Gasmaster Industries
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CANADA

GMI800

800,000 Btu/hr Input

GMI 1M

1,000,000 Btu/hr Input

Gas-Fired Stainless Steel Boilers and Water Heaters

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

SERIAL NUMBER:
XXX. xx

GASMASTER DOCUMENTS

DESCRIPTON	SECTION
Performance & Structural Test Report	1
Q/C Department Release Report	1
Installation, Operation, & Maintenance Manual	2

DRAWINGS

NUMBER	DESCRIPTION	SECTION
1	Heat Exchanger Schematic	2
2	Control System Schematic	3
3	Gas Line	3
4	Inlet Manifold Assembly	3
5	Front View/ Dimensions	3
6	Side View/Dimensions	3
7	Top View/Dimensions	3

COMPONENTS' DOCUMENTS

MANUFACTURER	COMPONENT	SECTION
Riello	Catalogue	4
Honeywell/Siemens	Main Gas Valves	5
Asco	Pilot Gas Valve	6
Omron/Siemens	Temperature Controller	7
Honeywell	High Temperature Limit	8
McDonnell & Miller	Low Water Cut-Off Switch	9
Conbraco	Safety Relief Valve	11
Dungs	Air Pressure Switch	12
Antunes Control (Dungs/Honeywell)	Gas Pressure Switch	13
LFL	Gas Burner Controls	14
Siemens	Reversing Actuator	15
Maxitrol	Pressure Regulators	16

List of Contents

GMI 1M SPECIFICATIONS AND DIMENSIONS

CGA/AGA Input	Btu/h	1,000,000
CGA/AGA Output	Btu/hr	940,000 (as hot water boiler, tested in accordance with ANSI Z21.13)
	Btu/hr	970,000 (as water heater, tested in accordance with ANSI Z21.10.3
Boiler Efficiency @ full load	%	94.0
Water Heater Efficiency @ full load	%	97.0
Fuel		Natural Gas
Electrical Rating	V/PH/Hz/A	120/1/60, less than 12 amps
Heating surface	Ft^2	99.5
Boiler Shell Dimensions		
- Width	Inches	56±¼
- Depth	Inches	21±¼
- Height	Inches	50±¼
Overall Dimensions		
- Width	Inches	56±¼
- Depth	Inches	47.5±¼
- Height	Inches	69.5±¼
Shipping Weight	Lbs	1260
Supply/Return Connections	Inches	2 - Stainless Steel Flange, ANSI 150 lbs
Water Content	USG	13.5
Gas connection	Inches	1.5 NPTF
Gas inlet pressure	Inches WC	28 to 140
Flue connection	Inches	8
Flue duct material		Stainless Steel (air tight, corrosion resistant)
Air supply connection	Inches	N/A
Maximum working pressure	psig	160
Maximum working temperature	Degrees F	210
Minimum inlet water temperature		Any temperature above freezing
Minimum water flow rate*	USG/min	17.3 (For ΔT= 100F)
Minimum service clearance	Inches	Top 40, Front 40, Back 10, Floor 0
Minimum clearances to combustibles	Inches	Top 40, Front 40, Back 2, Opposite Burner Side 2, Burner Side 24, Floor non-combustible

*** Above flow rate is for typical boiler condition. For each case, please consult engineering.**

GMI 800MBH SPECIFICATIONS AND DIMENSIONS

CGA/AGA Input	Btu/h	800,000
CGA/AGA Output	Btu/hr	760,000 (as hot water boiler, tested in accordance with ANSI Z21.13)
	Btu/hr	780,000 (as water heater, tested in accordance with ANSI Z21.10.3
Boiler Efficiency @ full load	%	95.0
Water Heater Efficiency @ full load	%	98.0
Fuel		Natural Gas
Electrical Rating	V/PH/Hz/A	120/1/60, less than 12 amps
Heating surface	Ft^2	99.5
Boiler Shell Dimensions		
- Width	Inches	56±¼
- Depth	Inches	21±¼
- Height	Inches	50±¼
Overall Dimensions		
- Width	Inches	56±¼
- Depth	Inches	47.5±¼
- Height	Inches	79.5±¼
Shipping Weight	Lbs	1260
Supply/Return Connections	Inches	2 - Stainless Steel Flange, ANSI 150 lbs
Water Content	USG	13.5
Gas connection	Inches	1.5 NPTF
Gas inlet pressure	Inches WC	7 to 14
Flue connection	Inches	8
Flue duct material		Stainless Steel (air tight, corrosion resistant)
Air supply connection	Inches	N/A
Maximum working pressure	psig	160
Maximum working temperature	Degrees F	210
Minimum inlet water temperature		Any temperature above freezing
Minimum water flow rate*	USG/min	13.9 (For ΔT= 100F)
Minimum service clearance	Inches	Top 40, Front 40, Back 10, Floor 0
Minimum clearances to combustibles	Inches	Top 40, Front 40, Back 2, Opposite Burner Side 2, Burner Side 24, Floor non-combustible

*** Above flow rate is for typical boiler condition. For each case, please consult engineering.**

SECTION 1:

INTRODUCTION

1.1 Boiler/Water Heater Description

The Gasmaster GMI 1M is a gas-fired water tube boiler and water heater with nominal input rating of 1,000,000 Btu/hr. Each unit has three stainless steel coiled tubes (SA-249 Type 316L), 1" diameter and 0.049" wall thickness. All three coils are held parallel vertically by means of four stainless steel ready rods and adjustment nut assemblies. In between the coils are two mesh rings which act to increase the performance of the heat exchanger. The heat exchanger is fastened to supporting angle frame. The inlets and outlets of the coils are welded to the manifolds pipes of the boiler. On the inlet manifold assembly, in between the coils and the manifold are the purge valves.

