

# INSTALLATION OPERATION AND SERVICE MANUAL

## MICOFLAME® SERIES 2



### GAS FIRED COMMERCIAL COPPER TUBE BOILERS

#### FOR HYDRONIC HEATING

Non-Condensing Models; MFH800, 1000, 1200, 1400, 1600, 1800, 2000

Condensing Models; MFH802, 1002, 1202, 1402, 1602, 1802, 2002



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HLW



#### HOT WATER SUPPLY

Non Condensing Models; MFW800, 1000, 1200, 1400, 1600, 1800, 2000

Condensing Models; MFW802, 1002, 1202, 1402, 1602, 1802, 2002



**WARNING:** If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury or death

- Do not store or use gasoline or other flammable vapours and liquids in the vicinity of this or any other appliance.
- WHAT TO DO IF YOU SMELL GAS
  - Do not try to light any appliance,
  - Do not touch any electrical switch; do not use any phone in your building,
  - Immediately call your gas supplier from a neighbour's phone. Follow the gas supplier's instructions,
  - If you cannot reach your gas supplier, call the fire department.
- Qualified installer, service agency or the gas supplier must perform installation and service.

To the installer: After installation, these instructions must be given to the end user or left on or near the heater.  
To the End User: This booklet contains important information about this heater. Retain for future reference.

**CAMUS® HYDRONICS LTD.**

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## **INTRODUCTION**

Camus® Hydronics proudly introduces its MicoFlame® series 2 of commercial water heaters / hydronic boilers. These gas-burning appliances are thoughtfully designed for easy operation and maintenance. We are confident that you will come to appreciate the benefits of our product.

### **1 GENERAL INSTRUCTIONS**

The installation of this heater must conform to the requirements of the authority having jurisdiction or, in the absence of such requirements, to the latest or current as amended National Fuel Gas Code, ANSI Z223.1 or CAN/CGA B149 Installation Codes. All electrical wiring must be done in accordance with the requirements of the authority having jurisdiction or, in the absence of such requirements, with the National Electrical Code, ANSI/NFPA 70 or the Canadian Electrical Code Part I, CSA C22.1 Electrical Code.

Vent installations must be in accordance with Part 7, Venting of Equipment, of the latest edition or the current as amended National Fuel Gas Code, ANSI Z223.1, or Section 7, Venting Systems and Air Supply for Appliances, of the CAN/CGA B149, Installation Codes and applicable provisions of the local building codes.

When required by the authority having jurisdiction, the installation must conform to the Standard for Controls and Safety Devices for Automatically Fired Boilers, ANSI/ASME CSD-1.

The qualified installer shall instruct the end user in the safe and correct operation of this appliance and shall ensure that the heater is in safe working order prior to leaving the job site.

#### **WARRANTY:**

**Factory warranty shall apply only when the boiler is installed in accordance with local plumbing and building codes, ordinances and regulations, the printed instructions provided with it and good industry practices.**

**Excessive water hardness causing a lime build-up in the copper coils or tubes is not a fault of the boiler and is not covered by warranty. Consult the factory for recommendations for use in hard water areas.**

**Using or storing corrosive chemicals in the vicinity of this boiler can rapidly attack the copper tubes and coils and voids warranty.**

**The primary heat exchanger of this boiler is intended to operate under non-condensing conditions. Inlet temperatures must be maintained at 110°F or higher. Warranty is void if the primary heat exchanger is allowed to operate in condensing mode.**

**Damage caused by freezing or dry firing voids warranty.**

**This boiler is not to be used for temporary heating of buildings under construction.**

## 2 BOILER LOCATION

Install this boiler in a clean, dry location with adequate air supply and close to a good vent connection.

Do not locate this boiler in an area where it will be subject to freezing.

The boiler is suitable for installation on combustible flooring and should be located close to a floor drain in an area where leakage from the boiler or connections will not result in damage to the adjacent area or to lower floors in the structure.

If necessary, a suitable drain pan should be installed under the boiler.

If the boiler is installed above the level of the building's radiation system, a low water cutoff device must be installed in the boiler outlet at the time of installation. Some local codes require the installation of a low water cutoff on all systems.

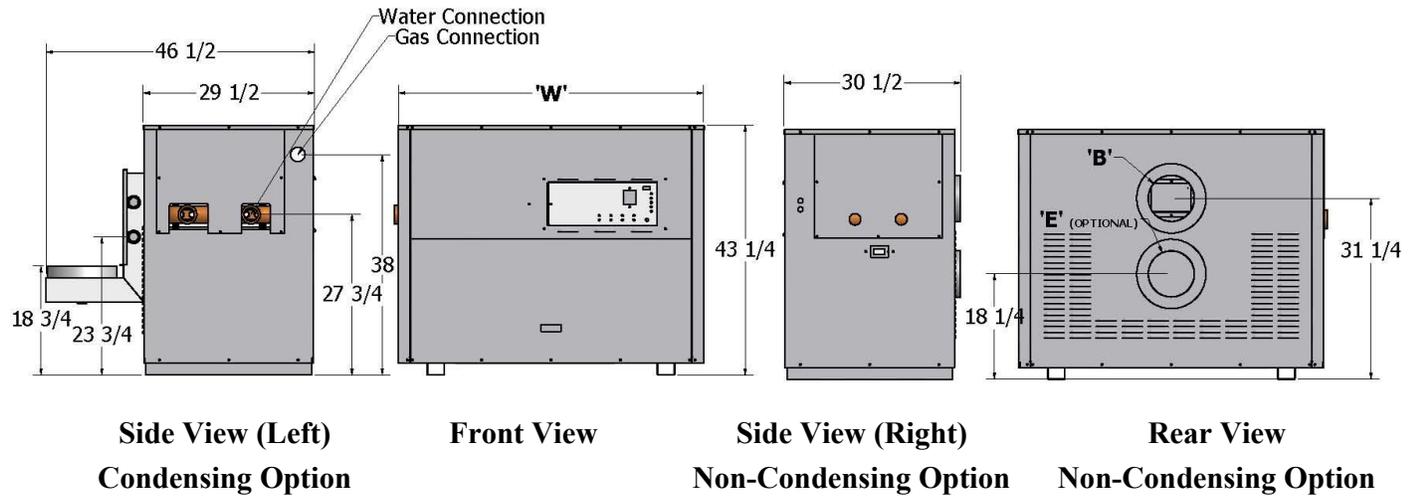
Locate the boiler so as to provide adequate clearance for inspection and service all around the unit. It is recommended that 24" be provided for the top and sides and 48" for the front.

This boiler is suitable for alcove installation with minimum clearances to combustibles as follows:

**Table 1: Clearance to Combustibles**

TOP:	12"
SIDES:	12"
REAR:	12"
VENT:	6"
FLOOR:	0"

**Figure 1: MicoFlame® II Dimensions**



**Table 2: Various Connection Sizes**

Model	W'	Water Connection	Gas Connection	B' Dia. Venting*			E' Dia.
				Outdoor	Condensing or Sidewall	Standard	Air Inlet
MF800	45 3/4	2 1/2	1	8	8	10	8
MF1000	52 3/4	2 1/2	1 1/4	8	8	10	8
MF1200	62	2 1/2	1 1/4	10	10	12	10
MF1400	71 1/4	2 1/2	1 1/4	10	10	12	10
MF1600	80 3/4	2 1/2	1 1/2	12	12	14	12
MF1800	89 3/4	2 1/2	1 1/2	12	12	14	12
MF2000	99	2 1/2	1 1/2	12	12	14	12

*\*Non-Condensing models are shipped with standard vent opening size unless sidewall vent is specified*

### **3 PROVIDE AIR FOR COMBUSTION AND VENTILATION**

Provisions for combustion and ventilation air are to be in accordance with the section “Air for Combustion and Installation”, Of the National Fuel Gas Code, ANSI Z223.1/NFPA 54, or clause 8.2, 8.3, 8.4 of “Natural Gas and Propane Installation Code”, CAN/CSA B149.1.2, or applicable provisions of the local building codes.

The operation of exhaust fans, compressors, air handling units etc. can rob air from the room, creating a negative pressure condition leading to reversal of the natural draft action of the venting system. Under these circumstances an engineered air supply is necessary.

If the heater is to be installed near a corrosive or potentially corrosive air supply, the heater must be isolated from it and outside air should be supplied as per code.

Potentially corrosive atmospheres will result from exposure to permanent wave solution, chlorinated waxes and cleaners, chlorine, water softening chemicals, carbon tetrachloride, halogen based refrigerants, Freon cleaning solvents, hydrochloric acid, cements and glues, masonry washing materials, antistatic fabric softeners, dry cleaning solvents, degreasing liquids, printing inks, paint removers, etc.

### **4 ELECTRICAL WIRING**

All electrical wiring to the boiler must be electrically bonded to ground in accordance with the requirements of the authority having jurisdiction or, in the absence of such requirements, with the National Electrical Code, ANSI/NFPA 70 or the Canadian Electrical Code Part I, CSA C22.1, Electrical Code.

Provide disconnecting means of sufficient rating within sight of the boiler. These heaters require an 115V, 60Hz supply. Depending on the pump used, a 15-amp breaker is usually sufficient.

Electrical connections must be made so that the circulator will operate before the gas valve can open. At no time may the control system allow the burner to fire without water flowing in the system.

Use minimum 18-gauge conductor for 24-volt field wiring to boiler. Splicing of wires is not recommended.

Use sealed tight conduit suitable for outdoor use for outdoor installations.

Use terminal strip provided inside control panel for low water cut-off and remote controller

Refer to wiring diagram provided with boiler.

## 5 STAGING OPERATION

Staging of the MicoFlame® series 2 is dependent on the number of burners supplied. Models 800 and 1000 are supplied with a single burner and are available as on/off and two stages. Models 1200 through 2000 are supplied with two burners and are available as on/off, 2-stage, 3-stage and 4-stage.

Each burner is supplied with a dedicated airflow proving signal and separate proved pilot ignition system. All fans must be running in order for the appliance to proceed to trial for ignition.

MicoFlame® series 2 supplied with more than one burner may use burners that are not of identical size in order to accommodate fans within the space allocated. In case where burners are not identical, the right side burner will be the one with the higher input.

Each MicoFlame® series 2 is supplied with the appropriate wiring diagram showing the actual staging sequence provided as well as any special controls or options requested.

When converting multiple MicoFlame® series 2 appliances to an external sequencing control it is absolutely necessary to program the sequencer properly by entering the number of stages provided on the appliance. In this way the sequencer will lead/lag or rotate the boilers properly.

A full diagnostics panel is provided on the MicoFlame® series 2. On a call for heat, status lights will light up if the particular safety is working properly. Once all safeties have been proved, the boiler will proceed to trial for ignition and will then sequentially bring on the burner stages (and the corresponding lights). If the safety proving sequence does not proceed to completion, the first safety light to remain off will indicate the cause of the problem. All other lights below the problem indicator light will also remain off.

Burner staging is arranged to allow a minimum firing rate of no less than 50% in order to minimize possibility of condensation in the venting. Staging of burners for models 1200 through 2000 is as follows:

**Table 3: Burner Firing Rates**

<b>Two Stage</b>	Left Burner	Right Burner
Stage 1	Low Fire	Low Fire
Stage 2	High Fire	High Fire

<b>Three Stage *</b>	Left Burner	Right Burner
Stage 1	Low Fire	Low Fire
Stage 2	Low Fire	High Fire
Stage 3	High Fire	High Fire

\* Recommended for Models 1400 and 1600

<b>Four Stage</b>	Left Burner	Right Burner
Stage 1	Low Fire	Low Fire
Stage 2	Low Fire	Low Fire
Stage 3	Low Fire	High Fire
Stage 4	High Fire	High Fire

## 6 GAS SUPPLY AND PIPING

This boiler is intended to operate at inlet gas pressures not exceeding ½ PSI (14" W.C.). If higher pressures are present, consult the gas company for correction.

When pressure testing the gas supply piping at pressures above ½ PSI, the boiler and its individual gas shut-off valve must be disconnected from the supply piping.

Provide a trap (drip leg) as close to the heater as possible.

Install a joint union and manual shut-off valve in the gas line near the heater to allow easy removal of the gas control assembly.

Provide gas pressures at inlet to boiler manifold as follows:

**Table 4: Gas Pressures at Inlet to Appliance**

	PROPANE	NATURAL GAS
Minimum Running (inches W.C.)	10	4*
Maximum Lockup (inches W.C.)	11	14

\* 7" W.C. recommended regulator setting

The gas supply line must be of adequate size to prevent undue pressure drop and must never be smaller than the size of the connection on the heater. Sizing based on Table 4 is recommended.

Before operating the boiler, the complete gas train and all connections must be tested using soap solution.

**Table 5: Recommended Gas Pipe Size**  
Single Appliance Installation

(For distance from natural gas meter or propane second stage regulator)

Input Btu/Hr	DISTANCE FROM NATURAL GAS METER OR PROPANE SECOND STAGE REGULATOR					
	0-100 FT		100-200 FT.		200-300 FT.	
	NAT.	L.P.	NAT.	L.P.	NAT.	L.P.
800,000	2"	1 ½"	2 ½"	2"	2 ½"	2"
1,000,000	2"	1 ½"	2 ½"	2"	2 ½"	2"
1,200,000	2 ½"	2"	2 ½"	2"	3"	2 ½"
1,400,000	2 ½"	2"	2 ½"	2"	3"	2 ½"
1,600,000	2 ½"	2"	3"	2 ½"	3"	2 ½"
1,800,000	2 ½"	2"	3"	2 ½"	3"	2 ½"
2,000,000	2 ½"	2"	3"	2 ½"	3"	2 ½"

## 7 VENTING

Boilers for outdoor installation are intended to vent using a listed vent cap.

For indoor installations venting must be in accordance with Part 7, Venting of Equipment, of the latest or current as amended of the National Fuel Gas Code, ANSI Z223.1, or Section 7, Venting of Equipment and Air Supply for Appliances, of the latest or current as amended CAN/CGA B149, Installation Codes, and applicable provisions of the local building codes.

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

Horizontal runs of vent pipe shall be securely supported (approximately every 4 feet) to prevent sagging and maintain a minimum upward slope of ¼" per foot from the boiler to the vent terminal.

When an existing boiler 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. At the time of removal of an existing boiler, the following steps must 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.

- a) Seal any unused openings in the common venting system.
- b) Visually inspect the venting system for proper size and horizontal pitch and determine that there is no blockage, restriction, leakage, corrosion or other deficiency, which could cause an unsafe condition.
- c) Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on the clothes dryers and any appliances not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed, do not operate a summer exhaust fan. Close fireplace dampers.
- d) Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so that appliance operates continuously.
- e) Test for spillage at the draft control device relief opening after 5 minutes of main burner operation. Use the flame of a match or candle or smoke from a cigarette.
- f) After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas-burning appliance to their previous condition of use.
- g) Any improper operation of the common venting system must be corrected so that the installation conforms to the latest or current as amended National Fuel Gas Code, ANSI Z223.1 or the latest or current as amended CAN/CGA B149, Installation Codes. 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 Part 11 of the latest or current as amended of the National Fuel Gas Code, ANSI Z223, 1 or the latest or current as amended of the CAN/CGA B149, Installation Codes.

Heat exchanger surfaces and vent piping should be checked every six months for deterioration and carbon deposits. Remove all soot or other obstructions from the chimney and flue, which might impede draft action. Replace any damaged or deteriorated parts of the venting system.

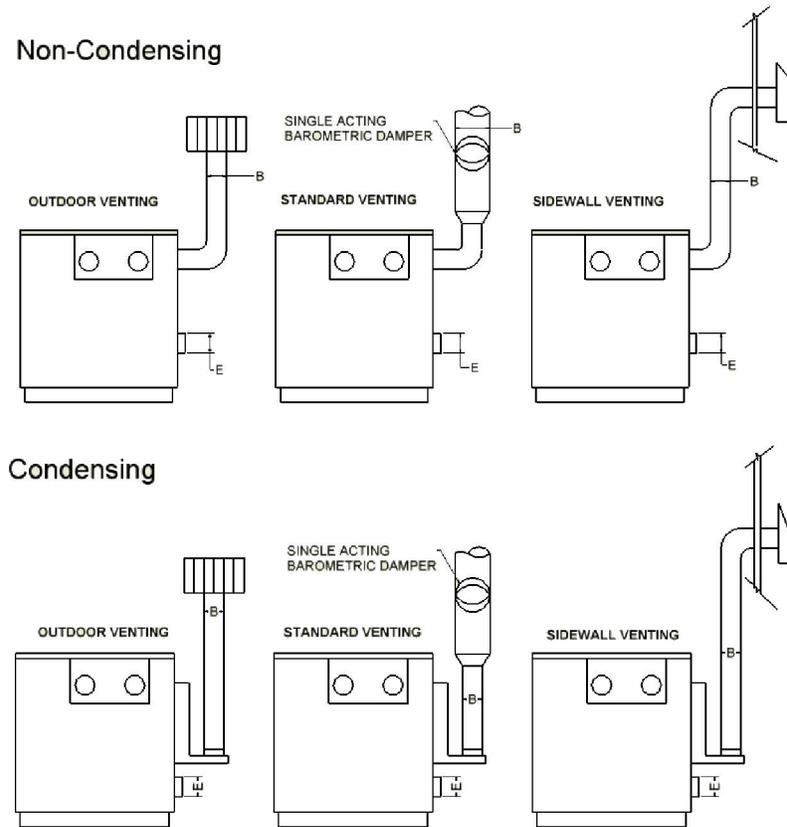
A qualified service technician should follow this procedure when inspecting and cleaning the heat exchanger and vent pipe.

