

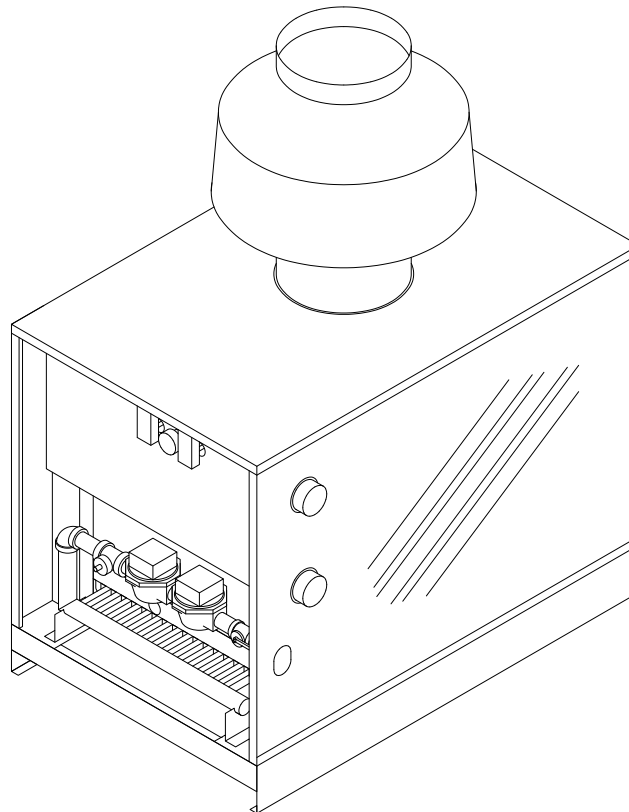


INSTALLATION AND SERVICE MANUAL

AAE SERIES GAS BOILERS

FOR MODELS AAE-480 TO AAE-3000
Featuring the BC-1 Controller on 1 & 2 stage models

See rear cover for Index



WARNING

Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury, or loss of life. Please carefully read this manual. For assistance or additional information, consult a qualified installer, service agency or the gas supplier.

Manufactured by

Allied Engineering Company

Division of E-Z-Rect Manufacturing Ltd.

Manufacturers of Gas and Electric Boilers, Stainless Steel Tanks, Heat Exchangers and Electric Boosters

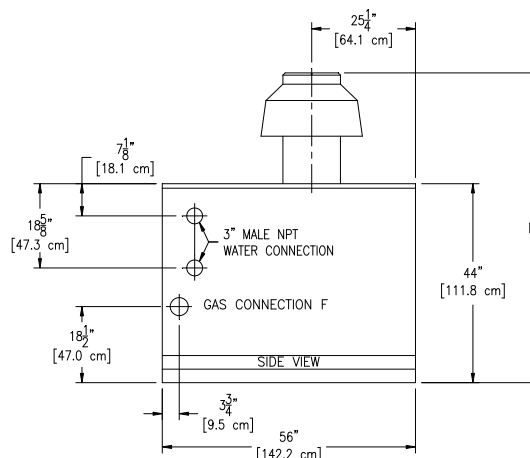
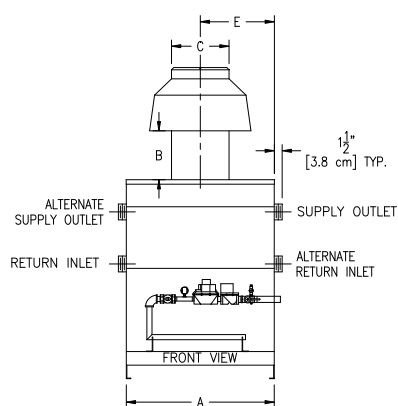
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AAE SERIES GAS BOILERS

DIMENSIONS AND SPECIFICATIONS



Standard Model Includes:

- Electronic Ignition
- Stainless Steel Burners
- Gas Valve
- Redundant Gas Valve
- BC-1 Microcontroller (single and two stage models only)
- Operating Aquastat
- Safety High Limit Aquastat
- Temperature / Pressure Gauge
- A.S.M.E. Pressure Relief Valve 30 p.s.i.
- Drain Valve
- Draft Hood
- Transformer
- Control Panel Enclosure
- Main On/Off Switch with Indicator Light

The Super Hot product improvement program may result in changes to the design and/or specifications being made without notice.

MODEL NUMBER	INPUT*		OUTPUT			DIM A**		DIM B		DIM C		DIM D		DIM E ***		GAS CONN F	WATER CONTENT		SHIPPING WEIGHT	
	MBH	kW	MBH	kW	H.P.	in	cm	in	cm	in	cm	in	cm	in	cm	Typical NPT	U.S. GAL.	L	lb	Kg
AAE480	480	141	384	113	11.5	24	61.0	10.5	26.7	10	25.4	68.9	175.0	12.0	30.5	1"	5.56	21.0	675	307
AAE600	600	176	480	141	14.3	27	68.6	10.5	26.7	10	25.4	68.9	175.0	13.5	34.3	1"	6.75	25.5	725	330
AAE720	720	211	576	169	17.2	30	76.2	10.5	26.7	12	30.5	71.2	181.0	15.0	38.1	1"	7.95	30.1	790	359
AAE840	840	246	672	197	20.1	33	83.8	10.5	26.7	14	35.6	72.9	185.1	16.5	41.9	1"	9.14	34.6	860	391
AAE960	960	281	768	225	22.9	36	91.4	10.5	26.7	14	35.6	72.9	185.1	18.0	45.7	1 1/4"	10.34	39.1	940	427
AAE1080	1080	317	864	253	25.8	39	99.0	10.5	26.7	16	40.6	76.0	193.0	19.5	49.5	1 1/4"	11.53	43.6	990	450
AAE1200	1200	352	960	281	28.7	42	106.7	10.5	26.7	16	40.6	76.0	193.0	21.0	53.3	1 1/4"	12.73	48.2	1050	477
AAE1320	1320	387	1056	310	31.5	45	114.3	10.5	26.7	18	45.7	77.3	196.3	22.5	57.2	1 1/4"	13.92	52.7	1140	518
AAE1440	1440	422	1152	338	34.4	48	121.9	10.5	26.7	18	45.7	77.3	196.3	24.0	61.0	1 1/4"	15.12	57.2	1205	548
AAE1560	1560	457	1248	366	37.3	51	129.5	10.5	26.7	18	45.7	77.3	196.3	25.5	64.8	1 1/4"	16.31	61.7	1270	577
AAE1680	1680	492	1344	394	40.1	54	137.2	10.5	26.7	20	50.8	78.7	199.9	27.0	68.6	1 1/2"	17.51	66.3	1350	614
AAE1800	1800	528	1440	422	43.0	57	144.8	10.5	26.7	22	55.9	80.7	205.0	28.5	72.4	1 1/2"	18.70	70.8	1440	655
AAE1920	1920	563	1536	450	45.9	60	152.4	10.5	26.7	22	55.9	80.7	205.0	30.0	76.2	1 1/2"	19.90	75.3	1520	691
AAE2040	2040	598	1632	478	48.7	63	160.0	10.5	26.7	24	61.0	82.6	209.8	31.5	80.0	1 1/2"	21.09	79.8	1605	730
AAE2160	2160	634	1728	506	51.6	66	167.6	10.5	26.7	24	61.0	82.6	209.8	33.0	83.8	1 1/2"	22.28	84.3	1645	748
AAE2280	2280	669	1824	535	54.5	69	175.2	10.5	26.7	24	61.0	82.6	209.8	34.5	87.6	1 1/2"	23.48	88.9	1690	768
AAE2400	2400	703	1920	563	57.3	72	182.9	10.5	26.7	24	61.0	82.6	209.8	36.0	91.4	1 1/2"	24.67	93.4	1770	805
AAE2495	2495	731	1996	584	59.6	75	190.5	12.0	30.5	2x18	2x45.7	78.8	200.2	2x18.25	2x46.4	2"	25.87	97.9	1850	841
AAE2640	2640	774	2112	619	63.1	78	198.1	12.0	30.5	2x18	2x45.7	78.8	200.2	2x19.75	2x50.2	2"	27.06	102.4	1890	859
AAE2760	2760	809	2208	647	65.9	81	205.7	12.0	30.5	2x18	2x45.7	78.8	200.2	2x20.25	2x51.4	2"	28.26	107.0	1935	880
AAE2880	2880	845	2304	675	68.8	84	213.4	12.0	30.5	2x18	2x45.7	78.8	200.2	2x21.00	2x53.3	2"	29.45	111.5	1975	898
AAE3000	3000	880	2400	703	71.7	87	221.0	12.0	30.5	2x18	2x45.7	78.8	200.2	2x21.75	2x55.3	2"	30.65	116.0	2020	918

* For Propane models derate Input 10%.