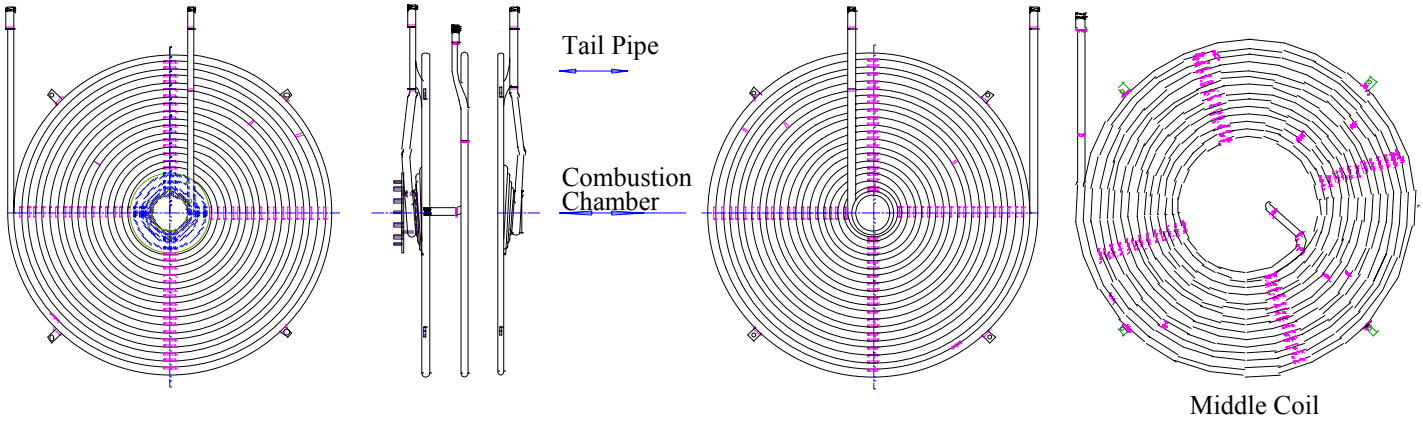


Figure 1: Heat Exchanger Configuration

The rest of the heat exchanger is a refractory assembly welded to hub on the rear coil and the burner assembly connected to the front hub. The refractory assembly consists of a ceramic refractory, insulation plate and support ring prevent hot gas escaping through the rear coil. The front hub and the front coil are connected and support a high performance gas burner. The weight of the burner is counter balanced by the heat exchanger.

The exact mechanism of heat exchange is a complicated engineering phenomenon, involving combination of flow, temperature, fouling factors, and two-phase conditions. However, the working of heat exchanger is a simple process. The gas burner ignites the gas and air inside the combustion chamber (the central space of the three coils). The hot gas particles cool and condense as they pass through the gaps of the coils. The flue particles are gathered in the boiler chamber (space outside the coils and within the liners) and exit through the chimney. The water flows in the opposite direction of gas. Feed water enters the each coil at the perimeter of the heat exchanger. The water picks up heat gradually as it circulates through the coil tubes and exits at the center (near the central hubs). The counter flow design reduces the impact of thermal shock and increases the heat exchanger life. The flue condensate is drained through a fitting at the bottom right of the boiler.

The boiler is designed for flue gas condensing for the high energy and a higher thermal efficiency. Flue condensation will occur if the temperature of the inlet water is below dew point, usually 120 degrees Fahrenheit. Because the flue condensate is a corrosive element, the internal structure of the boiler is constructed out of stainless steel 304/316L or better to offer the highest service life. Corrosion related failures are the typical problems which can be managed through a scheduled

progressive inspection and maintenance program. Lastly the condensate and the flue venting should be safely processed to the environment according to local jurisdiction and building codes.

1.2 Control System

The boiler/water heater control module consists of an "Individual Boiler/Water Heater Control Module", or the "BMS" (Boiler Management System) signal input module as an option.

With the "Individual Boiler/Water Heater Control Module", the unit's operation is governed by the desired outlet (hot water) temperature. Using a digital, high precision temperature controller, the owner will identify the required hot water temperature. A temperature sensor installed on the boiler/water heater outlet manifold continuously measures the outlet water temperature. A servomotor controlling the gas butterfly valve and the air damper (by means of a variable profile cam mechanism) allows for throttling of the air/gas mixture flowing into the Riello burner. For as long as the set temperature is above that of the outlet water, the boiler/water heater operates at maximum output capacity. Analogue output signals from the temperature sensor are sent to the temperature controller, which in turn sends corresponding signals to the servomotor. This throttles the flow of gas and combustion air in the gas butterfly valve and the air damper. Therefore, the appropriate volume of air/gas mixture flows into the burner, allowing for almost perfect air/gas mass, and volume ratios. As the outlet temperature approaches the set temperature, the air/gas mixture flow is gradually reduced by the servomotor (connected to the gas butterfly valve and the air damper). This results in the corresponding gradual decrease in the unit's capacity. Thus the throttle system allows for optimum continuous operation of the boiler, significantly reducing on/off cycles. The said system offers the user almost infinite modulating capacity within the boiler/water heater operating range.

1.3 Safety Features

Each Gasmaster GMI 1ML boiler and water heater is equipped with a number of safety features.

I: ***Low Water Cut-Off Switch:*** One "McDonnell & Miller" low water cut-off switch is installed on the outlet manifold. When water reaches the LWCO position, the burner should fire.

II: ***Flame Sensor:*** A Riello flame probe is used as a flame proving sensor. This is connected to the burner controller, and is installed inside the burner head. At any time after the main gas valve is opened, if flame is not detected for a period longer than 4 seconds, the burner controller will be deactivated and the main gas valve will immediately close.

III: ***High Temperature Limit:*** Each unit is equipped with a "Honeywell" high temperature limit switch. If outlet water temperature exceeds the temperature set on this switch, the burner controller will be deactivated and the gas valves will immediately close.

IV: ***Air Pressure Switch:*** One low air pressure switch is installed on the side of the blower and measures air pressure entering the burner (for exact location of the

switch please see item #5 on the drawing presented on page 4 of the Riello catalogue). If the combustion air pressure drops by more than 20% below the nominal air pressure (minimum pressure of 0.4" wc), the burner controller will be deactivated and the main gas valve will immediately close.

V: ***Relief Valve:*** A "Conbraco" safety relief valve with prescribed nominal pipe size of 1 1/4"valve inlet/outlet, minimum relief capacity of 4,974,000 Btu/hr and 150 psig relief pressure, is installed on the water outlet manifold and supplied as standard equipment. When the boiler or water heater is used in heating applications having working pressures in the range 40–160 psig, an appropriate pressure relief valve should be installed.

VI: ***Gas Pressure Switches:*** One manual reset low gas pressure switch is installed on the gas train in between the gas pressure regulator and the first safety shut off valve (please see the schematic diagram "Typical UL Schematic Gas Piping" on page 9 of the Riello catalogue). If the line pressure drops below 7" wc, the switch will open and the unit will immediately shut down. One Dungs high gas pressure switch is also installed on the side of the Riello burner (for exact location please see item #4 on the drawing presented on page 4 of the Riello catalogue). If the gas manifold pressure increases above 2.95" wc, the switch will open and the unit will immediately shut down.

