low fire to confirm settings again.
- c. If at any point of the modulation range, the carbon monoxide level is in excess of 200ppm and cannot be successfully adjusted below that level, contact RIVERSIDE HYDRONICS® customer service for assistance.

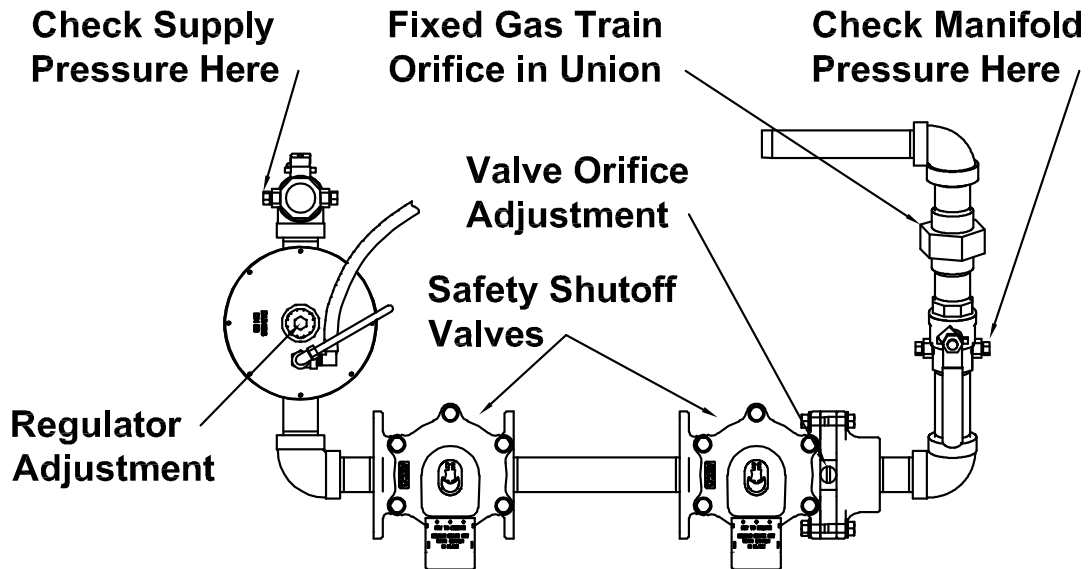
WARNING: Do not continue to operate the appliance with carbon monoxide levels above 200 ppm. Carbon monoxide is a colorless, odorless and poisonous gas that commonly results from gas combustion. High concentrations of Carbon Monoxide are extremely dangerous to humans and animals. Operation of an appliance at carbon monoxide levels above 200ppm can cause unsafe operation and the potential for poisonous carbon monoxide to enter occupied areas. Such improper installation can cause property damage, personal injury, exposure to hazardous materials or death.

- d. Close and seal the opening in the vent through which the combustion analyzer probe was inserted. Use a plug or seal with heavy adhesive backed aluminum tape with an adhesive suitable for the vent temperatures expected inside the selected and installed vent system and for condensing conditions.
25. Return the PS4 modulation parameter value to **nu** for automatic operation.
26. Enable or reconnect any BMS/BAS control interface removed prior to the setup and adjustment of each boiler.