1. Turn off electrical power and close main manual gas shut-off and allow boiler to cool down
2. Remove the vent pipe running to chimney. Remove top outer panel and flue collector access panel. Check heat exchanger, vent and chimney for obstruction and clean as necessary.
3. Remove burner from boiler and vacuum the burner, and the heat exchanger. If heat exchanger is excessively dirty it may be necessary to remove it from the boiler and wash it down with proper detergent cleaner. Be aware that the combustion chamber base is insulated with ¼" thick ceramic paper. If this material is damaged or displaced it must be replaced before starting up the boiler.
4. Reinstall parts removed in steps 2 and 3. Be sure that vent pipe has proper pitch and is properly sealed. Repair or replace any gaskets, which may have been damaged in steps 2 and 3.
5. **CAUTION:** When replacing the burner be careful to fully engage the back of the burner box into the retaining slot in the combustion chamber base. Failure to properly locate the burner will result in erratic flame operation with the possibility of delayed ignition on light off.

6. Restore electrical power and gas supply to boiler.
7. Place boiler in operation using lighting instructions provided.
8. While the boiler is operating, check for flue gas leaks and proper vent operation. Seal any flue gas leaks using appropriate gasket or sealing material. Carefully examine the flue collector access panel and heat exchanger ends.

The MicoFlame® series 2 is category 1, 85% efficient when supplied as a non-condensing appliance. When supplied with the optional condensing cartridge, the MicoFlame® series 2 is 95% efficient and is considered to be a category II or IV appliance. Three venting options are available for this boiler in both condensing and non-condensing configurations. See Figure 2 for details. (Please refer to Table 2 for vent dimensions)

**Figure 2: Venting Configuration**



## 7.1 OUTDOOR VENTING

When fitted with the factory supplied rain shield and UL approved vent cap, the MicoFlame® series 2 is self-venting. The following applies to outdoor installations:

1. Use only factory supplied rain shields.
2. Periodically check to ensure that air intake and vent cap are not obstructed.
3. Locate boiler at least 3 feet away from any overhang.
4. Locate boiler at least ten feet from building air intake.
5. Avoid installation in areas where runoff from adjacent building can spill onto boiler.

## **7.2     SIDEWALL VENTING**

When fitted with the factory supplied vent terminal, the MicoFlame® series 2 can vent up to 60 equivalent feet. Elbows can range from 8 to 15 feet in equivalent length depending on centreline radius. See Table 1 for vent sizes.

Boilers may be installed with either a horizontal sidewall vent or vertical roof top terminal. Terminals differ with each application. Horizontal lengths over 5 feet must be installed using corrosion resistant stainless steel. Use single wall vent and seal all joints or use pressure rated double wall vent.

Refer to local codes for proper installation and location of vent terminals.

When using sidewall vent, all vent connector seams and joints must be sealed with pressure sensitive aluminium tape or silicone sealant as specified by the vent manufacturer. Aluminium tape must meet the provisions of SMACNA AFTS-100-73 Standard.

When venting through unheated spaces with single wall vent, insulation should be wrapped around the vent pipe to prevent flue gas condensation inside the vent.

Periodically check to ensure that the vent terminal is unobstructed.

## **7.3     OUTDOOR AIR KIT**

When fitted with the factory supplied air inlet ring and air intake terminal, the MicoFlame® series 2 can draw outdoor air over an equivalent length of 60 feet. See Table 2 for vent sizes.

Boilers may be installed with either a horizontal sidewall vent or vertical roof top terminal. Terminals differ with each application.

The following applies to outdoor air installations:

1. Use only factory supplied air intake terminal.
2. Periodically check to ensure that air intake is not obstructed.
3. Refer to local codes for proper installation and location of vent terminals. Vertical vent terminal must be at least 3 feet above the highest point where it is located above the roof of a building and at least two feet higher than any part of the building within a horizontal distance of ten feet
4. Locate the air intake five feet away from the vent discharge. For sidewall venting locate the air intake below the vent outlet if possible.

## **7.4 FILTER KIT**

A louvered rear panel is the standard air inlet configuration for the MicoFlame® series 2. A filter kit is available. The filter is washable and accounts for an additional pressure loss of less than 0.05" W.C. Highly recommended for dusty environments.

The filter kit can also be provided when using the outdoor air kit.

## **7.5 STANDARD VENTING**

The MicoFlame® series 2 is a category 1 appliance and is approved for venting into a common standard chimney. If chimney height is much greater than 30 feet or if drafts are excessive, it may be preferable to provide a single acting barometric damper directly above the vent collar. This damper will ensure smooth light off and minimize standby loss through the boiler. Be sure to position the damper at least 6" away from the wall of the vent connector.

## **7.6 VENTING FOR CONDENSING APPLICATION**

When supplied with the optional condensing cartridge, the MicoFlame® series 2 is 95% efficient (category II or IV appliance) which requires the use of special venting system. Refer to installation instruction No. 93-0152-1. Only venting components listed by a nationally recognized testing agency may be used.

This appliance may be installed with conventional, sidewall or vertical venting. Conventional vented appliances operate with negative pressure in the vent pipe and require a special vent adapter to increase the flue outlet diameter. Sidewall and vertically vented appliances operate with positive pressure in the vent pipe and may be directly connected to the flue outlet without the use of an increaser.

Consult the vent pipe manufacturer's instructions for minimum clearances to combustible material for vent components. In the absence of instructions, the minimum clearance to combustible material is six inches.

Consult vent pipe manufacturer's instructions for proper method of sealing vent pipe sections and fittings. In the absence of instructions, make sure that pipe and fittings are clean by swabbing with alcohol. Use Dow Corning 736 or 732 RTV, Polybar # 500 RTV or Sil-bond 4500 or 6500 to seal vent pipe. Do not use other sealants or adhesives except as expressly permitted by vent manufacturer's instructions.

Consult vent pipe manufacturer's instructions for vent system assembly. Follow vent pipe manufacturer's instructions if those instructions differ from this section.

### **Common Venting**

Multiple appliances may be vented into a common chimney. The chimney must be lined with AL29-4C and a single acting barometric damper must be provided for each appliance. Vent diameters are to be increased by one size over the recommended size

A qualified professional using a proven vent-sizing program with input of accurate operating parameters must properly calculate sizing of the venting system. In applications where flue gas temperatures are lower than can support a Category II with conventional negative draft, it will be determined at the venting design stage that a positive pressure will be developed in the vent. It will then be necessary to either provide separate vents as for Category IV, or to provide an extractor at the chimney outlet in order to maintain a negative draft in the chimney and allow common venting.

Approval of the installation will be at the discretion of authorities having jurisdiction.

The chimney must be protected from down drafts, rain and debris by using a listed chimney cap.

## 8 ACCESSORIES

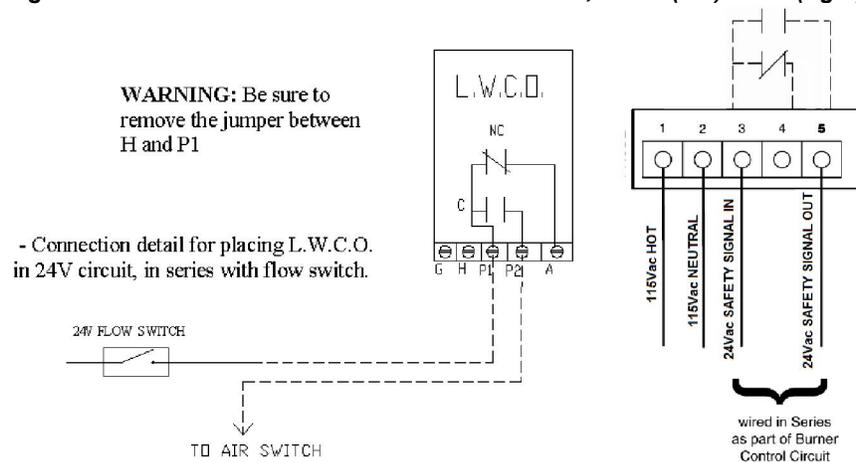
### WATER FLOW SWITCH (shipped loose)

A water flow switch is shipped loose and is to be installed in the outlet piping on all heating boilers and hot water supply boilers. The flow switch is wired in series with the 24VAC safety control circuit. A diagnostic light will be indicated on the control display on a low flow condition.

### LOW WATER CUTOFF (If Equipped)

If this boiler is installed above radiation level, a low water cut-off device must be installed at the time of boiler installation. Some local codes require the installation of a low water cut-off on all systems. Electronic low water cut-offs are available as a factory supplied option on all models. Low water cut-offs should be tested every six months. The normally open switch contact of the low water cutoff is to be wired in series with the flow switch. A diagnostic light will be indicated on the control display on a low flow condition. Caution: remove jumper when connecting to 24 VAC circuit.

Figure 3: Low Water Cut Off Electrical Connections, Watts (left) & ITT (right)



### RELIEF VALVE (shipped loose)

This appliance is supplied with a relief valve sized in accordance with ASME Boiler and Pressure Vessel Code, Section IV (“Heating Boilers”). The relief valve is to be installed in the vertical position and mounted in the hot water outlet. No valve is to be placed between the relief valve, and the appliance. To prevent water damage, the discharge from the relief valve shall be piped to a suitable floor drain for disposal when relief occurs. No reducing couplings or other restrictions shall be installed in the discharge line. The discharge line shall allow complete drainage of the valve and line. Relief valves should be manually operated at least once a year.

### CONDENSING HEAT RECOVERY MODULE PIPING CONFIGURATIONS

Caution: If isolation valves are provided on the CHRМ, the provision of a relief valve at the outlet of the secondary is recommended. This valve is to be sized at minimum for 10% of the input of the appliance and is to be piped to drain in a manner similar to the appliance relief valve.

### CHRМ IN SERIES WITH PRIMARY HEAT EXCHANGER (INTEGRATED LOOP)

The supply water (Cold water) is pre-heated by CHRМ and fed into the outlet of the primary Heat Exchanger. Provisions must be made to prevent cold water below 115°F (46°C) entering to the Primary Heat Exchanger.

## **BOILER APPLICATION (HYDRONIC HEATING)**

In case of boilers (Hydronic heating boiler) application, the return water (supply water) may be more than 115°F (46°C), therefore there is no need for a recirculation loop and the primary heat exchanger and CHRMs can be piped in parallel. Since the inlet water temperature to CHRMs exceeds 115°F (46°C) it will not condense fully and therefore the CHRMs will not perform to its maximum efficiency capacity. If water colder than 115°F (46°C) is available, it can be fed to the CHRMs.

## **WATER HEATER APPLICATION (HOT WATER SUPPLY)**

In case of domestic water supply (Water Heating), the fresh inlet water temperature will be less than 115°F (46 °C), in this case the CHRMs may be fed directly with part of the supply water using a secondary pump.

A pressure relief valve is supplied as standard equipment. The relief valve protects against damage that could be caused by malfunctioning controls or excessive water pressure. If a relief valve is not used, warranty is void.

The relief valve is to be located as near as practical to the outlet of the boiler. To maintain capacity do not reduce the inlet connection of the relief valve. Connect the outlet of the relief valve to a suitable drain. The drainpipe must point down from the valve and must not be smaller than the outlet of the valve. The end of the drain line should not be concealed or threaded and should be protected against freezing. No valve of any kind should be installed between the relief valve and the unit or in the drain line. Extensive runs, traps or bends could reduce the capacity of the valve. This valve should be checked for proper operation at least once a year by a qualified service technician.

## **9 FREEZE PROTECTION**

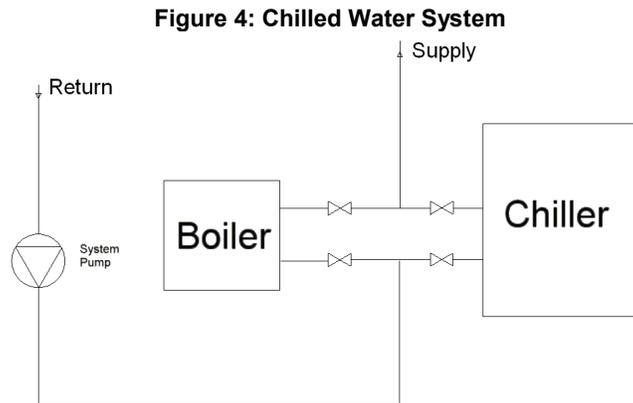
- Appliance installations are not recommended outdoors in areas where danger of freezing exists unless precautions are taken. Maintaining a mixture of 50% water and 50% propylene glycol is the preferred method of freeze protection in hydronic systems. This mixture will protect the appliance to approximately -35°F (-37°C). To maintain the same temperature rise across the appliance increase the GPM flow by 15% and the head loss by 20%.

The following example demonstrates the procedure to follow for calculating the revised head for the heat exchanger when using a water / glycol mixture.

- Given that Camus® is showing a heat exchanger flow and head loss of 100 gpm @ 10 feet
- Increasing the flow by 15% now results in a head loss of 13 feet at 115 gpm (from B&G system syzer). At this increased flow Camus® now recommends to increase the head loss by 20%.
- The requirement for the heat exchanger with water / glycol mixture will now be 115 gpm @ 15.6 feet. (ie. 1.2 x 13ft. = 15.6 ft.)
- A similar procedure must be followed to calculate the additional head loss in pipe and fittings in order to arrive at the proper pump selection.
- For outdoor installations regular inspections should be made to ensure that air intake and vent are clear. Always consider the use of a shelter such as a garden shed in lieu of direct exposure of the appliance to the elements. The additional protection afforded by the shelter will help to minimize nuisance problems with electrical connections and will allow easier servicing of the appliance under severe weather conditions.

## 10 WARNING REGARDING CHILLED WATER SYSTEMS

When a boiler is connected to an air conditioning system where the same water is used for heating and cooling, the chiller must be piped in parallel with the boiler. Appropriate flow control valves; manual or motorized must be provided to prevent the chilled water from entering the boiler. (See Figure 4)



When a boiler is connected to heating coils located in air handling units (where they may be exposed to refrigerated air circulation), the boiler piping system shall be equipped with a flow control valve or other automatic means to prevent gravity circulation of chilled water through the boiler. Chilled water in the boiler will create condensate on the boiler tubes, which will collect in the combustion chamber causing corrosion.

## 11 PIPING OF BOILER TO SYSTEM (FIG.5)

Check all applicable local heating, plumbing and building safety codes before proceeding.

Be sure to provide unions and gate valves at inlet and outlet to boiler so that it can be easily isolated for service.

This boiler is of a low mass design, which provides for instant heat transfer. Special attention to water flow rates will ensure that temperature rise does not exceed 35°F (19.4°C). The following table is provided as a guide. Based on normal water hardness

For application in areas known to have hard water conditions, choose a pump for the local water hardness conditions. Alternatively soften the water to normal hardness level.