1.4 Gas Lines

1.4.1 Pilot Gas Line

Referring to the "Typical UL Schematic Gas Piping" diagram on page 9 of the Riello catalogue, gas from the main supply line flows at the maximum pressure of 14" wc through the manual valve into the pilot line. From the pressure regulator it will then flow through the two, safety shut off valves into the burner. The pressure regulator is adjusted such that gas flows within 2" – 5" wc pressure into the first safety shut off valve. If pilot flame is not established within 5 seconds of the ignition trial time, the flame safeguard will shut off the pilot safety gas valves.

The pilot flame will ignite the air/gas mixture flowing through the burner within 5 seconds of the mixture flowing into the burner.

1.4.2 Main Gas Line

Referring to the same drawing, gas from the main supply line flows at a maximum pressure of 14" wc through the manual gas valve into the main gas line. From the pressure regulator it will then flow through the two safety shut off valves, into the second manual shut off valve. Finally gas flows through the gas adjustment butterfly valve into the burner where it is ignited by the pilot flame. The pressure regulator is adjusted such that the manifold gas pressure remains within 0.2 – 3.0" wc. This pressure is tested at the manifold gas pressure test point located on the side of the Riello burner (for exact location of the test point please see item #8 on the drawing presented on page 4 of Riello catalogue). Signals from the temperature controller are sent to the servomotor,

which controls the opening of the butterfly valve and the air damper. Subsequently, the valve and damper are proportionately closed or opened in order to decrease or increase the air/gas mixture flow into the burner. Hence, maintaining the outlet water at constant temperature, during changes in the load/demand (i.e. throttle or load tracking function).

NOTES

- *Air and gas flow rates are factory adjusted for optimum combustion quality. Note that these settings may vary slightly at different site conditions (calorific value of gas, duct length, etc.).*
- *After installation is completed, using a gas analyzer, the CO and O_2 contents of the exhaust gases should be re-checked to ensure their compliance with those achieved at the factory and reflected in the test report provided to your local Gasmaster representative.*
- *IF adjustments to the factory settings of air and gas flows are made, ensure that the manifold gas pressure does not exceed the 3.0" wc specified by the burner manufacturer.*

WARNING

Exceeding the maximum allowable gas manifold pressure could result in over-firing of the unit and may cause permanent damage to the unit.

1.5 Gas Manifold and Control Assembly Tests

Safe operation and all performance criteria of all Gasmaster products, incorporating the installed gas manifold and control assembly, are proven before delivery when the products are factory tested in accordance with the ANSI Z21.13b 2000 standards.

1.6 Code Compliance

In Canada, boiler installation must conform to the requirements identified in the CGA Codes CAN1-B149-1 or CAN1-B149-2 for gas burning appliances, CSA Codes B51 for boiler, pressure vessel, and pressure piping, and/or all applicable local codes. All electrical connections are to be made in accordance with the requirements of CSA C22.1, Canadian Electrical Code, Pat 1, and/or all applicable local codes.

In the United States of America, the installation must conform to the requirements of the authority having jurisdiction or, in the absence of such requirements, to the National Fuel Gas Code, ANSI Z223.1-latest edition. All electrical wiring must be carried out in accordance with the National Electrical Code ANSI/NFPA No.70-latest edition, and any additional state or local code requirements. If an external power source is used, the unit must be electrically grounded in accordance with the requirements of the authority having jurisdiction. In the absence of such authority, the boiler must be electrically grounded in accordance with the National Electrical Code ANSI/NFPA No. 70-latest edition.

The plumbing and condensate disposal must be carried out in accordance with the local plumbing codes.

NOTES

- *Boiler/water heater can be used in both closed loop and open loop (one pass) operations.*
- *In the commonwealth of Massachusetts the installation shall be carried out by a licensed gas fitter/plumber and comply with 48CMR*

1.7 Freeze Protection

- In either an open or closed loop configuration, the boiler must be isolated before draining. Due to the radial geometry of the unit, it can only be drained by forced air method. The operator can connect the forced air through the 3/8" air vent on the manifold and the drain connection on the 3/8" connection on the other manifold.

- For short term storage, the operator can add antifreeze to protect the boiler against freezing condition. In this case, the boiler or water heater does not need to be drained. The antifreeze must be compatible with hydronic heating systems.

1.8 Water Treatment

All heat exchanger coils are constructed from high grade stainless steel. Therefore, high oxygen content in the feed water should not result in any corrosion inside the coils. Since water flow through coils is in turbulent mode, and they are continuously expanding and contracting; the operation of the unit is to a large extent self cleaning. Therefore, other potential minerals that may exist in water should not have any adverse effect (on the tubes). However, if it is wished to supply soft water to the boiler or water heater, then a sodium-based ion-exchanger may be used. Note that "soft water" is defined as one having less than 0.12° British, or 0.17° US hardness level. Consult a local water treatment consultant to determine if water treatment is required.

SECTION 2:

INSTALLATION

2.1 Boiler/Water Heater Package

Each unit is supplied with:

1. Riello burner/blower.
2. Inlet and outlet manifolds.
3. High temperature cut off switch with manual reset.
4. Operating temperature controller.
5. Pressure relief valve.
6. Fully assembled gas train.
7. One Temperature sensor installed on the outlet manifold
8. Condensate drain connection.
9. Flame sensor (inside burner).
10. Flue gas connection.
11. Pressure-Pressure/temperature gauge.
12. One purge valve installed at the inlet of each coil.
13. All Safety features as described in **Section 1.3.**

Please contact Gasmaster Industries if items listed above are missing. Please be familiar with major parts of the boiler before operating. Always exercise caution when transporting. Instructions provided are only general guides, and are not substitute for common sense and sound safe practices.

2.2 Location

I: This boiler/water heater is for indoor installation only.

II: For service access to the Riello control box, condensate drain "U" trap, and gas train, refer to the clearances indicated on the boiler/water heater rating plate. Note that some jurisdictions may have their own clearance requirements. In such cases refer to all applicable local codes.

III: The boiler/water heater can be placed in a basement or utility room. It should not be placed in an unconditioned area where the unit and condensation could be subject to freezing temperatures.

IV: For reduced installation cost, locate the boiler/water heater as close to an outside wall as possible.