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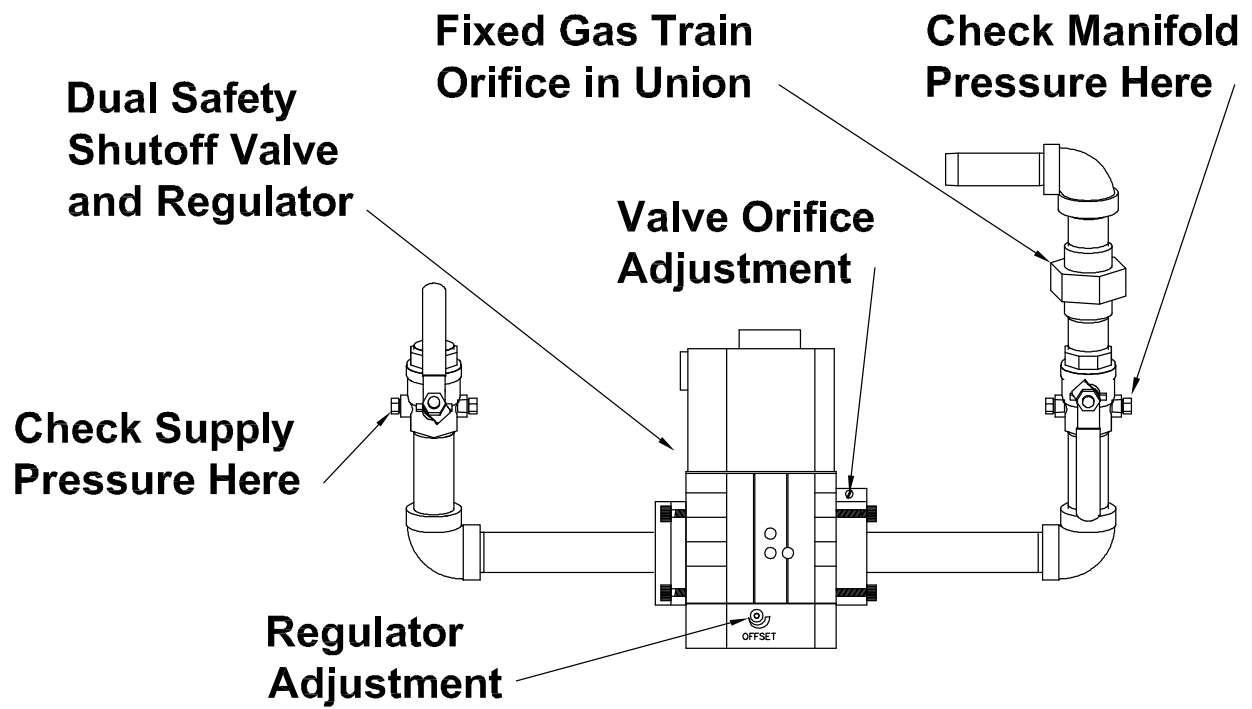


Gas Train Illustration for Model 400



Gas Train Illustration for Models 500 through 800
(Optional components may not be shown)

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Alternate Gas Train Illustration for Models 500 through 800
(Optional components may not be shown)

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14 TROUBLESHOOTING GUIDE

Problem	Probable Cause	Corrective Action	
Starting or Pre-purge Failure	Power Supply	Check fuse and/or circuit breaker.	
	On-Off Switch	Check if On-Off switch is illuminated when on. If not check panel fuse or incoming power.	
	Temperature Control TempTrac	Check that the operating temperature control is set higher than the temperature of the boiler. See Table 10.8 for indications of control or sensor faults.	
	Remote enable/disable open	See Table 10.8 for indication of condition. Enable boiler or place jumper between terminals R1-R2.	
	Electronic Low Water Cut-off (when installed)	Check internal ELWCO board for indication of failure. The red LED indicates a safe condition. Manual reset is required.	
	Gas Pressure Switches (when installed)	Gas pressure switches are attached to the gas train. Check for a tripped condition indicated by the manual reset button on the switch. Correct low gas pressure condition at the supply.	
	High Temperature Limiting Device	One manual, one auto reset limit device, set at 210F and 200F respectively, located at the control well on the top head of the tank. A high temperature condition may be caused by a failure of the TempTrac, temperature sensors. The failure can require manual reset depending which limit is tripped.	
	Combustion Air blower		Check if fan control relay is closed
			Blower motor may have failed.
			Fan VFD may be defective. Verify proper voltage.
	Air-proving Switch (if blower is functioning)		Check switch contacts are closed.
			Check for 120V at the N.O. side of air switch
			Check for 120V at the common side of air switch
Check if switch tubing is connected on both ends			
Flame Safeguard Control		Check for bad ground or bad control. Replace if necessary.	
Remote Proving Interlock		When terminal C1 and C2 are used a proving circuit for remote equipment, failure to close this circuit within the allotted time for Call-for-Heat will prevent operation and cause an alarm indication. Check for proper operation and proving of remote equipment.	
Loose Wire Connections		Check connections to all components	
Flame Failure	Power Supply	120 VAC is required for operation. Low voltage can cause failure. Voltage below 110 VAC must be investigated.	
	Flame Safeguard Control	Check for bad ground or bad control. Replace if necessary.	
	Hot Surface Igniter	Check resistance at room temperature and then the amperage draw during heat-up. Replace if the measured amperage is not within 3.5 to 5.0 Amps or if measured resistance is not within 40-100 ohms (at room temperature). Also, check for overheating condition due to damaged refractory around igniter.	
	Air-proving Switch	Check if switch is bouncing. Adjust or replace. Check VFD for proper speed settings.	
	Gas Pressure	Check for proper inlet static and dynamic gas pressure, 3.5" WC minimum.	
	Combustion	Inadequate flame signal may result from improper combustion. Adjust to proper CO2 levels at low fire. Inability to achieve proper CO2 throughout the modulation range may be caused by a defective gas valve, a defective regulator or blockage in the in the burner or combustion air supply.	
	Grounding	Check for proper ground from the flame control to the burner housing.	