* In Canada: For altitudes above 2,000 feet, contact the factory for the appropriate Input derate.

* In U.S.A.: For altitudes above 2,000 feet, reduce input 4% for each 1000 feet above sea level.

** Add 3" to dimension 'A' (1 1/2" to each side of boiler) to allow for 3" NPT water connections.

*** AAE2495 and above use dual draft hoods and Dimension "E" is measured from both left and right hand sides.

Options:

- Natural Gas models add suffix "N" - Propane models add suffix "P"
- Electronic Ignition add suffix "E"
- High/Low fire add suffix "M" - Full Modulation add suffix "MOD"



Boiler Water Flow Data

NOTE: The boiler should be properly sized for its heating application and maintain an adequate water flow rate during operation. Significantly oversizing the boiler or decreasing boiler water flow rate will cause excessive stage cycling and may result in premature failure of components.

Typical Water Flow Versus Pressure Drop Across Boiler

Model Number	20°F T.D.		30°F T.D.	
	U.S. GPM	P.D. FT.	U.S. GPM	P.D. FT.
AAE480	38.4	3.0	25.6	1.35
AAE600	47.9	3.0	32.0	1.35
AAE720	57.5	3.0	38.3	1.35
AAE840	67.1	3.0	44.7	1.35
AAE960	76.1	3.0	51.1	1.35
AAE1080	86.3	3.0	57.5	1.35
AAE1200	95.9	3.0	63.9	1.35
AAE1320	105	3.0	70.3	1.35
AAE1440	115	3.0	76.7	1.35
AAE1560	125	3.0	83.1	1.35
AAE1680	134	3.0	89.5	1.35
AAE1800	144	3.3	95.9	1.35
AAE1920	153	3.3	102	1.5
AAE2040	163	3.5	109	1.6
AAE2160	172	3.5	116	1.6
AAE2280	182	3.8	121	1.7
AAE2400	191	3.8	127	1.7
AAE2495	201	3.8	134	1.7
AAE2640	211	3.8	140	1.7
AAE2760	221	3.8	147	1.7
AAE2880	230	3.8	153	1.7
AAE3000	240	3.8	160	1.7



ABOUT OUR MANUALS

Your *Super Hot* boiler has been provided with the following manuals:

- *User's Information Manual* - This manual is intended for the **owner or user** of the boiler and provides information on routine operation and maintenance, and emergency shutdown.
- *Installation and Service Manual* - This manual must only be used by a **qualified heating installer, service technician or gas supplier**. Installation or service by anyone unqualified to do so may result in severe personal injury, death or substantial property damage.
- *BC-1 Controller Manual* - This manual must only be used by a **qualified heating installer or service technician**. BC-1 Controller Manual contains detailed information on controller operation applicable to single stage and two stage AAE boilers.

All manuals should be kept in the envelope provided and affixed adjacent to the boiler so that they are readily available for future reference.

Lighting Instructions

Section 1

1.1 SAFETY INSTRUCTIONS

WARNING

If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

- | | |
|--|--|
| <p>A. BEFORE LIGHTING smell all around the boiler area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.</p> <p>WHAT TO DO IF YOU SMELL GAS</p> <ul style="list-style-type: none"> • Do not try to light any appliance. • Do not touch any electrical switch; do not use any phone in your building. • Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions. • If you cannot reach your gas supplier, call the fire department. | <p>B. Use only your hand to push in or turn the gas control knob. Never use tools. If the knob will not push in or turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.</p> <p>C. Do not use this boiler if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.</p> |
|--|--|

1.2 LIGHTING INSTRUCTIONS

Your boiler is equipped with an intermittent electronic ignition system which will automatically light a pilot burner. After the module senses the pilot flame, the main gas valve and redundant valve will open, allowing the pilot burner to ignite the main burner. The following section provides instructions for lighting the boiler.



1.3 LIGHTING INSTRUCTIONS FOR INTERMITTENT ELECTRONIC IGNITION WITH NON-COMBINATION GAS VALVE

This boiler is equipped with an ignition device, which automatically lights the pilot. Do not try to light the pilot by hand. Before turning on the electrical power switch, be sure all gas supply lines are purged of air and power supply to control is the correct voltage.

If the pilot or main burners are not lit or the control system is locked-out due to flame failure, close the main and pilot gas shut-off valves and call your service technician or gas supplier. If you smell gas, STOP! Follow "A" in the safety instructions in *Section 1.1*.

Check Control Operation

1. STOP! Read the safety instructions in *Section 1.1*.
2. For 100% shut off check, close main and pilot manual gas shut off valves, turn off all electric power to the boiler and wait for five minutes to clear out any gas.
3. Then smell for gas, including near the floor. If you smell gas, STOP! Follow safety instructions in *Section 1.1*. If you don't smell gas, go to the next step.
4. Set the thermostat above room temperature and turn on all electric power to the boiler to energize the electronic ignition and pilot valve. After a few seconds, control system should "lockout" and all functions are off.
5. To take the control system out of "lockout" either press the reset button or interrupt power to the boiler, depending on the boiler controller. Some controllers will retry ignition automatically after 5 minutes lockout.

Start System

1. Turn on the main and pilot manual gas shut-off valves.
2. Set thermostat above room temperature and turn on all electrical power to the boiler.
3. Once the pilot flame is proven, the controller opens the main burner gas valves. The pilot flame will ignite the gas as it exits the main burner ports.
4. Set thermostat to the desired setting to put system back in service.

Relight Operation

Five minutes complete shut off period is required before attempting to relight the boiler. To relight the boiler, follow the Start System procedure (above).

To turn off gas to boiler or emergency shut-off

Follow *Section 1.4*

1.4 TO TURN OFF GAS TO THE BOILER OR EMERGENCY SHUT-OFF

WARNING

Should boiler overheat, or the gas supply fail to shut off, do not turn off or disconnect the electrical supply to the circulating pump. Instead, shut off the gas supply at a location external to the boiler.

1. Set the thermostat to the lowest setting.
2. Turn all electrical power to the boiler off.
3. Remove control access panel on the boiler if necessary.
4. Close the main and pilot manual gas shut off valves. The valve is "OFF" when handle is perpendicular to the direction of gas flow.
5. Replace control access panel if necessary.



Installation Instructions

Section 2

2.1 RECEIVING

INSPECT SHIPMENT FOR POSSIBLE DAMAGE. All goods are carefully manufactured, inspected, checked and packed by experienced workers. The manufacturer's responsibility ceases upon delivery of goods to the carrier in good condition. Any claims for damage, shortage in shipment or non-delivery must be filed immediately against the carrier by the consignee.