V: Flue gases can be vented out directly through a wall, or in case of retrofit installation, the flue gas duct can be extended into the existing chimney**.**

VI: Keep boiler/water heater area clear and free from combustible materials, gasoline, flammable vapors and liquids.

VII: Ensure that inlet to the blower is kept clear of any obstruction so that combustion air can flow freely through to the air intake blower.

VIII: A resilient pad to separate the boiler/water heater from floor IS NOT REQUIRED.

2.3 Relief Valve

A pressure relief valve is supplied as standard equipment. The relief valve is a mandatory protection against damage that could be caused by excessive water pressure. Either, mal-functioning of the controls, or creation of steam pockets due to water stagnation in some parts of the coils, may cause such excessive pressure. This latter condition could arise if one or both coils are not properly purged.

The pressure relief valve should be connected to a suitable water drain. The drain pipe MUST pitch down from the valve and its internal diameter should not be less than that of the relief valve. The end of the drain line should not cause any restriction to the water flow, and should be protected from freezing. There should not be any valve of any type installed between the pressure relief valve and the end of the drain line. Similarly, there should not be any instrument installed anywhere along the length of the drain valve, between the relief valve and the end of the drain line. The relief valve is installed in vertical position and should remain in that position at all times.

2.4 Water Connection

All pre-installation work has been completed at the factory. Two water manifolds (inlet and outlet headers) are provided with the unit. One low water cut-off switch is installed on the outlet manifold. One high temperature limit switch and one pressure relief valve are installed on the outlet manifold. A temperature sensor installed on the outlet manifold is connected to the appropriate terminals in the electrical control box. It is strongly recommended that user install a flow switch on the inlet pipe.

Cold-water inlet and hot water outlet connections are clearly marked on the respective manifolds of the boiler/water heater. The cold water supply line (in one pass applications), or return water (in closed loop applications) should be connected to the cold water inlet of the unit. The hot water supply line should be connected to the hot water outlet of the boiler.

For further information on methods of connecting supply and return water piping to boilers/water heaters consult available installation and piping guides developed according to local plumbing codes.

2.5 Condensate Line

Connect 1/2" ABS tubing from the condensate drain "U" trap, directly to the floor drain. Notice that the line MUST be pitched downward towards the floor drain to avoid traps. DO NOT install any valve of any type, or any other instrument between the condensate drain "U" trap and the end of the condensate line.

NOTE

- *To ensure proper flow of condensate, it is recommended to install a "drain vent" of approximately 1foot height at 0.5-1 foot downstream of the U trap.*

2.6 Gas Line Connections

The gas train comprises a pressure regulator, low gas pressure switch, solenoid valve, and the main gas valve. Gas pressure at the inlet to the pressure regulator should always remain in the 7" – 14" wc range. If higher pressures are present, consult the local gas company or gas installation codes for installing the appropriate gas pressure regulator. Gas line from the meter to the boiler/water heater should be of adequate size to prevent undue pressure drop. A manual shut off valve should be installed in the gas line upstream of the pressure regulator, so that the control instruments (main gas valve, boiler/water heater gas regulator, and low gas pressure switch) can be easily isolated and removed, whenever necessary. The valve should be clearly marked, located outside the unit's housing, readily visible and accessible for turning on and off. If the unit is to be installed in,

under, or directly attached to a pool, or spa, structure, the said manual valve should be located outside the structure.

NOTE

- *Inlet gas pressure upstream of the unit must always remain within the 7" – 14" wc range.*

2.7 Vent Connection

Flue vent should be 8". The duct should be corrosion resistant, air tight and short as possible. A condensate drain is highly recommended for long duct or single wall vent. The condensate drain pipe should pipe the condensate to appropriate drain. The combustion gases can be exhausted either directly through the wall, or through a chimney (in case of retrofit applications). If venting directly through a wall, allow at least a 5% rising slope of horizontal duct immediately after the exhaust outlet on the boiler. Vent installation should be done by professional contractor and in accordance to local building code and/or CSA B149.1 or ANSI Z223.1.

If due to site limitations there is insufficient vertical height, an exhaust fan, a power vent, or a draft inducer should be installed to assist exhaust gas venting. For multiple boilers venting, installing a barometric damper is recommended for balance exhaust.

Equivalent Lengths

90 deg. Elbow	3'
45 deg. Elbow	2'
Condensate Tee	2'
Vent Cap	3'

NOTES

- *The exhaust venting system must meet the requirements of category IV boilers (i.e. corrosion resistant, water and air-tight).*
- *The exhaust duct outlet to the atmosphere MUST be wind protected by an approved wind cap.*

2.7.1

Periodically inspect the vent duct for pin holes or cracks. Maintaining gas tight seal is very necessary and important. Please apply appropriate condensate sealant (Mill-Pac) on these openings.

When an existing boiler or water heater is removed from a common venting system, the common venting system is likely to be too large for proper venting of the appliances remaining connected to it. Therefore:

At the time of removal of an existing boiler or water heater, the following steps should be followed with each appliance remaining connected to the common venting system placed in operation, while the other appliances remaining connected to the common venting system are not in operation

I: Seal any unused openings in the common venting system.

II: Visually inspect the venting system for proper size and horizontal pitch and determine that there are no blockages, restrictions, leakages, corrosions or other deficiencies, which could cause an unsafe connection.

III: Any improper operation of the common venting system should be corrected, so the installation conforms to the National Fuel Gas Code, ANSI Z223.1. When resizing any portion of the common venting system, the common venting system should be resized to approach the minimum size as determined using the appropriate tables in Appendix G in the National Fuel Gas Code, ANSI Z223.1".

IV: To insulate the single wall duct against condensate corrosion, add about 1" mineral wool insulation or equivalent all around. The insulation will also assist exhaust gas draft.

2.7.2

For connection to gas vents or chimneys, vent installations should be in accordance with Part 7, Venting of Equipment, of the National Fuel Gas Code, ANSI Z223.1, or applicable provisions of the local building codes.

Vent connectors serving appliances vented by natural draft should not be connected into any portion of mechanical draft systems operating under positive pressure.

The horizontal portions of the venting system should be supported to prevent sagging. The methods of and intervals for support should be in accordance with the local code standards. Furthermore, the following installation requirements should also be satisfied:

I: Horizontal runs should slope upwards not less than 1/4" per foot (21 mm/m) from the boiler to the vent terminal.

II: The vent system should be installed to prevent accumulation of condensate.

III: Where necessary, the vent system must provide the means for drainage of condensate.