**Table 6: Flow and Pressure Drop at a Given Temperature Rise**

### ***Head Loss and Flow vs. Temperature Rise***

Model	20 °F		30 °F		35 °F	
	USGPM	ΔP ft.	USGPM	ΔP ft.	USGPM	ΔP ft.
800	66.6	2.8	44.4	1.1	38.0	0.8
1000	83.3	4.9	55.5	2.0	47.6	1.5
1200	100.0	6.9	66.7	3.1	57.1	2.4
1400	*	*	77.8	4.3	66.7	3.4
1600	*	*	88.9	5.4	76.2	4.0
1800	*	*	100.0	6.9	85.7	5.1
2000	*	*	*	*	95.2	6.2

\* Contact factory for recommendations

Figure 5: Typical Boiler Piping System

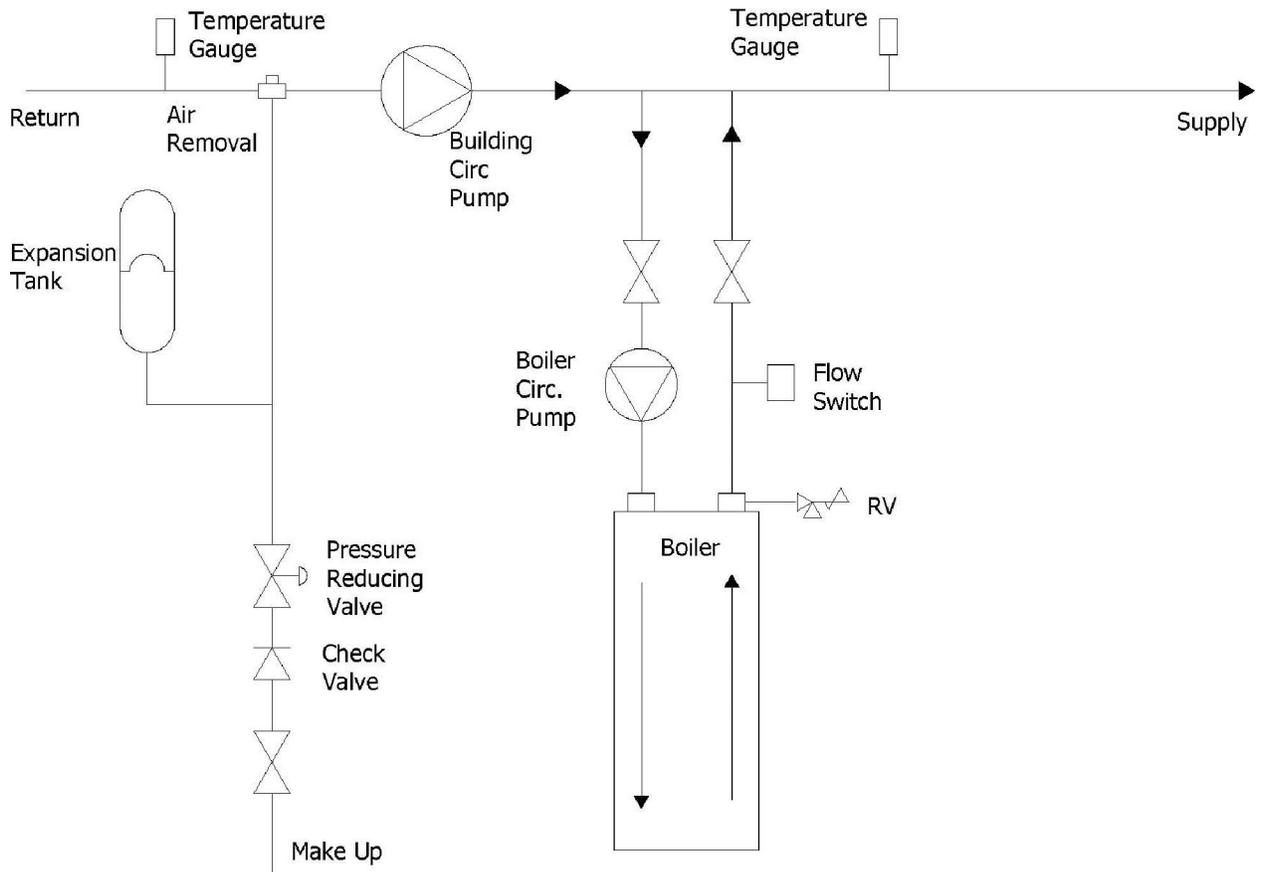
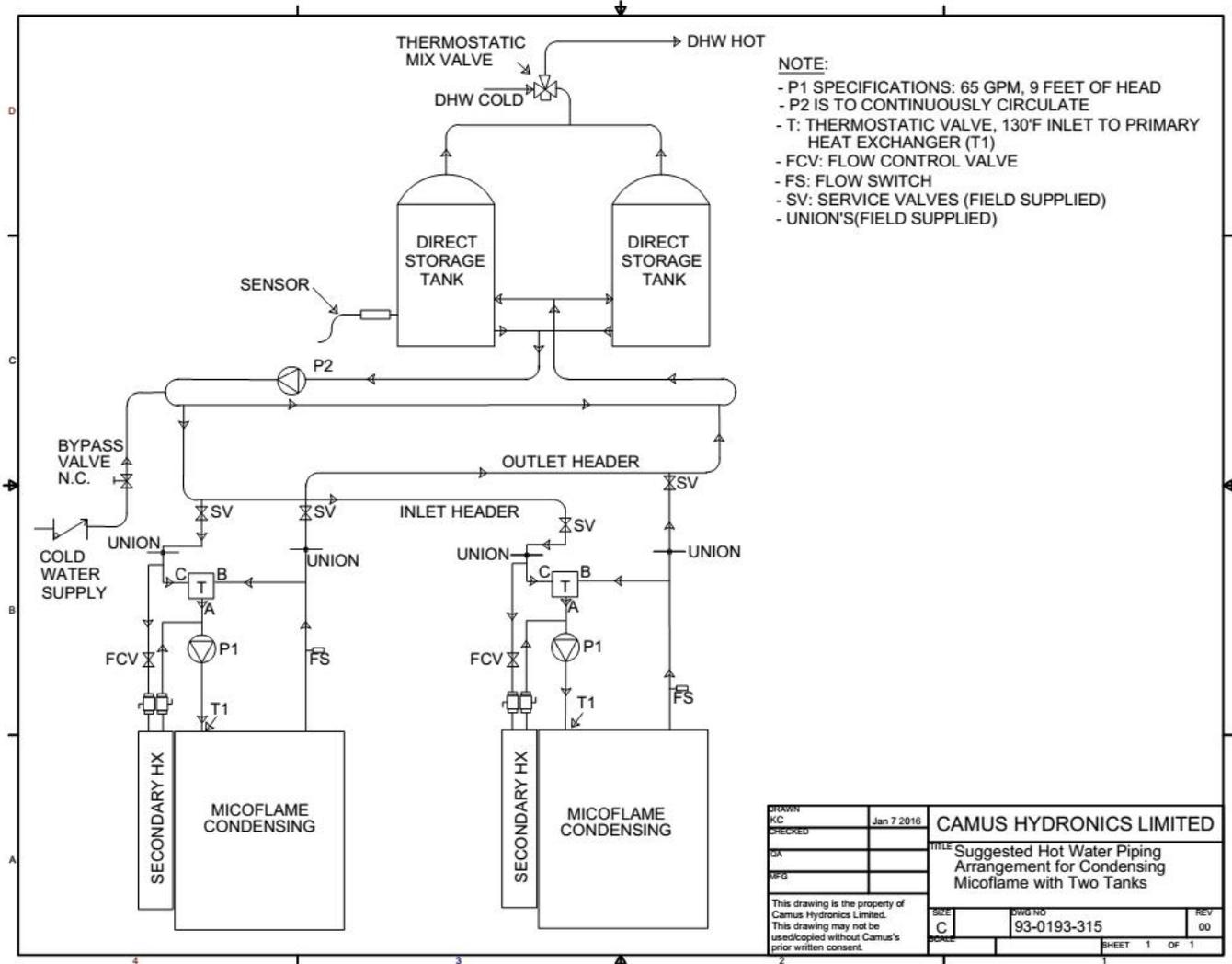


Figure 6: Typical Water Heating System



If the boiler is installed above radiation level, it must be provided with a low water cutoff device at the time of boiler installation. (Available from factory)

To eliminate trapped air, install venting devices at high points in the system as well as in the piping on the suction of the pump and in the piping on the discharge of the boiler.

Suitable pipe hangers must support the weight of all water and gas piping or floor stands.

Do not allow the boiler to run with inlet water temperature below 115°F (46°C).

The boiler must be installed so that the gas ignition system components are protected from water (dripping, spraying, rain, etc.) During appliance operation and service (circulator replacement, control replacement, etc.)

## **12 PLACING BOILER IN OPERATION**

The MicoFlame® series 2 boiler should be installed and started up by qualified personnel.

With the boiler off, open makeup water valve and allow system to fill slowly. Adjust the pressure regulator to provide at least 15 PSIG in the system when cold.

With all air vents open, run system circulating pump for a minimum of 30 minutes with the boiler off.

Open all strainers in the circulating system and check for debris.

Check liquid level in expansion tank. With system full of water at 15 PSIG, the level of water in the expansion tank should not exceed  $\frac{1}{4}$  of the total volume with the balance filled with air.

Start up boiler following instructions provided. Operate entire system including pumps and radiation for at least 1 hour. Minimum operating system pressure when hot must not drop below 30 PSIG.

Check water level in expansion tank. If level exceeds  $\frac{1}{2}$  of tank volume, air is still trapped in system. Shut down boiler and continue to run pumps.

Within 3 days of start up, recheck all air vents and expansion tank as described above.

## **13 INSTRUMENTATION AND CONTROLS**

The appliance is equipped with safety controls as well as operational controls.

### **13.1 SAFETY CONTROLS**

#### **High Temperature Limit**

The high temperature limit is located behind the appliance's access doors. A remote capillary bulb runs to a thermo-well on the outlet side of the inlet/outlet header. The appliance high limit is set at the factory to 210°F for hot water and 230°F for heating.

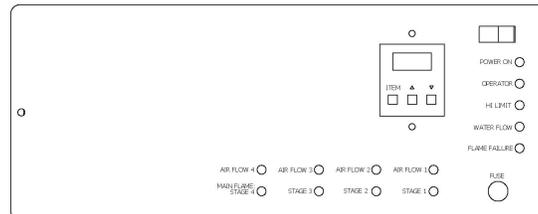
#### **Air Flow Switch**

A differential air pressure switch is provided to prove the operation of the fan and adequate air flow to the burner. The pressure switch sensing point is at the inlet to the mixing tube where the air and gas mixes. The LED indicator for air flow will not illuminate should the pressure switch detect a sustained low air condition. The appliance is provided with one air switch per burner module.

## 13.2 CONTROL PANEL

The appliance is provided with a control panel at the front. Operating controls are installed inside the control box and are accessible by undoing the thumb screw and opening the door. The diagnostic information centre as well as the on/off switch, 24V fuse, and the appliance temperature controls reside on the control box door.

**Figure 7 – Display, Appliance Temperature Controller and Indicating LED**

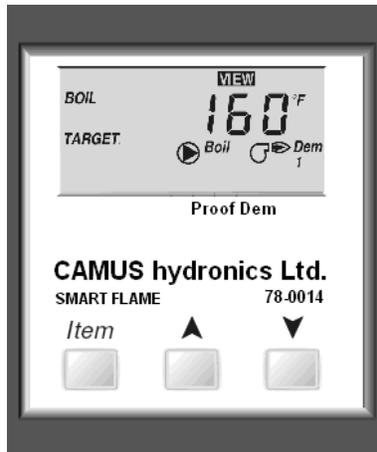


The Boiler Temperature Controller (BTC 1) for this appliance is a Camus BTC4PA Staging SmartFlame control. It initiates the local call for heat and sets the target return (appliance inlet) water temperature. This controller offers eight modes of operation which provides set point as well as reset control. It provides the following:

- Readings of inlet and outlet water temperatures as well as  $\Delta T$  temperature rise.
- Eight pre-set modes of operation; mode 1 for heating and constant circulation DHW, modes 2, 4, and 5 for heating, mode 3 for DHW with remote sensing and mode 6, 7 and 8 for operation by a remote controller.
- Operation as an auto reset limit.
- Operation as a control for inlet water temperature.
- Optional tank mounted sensor used in conjunction with inlet sensor.
- Adjustable pump delay feature based on  $\Delta T$  temperature difference between inlet and outlet temperatures. Pump contacts are located on terminals 13 & 14. Accepts 1/6 hp, an optional 1 HP relay is available.
- Adjustable; target temp, inter-stage differential, on delay between stages, minimum on time per stage, minimum off time per stage.
- Display of run hours for maintenance purposes. Counter wraps around at 10000 hours. Pressing and holding up and down arrow key simultaneously will reset the counter.
- Flame failure signal 24V.
- Molex connector for ease of service.
- Error message display.
- Test override feature to test pump operation, stages 1, 2, and alarm. Press and hold the UP button to test. After one second the pump will turn ON. Stage 1 will turn ON after four seconds. Stage 2 will turn ON after seven seconds. Alarm will turn ON after ten seconds. The controller will return to normal operation after releasing the UP button.
- Pump exercising feature runs pump 10 seconds every three days of no pump operation.

### Setting the Appliance Temperature Control

Press and hold the ITEM, UP and DOWN buttons simultaneously for 1 second. The appliance will shut down and pressing the ITEM key and then selecting the desired setting using the UP, DOWN buttons, can now make the settings. Pressing the ITEM key again will cause the last setting to be accepted. After settings have been made wait 30 seconds for the control to return to normal operating mode. In normal operating mode the inlet temperature, outlet temperature,  $\Delta T$  temperature and ON hours can be viewed by repeatedly pressing the ITEM key only. If you wish to check the setting you will have to start again by pressing and holding the ITEM, UP and DOWN buttons simultaneously for 1 second, and then use only the ITEM key to scroll through the settings. After checking the settings allow the control to return to normal operation on its own. Default setting is outlet temperature.



KEY	KEY DESCRIPTION
Item	The abbreviated name of the selected item will be displayed in the item field of the display. To view the next item, press the Item button.
▲	Increase a parameter value.
▼	Decrease a parameter value.

#### Levels of Access

View – Access to general boiler and display settings and will allow adjustments to the central heating and domestic hot water setpoint.

Adjust – Access to all user parameters and allows for changes to additional boiler parameters to allow for ease of startup and serviceability.

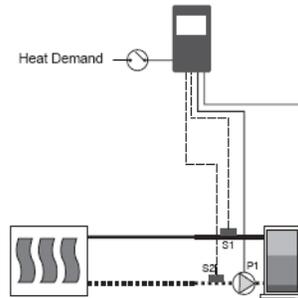
#### General Symbol Description

SYMBOL	SYMBOL NAME	SYMBOL DESCRIPTION
<b>Boil</b>	Boiler Pump	Shown when boiler pump is in operation
<b>DHW</b>	DHW Pump	Shown when DHW pump is in operation
<b>Dem 1</b>	Heat Demand	Shown when heat demand is present
<b>Dem 2</b>	Flame Proof	Shown when flame signal is proven
	Burner	Shown when burner is on
	Warning	Shown when an error is present
	Pointers	Shows the operation as indicated by the text (Proof Dem)
<b>WWSD</b>	WWSD	Displays when the control is in Warm Weather Shutdown

### 13.2.1 MODE 1 & 2: SETPOINT OPERATION

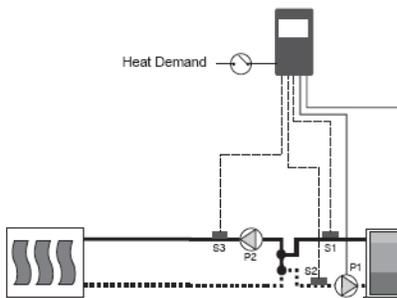
#### Mode 1

Intended for hydronic heating. The set-point for inlet water control is pre-set to 180°F and the auto re-set limit is set to 230°F. The inlet set-point can be adjusted, however the limit is fixed. In addition to the auto reset limit the factory installs a manual re-set limit set to 250°F. The control turns on the appliance pump and stages the appliance to maintain set-point target temperature at the **appliance inlet** temperature whenever an external heat demand is present. Once the external heat demand is removed, the control turns off the appliance and operates the appliance pump based on the purge feature



#### Mode 2

Intended for hydronic heating. The set-point for inlet water control is pre-set to 180°F and the auto re-set limit is set to 230°F. The inlet set-point can be adjusted, however the limit is fixed. In addition to the auto reset limit the factory installs a manual re-set limit set to 250°F. The control turns on the appliance pump and stages the appliance to maintain set-point target temperature at the appliance inlet temperature whenever an external heat demand is present. Once the external heat demand is removed, the control turns off the appliance and operates the appliance pump based on the purge feature. The control turns on the appliance pump and stages the appliance to the set-point target temperature at the **system** temperature whenever an external heat demand is present. Once the last appliance stage turns off and the heat demand is still present, the control then operates the appliance pump based on the purge feature. In this case, it is imperative that the system pump operates continuously in order to provide constant circulation past the system sensor. The appliance pump then turns back on with the first stage of the appliance. If the heat demand is removed, the appliance is turned off and the control operates the appliance pump P1 based on the purge feature.