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15 REPLACEMENT PARTS

15.1 Burner Assemblies

Burner Assembly Illustration for Model 400 (Optional components may not be shown)

LIST OF MATERIALS			
ITEM	QTY	P/N	DESCRIPTION
BURNER ASSEMBLY COMPONENTS			
1A	1	119467	BLOWER FIXED SPEED
1B	1	119466	BLOWER VARIABLE SPEED
2	4	3475	1/4 HEX NUT
3	4	3494	1/4 LOCK WASHER
4	4	15607	1/4 FLAT WASHER
5	~	110697	WIRE HARNESS
6	1	114154	3/4 X 2 1/2 NIPPLE
7	1	122576	CAP, ORIFICE 3 X 1 3/4 ID
8	1	119469	FLEXIBLE ADAPTER
9	1	118016	ELL BRASS HOSE CONNECTOR
10	1	121704	4 PVC X 12 PIPE
11	1	116929	4 TO 6 PVC BUSHING
12	1	121853	AIR INLET SCREEN 6.63 OD
13	3	76797	3/4 SS TEK SCREW
14	1	115276	BURNER
15	2	120493	BLOWER FLANGE GASKET
16	4	79972	1/4 WING NUT
17	1	113960	IGNITER COVER
18	1	107775	HOT SURFACE IGNITER
19	1	111791	IGNITER GASKET
20	1	128538	BURNER BULKHEAD
21	1	122232	CONDUIT CONNECTOR GB
22	1	120333	1/4 NYLON HOSE CLAMP
23	2 FT	101923	3/16 ID SILICONE TUBING
24	1	5995	3/4 X 6 NIPPLE
25	3	5991	3/4 X 2 NIPPLE
26	1	5928	3/4 UNION
27	3	6160	3/4 ELL
28	1	5993	3/4 X 4 NIPPLE
29	2	5336	3/4 SHUTOFF VALVE
30	1	114262	3/4 X 3 1/2 NIPPLE
31	1	109509	3/4 GAS VALVE
32	4	38607	STAR WASHER 1/4

NOTE:
 A. CONNECT TUBING TO HOSE BARB ON AIR INTAKE.
 B. CONNECT TUBING TO GAS VALVE REGULATOR AND SECURE WITH CLAMP.
 C. ATTACH SCREEN TO BUSHING WITH (3) TEK SCREWS.
 D. TIGHTEN ELBOW TO THE ANGLE INDICATED FOR PROPER POSITIONING OF THE GAS TRAIN.