2.7.3

Vent termination should be in accordance with all applicable local codes. In addition, the following conditions must be satisfied:

I: Distances from adjacent public walkways, buildings, windows and building openings, should be consistent with the National Fuel Gas Code, ANSI Z223.1.

II: Minimum clearance of 4 feet (1.22 m) horizontally and in no case above or below, unless a 4-foot (1.22 m) horizontal distance is maintained from electric meters, gas meters, regulators and relief equipment.

2.7.4

It is recommended to install prefabricated factory-made vent parts each designed to be assembled with the other without requiring field fabrication.

MANUFACTURER	VENT PART MODEL	MATERIAL
Heat-Fab Inc.	Saf-T Vent system	Stainless Steel

2.8 General Instructions

2.8.1

The boiler/water heater and its individual shutoff valves must be disconnected from the gas supply piping system during any pressure testing of that system, at test pressures in excess of 0.5 psig. The unit 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 or less that 0.5 psig.

2.8.2

The boiler/water heater should be installed such that the gas ignition system components are protected from water (dripping, spraying, rain, etc.) during appliance operation or service.

2.8.3

The boiler/water heater and its gas connection must be leak tested, before placing the boiler in operation.

2.8.4

The boiler/water heater when installed must be electrically grounded and bonded in accordance with the local codes or in the absence of such codes, in accordance with the National Electrical Code, ANSI/NFPA 70.

2.8.5

The boiler/water heater should be located in an area where leakage of the tank, or connections, will not result in damage to the area adjacent to the appliance or to the structure. When such locations cannot be avoided, it is recommended that a suitable drain pan, that drains adequately be installed under the boiler. The pan must not restrict air- flow.

2.8.6

The boiler should always be purged of natural gases before starting up. The operator should also investigate and identify the cause of any trip before attempting to relight the boiler.

2.8.7

For proper operation of a spa or hot tub the following safety rules should be observed:

- Spa or hot tub water temperature should never exceed 104º F (40º C). A temperature of 100º F (38º C) is considered safe for an adult. Special caution is suggested for young children.
- Drinking alcoholic beverages before or during hot tub or spa use can cause drowsiness, which could lead to unconsciousness and subsequently resulting in drowning.

- Pregnant women should be cautious. Soaking in water above 102º F (39º C) can cause fetal damage during the first three months of pregnancy. Pregnant women should respect the 100º F (38º C) maximum rule.

- Before entering the spa or hot tub, the water temperature should be checked with an accurate thermometer. Spa or hot tub thermostats may have an inaccuracy, as high as 4º F in regulating the water temperature.

- Persons with medical history of heart disease, circulatory problems, diabetes or blood pressure should obtain their physician's advice before using spas or hot tubs.

- Persons taking medications, which induce drowsiness, should not use spas or hot tubs.

SECTION 3:

OPERATION

3.1 Sequence of Operation

3.1.1 Safety Loop

A: Components

Referring to Figure 2 (Control System Schematic) the safety loop includes the following components:

I: ***High temperature cut off switch:*** This is a manual reset switch and is normally closed. It is installed on the outlet manifold. The desired high limit temperature can be set by the owner and is usually 10 °F above the maximum operating temperature. In no event should this switch be set at above 210 °F. If the outlet temperature increases above the set temperature, this switch will open and the unit will go into the "lock-out" mode. The unit will remain in this mode until the operator manually resets the switch.

II: ***Operating temperature switch:*** This contact normally closes when the actual value is less than the set point and is embedded in the temperature controller unit. The desired outlet temperature (desired set point) is also set by the owner on the same temperature controller.

III: ***Low water cut off switch:*** This switch in the safety loop is installed at the end of the manifold. The switch is normally open, and as soon as water level in the system reaches the point where the switch is installed, it will close.

IV: ***Remote Enable/Disable Terminals:*** There are "Remote Enable/Disable" terminals in the control panel. These terminals can be used for the BMS connections, if required.

V: ***Low gas pressure switch:*** A manual reset low gas pressure switch is installed on the gas train between the gas pressure regulator and the first safety shut off valve (please see item #4 on the schematic diagram "Typical UL Schematic Gas Piping" on page 9 of the Riello catalogue). If the line pressure drops below 7" wc, the switch will open and the unit will immediately shut down.

VI: ***Air Pressure Switches:*** One low air pressure switch is installed on the side of the blower and measures air pressure entering the burner (for exact location of the switch please see item #14 on the drawing presented on page 4 of the Riello catalogue). If the combustion air pressure drops by more than 20% below the nominal air pressure (minimum pressure of 0.4" wc), the burner controller will be deactivated and the main gas valve will immediately close.

WARNING

Do not bypass any of the instruments in the safety loop. Doing so may cause serious damage to the unit and its surroundings.

B: Sequence of Events

I: Every boiler/water heater is fully tested at the factory prior to shipment. When the unit is tested at the factory, a "jumper" is placed between terminals identified as "Remote Enable/Disable" (see Figure 2). If BMS is used, this jumper should be replaced by wires from the BMS. In the absence of a BMS, the operation of the unit is governed by the temperature controller.

II: Once the blower starts operating, the air pressure switch will close. This switch has been factory adjusted such that when the blower reaches its minimum frequency it will close.

3.1.2 Pre-Purge

I: When the air pressure switch is closed and safety loop is satisfied, pre-purge will start.

II: Blower continues to run at its maximum frequency for a period identified as the purge time.

3.1.3 Pilot Flame

I: After completion of the pre-purge period, the burner controller sends the required voltage to the ignition system, and 120V to the two. pilot safety shut off valves. The valves open simultaneously with the activation of the ignition rod. Upon pilot ignition, and after the flame is detected by the sensor, the ignition rod will be deactivated.

II: If after 5 seconds activation of the flame rod and opening of the gas valves, pilot flame is not established and detected by the flame sensor, the gas valves will immediately shut down and the boiler/water heater goes into the "lock-out" mode. The unit will not re-start until the burner controller is manually reset.

3.1.4 Main Flame

I: Once the pilot flame is established, the burner controller will send 120V to the two main safety shut off valves. From these valves gas flows into the gas butterfly valve (see schematic diagram on page 9 of the Riello catalogue).

II: Air supplied by the blower flows through to the burner head where it mixes with gas and the air/gas mixture is ignited.

III: The pilot safety shut off valves will open five seconds after the main safety valves are closed. If at any time during the operation, flame (pilot or main) is not detected the boiler/water heater will immediately shut down and will not restart until the burner controller is manually reset.