### 13.2.2 MODE 1 & 2: SETPOINT OPERATION: VIEW DISPLAY

From the Home display;

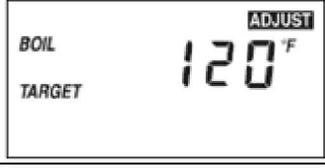
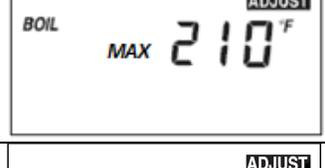
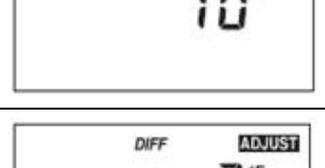
- 1) Press [ITEM] to view the following parameters:

Display	Parameter Name	Parameter Description	Parameter Range
	Boiler System Temperature (Mode 2 ONLY)	Real-time System Temperature to Boiler	14 to 266°F (-10 to 130°C)
	Boiler Outlet Temperature	Real-time Outlet Temperature to Boiler	14 to 266°F (-10 to 130°C)
	Boiler Inlet Temperature	Real-time Inlet Temperature to Boiler	14 to 266°F (-10 to 130°C)
	Boiler Delta T	Real-time temperature difference between the outlet sensor and the inlet sensor.	-99 to 252°F (-72 to 140°C)
	Total Run Time Since Installation	Monitors the amount of operational time since the unit was installed. The two digits are the thousands of hours and the three-digit display shows the hundreds of hours. Press (▲, ▼) simultaneously to reset the counter	Alternates between 00 and 999

### 13.2.3 MODE 1 & 2: SETPOINT OPERATION: ADJUST DISPLAY

From the Home display;

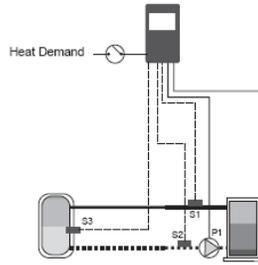
- 1) Press (Item, ▲, ▼) simultaneously to view the following parameters:

Display	Parameter Name	Parameter Description	Parameter Range
 The display shows the word "MODE" on the left and a large digit "1" in the center. A small "ADJUST" button icon is in the top right corner.	Mode	Operating mode for the boiler. <b>NOTE:</b> A complete description of each mode can be found in section 8.4 Modes of Operation in this manual.	1 to 8 Default = 1
 The display shows "BOIL" and "TARGET" on the left. A large "120" is in the center with a small "°F" to its right. A small "ADJUST" button icon is in the top right corner.	Boiler Target Temperature	To provide a target setpoint for the heating system. Setpoint is controlled to the inlet sensor	70 to 220°F (21 to 104°C) Default = 120°F (49°C)
 The display shows "BOIL" and "MAX" on the left. A large "210" is in the center with a small "°F" to its right. A small "ADJUST" button icon is in the top right corner.	Boil Max	Maximum boiler target temperature	120 to 225°F (48 to 107°C) Default = 210°F (99°C)
 The display shows "BOIL" and "MASS" on the left. A large digit "1" is in the center. A small "ADJUST" button icon is in the top right corner.	Boil Mass (Mode 2 ONLY)	Thermal mass of boiler. This determines interstage delay and minimum on and minimum off times.	1 to 3 Default = 1
 The display shows "DIFF" on the left. A large "10" is in the center with a small "°F" to its right. A small "ADJUST" button icon is in the top right corner.	Differential Temperature	To start the boiler below the Boiler Target temperature. For example, if the value is 10°F and the Boiler Target is 160°F the boiler will begin to modulate at 150°F and shut off at 170°F.	Au, 2 to 42°F (Au, -17 to 6°C) Default = 10°F
 The display shows "DIFF" and "STG" on the left. A large "3" is in the center with a small "°F" to its right. A small "ADJUST" button icon is in the top right corner.	Stage Differential	Dictates the staging of the boiler and each stage is iterative. For example, if the value is 3°F. Stage 1 will be active 3°F below setpoint, Stage 1 & 2 will be active 6°F below setpoint.	Au, 2 to 42°F (Au, -17 to 6°C) Default = 10°F
 The display shows "ON" and "DLY" on the left. A large "1:00" is in the center with a small "min" to its right. A small "ADJUST" button icon is in the top right corner.	On Delay	Interstage delay to activate the next stage	0:10 to 8:00 minutes Default = 1:00 minute
 The display shows "ON" and "MIN" on the left. A large "0:30" is in the center with a small "min" to its right. A small "ADJUST" button icon is in the top right corner.	Minimum On Time	Minimum on time for each stage	0:10 to 5:00 minutes Default = 0:30 minute

	Minimum Off Time	Minimum off time for each stage	0:10 to 5:00 minutes Default = 0:50 minutes
	Pump Delay	Boiler post pump time after burner has shut off, in seconds.	OFF, 0:20 to 9:55 min, On Default = 1:00 min
	Temperature Units	Select the desired unit of measurement	°F, °C Default = °F

### 13.2.4 MODE 3: DHW SETPOINT OPERATION

Mode 3 is intended for domestic water heating. The set-point for inlet water control is pre-set to 140°F and the auto re-set limit is set to 200°F. The inlet set-point can be adjusted, however the limit is fixed. In addition to the auto reset limit the factory installs a manual re-set limit set to 210°F. The control turns on the appliance pump and stages the appliance to maintain set-point target temperature at the **appliance** inlet temperature. An internal demand is generated from the DHW sensor which could be placed in the storage tank while the external heat demand is permanently wired or through a timer. Once the DHW tank is satisfied (internal demand is removed), the control turns off the appliance and operates the appliance pump based on the purge feature.



### 13.2.5 MODE 3: SETPOINT OPERATION: VIEW DISPLAY

From the Home display;

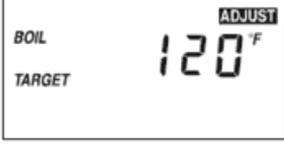
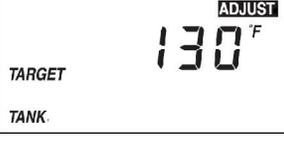
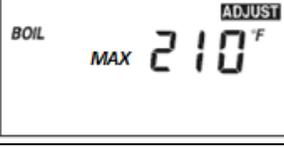
- 1) Press [ITEM] to view the following parameters:

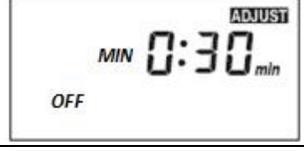
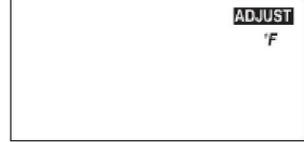
Display	Parameter Name	Parameter Description	Parameter Range
	Boiler Outlet Temperature	Real-time Outlet Temperature to Boiler	14 to 266°F (-10 to 130°C)
	Boiler Inlet Temperature	Real-time Inlet Temperature to Boiler	14 to 266°F (-10 to 130°C)
	Boiler Delta T	Real-time temperature difference between the outlet sensor and the inlet sensor.	-99 to 252°F (-72 to 140°C)
	Tank Temperature	Real-time Tank Temperature to Boiler	14 to 266°F (-10 to 130°C)
	Total Run Time Since Installation	Monitors the amount of operational time since the unit was installed. The two digits are the thousands of hours and the three-digit display shows the hundreds of hours. Press (▲, ▼) simultaneously to reset the counter	Alternates between 00 and 999

### 13.2.6 MODE 3: DHW SETPOINT OPERATION: ADJUST DISPLAY

From the Home display;

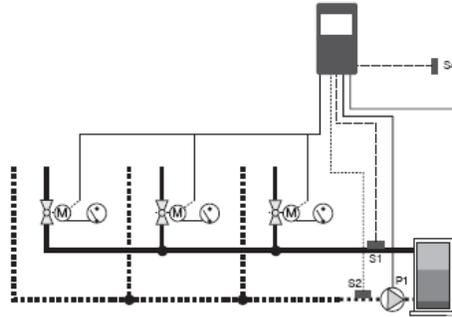
- 1) Press (Item, ▲, ▼) simultaneously to view the following parameters:

Display	Parameter Name	Parameter Description	Parameter Range
	Mode	Operating mode for the boiler. <b>NOTE:</b> A complete description of each mode can be found in section 8.4 Modes of Operation in this manual.	1 to 8 Default = 1
	Boiler Target Temperature	To provide a target setpoint for the heating system. Setpoint is controlled to the inlet sensor	OFF, 70 to 220°F (OFF, 21 to 104°C) Default = 140°F (82°C)
	Tank Target Temperature	To provide a target setpoint for the Tank. Setpoint is controlled to the Tank sensor	OFF, 70 to 190°F (OFF, 21 to 88°C) Default = 130°F (54°C)
	Tank Differential	To provide a modulation rate above and below the Tank Target Temperature. For example, if the value is 10°F and the Tank Target Temperature is 160°F the boiler will begin to modulate at 150°F and shut off at 170°F.	2 to 10°F (1 to 5°C) Default = 3°F (1°C)
	Boil Max	Maximum boiler target temperature	120 to 225°F (48 to 107°C) Default = 210°F (99°C)
	Differential Temperature	To start the boiler below the Boiler Target temperature. For example, if the value is 10°F and the Boiler Target is 160°F the boiler will begin to modulate at 150°F and shut off at 170°F.	Au, 2 to 42°F (Au, -17 to 5°C) Default = 10°F
	Stage Differential	Dictates the staging of the boiler and each stage is iterative. For example, if the value is 3°F. Stage 1 will be active 3°F below setpoint, Stage 1 & 2 will be active 6°F below setpoint.	Au, 2 to 42°F (Au, -17 to 6°C) Default = 10°F

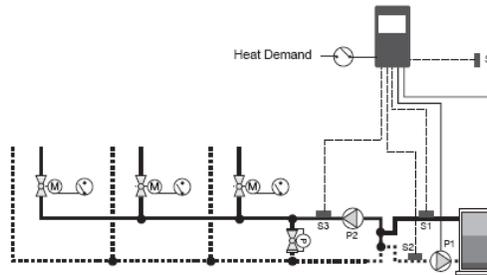
	On Delay	Interstage delay to activate the next stage	0:10 to 8:00 minutes Default = 1:00 minute
	Minimum On Time	Minimum on time for each stage	0:10 to 5:00 minutes Default = 0:30 minute
	Minimum Off Time	Minimum off time for each stage	0:10 to 5:00 minutes Default = 0:50 minutes
	Pump Delay	Boiler post pump time after burner has shut off, in seconds.	OFF, 0:20 to 9:55 min, On Default = 1:00 min
	Temperature Units	Select the desired unit of measurement	°F, °C Default = °F

### 13.2.7 MODE 4 & 5: OUTDOOR RESET OPERATION

Mode 4 is intended for hydronic heating. The set-point for inlet water control is pre-set to 180°F and the auto re-set limit is set to 230°F. The inlet set-point can be adjusted, however the limit is fixed. In addition to the auto reset limit the factory installs a manual re-set limit set to 250°F. The control turns on the appliance pump and stages the appliance to maintain outdoor reset target temperature at the **appliance** inlet temperature whenever an external heat demand is present. Once the external heat demand is removed, the control turns off the appliance and operates the appliance pump based on the purge feature.



Mode 5 is intended for hydronic heating. The set-point for inlet water control is pre-set to 180°F and the auto re-set limit is set to 230°F. The inlet set-point can be adjusted, however the limit is fixed. In addition to the auto reset limit the factory installs a manual re-set limit set to 250°F. The control turns on the appliance pump and stages the appliance to maintain outdoor reset target temperature at the **system** temperature whenever an external heat demand is present. Once the last appliance stage turns off and the heat demand is still present, the control then operates the appliance pump based on the purge feature. In this case, it is imperative that the system pump operates continuously in order to provide constant circulation past the system sensor. The appliance pump then turns back on with the first stage of the appliance. If the heat demand is removed, the appliance is turned off and the control operates the appliance pump based on the purge feature.



### 13.2.8 MODE 4 & 5: OUTDOOR RESET OPERATION: VIEW DISPLAY

From the Home display;

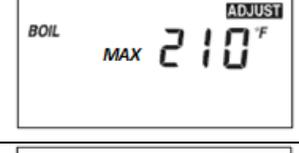
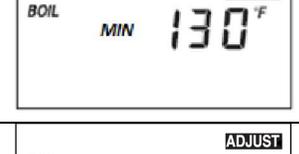
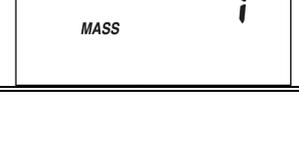
- 1) Press [ITEM] to view the following parameters:

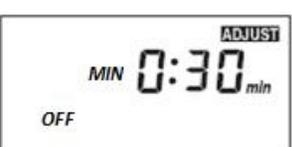
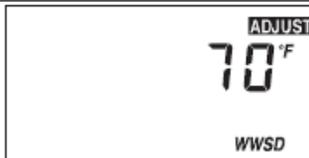
Display		Parameter Name	Parameter Description	Parameter Range
OUTDR	VIEW 32 °F	Outdoor Temperature	Real-time Outdoor Temperature	-60 to 190°F (-51 to 88°C)
BOILSUP	VIEW 170 °F	Boiler Supply Temperature (Mode 5 ONLY)	Real-time System Temperature to Boiler	14 to 266°F (-10 to 130°C)
BOIL OUT	VIEW 170 °F	Boiler Outlet Temperature	Real-time Outlet Temperature to Boiler	14 to 266°F (-10 to 130°C)
BOIL IN	VIEW 145 °F	Boiler Inlet Temperature	Real-time Inlet Temperature to Boiler	14 to 266°F (-10 to 130°C)
BOIL ΔT	VIEW 25 °F	Boiler Delta T	Real-time temperature difference between the outlet sensor and the inlet sensor.	-99 to 252°F (-72 to 140°C)
BOIL ON	VIEW 000	Total Run Time Since Installation	Monitors the amount of operational time since the unit was installed. The two digits are the thousands of hours and the three-digit display shows the hundreds of hours. Press (▲, ▼) simultaneously to reset the counter	Alternates between 00 and 999

### 13.2.9 MODE 4 & 5: OUTDOOR RESET OPERATION: ADJUST DISPLAY

From the Home display;

- 1) Press (Item, ▲, ▼) simultaneously to view the following parameters:

Display	Parameter Name	Parameter Description	Parameter Range
	Mode	Operating mode for the boiler. <b>NOTE:</b> A complete description of each mode can be found in section 8.4 Modes of Operation in this manual.	1 to 8 Default = 1
	Outdoor Start Temperature	Outdoor starting temperature used in the reset ratio for the heating system. Typically set to the desired building temperature.	35 to 85°F (2 to 29°C) Default = 60°F (21°C)
	Outdoor Design Temperature	Outdoor design temperature used in the reset ratio for the heating system. Set to the coldest annual outdoor temperature in the local area.	-60 to 50°F (-51 to 10°C) Default = -10°F (-23°C)
	Boiler Start Temperature	Starting water temperature used in the reset ratio calculation for the heating system. Typically set to the desired building temperature.	35 to 150°F (2 to 66°C) Default = 70°F (21°C)
	Boiler Design Temperature	Boiler design water temperature used in the reset ratio calculation for the heating system. Set to the boiler water temperature required to heat the building on the coldest annual outdoor temperature.	70 to 230°F (21 to 110°C) Default = 180°F (82°C)
	Boil Max	Maximum boiler target temperature	120 to 225°F (48 to 107°C) Default = 210°F (99°C)
	Boil Min	Minimum boiler target temperature	80 to 180°F (26 to 82°C) Default = 130°F (54°C)
	Boil Mass (Mode 5 ONLY)	Thermal mass of boiler. This determines interstage delay and minimum on and minimum off times.	1 to 3 Default = 1

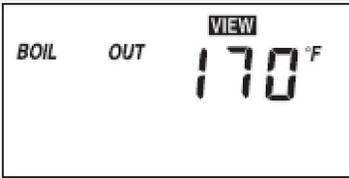
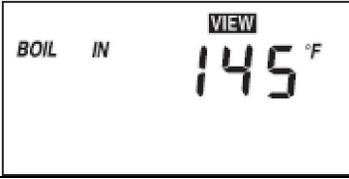
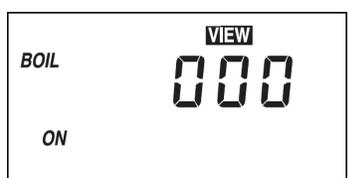
	Differential Temperature	To provide a modulation rate above and below the Boiler Target temperature. For example, if the value is 10°F and the Boiler Target is 160°F the boiler will begin to modulate at 150°F and shut off at 170°F.	Au, 2 to 42°F (Au, -16 to 5°C) Default = 10°F
	Stage Differential	Dictates the staging of the boiler and each stage is iterative. For example, if the value is 3°F. Stage 1 will be active 3°F below setpoint, Stage 1 & 2 will be active 6°F below setpoint.	Au, 2 to 42°F (Au, -17 to 6°C) Default = 10°F
	On Delay	Interstage delay to activate the next stage	0:10 to 8:00 minutes Default = 1:00 minute
	Minimum On Time	Minimum on time for each stage	0:10 to 5:00 minutes Default = 0:30 minute
	Minimum Off Time	Minimum off time for each stage	0:10 to 5:00 minutes Default = 0:50 minutes
	Pump Delay	Boiler post pump time after burner has shut off, in seconds.	OFF, 0:20 to 9:55 min, On Default = 1:00 min
	Warm Weather Shutdown Temperature	Warm weather shutdown temperature using outdoor reset.	35 to 105°F, OFF (2 to 41°C, OFF) Default = 0:20 min
	Temperature Units	Select the desired unit of measurement	°F, °C Default = °F

## 12.4 MODE 6: EXTERNAL SEQUENCER OPERATION: VIEW DISPLAY

**Mode 6** is intended for multiple appliance application and all stages are closed at all times. In essence there is no operator at the appliance. A removable jumper is provided in the electrical enclosure across the contacts to be used for connection to the remote operator. The fixed auto re-set limit is set to 230°F. In addition to the auto reset limit the factory installs a manual re-set limit set to 250°F. The control provides pump operation. Staging operation is provided by an external sequencing control. Heat demand provided via external analog input signal from Tekmar sequencing control (275). The control turns on the boiler pump and adjusts the number of stages being fired in proportion to the analog input signal. Note: Existing Tekmar sequencing control (264, 268) can be used to control the boiler staging. In this case, the BTC turns on the boiler pump and Stage 1 when an external heat demand is present. Stage 2, 3, and 4 are controlled by the sequencing control. Each control turns on its respective appliance pump and stage 1 contact whenever an external heat demand is present. Once the external heat demand is removed from the control, the control turns off the stage 1 contact and operates the pump to provide purging. Once the purge period is complete, the control turns off the appliance pump.