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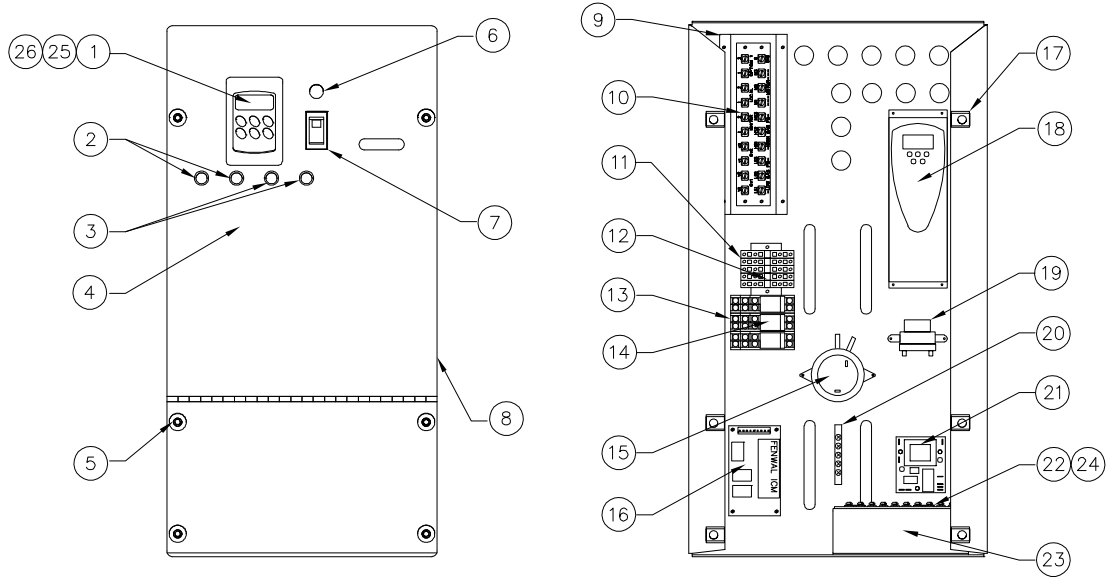
Burner Assembly Illustration for Models 500 through 800 (Optional components may not be shown)

LIST OF MATERIALS			
ITEM	QTY	PART NO.	DESCRIPTION
BURNER ASSEMBLY COMPONENTS			
1A	1	119467	BLOWER FIXED SPEED
1B	1	119466	BLOWER VARIABLE SPEED
2	4	3475	1/4 HEX NUT
3	4	3494	1/4 LOCK WASHER
4	4	15607	1/4 FLAT WASHER
5	1	5940	BLACK PLUG 1/4
6	1	101216	PRESSURE SWITCH HIGH GAS
7	1	122575	CAP, ORIFICE 3 X 2
8	1	119469	FLEXIBLE ADAPTER
9	2	118016	1/8 NPT X 1/4 HOSE BARB
10	1	121704	4" PVC X 12 PIPE
11	1	116929	4" TO 6" PVC BUSHING
12	1	121853	AIR INLET SCREEN 6.63 OD
13	3	76797	3/4 SS TEK SCREW
14	1	115276	BURNER
15	2	120493	BLOWER FLANGE GASKET
16	4	79972	1/4 WING NUT
17	1	113960	IGNITER COVER
18	1	107775	HOT SURFACE IGNITER
19	1	111791	IGNITER GASKET
20	1	128538	BURNER BULKHEAD
21	1	6437	BRASS TEE 1/8
22	3	6157	BLACK ELL 1/4
23	2 FT	101923	3/16 SILICONE TUBING
24	1	5995	3/4 X 6 NIPPLE
25	6	6011	1 X 2 NIPPLE
26	1	5929	1 UNION
27	3	6163	1 ELL
28	1	6018	1 X 7 NIPPLE
29	2	52823	1 SHUTOFF VALVE
30	1	6013	1 X 3 1/2 NIPPLE
31	2	118269	SAFETY GAS VALVE
32	1	79524	REGULATOR
33	1	6012	1 X 3 NIPPLE
34	1	6164	3/4 X 1 ELL
35	1	115770	ADAPTER FLANGE
36	1	115786	SHUTTER VALVE
37	1	101201	PRESSURE SWITCH LOW GAS
38	1	6508	BRASS NIPPLE 1/8 X CL
39	1	5196	SNUBBER 90DEG #80
40	0.5 FT	3299	ALUMINUM TUBING 1/4
41	1	6547	BRASS BUSHING 1/4 X 1/8
42	5	5972	BLACK NIPPLE 1/4 X 1
43	1	22264	BLACK NIPPLE 1/4 X 4
44	1	5839	BLACK TEE 1/4
45	4	38607	STAR WASHER 1/4
46	1	122828	BRASS BARB HOSE BARB

NOTE:
 A. CONNECT TUBING TO HOSE BARB ON AIR INTAKE.
 B. CONNECT TUBING TO GAS VALVE REGULATOR HOSE BARB.
 C. ATTACH SCREEN TO BUSHING WITH 3 TEK SCREWS.
 D. TIGHTEN ELBOW TO THE ANGLE INDICATED FOR PROPER POSITIONING OF THE GAS TRAIN.
 E. HIGH GAS PRESSURE SWITCH IS CONNECTED HERE TO THE UPPER PORT ON THE REGULATOR.
 F. LOW GAS PRESSURE SWITCH IS CONNECTED HERE. TEST PORTS MUST BE ORIENTATED AS DEPICTED. REMOVE HANDLE AND INSTALL 180° FROM ORIGINAL POSITION.