Use care when receiving and unpacking the boiler. Dropping the boiler may cause damage and prevent safe and proper operation.

2.2 INSTALLATION CODES AND REQUIREMENTS

All applicable national, provincial/state, and local codes, laws, regulations, and ordinances must be followed. They expand on and take precedence over any recommendations in this booklet. Authorities having jurisdiction shall be consulted before installations are made.

In **Canada**, the installation must conform to the requirements of the authority having jurisdiction or, in the absence of such requirements, to the *CAN/CSA B149 Installation Codes* (current edition). All electrical wiring must be in accordance with the *Canadian Electrical Code, CSA C22.1 Part 1* (current edition) and applicable local codes.

In the **United States of America**, the installation must conform to the requirements of the authority having jurisdiction or, in the absence of such requirements, to the *National Fuel Gas Code, ANSI Z223.1* (current edition). All electrical wiring must be in accordance with the *National Electrical Code, ANSI/NFPA 70* (current edition) and applicable local codes.

Where required by the authority having jurisdiction, follow the *Standard for Controls and Safety Devices for Automatically Fired Boilers, ANSI/ASME CSD-1* (current edition).

2.3 LOCATION

AAE boilers are intended for indoor installation only. Observe the following minimum clearances from the boiler to combustible materials:

Clearances to Combustible Materials								
Model	Sides		Rear		Top		Front (service)	
	in	mm	in	mm	in	mm	in	mm
AAE	6	153	6	153	36	915	40	1016

- Maintain a clearance of 6" (153 mm) from draft hood and the flue pipe in any direction.
- Allow ample space for boiler inlet and outlet connections, and gas connection.
- Boiler must be installed on a stable and level foundation.
- AAE Series boilers must be installed on a Non-Combustible floor.
- **A hot water boiler installed above radiation level must be provided with a low water cutoff device at the time of boiler installation.**
- This boiler must be installed such that gas ignition system components are protected from water (dripping, spraying, rain, etc.) during appliance operation and service.



2.4 GAS SERVICE PIPING

The boiler and its gas connection must be leak tested before placing the boiler in operation. The gas controls furnished are suitable for a maximum operating gas pressure of 1/2 psi (14 inches water column).

The boiler and its individual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of 1/2 psig (14 inches water column).

The boiler must be isolated from the gas supply piping system by closing its individual manual shutoff valve during any pressure testing at test pressures equal to or less than 1/2 psig (14 inches water column).

A manual main shut-off valve should be installed in the gas line outside the boiler jacket and as required in *Section 2.2*. The valve should be readily accessible for turning on and off.

A drip pocket or sediment trap should be installed in the gas supply line upstream of the gas controls and as close to the boiler as possible (example shown in Figure 7 in *Section 6*).

Some pressure regulators or pressure regulating sections of gas valves are provided with an integral vent limiter and threaded connection. A bleed or gas relief line should be connected to it and piped to the outdoors.

The pipe compound used should be resistant to the action of liquefied petroleum gases. Check for gas leaks in piping before placing the boiler in operation by using a soap and water solution. **DO NOT USE AN OPEN FLAME.**

INSTALLER MUST IDENTIFY EMERGENCY SHUT-OFF DEVICES.

All piping and fittings must be installed as per codes in *Section 2.2*.

2.5 AIR SUPPLY FOR COMBUSTION AND VENTILATION

A sufficient air supply **MUST** be provided to this boiler. Air openings to the boiler room provide the air for combustion, flue gas dilution and ventilation and are always required, regardless whether the air is taken from inside or outside. The air opening size and location (as well as other air supply and venting considerations) must conform to *Section 2.2*.

The boiler room must never be under a negative pressure. Always provide air openings sized not only to the dimensions required for the total input of all fuel-fired appliances in the boiler space, but also to handle the air movement rate of any **exhaust fans** or **air movers** using air from the building or space.

The venting terminations must always be kept clear of obstructions (i.e. snow, ice, etc.). Louvers and grilles used in the air supply and ventilation system should be kept clear of any dust, dirt, or debris which will block proper air flow.

2.6 CORROSIVE ATMOSPHERES

If a gas boiler is to be installed near a corrosive or potentially corrosive air supply, the boiler should be isolated from it and outside air should be supplied as recommended in *Section 2.5*.

Chemical vapors from products containing **chlorine** or **fluorine** must be avoided. Even though these chemicals may be safe to breathe, corrosive substances can become liberated when passed through a gas flame. Even at low concentrations, these chemicals can significantly contaminate the air supply and shorten the life of any gas burning appliance. The following is a list of some of the products which should be avoided:

- bleaches and chlorinated cleaning products
- paints and sprays
- water softeners (calcium or sodium chloride)
- leaking refrigeration equipment
- freon from common aerosol dispensers

These chemicals are especially common near swimming pools, beauty shops, dry cleaning establishments, laundry areas, workshops, and garages. **The warranty is void when failure is due to corrosion.**



2.7 VENTING

The responsibility of providing a suitable vent of adequate draft capacity and in good usable condition is that of the gas fitter/installer. Interference with the air supply for the boiler shall be prohibited.

Vent installation and type of gas vent or vent connector MUST follow all applicable national, provincial/state, and local codes, laws, regulations, and ordinances as described in *Section 2.2*.

For boilers for connection to gas vents or chimneys, vent installations shall be in accordance with Part 7, Venting of Equipment, of the National Fuel Gas Code, ANSI Z223.1 or Section 7, Venting Systems and Air Supply for Appliances, of the CAN/CGA B149, Installation Codes, or applicable provisions of the local building codes.

The venting shall be supported as required by applicable code(s). Horizontal runs shall slope upward not less than ¼ inch per foot (21 mm/m) from the boiler to the vent terminal.

This unit must be installed with the factory supplied draft hood in place. The draft hood is a safety device designed to control chimney drafts that might affect combustion or blow out the pilot. The draft hood supplied with the boiler must not be altered. The minimum skirt height as indicated on the draft hood must be maintained.

Vent connectors serving the boiler must not be connected into any portion of mechanical draft systems operating under positive pressure.

Vent Terminal Information

The minimum distance from the termination of a vent terminal to adjacent public walkways, adjacent buildings, operable windows and building openings shall be not less than those values specified in the *National Fuel Gas Code, ANSI Z223.1* and/or *CAN/CGA Installation Codes*.

For proper operation, the vent terminal must be kept free of snow and other debris at all times.

To prevent discoloration and degradation of building materials by flue gases and flue gas condensation, ensure that the vent terminal is installed clear of nearby obstacles. In all cases, installation shall be in accordance with code.

Maintain a minimum clearance of 4 feet (1.22 m) horizontally, and in no case above or below, unless a 4 foot (1.22 m) clearance is maintained from electric meters, gas meters, regulators and relief equipment.

Removal of an Existing Boiler

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 connected to it.

At the time of removal of an existing boiler, the following steps shall 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 there is no blockage or restriction, leakage, corrosion and other deficiencies 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 clothes dryers and any appliance 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 boiler being inspected. Follow the lighting instructions. Adjust the thermostat so the boiler will operate continuously.
- e) Test for spillage at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, cigar or pipe.



- 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 conditions of use.
- g) Any improper operation of the common venting system should be corrected so the installation conforms with the *National Fuel Gas Code, ANSI Z223.1* and/or *CAN/CGA Installation Codes*. When re-sizing 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 *National Fuel Gas Code, ANSI Z223.1* and/or *CAN/CGA Installation Codes*.

2.8 BOILER PIPING SYSTEM

The boiler piping system of a hot water boiler connected to heating coils located in air handling units where they may be exposed to refrigerated air circulation must be equipped with flow control valves or other automatic means to prevent gravity circulation of the boiler water during the cooling cycle.