From the Home display;

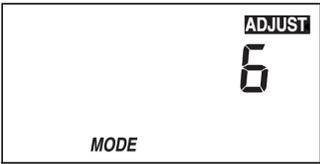
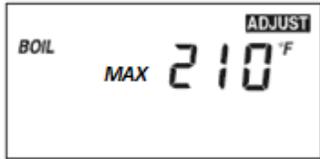
- 1) Press [ITEM] to view the following parameters:

Display	Parameter Name	Parameter Description	Parameter Range
	Boiler Outlet Temperature	Real-time Outlet Temperature to Boiler	14 to 266°F (-10 to 130°C)
	Boiler Inlet Temperature	Real-time Inlet Temperature to Boiler	14 to 266°F (-10 to 130°C)
	Boiler Delta T	Real-time temperature difference between the outlet sensor and the inlet sensor.	-99 to 252°F (-72 to 140°C)
	Total Run Time Since Installation	Monitors the amount of operational time since the unit was installed. The two digits are the thousands of hours and the three-digit display shows the hundreds of hours. Press (▲, ▼) simultaneously to reset the counter	Alternates between 00 and 999

## 12.5 MODE 6: EXTERNAL SEQUENCER OPERATION: ADJUST DISPLAY

From the Home display;

- 1) Press (Item, ▲, ▼) simultaneously to view the following parameters:

Display	Parameter Name	Parameter Description	Parameter Range
 The display shows the word "MODE" at the bottom left, a large number "6" in the center, and the word "ADJUST" in a small box at the top right.	Mode	Operating mode for the boiler. <b>NOTE:</b> A complete description of each mode can be found in section 8.4 Modes of Operation in this manual.	1 to 8  Default = 1
 The display shows "BOIL" at the top left, "MAX" at the bottom left, a large "210" in the center, and "°F" at the top right. "ADJUST" is in a small box at the top right.	Boil Max	Maximum boiler target temperature	120 to 225°F (48 to 107°C)  Default = 210°F (99°C)
 The display shows "DLY" at the bottom left, a large "0:20" in the center, and "min" at the bottom right. "ADJUST" is in a small box at the top right.	Pump Delay	Boiler post pump time after burner has shut off, in seconds.	OFF, 0:20 to 9:55 min, On  Default = 1:00 min
 The display shows "ADJUST" in a small box at the top right and "°F" in the center.	Temperature Units	Select the desired unit of measurement	°F, °C  Default = °F

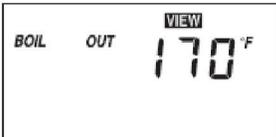
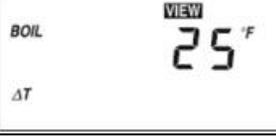
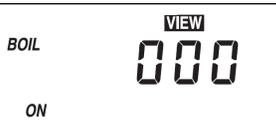
## 12.6 MODE 7 & 8: EXTERNAL TEMPERATURE TARGET OPERATION: VIEW DISPLAY

**Mode 7** A removable jumper is provided in the electrical enclosure across the contacts to be used for connection to the remote operator. Heat demand provided via external analog input signal from EMS or tN4 system control (e.g. 420). The control turns on the boiler pump and operates the boiler to maintain the boiler target at the boiler **inlet** sensor whenever a heat demand is present. Once the external heat demand is removed from the control, the control turns off the stage 1 contact and operates the pump to provide purging. Once the purge period is complete, the control turns off the appliance pump.

**Mode 8** A removable jumper is provided in the electrical enclosure across the contacts to be used for connection to the remote operator. Heat demand provided via external analog input signal from EMS or tN4 system control (e.g. 420). The control turns on the boiler pump and operates the boiler to maintain the boiler target at the **system** sensor whenever a heat demand is present. Once the external heat demand is removed from the control, the control turns off the stage 1 contact and operates the pump to provide purging. Once the purge period is complete, the control turns off the appliance pump.

From the Home display;

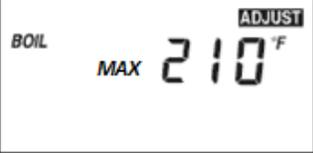
- 1) Press [ITEM] to view the following parameters:

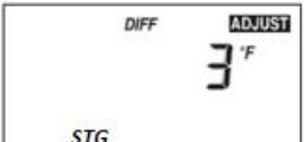
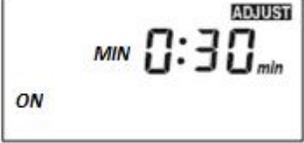
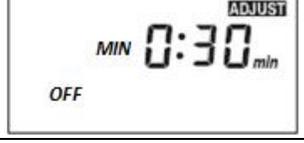
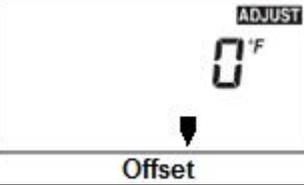
Display	Parameter Name	Parameter Description	Parameter Range
	Boiler Outlet Temperature	Real-time Outlet Temperature to Boiler	14 to 266°F (-10 to 130°C)
	Boiler Inlet Temperature	Real-time Inlet Temperature to Boiler	14 to 266°F (-10 to 130°C)
	Boiler Delta T	Real-time temperature difference between the outlet sensor and the inlet sensor.	-99 to 252°F (-72 to 140°C)
	Total Run Time Since Installation	Monitors the amount of operational time since the unit was installed. The two digits are the thousands of hours and the three-digit display shows the hundreds of hours. Press (▲, ▼) simultaneously to reset the counter	Alternates between 00 and 999
	Boiler Target Temperature	To provide a target setpoint for the heating system. Setpoint is controlled to the inlet sensor	OFF, 70 to 220°F (OFF, 21 to 104°C)

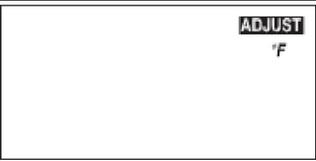
### 12.7 MODE 7 & 8: EXTERNAL TEMPERATURE TARGET OPERATION: ADJUST DISPLAY

From the Home display;

- 1) Press (Item, ▲, ▼) simultaneously to view the following parameters:

Display	Parameter Name	Parameter Description	Parameter Range
	Mode	Operating mode for the boiler.	1 to 8 Default = 1
	Boil Max	Maximum boiler target temperature	120 to 225°F (48 to 107°C) Default = 210°F (99°C)

	Boil Min	Minimum boiler target temperature	80 to 180°F (26 to 82°C)  Default = 130°F (54°C)
	Differential Temperature	To start the boiler below the Boiler Target temperature. For example, if the value is 10°F and the Boiler Target is 160°F the boiler will begin to modulate at 150°F and shut off at 170°F.	Au, 2 to 42°F (Au, -17 to 5°C)  Default = 10°F
	Stage Differential	Dictates the staging of the boiler and each stage is iterative. For example, if the value is 3°F. Stage 1 will be active 3°F below setpoint, Stage 1 & 2 will be active 6°F below setpoint.	Au, 2 to 42°F (Au, -17 to 6°C)  Default = 10°F
	On Delay	Interstage delay to activate the next stage	0:10 to 8:00 minutes  Default = 1:00 minute
	Minimum On Time	Minimum on time for each stage	0:10 to 5:00 minutes  Default = 0:30 minute
	Minimum Off Time	Minimum off time for each stage	0:10 to 5:00 minutes  Default = 0:50 minutes
	Pump Delay	Boiler post pump time after burner has shut off, in seconds.	OFF, 0:20 to 9:55 min, On  Default = 1:00 min
	External Input Signal (Mode 8 ONLY)	Select the range for the external input signal that adjusts the boiler target.	0:10 or 2:10  Default = 0:10
	Offset	Select the amount of temperature offset to add to the boiler target calculated from the external input signal.	-10 to 10°F (-5 to 5°C)  Default = 0°F

	Temperature Units	Select the desired unit of measurement	°F, °C Default = °F
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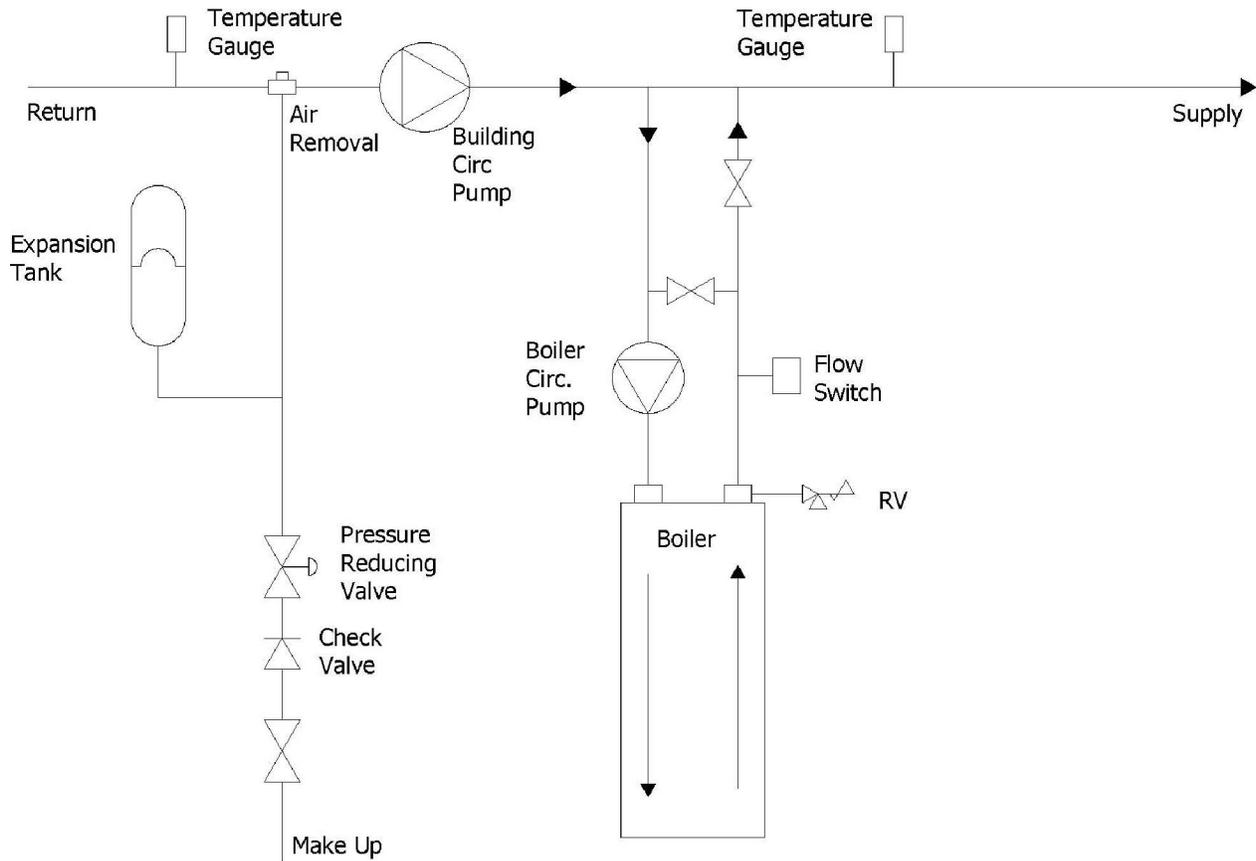
## 14 IGNITION SYSTEM SAFETY SHUT-OFF DEVICE

After initial fill while the main burner is firing, shut off gas to the pilot and clock the time taken for the main gas valve to shut down. If the safety control is functioning properly, power to the gas valve will be shut off within 4 seconds of the pilot gas being shut off. If shut down takes longer, ignition control or gas valve may be defective.

## 15 LOW WATER TEMPERATURE SYSTEMS

In applications where the heating system requires supply water temperatures below 110 °F, a bypass line must be installed upstream of the boiler pump so that outlet water can be re-circulated to raise the inlet temp to a minimum of 110 °F. Balancing valves, preferably globe valves are used to adjust flow. (See Figure 8)

**Figure 8: Low Water Temperature System**

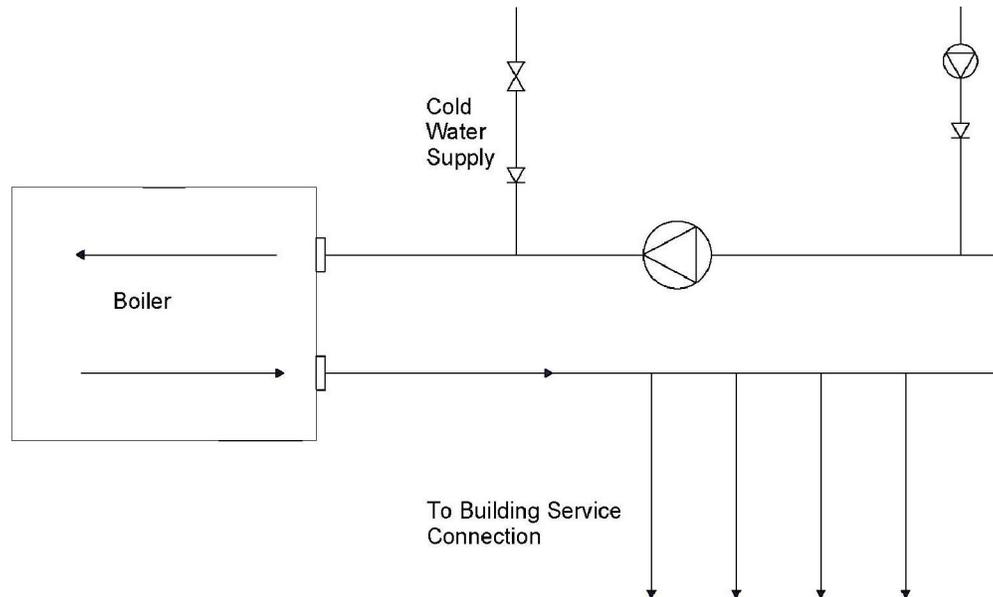


- Adjustment procedure.
  - a. Fully open bypass and outlet valves.
  - b. With boiler running, read inlet temperature after 15 minutes.
  - c. If the inlet temperature is less than 110°F slowly close outlet valve until the inlet temperature climbs to 110°F
  - d. If the inlet temperature is greater than 110°F but not greater than 140°F no further adjustment is required.
  - e. Check the inlet temperature after 5 minutes and make final adjustments.

## 16 INSTANTANEOUS WATER HEATER

An instantaneous water heater is designed to deliver hot water without the use of a storage tank. It is suitable for applications with variable load such as restaurants, condominiums, apartments and motels. (See Figure 8) Call factory for recommendations.

**Figure 9: Instantaneous Water Piping Suggested System**



## 17 CONDENSING HEAT RECOVERY MODULE

The MicoFlame® could be provided in condensing mode for a variety of application including domestic hot water and hydronic space heating.

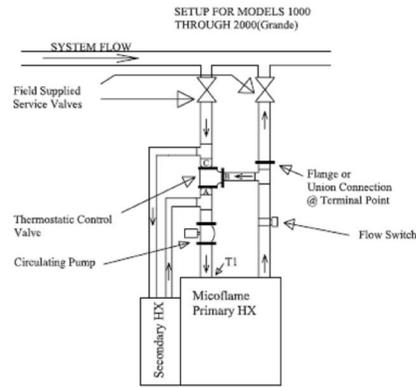
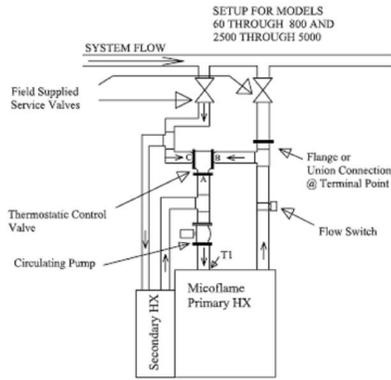
The CHRM is intended to extract total (sensible and latent) heat from the flue gases downstream of the primary heat exchanger. As a result, condensation of moisture in the flue gas will take place on the CHRM surfaces and in the exhaust vent. This condensation is a natural outcome when efficiencies exceed 90%.

A neutralizer cartridge is provided and must be installed in the line from the condensate collection pot to the drain. PH level of the condensate is to be checked regularly and neutralizing medium is to be replaced as required to maintain effectiveness. A neutralizer cartridge is available from the factory.

Recommended installation methods of the condensing MicoFlame® will vary depending on the application and the expected water temperature variation of the system.