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15.2 Control Panel Enclosure Component Layout and Replacement PN's



LIST OF MATERIALS			
ITEM	QTY	PART NO.	DESCRIPTION
CONTROL PANEL COMPONENTS			
1	1	see next page	TempTrac Control
2	2	70573	Reset / Test Switch N.C. Momentary
3	2	122342	Indicating Light
4	1	124016	Main Decal
5	4	121323	Thumb Screw 1/4-20
6	1	5613	Fuse Holder
	1	76267	Fuse
7	1	70565	On / Off Switch
8	1	121250	Metal Face Plate
9	1	121705	Board Mount
10	1	122346	Terminal Board
11	6	122319	Terminal Block
12	4	122320	Terminal Block Jumper
13	2	122317	Relay Socket
14	2	124344	Relay DPDT
15	1	121444	Air Proving Switch
16	1	121945	Flame Control (HSI)
17	1	121433	Clip Nut 1/4-20
			Blower VFD
	1	125235	Blower VFD for 399 MBtu/H
	1	125234	Blower VFD for 500 MBtu/H
	1	125233	Blower VFD for 600 MBtu/H
	1	125232	Blower VFD for 650 MBtu/H
	1	125231	Blower VFD for 700 MBtu/H
	1	124531	Blower VFD for 750 MBtu/H
	1	125230	Blower VFD for 800 MBtu/H
18	1	122318	120V To 24V Transformer
19	1	122321	Ground Bar
20	1	113915	Electronic Low Water Cutoff
21	1	122595	Terminal Board Field Access
22	1	121749	Terminal Board Mount
23	1	102467	Jumper, Elec-Tron #ESJ-145
24	2	102467	Jumper, Elec-Tron #ESJ-145
25	1	104195	Thermostat Probe Dixell 5"
26	1	102163	Thermostat Probe Dixell 25"