The boiler, when used in connection with a refrigeration system, must be installed so the chilled medium is piped in parallel with the boiler with appropriate valves to prevent the chilled medium from entering the boiler.

2.9 CORROSION PREVENTION (INTERNAL)

The use of oxygen barrier tubing is recommended to protect the system and its components (e.g. pump) from corrosion. Should your system include "non-oxygen barrier" tubing please contact the factory or a heating professional for recommendations.

If freeze protection is required, use an inhibited propylene glycol solution which is specifically designed for hydronic heating systems and always maintained at a neutral pH (e.g. Fernox Alphi-11 or equivalent). Follow the supplier's instructions for proper use and maintenance. Do not use automotive antifreeze.

Some types of chemical additives can cause problems such as accelerated corrosion and result in premature failure of the boiler heat exchanger and/or system components, especially when not properly used or maintained. Corrosion is a preventable condition and is not covered by the product warranty.

2.10 SYSTEM OPERATING REQUIREMENTS

WARNING

If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

Avoid unnecessary replenishment of system water. It can allow oxygen to enter the system and cause serious corrosion problems. As well, minerals dissolved in the water supply will precipitate when heated; minerals preferentially deposit in the heat exchanger. Do not draw water from the heating system for cleaning, flushing, etc.

Super Hot AAE series boilers are designed for use in closed loop systems and are not intended for open systems, as in heating pool water or systems where water is constantly replenished. Operating the boiler in an open system will result in premature failure of the heat exchanger. Super Hot boilers may be used to heat water in open systems indirectly by installing a heat exchanger, such as the Super Hot C-Coil, to separate open and closed systems.

Heating systems with low temperature return water may cause flue gas moisture to condense on the boiler heat transfer surfaces, causing corrosion and restricting flue gas flow. Also, low temperature return water may overcool the flue gases, resulting in reduced vent suction. These are natural phenomena and are independent of the boiler design. As a guide to avoiding such corrosion and draft problems, it is imperative that the return water be not less than 135°F (57°C).

AAE SERIES BOILERS MUST ALWAYS BE USED WITH FORCED SYSTEM CIRCULATION.



2.11 PRESSURE RELIEF VALVE

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

The pressure relief valve should be installed on the boiler outlet with its spindle vertical. The connection between the boiler and the relief valve must have at least the area of the valve inlet.

A discharge pipe should be used. The discharge pipe outlet should be positioned over a suitable drain and so arranged that there will be no danger of being scalded. The discharge pipe must pitch down from the pressure relief valve and should be no smaller than the outlet of the valve. The end of the discharge pipe should not be concealed or threaded and should be protected from freezing. Extensive runs, traps or bends could reduce the capacity of the pressure relief valve.

No valve of any type should be installed between the pressure relief valve and unit or in the discharge pipe. The pressure relief valve is a code requirement. Field installation of the relief valve must be consistent with the ANSI/ASME Boiler and Pressure Vessel Code, Section IV.

Avoid contact with the hot water discharged to prevent personal injury.

2.12 ELECTRICAL WIRING

WARNING

Risk of electric shock. This boiler may be connected to more than one electrical circuit. Turn off all electric power supply circuits at the electrical service panel or supply source. Failure to do so may result in severe personal injury or death.

All electrical wiring must conform to the requirements in *Section 2.2*.

Run a separate circuit from the electrical service panel through a fused disconnect switch to the boiler. This 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* (current edition) and and/or the *Canadian Electrical Code, CSA C22.1 Part 1* (current edition). Field wiring shall conform to *Section 2.2* and to the temperature limitations of Type T [63°F (35°C) rise] or better.

Make field connections as shown in the wiring diagrams provided with this manual or on the sticker placed on the inside of the door panel of the boiler.

2.13 BC-1 CONTROLLER WIRING

The BC-1 controller is supplied as standard option with two stage and single stage boilers; it is not supplied with boilers equipped with a full modulating gas valve. For convenience, the BC-1 controller is factory wired to terminal block TB4 and ready for field wiring connections. The field wiring to TB4 is determined based on the operating mode selected (i.e. mode 1 to 6), the heating application and the piping arrangement (i.e. parallel or primary/secondary). Refer to Figure 1 for the wiring diagram for each mode. For a detailed explanation of the modes and controller operation, refer to the *BC-1 Controller Manual*.



Field wiring to terminal block TB4

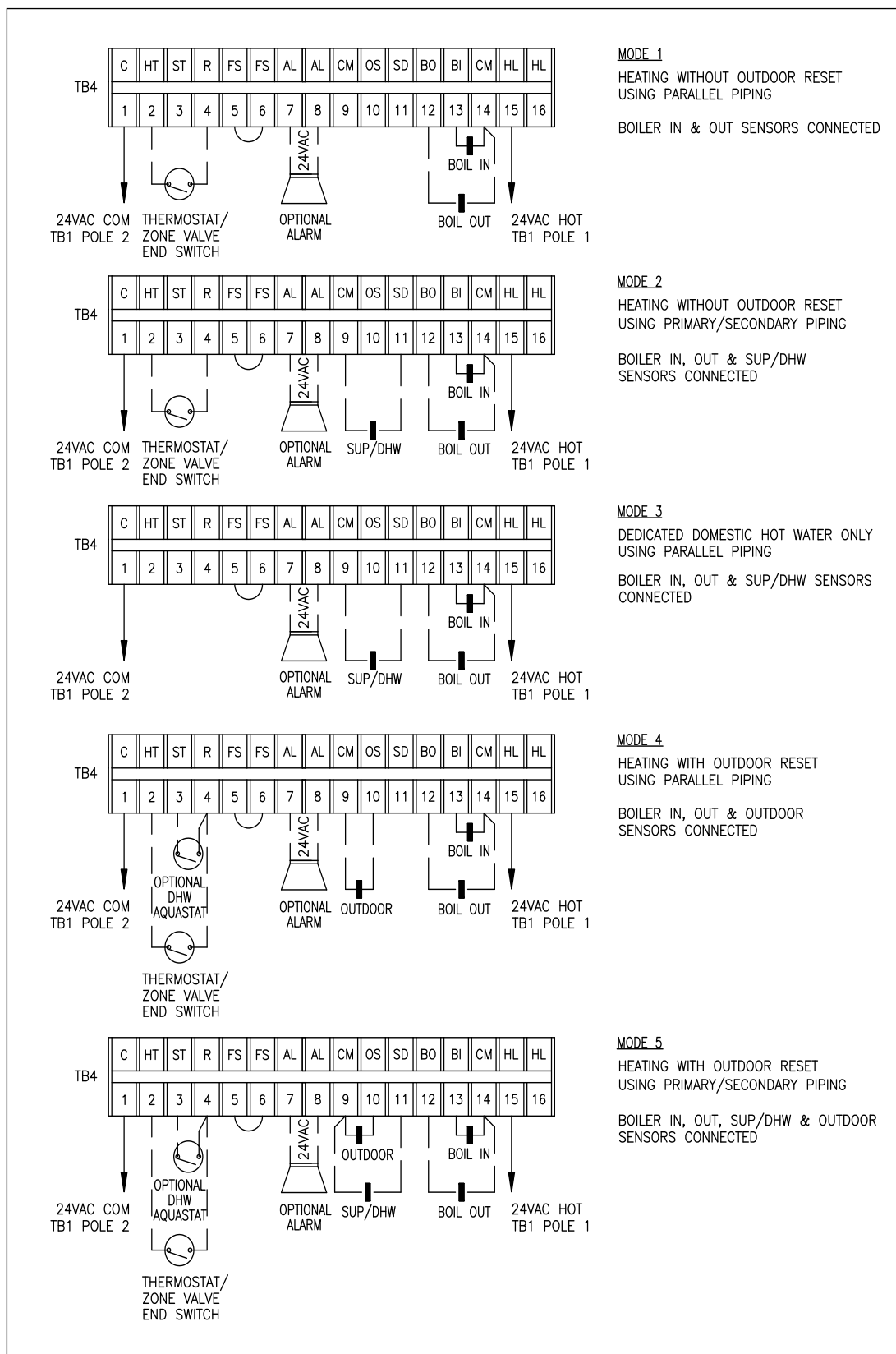


Figure 1 – Field wiring to terminal block TB4



Electrical Connections

For all electrical connections: Strip wire ends and insert into the terminal block. Tighten terminal screw clamps to securely hold the wire.