Examples of recommended installation for typical applications are shown on the next page:

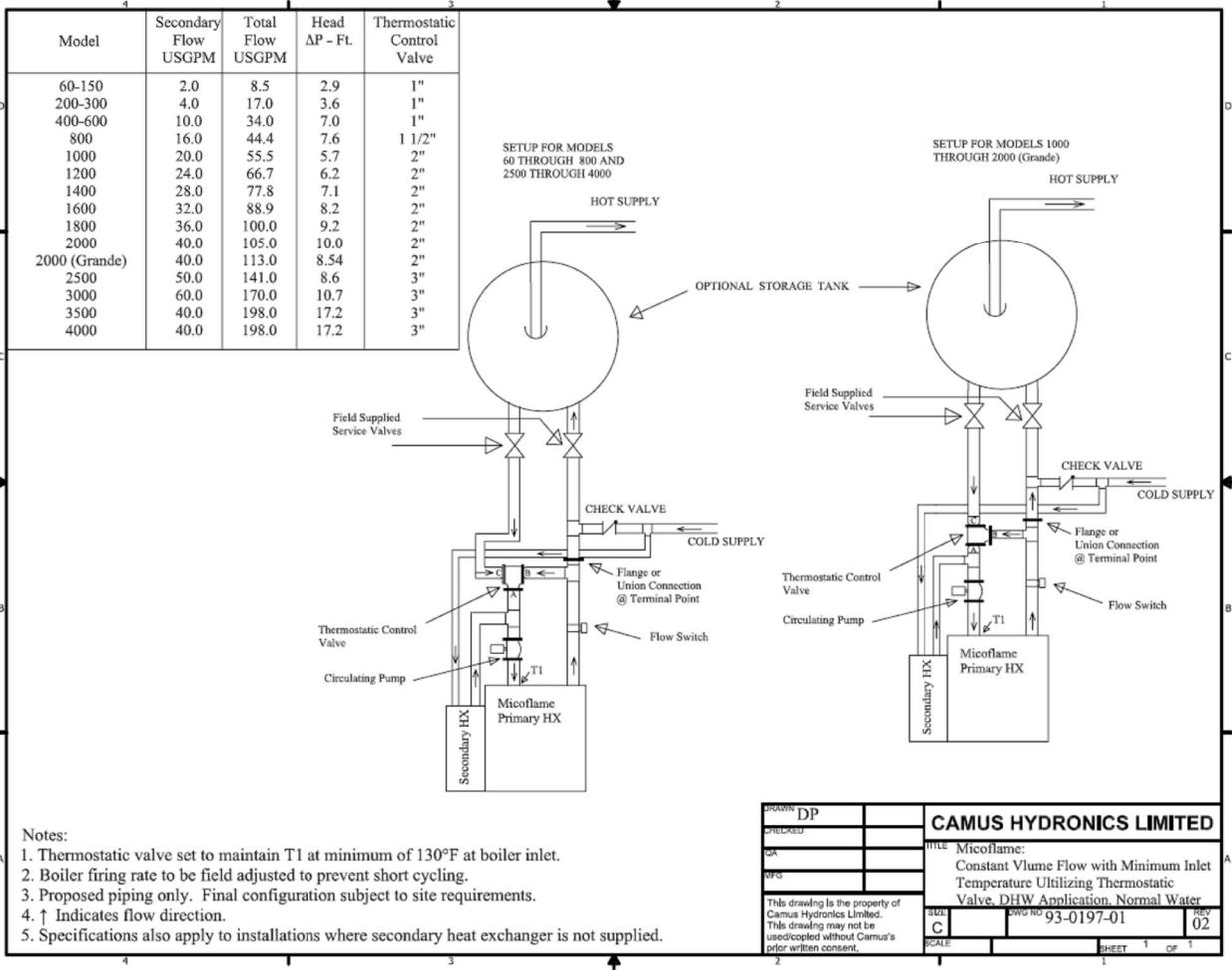
Model	Secondary Flow USGPM	Total Flow USGPM	Head ΔP - Ft.	Thermostatic Control Valve
60-150	2.0	8.5	2.9	1"
200-300	4.0	17.0	3.6	1"
400-600	10.0	34.0	7.0	1"
800	16.0	44.4	7.6	1 1/2"
1000	20.0	55.5	5.7	2"
1200	24.0	66.7	6.2	2"
1400	28.0	77.8	7.1	2"
1600	32.0	88.9	8.2	2"
1800	36.0	100.0	9.2	2"
2000	40.0	105.0	10.0	2"
2000 (Grande)	40.0	113.0	8.54	2"
2500	50.0	141.0	8.6	3"
3000	60.0	170.0	10.7	3"
3500	40.0	198.0	17.2	3"
4000	40.0	198.0	17.2	3"



Notes:

1. Thermostatic valve set to maintain T1 at minimum of 130°F at boiler inlet.
2. Boiler firing rate to be field adjusted to prevent short cycling.
3. Proposed piping only. Final configuration subject to site requirements.
4. ↑ Indicates flow direction.
5. Specifications also apply to installations where secondary heat exchanger is not supplied.

DRAWN	DP	<b>CAMUS HYDRONICS LIMITED</b>	
CHECKED		TITLE Micoflame:	
DATE		Constant Volume Flow with Minimum Inlet	
BY		Temperature Utilizing Thermostatic Valve,	
		Heating Application	
This drawing is the property of Camus Hydronics Limited. This drawing may not be used/copied without Camus's prior written consent.		SIZE C	DWG NO 93-0197
		SCALE	REV 02
		SHEET 1 OF 1	



## 18 PILOT AND MAIN BURNER FLAMES

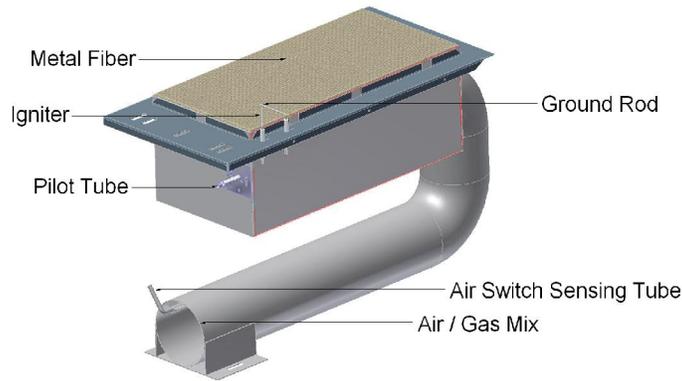
To maintain safe operation and the greatest efficiency of the boiler, check the main burner and pilot burner every six months for proper flame characteristics.

### 18.1 MAIN BURNER

The main burner, Figure 9 should display the following characteristics;

- Acceptable CO and CO<sub>2</sub> levels for complete combustion.
- Light off smoothly.
- Reasonably quiet while running.
- Stable flame with minimum of lifting.
- Blue flame with natural gas, yellow tips with propane gas

**Figure 10: Burner**



If burner characteristics do not match the above, check for proper air box pressure. Also look for accumulation of lint and other foreign material at fan air inlets. Typical air box settings are as follows (a setting in brackets denotes condensing application):

**Table 7: Typical Air Box Settings**

MODEL	AIR BOX " W.C. (with burner firing)		FLUE SWITCH RECYCLE POINT " W.C	
	Left Burner	Right Burner	Left Burner	Right Burner
800	-	1.4 (1.7)	-	1.0 (1.4)
1000	-	1.9 (2.2)	-	1.5 (1.9)
1200	0.9 (1.1)	0.9 (1.1)	0.8 (0.9)	0.7 (0.9)
1400	0.9 (1.1)	1.4 (1.7)	0.7 (0.9)	1.1 (1.3)
1600	0.9 (1.1)	1.9 (2.2)	0.7 (0.9)	1.5 (1.8)
1800	1.6 (1.9)	1.6 (1.9)	1.2 (1.6)	1.2 (1.6)
2000	1.9 (2.2)	1.9 (2.2)	1.5 (1.9)	1.5 (1.9)

Depending on field conditions air box pressures will have to be adjusted accordingly. Always set the appliance for a CO<sub>2</sub> level in the range of 7.5% to 8.5 % for non-condensing appliances and 8.5% to 9.0% for condensing appliances. For propane fired appliances the settings will be approximately 1.5% higher.

A qualified service technician should follow this procedure when burner needs cleaning.

1. Shut off power and close main manual gas valve.
  - Allow burner to cool before removal.
2. Remove access cover screws.
  - Disconnect pilot gas at bulkhead fitting.
  - Disconnect ground wire and ignition wire.
  - Remove two wing nuts holding down burner.
  - Gently pull down and forward to disengage burner.
  - Remove burner being careful to not damage the igniter or ground electrodes.
3. Thoroughly clean burner. Check all ports and air channels for blockage.
4. Reinstall the burner being careful to fully engage the back of the burner box into the retaining slot in the combustion chamber base. Failure to properly locate the burner will result in erratic flame operation with the possibility of delayed ignition on light off.
5. Restore electrical power and gas supply to the boiler.
  - Following the lighting instructions put the boiler back into operation
  - Check for gas leaks and proper boiler and vent operation.

## 18.2 PILOT BURNER

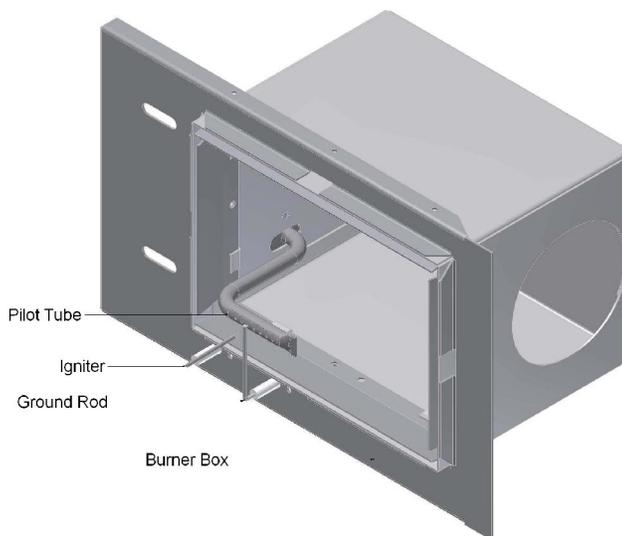
Turn the pilot firing valve to off position and allow the boiler to try for ignition. Observe the spark making sure that it is strong and continuous.

If the spark is not acceptable the igniter will have to be adjusted. This can be readily accomplished after removing the main burner.

The spark gap should be 1/8" to 3/16" between igniter and ground rod and 3/8" between igniter and surface of metal fiber. Make sure that the electrode does not appear overheated or fouled with carbon. It may be necessary to clean the ignition electrode using steel wool. Once the pilot appears to be properly set, reinstall it into the appliance making sure to properly tighten the pilot line connection.

If the pilot is removed from the main burner in the course of servicing the appliance, it is important to reinstall it so that there is no gap between the top surface of the pilot tube and the underside of the metal filter support screen. When properly set it will not be possible to slip a business card between the pilot burner and the support screen. Figure 13 shows the burner box assembly with the metal filter cover removed to expose pilot tube.

**Figure 11: Pilot and Burner Box**



### **Pilot Pressure Setting**

The pilot is preset at the factory. The following description is for the benefit of the start-up technician should minor adjustment be required.

The pilot burner is controlled by a separate pilot valve. Pilot pressure setting is as shown in Table 7. A view port is provided on the appliance's return end to view the pilot and the main burners. If adjustment is necessary, the following steps must be followed: Remove the lower front jacket panel; Remove the 1/8" plug from the elbow pressure tap and connect a manometer; Remove regulator adjustment screw cap from the pilot valve; Rotate the regulator adjustment screw clockwise to increase the manifold pressure or counter-clockwise to decrease it; Once satisfied replace the regulator adjustment screw cap and the elbow pressure tap plug.

**Table 7 – Gas pressures at inlet to pilot**

	PROPANE	NATURAL GAS
Minimum (inches W.C.)	3.9	3.5
Maximum (inches W.C.)	7.0	4.5

Once the spark is satisfactory, open the pilot gas and allow the pilot burner to light. Once air has been purged from the pilot line, the pilot flame should appear almost instantly at the initiation of spark. Cycle the pilot several times to confirm reliability. A properly set pilot will appear blue and will engulf the igniter and ground electrode. (See Figure 13)

Open the firing valve and allow the main burner to light. The pilot must not extinguish. After running for 15 minutes, cycle the boiler to ensure that the pilot remains stable.

#### **Pilot Flame Rectification Setting**

The pilot flame rectification was preset at the factory. The following description is for the benefit of the start-up technician should minor adjustment be required. Set pilot to obtain best  $\mu\text{A}$  reading from flame rectification. Minimum average signal of  $1.5 \mu\text{A}$  is required. If required, test the signal using a DC  $\mu\text{A}$  meter following this procedure for Honeywell S8600 ignition module: Disconnect ground wire at appliance transformer; Disconnect the 24V power and ground wires from all S8600 ignition modules not being tested; Set meter to  $\mu\text{A}$  DC: Connect one of the meter's terminals to the burner ground terminal on the S8600 and the other terminal to the burner ground wire; Pilot running without main burner will generate  $1.5 \mu\text{A}$  average for best operation. With main burner running, the signal will be in a range of  $4.0$  to  $7.0\mu\text{A}$ .

## 19 OPERATION AND SERVICE

### OPERATION:

Before operating the boiler, the entire system must be filled with water, purged of air and checked for leaks. Do not use Stop leak or other boiler compounds. The gas piping must also be leak tested.

Any safety devices including low water cutoff, flow switch and high limit used in with this boiler must receive periodic inspection (every six months) to assure proper operation. A low water cutoff of the float type should be flushed every six months. All relief valves should be inspected and manually operated every six months.

For your safety follow the lighting and operating instructions below and on the boiler.

To turn on main burner, slowly open firing valve after pilot is established.

Set primary system controller to desired temperature.

To turn off boiler close main manual gas valve, close pilot manual valve and turn off electric power to system.

### SERVICE:

Disconnect main power and turn off gas supply before servicing unit.

To remove and clean the burner, follow the detailed procedure in section 17 of this manual

After the first season of operation inspect the heat exchanger and venting. Follow the detailed instructions in section 6 of this manual.

**CAUTION:** Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. Verify proper operation after servicing.

Any audible sounds in the equipment, like pinging, crackling or hissing are indications of scaling or lack of sufficient water flow. Under these conditions the boiler must be shut down immediately and the heat exchanger checked for damage. If the exchanger is damaged from scaling, it is not covered by warranty.

Should your equipment be subjected to fire, flood or some other unusual condition, turn off all gas and electrical supply. If you are unable to turn off the gas, call your gas company or gas supplier at once. Do not put the unit back in operation until it has been checked by a qualified agency to ensure that all controls are functioning properly.

Units that are not operated for a period of 60 days or more are considered seasonal operations. It is recommended that before returning one of these units to service, the proper operation of all controls be checked by a qualified service technician.

## 20 LIGHTING INSTRUCTIONS

1. Turn off electric power to boiler.
2. Close main manual valve and main firing valve and wait 5 minutes.
3. Set primary system controller to desired temperature.
4. Open pilot valve.
5. Turn on electric power to boiler. The electrode at the pilot should begin to spark after pre-purge is complete. The pilot valve will open to permit gas flow to the pilot.
6. There is a 15 second trial for ignition, which is enough time to light the pilot if air is not present in the pilot line. If pilot fails to light and you suspect air in the line, close the main manual valve and repeat lighting steps 1 thru 5.
7. Once the pilot lights, it should envelope the ignition rod and ground electrode. The pilot can be adjusted by removing the pilot regulator cover and turning the adjustment screw counter clockwise to decrease it or clockwise to increase it.

8. Open the main manual and main firing valves to allow gas to reach the main burner. If the main burner fails to ignite, turn the firing valve off and check to see that the pilot is burning. If not, repeat lighting procedure steps 1 thru 7.