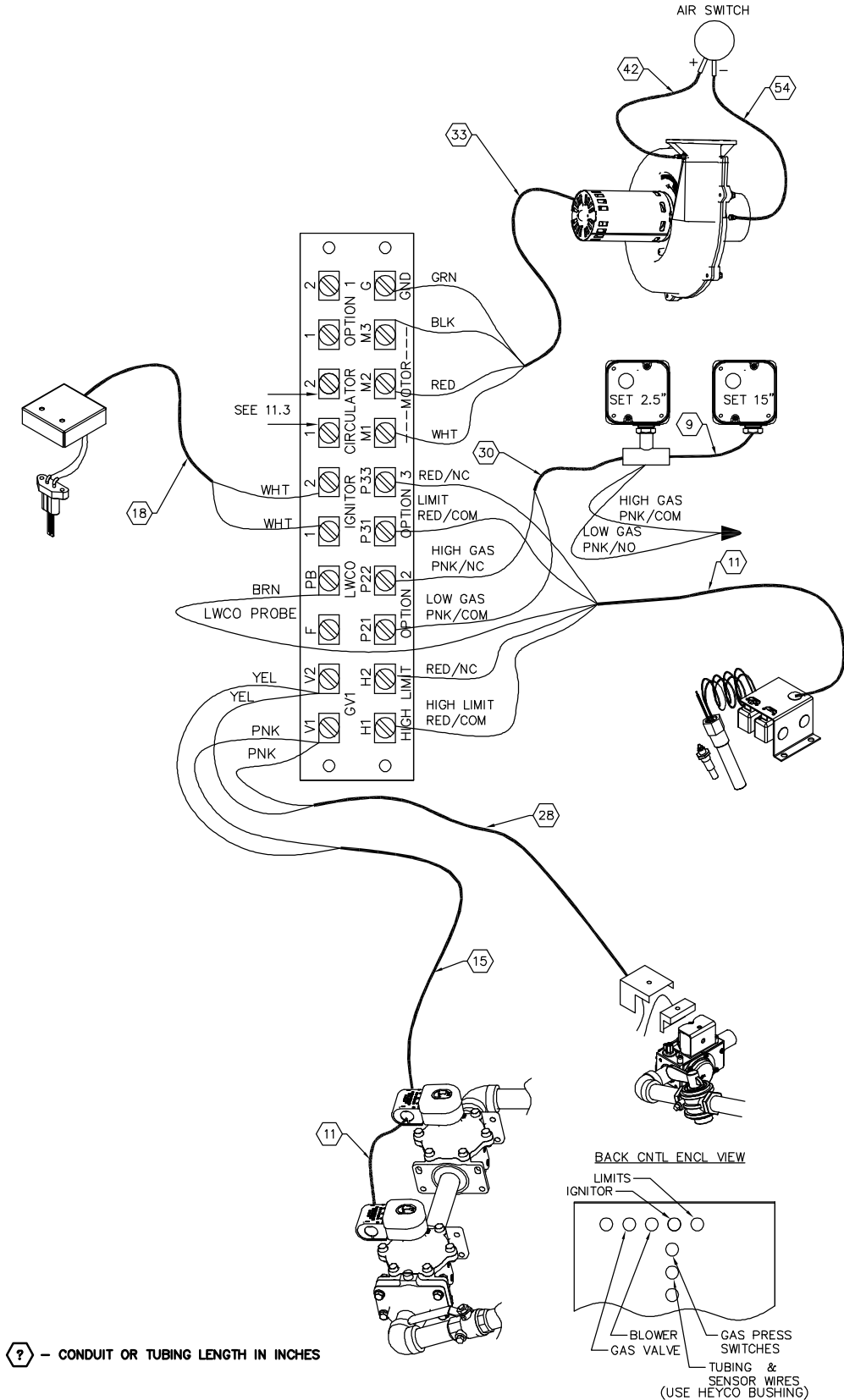
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15.3 Replacement TempTrac Kit Part List

Input	Venting Material Used	Outdoor Reset	Temptrac Kit PN
400 MBH	Stainless Steel	No	124567
500 MBH	Stainless Steel	No	124568
600 MBH	Stainless Steel	No	124569
650 MBH	Stainless Steel	No	124564
700-800 MBH	Stainless Steel	No	124565
400 MBH	PVC	No	125724
500 MBH	PVC	No	125725
600 MBH	PVC	No	125726
650 MBH	PVC	No	125727
700-800 MBH	PVC	No	125728
400 MBH	Polypropylene or CPVC	No	125729
500 MBH	Polypropylene or CPVC	No	125730
600 MBH	Polypropylene or CPVC	No	125731
650 MBH	Polypropylene or CPVC	No	125732
700-800 MBH	Polypropylene or CPVC	No	125733
400 MBH	-	Yes	Contact Factory
500 MBH	-	Yes	
600 MBH	-	Yes	
650 MBH	-	Yes	
700-800 MBH	-	Yes	

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15.4 Component Wiring and Conduit Routing Details