CAUTION - Risk of damage to the controller - Do not apply power to any connections on terminal block TB4. 24 Vac has been factory wired to terminals C-1 and HL-15.

Terminal Block	Connections	Name	Description / Comments
TB4	BO & CM	Boiler Outlet Sensor	Connect boiler outlet water temperature sensor to terminals BO and CM (common). The Boiler Outlet Sensor must be attached using a cable tie to the boiler outlet pipe.
	BI & CM	Boiler Inlet Sensor	Connect inlet water temperature sensor to terminals BI and CM (common). The Boiler Inlet Sensor must be attached using a cable tie to the boiler inlet pipe.
	OS & CM	Outdoor Sensor	Optional Outdoor Sensor (for Mode 4 and 5 only): Connect Outdoor Sensor 070 to terminals OS and CM (common). The Outdoor Sensor is installed on an exterior wall, typically facing North, and above the snow line. It should be shielded from effects of heat or cold to prevent false outdoor temperature readings. Avoid direct sunlight, exhaust fans, appliance vents, and excessive moisture.
	SD & CM	Supply/DHW Sensor	Optional (for Modes 2, 3, and 5 only). Connect a Supply or DHW Sensor 071 to terminals SD and CM (common). The Supply/DHW sensor is inserted into a thermowell on the DHW tank or attached using a cable tie to the supply pipe.
	AL & AL	Alarm	Optional. The alarm contacts are a powered output, do not apply power. Connect an alarm (beeper, light, or relay) with a rating of 24 Vac and maximum 0.45 A to terminals AL and AL.
	FS & FS	Flow Switch	Not used. Leave Jumper 5-6 on TB4. For convenience, the Flow Switch terminals have been relocated to terminal block TB2, poles T1 & S. Do not apply power.
	ST & R	Setpoint DHW Demand	Optional Domestic Hot Water Aquastat (for Modes 4 and 5 only): Connect domestic hot water aquastat to terminals ST and R. Closed is activation. Do not apply power.
	HT & R	Heat Demand	Connect Thermostat or Zone Valve End Switch to terminals HT and R. Closed is activation. Do not apply power.

BC-1 Controller Information

Section 3

WARNING

The following section summarizes information found in the *BC-1 Controller Manual*. Read all instructions in this manual and the BC-1 Controller Manual before placing the boiler in operation or making adjustments to the controller. Adjustments must be made by a qualified heating technician.

3.1 CONTROLLER INFORMATION

Control Board Dimensions:

4-3/4" (L) x 2-7/8" (W) x 1-7/8" (H).

Power Outputs:

Boiler Stage outputs from 15-STG1 and 17-STG2 terminals are 24 Vac, 60 Hz (when factory wired).

Alarm output from 23-ALARM terminal is 24 Vac, 60 Hz, 0.45 A maximum (when factory wired). Alarm is wired to terminal block TB4, terminals AL&AL.

Signal Inputs (Do not apply external power):

The following signal inputs are located on terminal block TB4:

- HT&R:** Room thermostat or zone valve end switch, 24Vac switching input, closed is activation.
- ST&R:** Setpoint DHW aquastat, 24Vac switching input, closed is activation.
- FS&FS:** Flow switch, 24Vac switching input, closed is activation.

Thermistor Sensors

- BO&CM:** Boiler outlet sensor
- BI&CM:** Boiler inlet sensor
- OS&CM:** Outdoor sensor
- SD&CM:** Supply / DHW sensor

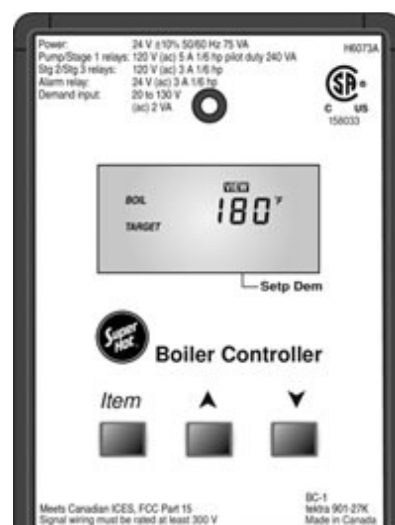


Figure 2 – BC-1 Controller



3.2 CONTROLLER DISPLAY

The BC1 uses a Liquid Crystal Display (LCD) as a method of supplying information. You use the LCD in order to setup and monitor the operation of your system. The BC-1 uses three push buttons (Item, ▲, ▼) for selecting and adjusting settings. As you program your control, record your settings for future reference.