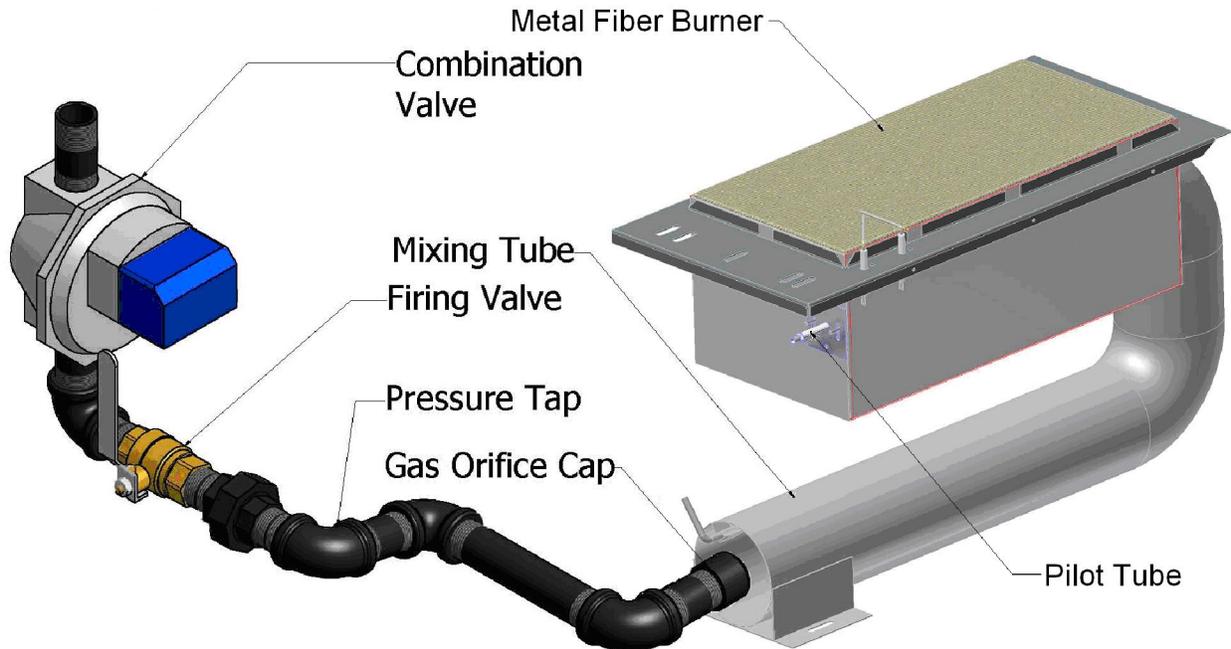
TO TURN OFF BOILER: Close main manual valve and main firing valve and turn off electric power to system.

## 21 TROUBLE SHOOTING GUIDE

SYMPTOM	SOLUTION
1. Power light is not lit when switch is flipped to "ON"	<ul style="list-style-type: none"> <li>• Check wiring to switch.</li> <li>• Check circuit breaker.</li> <li>• Check fuse.</li> </ul>
2. Water flow light remains off.	<ul style="list-style-type: none"> <li>• Verify that pump is running.</li> <li>• Check wiring to flow switch.</li> </ul>
3. Pilot sparks but does not light	<ul style="list-style-type: none"> <li>• Verify that main manual valve is open.</li> <li>• Follow lighting instructions to bleed air out of pilot line.</li> <li>• Remove main burner and inspect for moisture or dirt in pilot or in pilot line.</li> <li>• Verify that pilot is sealed to main burner base.</li> <li>• Verify that gas connections are tight.</li> </ul>
4. Pilot lights momentarily, goes out and then sparks again repeatedly	<ul style="list-style-type: none"> <li>• Observe pilot for proper flame. Adjust if necessary.</li> <li>• Check pilot flame signal. Properly set pilot to generate 1.5 <math>\mu</math>A. D.C. on average.</li> <li>• Remove main burner and ensure that igniter and ground electrodes are positioned properly. Clean with steel wool if necessary.</li> <li>• Verify that back of burner box is fully engaged into the retaining slot in the combustion chamber base.</li> </ul>
5. Pilot lights but main burner does not fire.	<ul style="list-style-type: none"> <li>• Verify that high limit is set high enough to prevent short cycling.</li> <li>• Check pilot flame signal (<math>\mu</math>A).</li> <li>• Adjust pilot pressure for steady flame</li> <li>• Remove main burner. Check position of igniter and ground electrode. Clean with steel wool if necessary.</li> </ul>
6. Main burner lights but cycles off after a few minutes	<ul style="list-style-type: none"> <li>• Verify that high limit is set high enough to prevent short cycling.</li> <li>• Adjust pilot pressure for steady flame</li> <li>• Remove main burner. Adjust pilot shield and clean ignition sensor.</li> </ul>
7. Boiler starts to whine as the temperature rise increases.	<ul style="list-style-type: none"> <li>• Verify that all air is bled from system.</li> <li>• Verify that the static pressure in cold system is at least 15 psig.</li> <li>• Check temperature rise across boiler to ensure adequate water flow.</li> <li>• If necessary, increase static water pressure and decrease gas pressure.</li> </ul>

## 22 TYPICAL GAS TRAIN

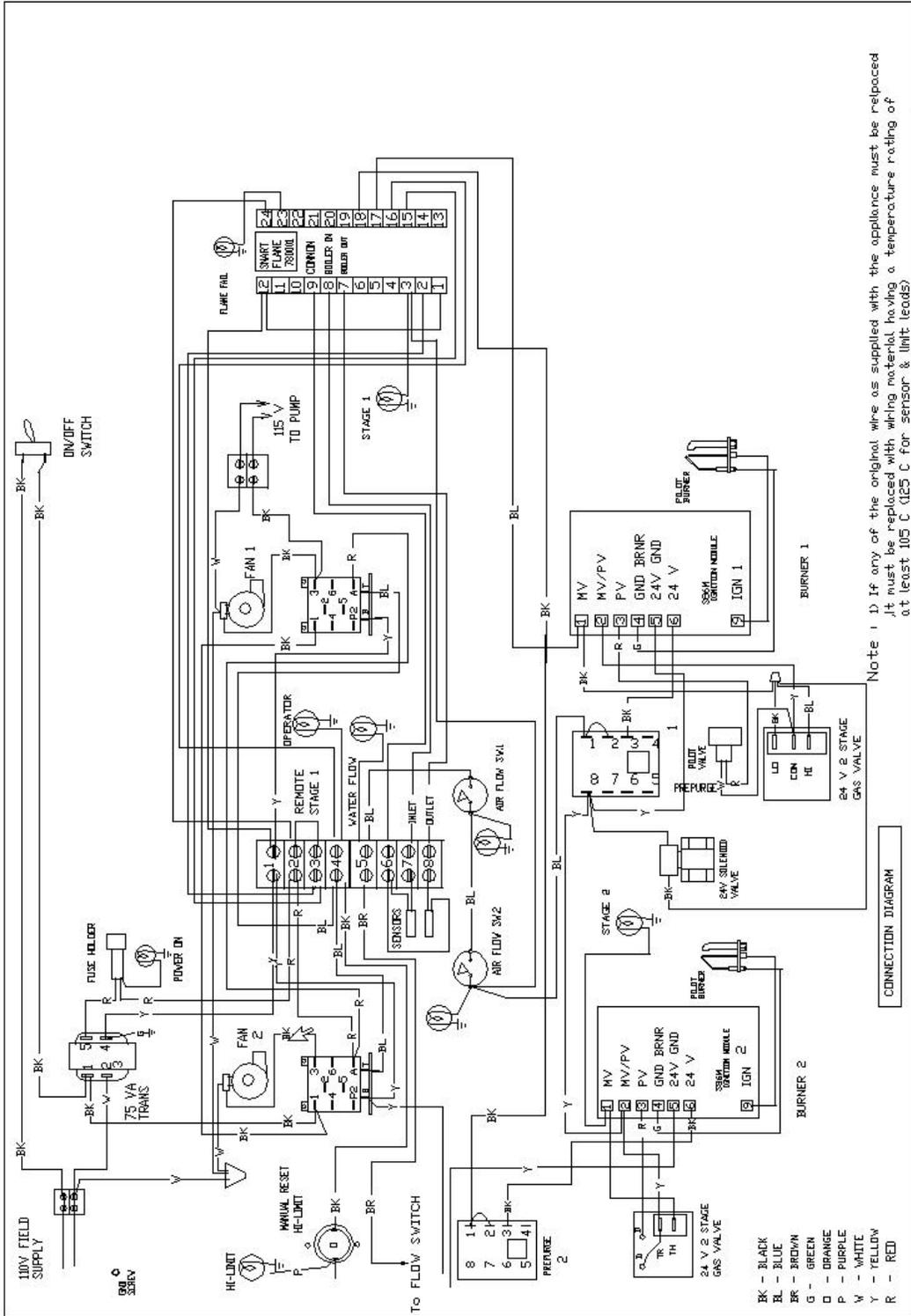
Figure 12: Gas Train



## 23 ELECTRICAL DIAGRAMS

Each MicoFlame® series 2 boiler will be provided with its own wiring diagram to guarantee that any options ordered with the unit are properly detailed.

The following diagrams 99-5072 and 99-5082 are provided as typical samples only.



**DESC:** MICROFLAME II, MODEL S 1400-2000, 2 STAGE, SMARTFLAME, CW PUMP DELAY, DHW

**DATE:** 09/24/04

**SCALE:** INTS

**DR:** C.P.

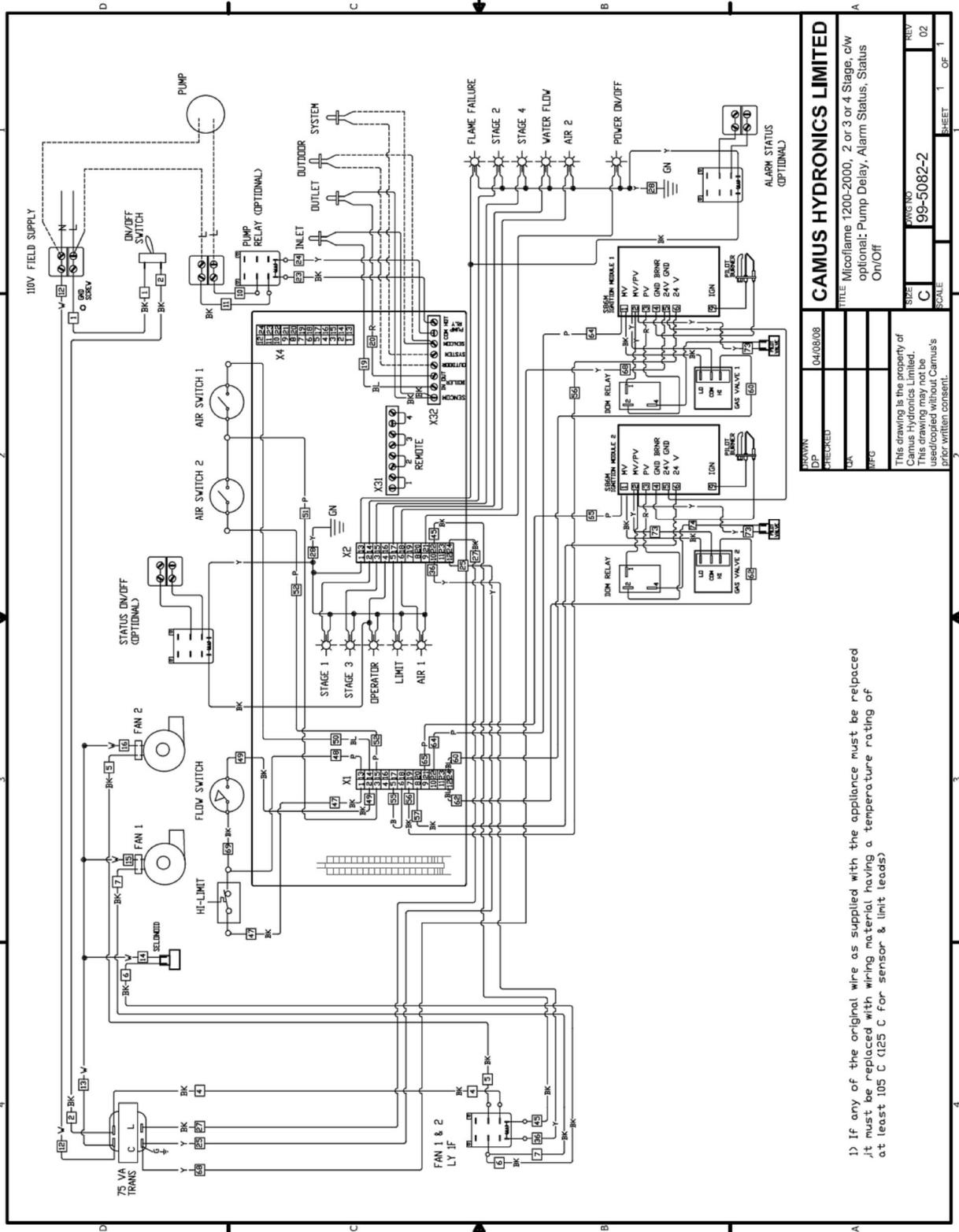
**REV:** 01

**DWG:** 99-5072-1-C

**CAMUS HYDRONICS LTD.**

**Note:** 1) If any of the original wire as supplied with the appliance must be replaced, it must be replaced with wiring material having a temperature rating of at least 105 C (125 C for sensor & limit leads)

**CONNECTION DIAGRAM**



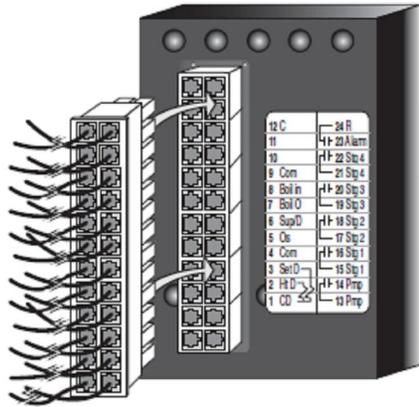
REVISED	04/08/08
DP	
FIELDWED	
UN	
DFG	
This drawing is the property of Camus Hydronics Limited. This drawing may not be used/copied without Camus's prior written consent.	
SIZE	AWG/NO
C	99-5082-2
SCALE	
SHEET	1 OF 1

**CAMUS HYDRONICS LIMITED**

TITLE Micollame 1200-2000, 2 or 3 or 4 Stage, c/w optional: Pump Delay, Alarm Status, Status On/Off

1) If any of the original wire as supplied with the appliance must be replaced, it must be replaced with wiring material having a temperature rating of at least 105 C (125 C for sensor & limit leads)

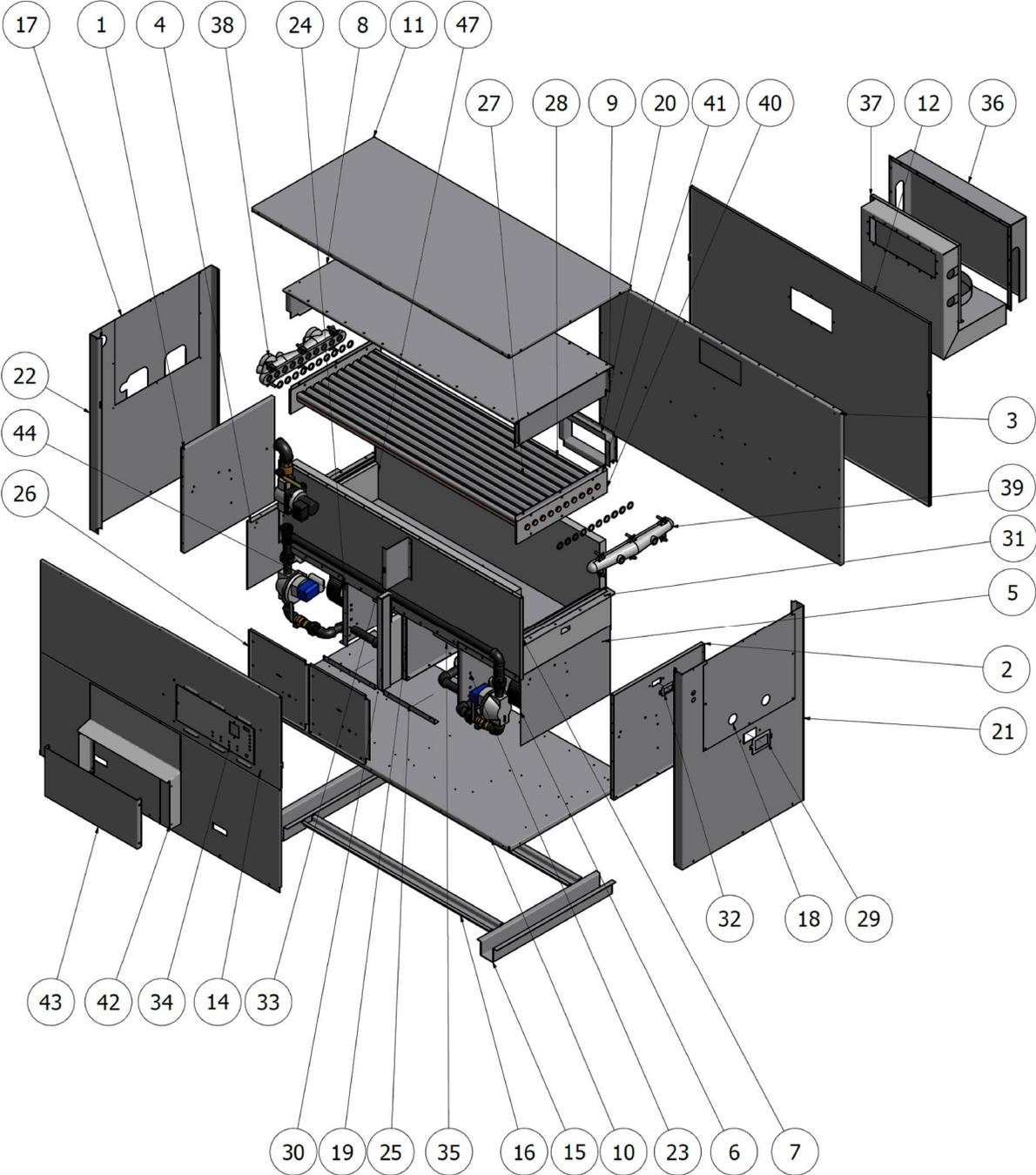
## Tekmar BTC-4PA Electrical Connections