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16 PERIODIC MAINTENANCE

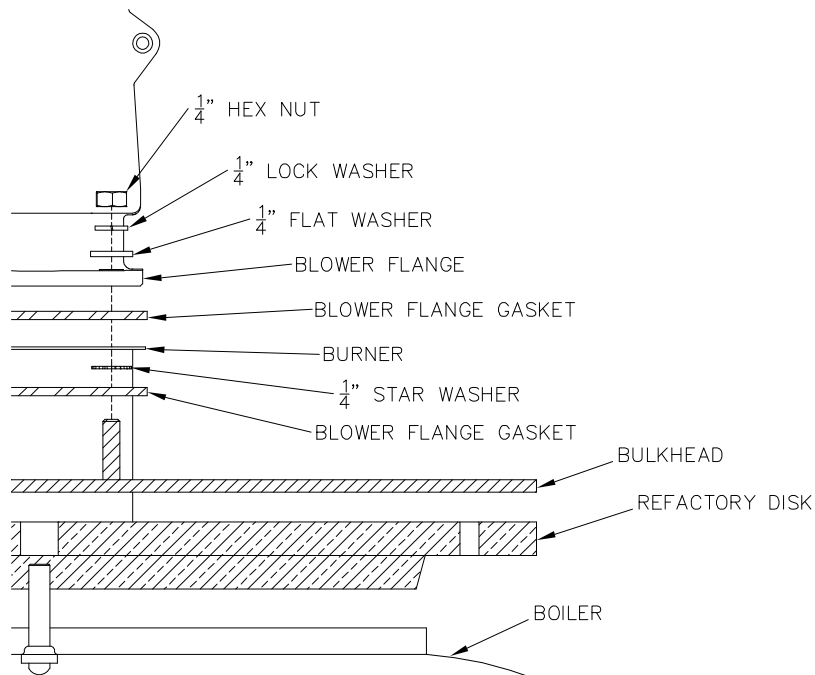
Listed below are items that must be checked to ensure safe reliable operations. Maintenance must be performed by a qualified service or maintenance provider. To ensure proper maintenance, the following instructions should be posted near the appliance and maintained in legible condition. Verify proper operation after servicing.

WARNING: When servicing the controls, use exact, Factory authorized, replacement parts and label all wires prior to disconnection. Verify proper operation after servicing. Incorrect parts substitution and wiring errors can cause damage, improper operation, fire, carbon monoxide, exposure to toxic fumes or other unexpected and unsafe conditions that can result in fire, personal injury or death.

1. Examine the appliance and venting system at least once a year. Check more often in first year to determine inspection interval.
 - a. Check all joints and pipe connections for tightness, corrosion or deterioration.
 - b. Check the electronic-ignition system for quick ignition and a proper flame signal.
 - c. Check all safety controls including thermostats for proper operation.
 - d. Check safety shut-off valves for operation and tightness.
 - e. Have the entire system, including, but not limited to, the burner, heat exchanger and venting system, periodically inspected by a qualified service agency.
2. Exposure to Dusty or Dirty Combustion Air: An appliance installed in a dust or dirt contaminated atmosphere will require an optional air inlet filter box. Replace the filter on a 3 to 6 month schedule or more often, based on severity of contamination. Without an inlet air filter, contaminants or non-combustible particulate matter such as dust, dirt, dryer lint, concrete dust, dry wall dust or the like can block burner ports and cause unsafe operation and a non-warrantable failure. Do not remove filter until a suitable replacement is available. The air filter is available through your RIVERSIDE HYDRONICS® Representative or use any standard capacity MERV 7, pleated air filter, 12"x24"x1".
3. Any sign of soot on the heat exchanger or in the flue indicates the need for a combustion inspection. Properly installed and adjusted units seldom need heat exchanger cleaning. If soot has formed, the most common causes are restricted combustion air or excessive gas. A blocked heat exchanger can cause unsafe operation and will reduce efficiency. To inspect and clean the heat exchanger, a qualified service agent or installer should use the procedures described in items 4, 5 & 6 below.
4. All gaskets on disassembled components must be replaced on reassembly with exact, Factory Authorized, replacement parts only. Gasket kits are available from your RIVERSIDE HYDRONICS® Representative or by contacting RIVERSIDE HYDRONICS®, LLC.
5. Burner and/or Heat Exchanger Inspection and Cleaning Procedure:
 - a. Turn off main power to unit.
 - b. Turn off gas supply.
 - c. Write notes and/or take pictures during this process to aid in correct reassembly.
 - d. Disconnect electrical the components by disconnecting the wires going to terminal strip in the top control enclosure and the respective conduit connections on the back of the control enclosure. If a wiring diagram is not attached to the back of the enclosure door or otherwise provided with the boiler, make careful notes of the locations for all the wires.
 - e. Remove the metal cover on top of the appliance by disconnecting the fasteners holding it to the plastic jacket.
 - f. Remove the hot surface igniter, (HSI) from the burner. Be very careful not to bump the igniter element due to the fragility of the igniter.
 - g. Break the unions that connect the gas train to the blower and the gas supply pipe. Remove the gas train.
 - h. Remove the nuts that secure the burner top plate to the combustion chamber and lift the blower/burner assembly up until it is completely extracted from boiler.
 - i. Inspect top plate refractory for damage. The refractory must provide a tight seal against the top edge of the burner deck.
 - j. Inspect the burner surface for signs of cracking or thermal fatigue.