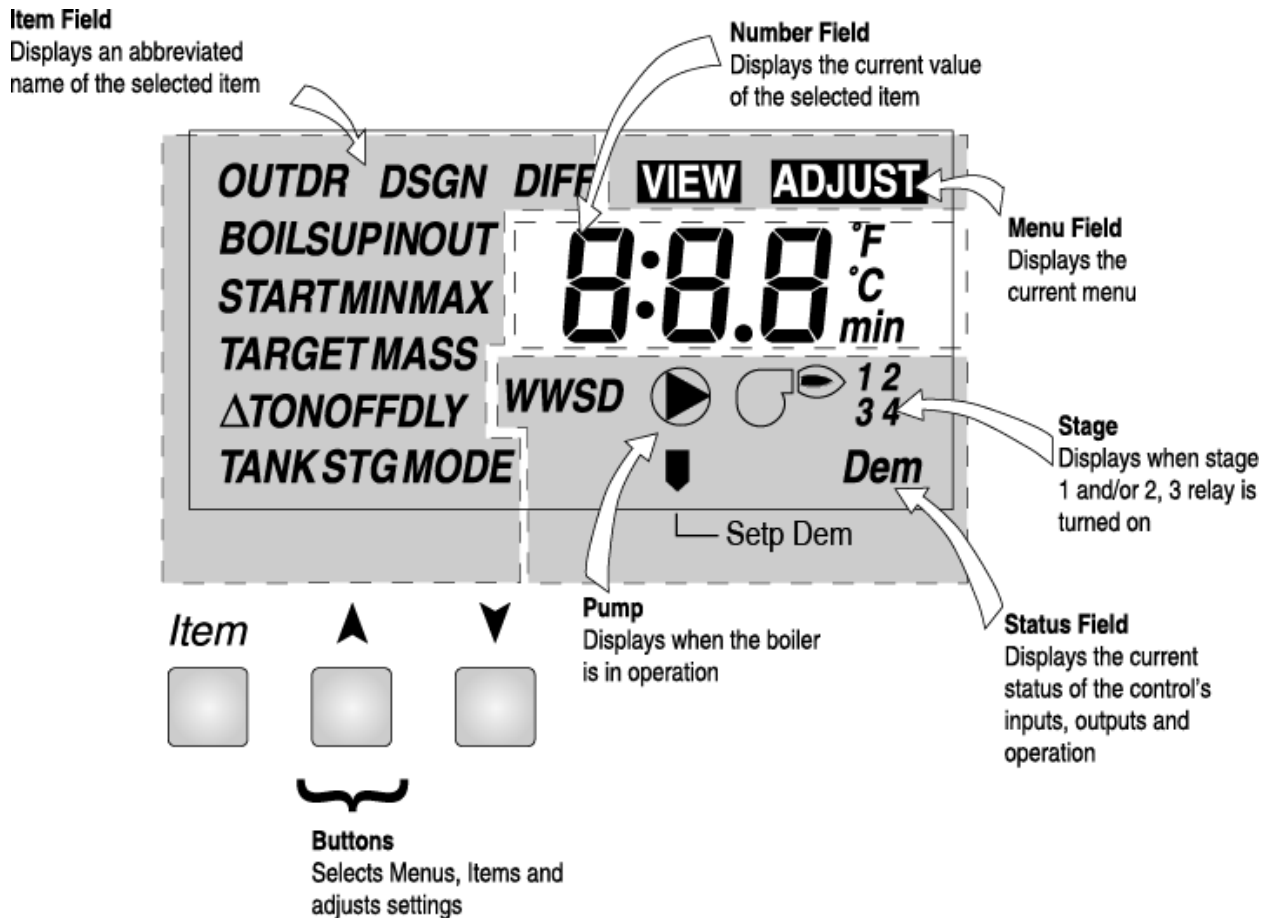


Figure 3 - BC1 Controller LCD Display

Menu

All of the items displayed by the control are organized into two menus. These menus are listed on the upper right hand side of the display (Menu Field). The default menu for the BC-1 is the View menu. While in the View menu, the VIEW segment is displayed. To select the Adjust menu, press and hold simultaneously all three buttons for 1 second. The display then advances to the Adjust menu and the ADJUST segment is turned on in the display. The display will automatically revert back to the View menu after 20 seconds of keypad inactivity. Once in a menu, there will be a group of items that can be viewed within that menu.

Item

The abbreviated name of the selected item will be displayed in the item field of the display. To view the next available item, press and release the Item button. Once you have reached the last available item in a menu, pressing and releasing the Item button will return the display to the first item in the selected menu.

Adjust

To make an adjustment to a setting in the control, begin by selecting the Adjust menu by pressing and holding simultaneously all three buttons. Then select the desired item using the Item button. Finally, use the ▲ or ▼ button to make the adjustment.




BC-1 Display Items in Installer Mode

VIEW MENU

Item Field	in Mode	Description
OUTDR	4,5	Outdoor air temperature measured by outdoor sensor
BOIL TARGET	1,2,3,4,5	Target boiler supply temperature the control is trying to maintain at the boiler supply sensor or the boiler outlet sensor
BOIL SUP	2,5	Current boiler supply water temperature as measured by the boiler supply sensor.
BOIL OUT	1,3,4,6	Current boiler outlet water temperature as measured by the boiler supply sensor
BOIL IN	All	Current boiler inlet water temperature as measured by the boiler inlet sensor.
BOIL ΔT	All	Current T (temperature difference) between the boiler outlet sensor and the boiler inlet sensor
TANK	3	Current DHW tank temperature as measured by the DHW sensor
BOIL ON	All	The total number of running hours of the boiler since this item was last cleared

ADJUST MENU

Item Field	Default	Description
MODE	1	Sets the operating mode for the control. Mode 1 (parallel, setpoint); Mode 2 (primary/secondary, setpoint); Mode 3 (parallel, dedicated DHW generation only); Mode 4 (parallel, outdoor reset with optional DHW override); Mode 5 (primary/secondary, outdoor reset with optional DHW override)
BOIL TARGET	180°F	Minimum boiler target temperature during reset override, setpoint or DHW operation.
TANK TARGET	140°F	Sets the DHW storage tank's temperature. Used in Mode 3 only.
TANK DIFF	5°F	Sets the differential for the DHW storage tank.
OUTDR START	70°F	The outdoor starting temperature used in the reset ratio for the heating system.
OUTDR DSGN	25°F	The design outdoor air temperature used in the heat loss calculations for the heating system.
BOIL START	70°F	The starting water temperature used in the reset ratio calculation for the heating system.
BOIL DSGN	180°F	The design water temperature used in the heat loss calculations for the heating system.
BOIL MAX	210°F	The maximum boiler target water temperature.
BOIL MASS	2	The thermal mass of the boiler used. Always use 2 for the Super Hot AAE Boiler.
DIFF	20°F	The differential that the control is to use when it is operating the boiler.
DLY 	0:30 min	Determines when to stop purging the pump.
WWSD	70°F	The system's warm weather shut down.
°F / °C	°F	The units of measure that all of the temperatures are to be displayed in by the control.



3.3 CONTROLLER OPERATION

When the controller is powered, the controller enters the operating mode if there are no sensor or high limit errors present. The user should select one of the following modes from the controller adjust menu:

Mode 1 - Setpoint operation using parallel piping: Operates boiler stages to maintain fixed temperature at boiler outlet sensor when a heat demand is present.

Mode 2 - Setpoint operation using primary/secondary piping: Operates boiler stages to maintain fixed temperature at boiler supply sensor when a heat demand is present.

Mode 3 - Dedicated DHW Generation: Operates boiler stages to maintain fixed temperature at the boiler outlet sensor when an internal demand for DHW is generated based on the DHW sensor. An indirect hot water tank must be used to separate the AAE from an open system.

Mode 4 - Outdoor reset with reset override using parallel piping: Operates stages to maintain an outdoor reset temperature at the boiler outlet sensor. When there is a call for "reset override" from the DHW aquastat (i.e. ST&R is closed), the control operates the stages to maintain a setpoint temperature at the boiler outlet sensor. If both heat demand and setpoint DHW demand are present at the same time, the controller targets the higher of the two requirements.

Mode 5 - Outdoor reset with reset override using primary/secondary piping: Operates stages to maintain an outdoor reset temperature at the boiler supply sensor. When there is a call for "reset override" from the DHW aquastat (i.e. ST&R is closed), the control operates the stages to maintain a setpoint temperature at the boiler supply sensor. If both heat demand and setpoint DHW demand are present at the same time, the controller targets the higher of the two requirements.

Mode 6 – External boiler control: This mode can be used when connecting multiple boilers to an external boiler control or an energy management system (EMS). The BC-1 is used to provide boiler pump control and operates stage 1 and pump when a heat demand is present. The stage 1 terminals on the external boiler control must be connected to the heat demand terminals HT & R of terminal block TB4 on the boiler. Next, the 5 & 6 jumper wire of terminal block TB1 on the boiler must be removed, and the stage 2 terminals on the external boiler control connected to 6 and 24Vac (R). See wiring diagram for details.

When there is a heat demand or DHW demand the controller will switch on the system pump. If the sensor is not satisfied, the controller will switch on additional stage(s), in sequence, and based on PID (proportional, integral, derivative) logic. The controller continuously monitors the sensors and examines the difference between the target temperature and the sensor temperature. Depending on the difference in temperature (proportional), the time (integral), and how fast or slow the temperature is changing (derivative), it will determine when to switch a stage on or off. This feature prevents "short cycling", which can quickly wear out contactors and cause rapid temperature fluctuations.

The heating routine will operate until the water temperature reaches the user-defined temperature setting. Once reached, the control will automatically cycle the stage(s) of the boiler on or off, as necessary, to maintain the supply water temperature. The required number of stages which are activated is determined by the controller. After the call for heat has been satisfied, the stage(s) of the boiler will switch off, in sequence, followed by the pump.

3.4 RESET OVERRIDE

WARNING

If both Heat Demand and Setpoint DHW Demand are present at the same time, the controller targets the higher temperature of the two requirements. This may result in higher than intended water temperatures in either space heating loop or domestic hot water (DHW) heating loop. Use pipe rated for use at the highest possible water temperature.