3.1.5 Operation

The unit continues to operate at low fire for as long as the outlet (discharge) temperature remains higher than the desired temperature- with respect to the differentials -, and lower than the maximum operating temperature; both being set on the temperature controller. The temperature sensor installed on the outlet manifold continuously measures the discharge water temperature. Signals from this sensor are sent to the temperature controller. If the temperature measured by the sensor is below that of the desired temperature, corresponding signals are sent to the servomotor. This will open the gas butterfly valve and air damper proportionately, thereby increasing the input capacity of the unit to its maximum value at high fire. As soon as the discharge water reaches the desired temperature (set on the controller by the owner), the process is reversed and the input is decreased so that discharge water remains at constant temperature. This throttle (load tracking) process continuously takes place through increase or decrease in the air/gas mixture (opening/closing of the butterfly valve and air damper), thereby

ensuring water is always supplied at ± 1 °C of the desired operating (discharge) temperature.

If the outlet water temperature reaches the maximum operating temperature, the boiler/water heater will shut down and goes into the stand by mode. The unit will automatically re-start when the water temperature drops below the operating set point minus the differential temperature.

NOTE

- *If as a result of mal-functioning of the temperature controller the discharge water temperature increases above that of the high limit temperature switch, the unit will automatically shut down and will not re-start until said switch is manually re-set.*

3.2 PRE-COMMISSIONING

I: Water connections (Return and Supply Lines)

- Purging air from the piping system, and from the boiler/water heater.
  To purge the unit, close 2 of the 3 purge valves and run water through the open coil for at least five minutes. The coil is now completely purged. Repeat the process for the remaining 2 coils, until all 3 coils are completely purged.

II: Gas Connections

- All pipe connections should be carried out in strict compliance with all applicable local codes.
- Selection of the gas regulator model and size should be carried out in accordance with the design requirements.
- Conduct a complete leak test on the unit's gas train, and all gas lines connected to it.
- Measure the static pressure upstream of the unit to ensure it is within the prescribed range of 7" - 14 " wc.

III: Vent Connection

- Installation must be carried out in accordance to all applicable local codes and factory guidelines.
- When required, a proper drain should be installed on the vent.

IV: Condensate Line Connection

- Inspect the condensate line and ensure it is installed in accordance with the factory guidelines.

V: Power Connection

- Inspect all wiring connections to the unit and ensure they comply with all applicable local codes.
- Ensure that the appropriate power supply has been connected to the unit (please refer to the electrical rating on the unit's nameplate).
- Ensure that the temporary jumpers have been removed from the unit's control panel.
- If applicable, ensure that the external control connections have been wired.

WARNING

Ensure that the manual gas valve is closed prior to power being supplied to the boiler/water heater

NOTE

- *Start-up and commissioning MUST be carried out by a GMI qualified technician.*

WARNING

The field start-up report MUST be faxed to GMI at 604-574-9572 within 10 days of start-up. Failure to do so will result in cancellation of all expressed and/or implied warranties.

3.3 Commissioning

I: Purge heat exchanger coils in accordance with the procedure outlined in paragraph ***I*** of section 3.2.

II: Connect (plug in) the power supply to the proper outlet. Turn the "ON/OFF" switch to the "ON" position.

III: After the system has undergone the sequence of events described in Section 3.1 above and when the two safety shut off valves in the main gas line are opened, the unit will be in regular operating mode.

IV: The Dungs air pressure switch installed on the side panel of the unit has been factory set at 0.3" wc. With the unit in operation, measure the exhaust gas pressure inside the housing at the "T" connection located under the pressure switch.

V: The boiler should be purged of any combustible gases before starting.

VI: Test Points

- Measure gas line pressure upstream of the gas pressure regulator to ensure it is within the specified range of 7" – 14" wc.
- Measure the gas manifold pressure at the test point located adjacent to the burner's gas inlet connection port (for exact location please see item #8 on page 4 of the Riello catalogue), ensure it is within the specified 0.2" –3.0" wc.
- Measure the manifold air pressure at the test point located on the side of the burner (please see item #7 on page 4 of the Riello catalogue). Ensure this pressure is between 0.4" – 1.4" wc.

WARNING

The gas manifold pressure should not exceed the maximum value shown on the unit's nameplate.

3.4 GENERAL INSTRUCTIONS

I: Should overheating occur or the gas supply valve fails to shut off, do not turn off or disconnect the electrical supply to the pump. Instead, shut off the gas supply at a location external to the unit.

II: **Do not use this boiler/water heater if any part has been under water.** Immediately call a qualified service technician to inspect the boiler/water heater and to replace any part of the control system or any gas control component, which has been under water.

III: Perform routine maintenance, calibration and testing of the burner management system and combustible control.

IV: Inspect the boiler water side regularly for signs of build up of scales or solids. The boiler may need water treatment or a mechanical and chemical cleaning.

SECTION 4:

MAINTENANCE

4.1 Service Hints

I: Gasmaster boilers and water heaters have been designed and developed based on a unique patented technology. When operated properly, the products will provide the owner with years of trouble free performance. To benefit for many years, from the unique performance characteristics of these boilers and water heaters, it is recommended to have your boiler/water heater inspected by a qualified service person at least once every year.

II: Ensure that air intake and exhaust ducts are always free of any debris and restrictions. This will allow the electric motor to operate under normal loads, as well as allowing for a clean combustion process. Do not store anything against the boiler and ensure that the boiler is kept in a clean environment. Do not store any combustible material, flammable liquid, or vapor, in the vicinity of the boiler.

III: Should overheating occur or the gas supply fails to shut off, turn off the manual gas control valve.

IV: Label all wires prior to disconnection when servicing the controls. Wiring errors can cause improper and dangerous operation.

V: Verify proper operation after each service (refer to the start-up report).

VI: The following precautions should be taken at least once a year:

- Check the condensate drain line (including the "U" trap) to ensure there is no restriction in the line.
- Check the duct and draft hood to ensure there is no restrictions or signs of rust. Ask your service person to clean the duct and the draft hood, if required.
- Inspect the sheet metal covering the insulation for any sign of rust or corrosion. If necessary, contact your service person to clean the sheet metal panels.
- Inspect all flue gas passageways, including the inner surface of the heat exchanger for any sign of rust or corrosion. If necessary, contact your service person to clean the surfaces.
- Inspect the central plate and the burner for any sign of damage or corrosion. Contact your service person for cleaning the surfaces or replacement of the component, if necessary.