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- k. If internal inspection of the burner is desired or the burner or blower must be replaced, remove the nuts that attach the blower to the burner top plate to remove the blower. The burner can now be extracted. Be careful not to damage the refractory when removing the burner. With the burner removed, inspect the deck surface of the burner for lent or other blockage carried in the fuel air stream. If blockage has accumulated, use brush to loosen debris and use a vacuum or water to remove it from the burner cavities.
 - l. Replace any damaged components and reassemble in reverse order. (6 ft/lbs).
 - m. Cycle unit and test to verify all safety and operating controls are properly functioning and the burner top plate flange is free of leaks.
6. If equipped, the combustion air filter should be replaced every six months. To avoid nuisance shutdown in dirty environments, check and replace filter more frequently.
 7. The vent connector is connected to the flue collector shell by 8 studs and the seal between them is maintained by die-cut elastomeric gasket. A leak at this joint may be evidenced by condensate forming on the surrounding surfaces or pooling below the connection. Any leak must be addressed immediately by replacing the gasket with the factory authorized replacement part only.
 8. Inspect low water cutoffs and relief valves for proper operation at every six months, or more often if indicated by inspection.
 9. Keep appliance area clear and free from combustible materials, gasoline and other flammable vapors and liquids.
 10. Check frequently to be sure the flow of combustion and ventilation air is unobstructed to the appliance.
 11. When electrical controls are serviced or replaced, label all connections as they are removed, to know the proper placement on the replacement part.
 12. All replacement parts are available through your RIVERSIDE HYDRONICS® Dealer. If you need assistance identifying or contacting your local dealer, you may contact RIVERSIDE HYDRONICS®, LLC directly at the address and telephone number located on the first and last page of this manual.
 13. If the appliance is to be shut down for an extended period of time, the primary gas valve should be shut off. When the appliance is returned to service, a thorough inspection of all utilities and general appliance condition should be conducted.



Burner Attachment Layering Illustration

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17 RECOMMENDED MAINTENANCE SCHEDULE

Regular service by a qualified service agency and routine maintenance must be performed to ensure safe, reliable and efficient operation.

Yearly (Beginning of Each Heating Season)

Schedule annual service call by qualified service agency.

1. Check for piping leaks around pumps, relief valves, and tank connections. Repair, if found.
2. Check to ensure area is free from combustible materials, gasoline, and other flammable vapors or liquids.
3. Visually inspect venting system for proper function, deterioration or leakage.
4. Check relief valve. Refer to manufacturer's instructions on valve.
5. Inspect condensate drain and ensure condensate is directed to an appropriate condensate system or drain, as required by local codes.
6. Check all operation of safety devices. Refer to manufacturer's instructions.
7. Inspect burner and gas train components for wear or deterioration.
8. Check the electronic-ignition system for quick ignition and proper flame signal.
9. Check safety shut-off valves for proper operation and tightness.
10. Follow startup procedure in Installation & Maintenance Manual.

Semi-Annually (Every Six Months)

1. Test Low-water-cut-off (if equipped). Refer to manufacturer's instructions and reset.
2. Test the electronic-ignition flame failure detection system. Refer to manufacturer's instructions and reset.

Monthly

1. Check condensate drain system.
2. Visually inspect venting system for proper function, deterioration or leakage.
3. Confirm the low-water cutoff and alarm are operating
4. Check combustion air filter (if equipped) and replace as required.

Daily

1. Check for and remove any obstruction to the flow of combustion or ventilation air to the unit.
2. Check to ensure area is free from combustible materials, gasoline, and other flammable vapors or liquids.
3. Check gauges, monitors and indicators.

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Since RIVERSIDE HYDRONICS[®], LLC cannot control the use of the appliance, water conditions, or maintenance, the warranty on the heat exchanger does not cover poor performance, structural failure, or leaking due to an excessive accumulation of precipitants.

MODEL NUMBER: _____

SERIAL NUMBER: _____

INSTALLATION DATE: _____

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