The BC-1 Controller has one pump relay which is normally open and will close (i.e. pump energized) when either a Heat Demand or Setpoint DHW Demand is present. When using Reset Override, a **switching external pump relay** (e.g. tekmar Relay 003) should be utilized to stop hot water flow to the

space heating loop (e.g. radiant in-floor) and redirect it to the DHW heating loop during a Setpoint DHW Demand. See Figure 4 and Figure 5.

MODE 4 ONLY

(Outdoor reset and reset override)

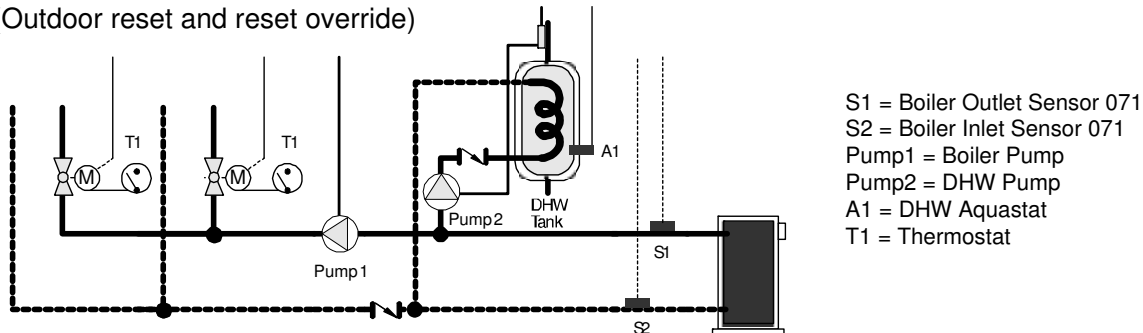


Figure 4 – Typical piping diagram in Mode 4

Sequence of Operation

Thermostat (T1) closed - Thermostat creates a Heat Demand resulting in a boiler target based on the outdoor reset settings. The boiler pump (Pump1) operates.

DHW Aquastat (A1) closed - DHW Aquastat creates Setpoint DHW Demand and activates external pump relay. The external pump relay causes the following actions:

- 1) Power for the boiler pump (Pump1) is broken. Pump1 does not operate.
- 2) Power for the DHW pump (Pump2) is made. Pump2 operates.
- 3) Setpoint DHW Demand creates a boiler target based on the higher requirement of the outdoor reset and reset override setting.

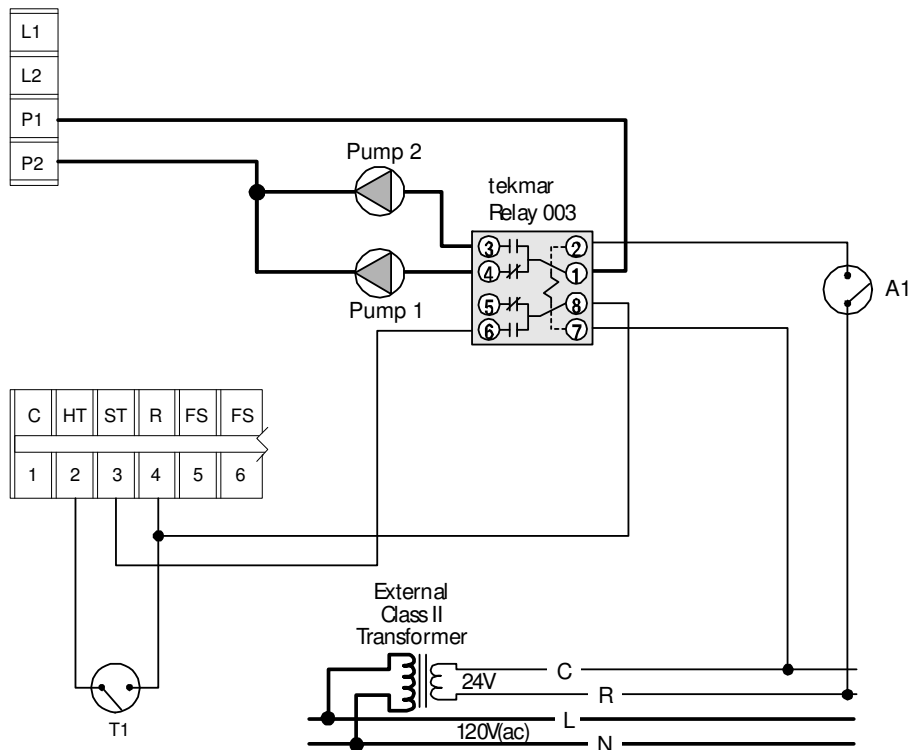


Figure 5 – Wiring diagram illustrating use of an External Relay to control pump operation



3.5 CONTROLLER MOUNTING

The BC-1 controller mounts on the controller mounting plate on the control panel using a sheet metal screw. The LCD and buttons should be visible and accessible from outside the front of the boiler casing. To remove the controller: 1.) remove the front casing panel, 2.) pull off the black plastic top cover of the controller, 3.) unscrew the sheet metal screw, 4.) lift the controller slightly out of the rectangular cutout in the mounting plate, 5.) pull off the Molex connector while simultaneously holding down the tab on the left side.

Startup Instructions

Section 4

4.1 PRE-STARTUP

- a. Fill entire heating system with water and vent or purge air from system. Add water as needed to reach boiler operating pressure. Water should be of suitable quality. Do not use water with high hardness.
- b. Check for and repair any leaks in water piping.
- c. Check burners to see that they are not dislodged.
- d. Check for proper installation of pressure relief valve, draft hood, and venting.
- e. Check that the electrical wiring matches the wiring diagram in this manual or on the boiler.
- f. Use a soap solution to check for leaks in gas piping from meter to boiler pilot and manifold. Repair and retest any leaks found.
- g. Operate circulating pump and vent all radiation units and high points in system piping.

4.2 STARTUP

WARNING

The following instructions are intended as a guide for qualified persons. Before lighting the boiler, the pre-startup instructions of *Section 4.1* MUST be performed. If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury or loss of life.


Intermittent pilot

This boiler does not have a continuous pilot flame. It is equipped with an ignition device which automatically lights the pilot. Do not try to light the pilot by hand.

In the event of failure of any component, either the system will not operate or it will go into safety lockout.

- 1) Make sure the Gas Valve and all electrical power to the boiler are "OFF".
- 2) Set room thermostat to the lowest setting.
- 3) Connect a manometer at pressure tapping on downstream section of gas valve.
- 4) Wait five minutes to clear out any gas. If you smell gas, STOP! Follow the safety instructions provided in *Section 1.1* under WHAT TO DO IF YOU SMELL GAS. Remember that propane does not vent upward naturally.
- 5) Check the ignition control module as follows:
 - a) Set thermostat above room temperature to call for heat and turn power on for the boiler.
 - b) Watch for spark at pilot burner on units equipped with spark ignition. All models will automatically lockout if no pilot flame is detected within 15 seconds. Automatic retry will occur in 5 minutes.
- 6) Press and hold three keys found below the LCD screen of the controller until "Adjust" is displayed (Figure 3). In adjust mode, enter the desired settings for your heating application (see *BC-1 Boiler Controller Manual* for more information).