4.2 Troubleshooting

Fault	Cause	Corrective Action
♦ Blower does not start	♦ Power not supplied to the unit.	♦ Ensure power switch is on. ♦ Check both fuses on the power and the supply sides.
	♦ Safety loop open.	♦ Ensure BMS (if connected) calls for heat. ♦ Ensure high temperature limit switch is closed. ♦ Ensure maximum operating temperature switch is closed. ♦ Ensure low gas pressure switch is closed.
	♦ None of the above	♦ See page 20 of the Riello catalogue for burner controller trouble shooting.
♦ Unit does not start	♦ Blower does not run.	♦ See above
	♦ Air pressure switch installed on the housing is open.	♦ Adjust switch. ♦ Replace switch (if defective).
	♦ Gas pressure switch is open.	♦ Adjust the switch. ♦ Replace switch (if defective).
	♦ No ignition.	♦ See page 20 of the Riello catalogue for burner trouble controller trouble shooting
♦ Pilot flame failure	♦ Pilot gas valve not opened	♦ Check the electrical connections to ensure they are all securely connected (see the schematic wiring diagram for terminals). ♦ Check the two safety shut off valves. Replace if defective.
	♦ No ignition	♦ Check the electrical connections to ensure they are all securely connected (see "Factory Wiring Diagram" on page 15 of the Riello catalogue) for terminals. ♦ Check the flame rod to ensure it is clean and free of any sedimentation. Clean flame rod if necessary. ♦ Check the flame rod for any cracks or other defects. Replace flame rod if necessary. ♦ Measure gas pressure in the pilot line at the exit test port of the second safety valve (downstream of the regulator). Ensure it is within the specified 2"-5" wc. If pressure is not available check both safety shut off valves and the pressure regulator. Replace any defective component, if necessary.

♦ Main flame failure	♦ Main gas valve not opened.	♦ Check the electrical connections to ensure they are all securely connected. ♦ Check the two safety shut off valves. Replace if defective.
	♦ Insufficient gas pressure	♦ Check gas pressure at the inlet test port of the first safety shut off valve. It should be within the specified 7-14" wc range. Adjust the pressure regulator to obtain the required pressure. If problem persists, replace the valve. Repeat process for the second safety shut off valve.
	♦ Unit out of adjustment	♦ Check the gas manifold pressure to ensure it complies with the value given in the factory test report. If required, re-adjust the boiler/water (see factory test report for the adjustment values).
	♦ Insufficient draft	♦ Check the vent system to ensure it is not clogged.
♦ Unit fails at frequent intervals (excessive cycling)	♦ Operating temperature is set too low.	♦ Check the setting on the operating temperature to ensure it is set at the desired temperature. ♦ If applicable, check the differential adjustment on the operating temperature.
	♦ Break in controls wiring.	♦ Check all connections to and from the wiring block located immediately below the blower.
	♦ Unit is over-sized	♦ Check the maximum heat requirement with the engineer and ensure the unit is of the appropriate size.
♦ Unclean combustion	♦ Insufficient air in the mechanical room	♦ Check all the louvers and air openings in the mechanical room to ensure they are free of any obstructions and there is sufficient inflow of fresh air into the room.
	♦ Unit out of adjustment	♦ Using a gas analyzer re-adjust the air and gas settings.
♦ Air bubble sound in the unit.	♦ Poor water circulation in one or both coils	♦ Completely purge each coil.
	♦ Foreign material in one or both coils.	♦ Drain each coil with pressurized air and re-purge.
	♦ Steam pockets in one or both coils.	♦ Check water flow rate in each coil to ensure it complies with the required minimum flow rate (15 GPM).
♦ Gas Odor	♦ Leak in piping.	♦ Using a gas detector, check all the connections (inlet and outlet) of all instruments on the gas line. Repair as required.
	♦ Exhaust gas leakage	♦ Check the vent system to ensure there are no cracks or other openings (holes cut for insertion of thermocouples during the start-up). Repair if required.

START-UP REPORT

FIELD START UP REPORT

SERIAL NO. _____ MODEL _____ Type of Appliance _____ Label Date _____

Installation Address _____

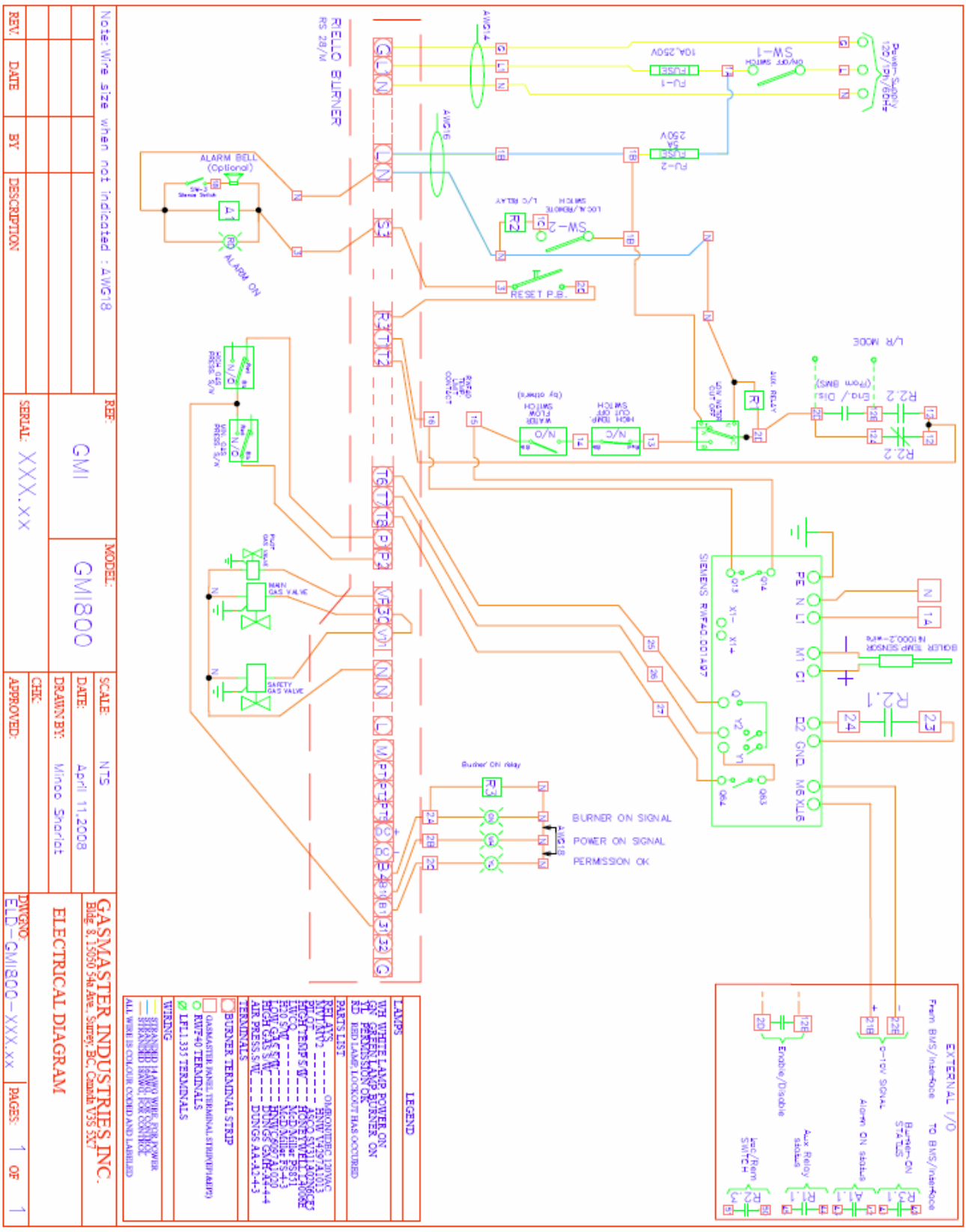
Installer Name _____ Phone # _____ Type of Installation _____ (hotel,school,etc)