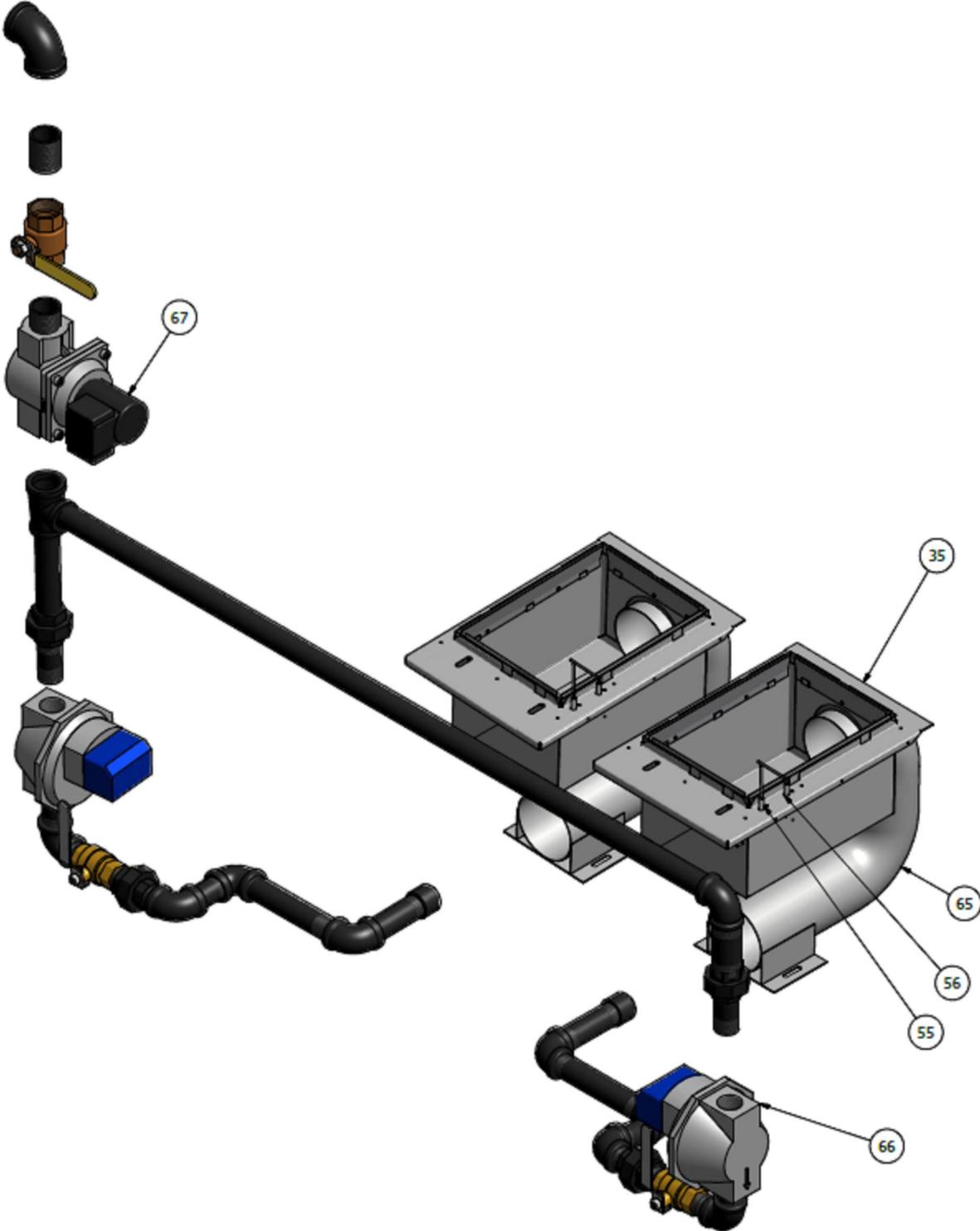
12C	24R
11	23Alarm
10 +Vdc	22 Stg 4
9 Com(-)	21 Stg 4
8 Boil in	20 Stg 3
7 Boil O	19 Stg 3
6 Sys/D	18 Stg 2
5 Outdr	17 Stg 2
4 Com	16 Stg 1
3 Pr D	15 Stg 1
2 Ht D	14 Pmp
1 CD	13 Pmp

Tekmar BTC-4PA		
Terminal #	Label	Description
1	CD	Unused
2	HtD	Call for heat signal
3	Pr D	Proof Demand to signal pilot is active
4	Com	Common terminal for Outdoor, System and/or DHW sensors
5	Outdr	10kΩ outdoor sensor
6	Sys/D	10kΩ system or DHW sensor
7	Boil O	10kΩ boiler outlet sensor
8	Boil in	10kΩ boiler inlet sensor
9	Com	Common terminal for boiler outlet and inlet sensor
10	+Vdc	+Vdc for Modes 6, 7 for setpoint input
11	--	Unused
12	C	24Vac return for Tekmar BTC
13	Pmp	Normally open pump contacts, closes on a call for heat
14	Pmp	
15	Stg 1	Stage 1 burner contacts
16	Stg 1	
17	Stg 2	Stage 2 burner contacts
18	Stg 2	
19	Stg 3	Stage 3 burner contacts
20	Stg 3	
21	Stg 4	Stage 4 burner contacts
22	Stg 4	
23	Alarm	Alarm signal, closes in the event of a fault (24Vac)
24	R	24vac supply for Tekmar BTC

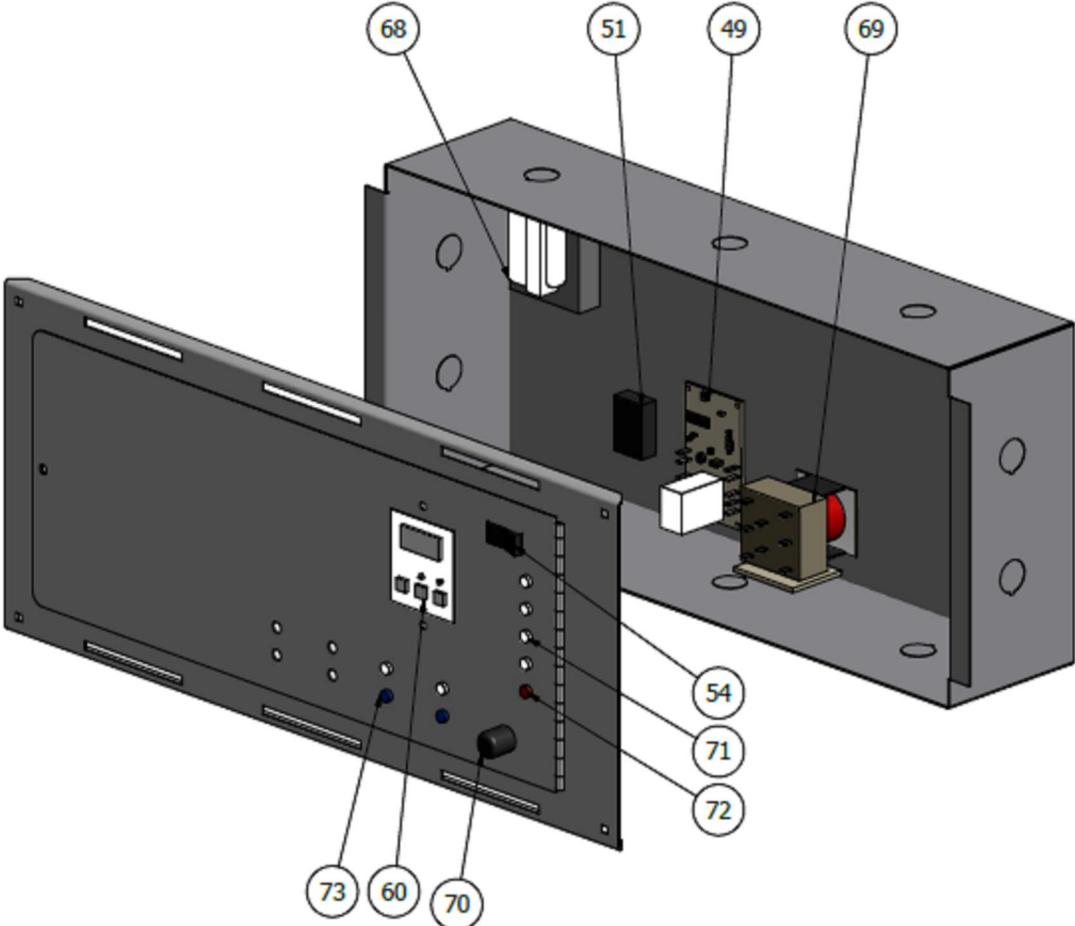
**24 EXPLODED VIEW**



MicoFlame® II Gas Train



MicoFlame® II 800 – 1000 Control Box



## 25 MICO FLAME REPLACEMENT PARTS LIST

		<b>MicoFlame® II Model Size</b>							
<b>Item #</b>	<b>Part Description</b>	<b>800</b>	<b>1000</b>	<b>1200</b>	<b>1400</b>	<b>1600</b>	<b>1800</b>	<b>2000</b>	
1	Combustion Chamber End Panel - Left	14-4100							
2	Combustion Chamber End Panel - Right	14-4101-08-10			14-4101-12-20				
3	Combustion Chamber Rear Panel- <b>Non Condensing</b>	14-4102-08	14-4102-10	14-4102-12	14-4102-14	14-4102-16	14-4102-18	14-4102-20	
	Combustion Chamber Rear Panel- <b>Condensing</b>	14-4102-08-51	14-4102-10-51	14-4102-12-51	14-4102-14-51	14-4102-16-51	14-4102-18-51	14-4102-20-51	
4	Combustion Chamber Support - Left	14-4103							
5	Combustion Chamber Support - Right	14-4104-08-10			14-4104-12-20				
6	Combustion Chamber Base Panel	14-4105-08	14-4105-10	14-4105-12	14-4105-14	14-4105-16	14-4105-18	14-4105-20	
7	Combustion Chamber Upper Front Panel	14-4106-08	14-4106-10	14-4106-12	14-4106-14	14-4106-16	14-4106-18	14-4106-20	
8	Flue Collector Top	14-4107-08	14-4107-10	14-4107-12	14-4107-14	14-4107-16	14-4107-18	14-4107-20	
9	Flue Collector End Bracket	14-4108							
10	Base Panel	14-4109-08	14-4109-10	14-4109-12	14-4109-14	14-4109-16	14-4109-18	14-4109-20	
11	Outer Jacket Top Cover	14-4110-08	14-4110-10	14-4110-12	14-4110-14	14-4110-16	14-4110-18	14-4110-20	
*12	Outer Jacket Back Panel- <b>Condensing</b>	14-4111-08-51	14-4111-10-51	14-4111-12-51	14-4111-14-51	14-4111-16-51	14-4111-18-51	14-4111-20-51	
	Outer Jacket Back Panel- <b>Non Condensing/Outdoor</b>	14-4111-08-61	14-4111-10-61	14-4111-12-61	14-4111-14-61	14-4111-16-61	14-4111-18-61	14-4111-20-61	
13	Outer Jacket Lower Front Panel ( <b>2 Required Per Unit</b> )	14-4112-08	14-4112-10	14-4112-12	14-4112-14	14-4112-16	14-4112-18	14-4112-20	
14	Outer Jacket Upper Front Panel	14-4113-08	14-4113-10	14-4113-12	14-4113-14	14-4113-16	14-4113-18	14-4113-20	
15	Leg	14-4114							
16	Stiffener	14-4115-08	14-4115-10	14-4115-12	14-4115-14	14-4115-16	14-4115-18	14-4115-20	
17	Inlet Outlet Side Access Panel	14-4116							
18	Return Side Access Panel	14-4117							

Item #	Part Description	MicoFlame® II Model Size						
		800	1000	1200	1400	1600	1800	2000
19	Combustion Chamber Support - Centre	N/A		14-4118-12-20				
*20	Flue Collector Outlet- <b>Non Condensing</b>	14-4119-08-10		14-4119-12-16			14-4119-18-20	
	Flue Collector Outlet- <b>Condensing</b>	14-4120-08-10-51		14-4120-12-20-51				
21	Outer Jacket Side Panel - Right	14-4131						
22	Outer Jacket Side Panel - Left	14-4132						
23	Fan Mounting Support - Right	N/A		14-4133				
24	Fan Mounting Support - Left	14-4139						
25	Burner Door Stop	14-4134-08	14-4134-10	14-4134-12	14-4134-14	14-4134-16	14-4134-18	14-4134-20
26	Burner Door	14-4140-08	14-4140-10	14-4140-12	14-4140-14	14-4140-16	14-4140-18	14-4140-20
27	V Baffles ( <b>800-1200 9 Required per Unit, 1400-2000 18 Required per Unit</b> )	14-4141-08	14-4141-10	14-4141-12	14-4141-14	14-4141-16	14-4141-18	14-4141-20
28	HX Front and Back Baffles ( <b>2 Required per Unit, 1 front and 1 back</b> )	14-4142-08	14-4142-10	14-4142-12	14-4142-14	14-4142-16	14-4142-18	14-4142-20
29	Outer Jacket Sight Glass Frame	14-4151						
30	Outer Jacket Door Jam	14-4152						
31	Heat Exchanger Support Weldment ( <b>2 Required Per Unit</b> )	14-4153						
32	Inner Jacket Sight Glass Frame	14-4154						
33	Outer Jacket Top Panel Support	14-4155						
34	Control Panel Assembly	14-4160						
35	Two Tile Burner Box Assembly	N/A		14-4125-02			N/A	
	Three Tile Burner Box Assembly	14-4125-03						
36	Economizer Cover	14-4146-08-10		14-4146-18-20			14-4165-01	
37	Economizer Assembly	14-4148-03		14-4166-01				
38	Inlet/Outlet Header	15-5004						

Item #	Part Description	MicoFlame® II Model Size						
		800	1000	1200	1400	1600	1800	2000
39	Return Header	15-5005						
40	Header Bar	15-4157						
41	Header Bar Stop (2 Required Per Unit)	14-4138						
42	Control Panel Outer Cover	14-4171						
43	Control Panel Outer Cover Door	14-4172						
44	Blower Assembly	55-0001						
45	Ignition Module Continuous	S8610M3017						
46	Ignition Module Single Try	S8610043010						
47	Refractory Set	800-RFRS	1000-RFRS	1200-RFRS	1400-RFRS	1600-RFRS	1800-RFRS	2000-RFRS
48	Donut Gasket	CH010						
49	Pre-Purge Card	TTMOR24A1X7						
50	30 Second Delay on Make	24-IMS24AaX30						
51	Pump Delay Relay	LY1F24VAC						
52	Pilot Solenoid	CV100B6N-22-0001						
53	Red Strip Gasket	Red Silicone Sponge Gasket						
54	On/Off Switch	ESWRB141D1121/ACC-F						
55	Igniter	PSE-CH8						
56	Flame Sensor	PSE-CH7						
*57	Ceramic Pilot Assembly (NG)	66-0107						
	Mesh Pilot Assembly (NG)	66-5013						
*58	Ceramic Pilot Assembly (LP)	66-0108						
	Mesh Pilot Assembly (LP)	66-5014						

Item #	Part Description	MicoFlame® II Model Size						
		800	1000	1200	1400	1600	1800	2000
59	Ignitor Module (Continuous)	S8610M3017						
	Ignitor Module (Single Try)	S8600112010						
60	Tekmar Controller (STG)	BTC4PA						
61	Air Switch	IS3010106-5769A						
62	Low Gas Switch <b>(Not Shown in Exploded View, in Boiler Price Book)</b>	C6097A1012						
63	High Gas Switch <b>(Not Shown in Exploded View, in Boiler Price Book)</b>	C6097B1028						
64	115/24V AC Transformer	HCT-01J28807						
65	Mixing Tube <b>(2 Required per Unit)</b>	MF1-GMTM-04-CH						
66	Gas Valve (left)	V8944B1092	V8944B1100	V8944B1092	V8944B1092	V8944B1092	V8944B1092	V8944B1100
	Gas Valve (right)	N/A	N/A	V8944B1092	V8944B1092	V8944B1100	V8944B1092	V8944B1100
67	Solenoid Valve (left)	K3A462U	V4295A1049				V4295A1056	
68	Transformer	HCT-01J2BB07						
69	Fan Manager	ST82D1004						
70	Breaker (4 AMP)	W28-XQ1A-4						
71	White Indicator LED	LXR5010UW42149						
72	Red Indicator LED	LXR5010UB28230						
73	Blue Indicator LED	LXR5010S128230						



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