ELEC./CONTROL SECTION		GAS SECTION		
ALL WIRES TIGHT	☐	GAS TRAIN TIGHT	☐	
RATED VOLTAGE	_____	MAIN GAS VALVE TIGHTNESS TEST	☐	
ACTUAL VOLTAGE	_____	TYPE OF FUEL : NAT. GAS ☐	PROPANE ☐	MAX INPUT(MBH)_____
RATED F.L.A.	_____		HIGH	LOW
ACTUAL F.L.A.	_____	INLET GAS _____ "w.c. off	_____ "w.c. run	_____ "w.c. run
TRIAL FOR IGNITION	_____ Sec.	MANIFOLD GAS	_____ "w.c.	_____ "w.c.
IGNITION TYPE	_____	BLOWER SPEED	_____ RPM	_____ RPM
PRE PURGE	_____ Sec.	NET STACK TEMPERATURE	_____ F	_____ F
PROOF OF LOW FIRE START	☐	MAIN FLAME SIGNAL	_____ V	_____ V
SAFETY LOOP WORKS PROPERLY	☐	BURNER MIXER POSITION	_____	_____
OPER. TEMP SET POINT IS CONTROLLED		MEG VALVE CURRENT	_____ (mA)	_____ (mA)
BY _____		PILOT GAS PRESSURE	_____ "w.c.	
SET POINT IS	_____ F	PILOT FLAME SIGNAL	_____ V	
OPERATIONAL TEMPERATURE IS SET ON	_____ F	GAS ANALYZER PRINTOUT REPORT# _____ (Attached)		
		WATER INLET TEMP _____ F	WATER OUTLET TEMP _____ F	
DIFFERENTIAL IS SET ON	_____ F	APPROX STACK LENGTH _____ Ft (Horizontal)	_____ Ft (Vertical)	_____
HIGH TEMPERATURE LIMIT IS SET ON	_____ F	DRAFT _____ "w.c. (measured where stack exits boiler)		
		Total cycles	Total hours	(For 7800 series)

CONTROL/SAFETY DEVICES	Ok		Ok	OTHER OPTIONAL DEVICES (LISTED)	Ok
HIGH TEMP. LIMIT	☐	AIR(AIR/GAS) PRESSURE SWITCH	☐		☐
OPER. TEMP CONTROL	☐	BLOCKED VENT PRESS. SWITCH	☐		☐
LOW WATER CUT OFF	☐	PRESSURE RELIEF VALVE	☐		☐
FLOW SWITCH	☐	ALARM BELL	☐		☐
LOW GAS PRESSURE SWITCH	☐	PRESSURE GAUGE	☐		☐
HIGH GAS PRESSURE SWITCH	☐		☐		☐

Mechanical Contractor:	TEL:	DATE:	**COMMENTS :**
Start up company:	TEL:	DATE:	
Start up Technician:	TEL:	DATE:	
Signature:	TEL:	DATE:	

RETURN THIS REPORT TO GASMASTER IND. BY FAX (604) 574-9572


GASMASTER INDUSTRIES INC.
Bldg. 8, 19030 94a Ave. Surrey, BC, Canada V3S 5X7
ELECTRICAL DIAGRAM
DWG NO: ELD-GMI800-XXX.xx
PAGES: 1 OF 1
SERIAL: XXX.xx
MODEL: GMI800
REF: GMI
SCALE: NTS
DATE: April 11,2008
DRAWN BY: Mineo Sheriet
CHK:
APPROVED:
REV. DATE BY DESCRIPTION
Note: Wire size when not indicated : AWG18
RIELLO BURNER RS 28/M
ALARM BELL (Optional)
ALARM ON
RESET P.B.
SW-1 ON/OFF SWITCH
SW-2 LOCK/REMOTE SWITCH
Power Supply 120/1Ph/60Hz
FU-1 10A,250V
FU-2 5A 250V
AUX RELAY
L/R MODE
SIEMENS RMFAC01A07
BOILER TEMP SENSOR N1000.2-wire
BURNER ON SIGNAL
POWER ON SIGNAL
PERMISSION OK
EXTERNAL I/O
From BMS/Interface
TO BMS/Interface
Enable/Disable
0-10V SIGNAL
Alarm ON status
Burner ON STATUS
Aux Relay status
Loc/Rem SWITCH
LEGEND
LAMPS
WH WHITE LAMP POWER ON
GN GREEN LAMP BURNER ON
RD RED LAMP LOCKOUT HAS OCCURRED
PARTS LIST
TERMINALS
BURNER TERMINAL STRIP
GASMASTER PANEL TERMINAL STRIP(DETACHABLE)
RWF40 TERMINALS
LFL1.335 TERMINALS
WIRING
STRANDED 14AWG WIRE FOR POWER
STRANDED 18AWG FOR CONTROL
ALL WIRE IS COLOUR CODED AND LABELED