- 7) Turn Gas Valve to ON. When power is supplied to the controller, the LCD displays "- - -". When the thermostat calls for heat, the "- - -" screen is replaced with the boiler target temperature. Next, pilot burner should ignite followed by main burners and as BC-1 energizes stages indicated by the stage indicator, . Once the boiler water temperature reaches the setpoint, the controller will regulate the boiler water temperature using the two stages. The number of stages that switch on is based on the heating demand and user settings. Check main and pilot burners and adjust pilot, if necessary, as described in *Section 4.3*. After all room thermostats are satisfied, the controller de-energizes the two stages, in sequence.
- 8) Assure that all other gas appliances are turned off, including their pilot flames.
- 9) Check manifold pressure reading on the manometer and make necessary adjustments. Check burner input to match rating plate input.
- 10) Return thermostat and controls to normal operation settings.



4.3 CHECK BURNER SYSTEM

To maintain safe and efficient operation, examine the burner system regularly through the inspection hole near the pilot tube.

Check condition of burner system

It is possible for parts of the burners system to become plugged, cracked, eroded and/or dislodged resulting in unsafe operation.

Pilot Flame

Remove cap screw cover on gas valve, then adjust gas flow to the point where the thermocouple tip or sensor rod is completely enveloped by the flame (Figure 6), but not necessarily glowing red. Replace and tighten cap.

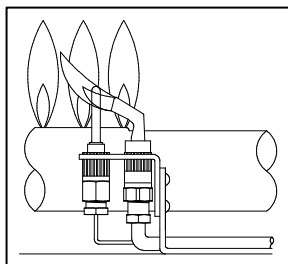


FIGURE 6 - PILOT FLAME
ADJUSTMENT

Check for lifting

Flames should not lift excessively from the burner ports. The flames may lift slightly during ignition or when the burners are cold.

Check ignition and extinction

Ignition should flow quickly and smoothly across all the burners. Popping noises or explosions from the burners during ignition, extinction or normal burner operation indicate the need for service.

Check flame color

An extremely yellow flame, as seen on a burning candle or match, is an indication of incomplete combustion and is usually accompanied by the formation of soot and carbon monoxide (carbon monoxide is a lethal, colorless and odorless gas). If soot is allowed to accumulate, it will partially restrict free passage of products of combustion to the flue. Under typically operating conditions, the flame should have a distinct bright blue inner cone and a blue/orange outer cone.

If any of the above problems are observed or the burner system does not operate properly, immediately take corrective measures.

4.4 AQUASTAT ADJUSTMENT

The factory mounted aquastat controls main burner firing by sensing outlet water temperature. To set the temperature of this control, adjust the dial until indicator points to the temperature (setpoint) at which the gas valve will close. The gas valve will open at setpoint less the differential. The Safety High-Limit aquastat may be fixed or adjustable. If it is adjustable, it should be set a minimum of 20°F (10°C) above the setting of the Operating/High-Limit aquastat. If the BC-1 controller is used, set both aquastats a minimum of 10°F (5°C) above the controller's maximum target temperature (see BOIL MAX setting) in order to avoid nuisance shut downs.

4.5 GAS MANIFOLD PRESSURE

The designated manifold pressures are as shown in the table below. A 1/8" NPT tapping is provided on the manifold or gas valve for connecting a manometer to check this pressure. Both natural gas and propane models are furnished with gas valves which have a built in gas pressure regulator. If necessary, adjust to the proper value by removing cap and turning adjusting screw clockwise to increase manifold pressure or counterclockwise to decrease manifold pressure.

Model	Natural Gas	Propane
AAE	3.5" W.C.	11.0" W.C.



4.6 CHECK INPUT & ORIFICES

For safety, the input shown on rating plate must not be exceeded. Check with the table below that the orifice size and input rate shown on your boiler rating plate match your application, i.e. boiler model, fuel type, and altitude. See AAE Specifications to find a boiler model's input rate.

FOR CANADA				
Model	Natural Gas		Propane	
	0 to 2,000 feet	2,000 to 4,500 feet	0 to 2,000 feet	2,000 to 4,500 feet
AAE	#27 orifice standard input	Contact Allied Eng. sales office for details	#45 orifice 10% derate input	Contact Allied Eng. sales office for details

FOR UNITED STATES				
Model	Natural Gas		Propane	
	0 to 2,000 feet	Over 2,000 feet	0 to 2,000 feet	Over 2,000 feet
AAE	#27 orifice standard input	Input must be reduced 4% for each 1000 ft above sea level. *	#45 orifice 10% derate input	Input must be reduced 4% for each 1000 ft above sea level. *

*Reference *National Fuel Gas Code ANSI Z223.1*, 8.1.2 High Altitude.

Small adjustments to the input rate can be made by varying the manifold pressure. Normally it should be adjusted no more than 0.2 inch w.c. for natural gas or 0.5 inch w.c. for propane from the manifold pressure specified on the rating plate.

WARNING

Exceeding the allowable input rate can produce dangerous concentrations of carbon monoxide, and cause the boiler to overheat resulting in severe personal injury, death or substantial property damage. Carbon monoxide is a lethal, colorless and odorless gas.

Input Rate Test

Consult gas company to determine the heating value of the gas supplied in Btu per cubic feet. Operate boiler for 15 minutes starting with all parts at room temperature and check input by clocking gas meter with all other gas appliances turned off, including their pilot flames. Use the following formula:

$$\text{INPUT (Btu/h)} = \frac{(3600) \times (\text{Heating Value of Gas}) \times (\text{Number of Cubic Feet Timed})}{\text{Seconds Clocked}}$$

To ensure accuracy for rating, clock enough cubic feet of gas so that there is at least one revolution of the test dial and the clocked time is at least 60 seconds.

Two Stage or Full Modulating Gas Valve

When a two stage or modulating gas valve is used, it must be checked for correct input at both "High" and "Low" fire settings. The clocked input rate MUST be within the "Minimum Input" and the "Input" as specified on the boiler's rating plate. To force a two stage or full modulating gas valve to low fire, see the valve manufacturer's instructions. Perform the Input Rate Test described above and adjust manifold pressure of High and Low settings as necessary. For altitudes above 2000 feet, DO NOT derate the "Minimum Input" rate.



4.7 CHECK FOR DRAFT HOOD SPILLAGE

WARNING

Continuous spillage at the draft hood relief opening may result in severe personal injury, death or substantial property damage.

After the main burners have operated for 5 minutes, check to see that combustion products are going up the chimney or gas vent properly by passing a lighted match (or smoke from a cigar, cigarette, or pipe) around the edge of the relief opening of the draft hood. If the chimney or gas vent is drawing properly, the match flame or smoke will be drawn into the draft hood. If not, the combustion products will tend to extinguish this flame. If the combustion products are escaping from the relief opening of the draft hood, IMMEDIATELY shutdown the boiler and make proper adjustments or repairs.

4.8 CHECK OF CONTROLS

After the unit has been operated for awhile, lower the aquastat setting below the setpoint and burner should shut off. Rotate the aquastat higher than setpoint and the main burner should ignite. Return the aquastat to its original setpoint and make sure boiler cycles normally. Repeat this type of check on the safety high-limit aquastat, thermostat and other system controls to ensure all work satisfactorily. If any of the safety or controls do not function, necessary corrections should be made immediately.

4.9 CHECK FOR GAS LEAKS

To identify gas leaks, smell for gas around boiler area and gas piping connections (See *Section 1.1*). To check a specific area for leakage, spray a mixture of soap and water onto the suspected area – active bubbling indicates a gas leak. DO NOT TEST FOR LEAKS WITH AN OPEN FLAME. Gas leaks must be repaired immediately.



4.10 INSTALLER'S CHECKLIST

	Reference Section
<input type="checkbox"/> The information printed on the boiler rating plate matches the application (i.e. altitude and fuel type).	4.6
<input type="checkbox"/> All applicable electrical codes have been met.	2.2, 2.12
<input type="checkbox"/> Gas piping has been purged and checked for leaks with a soap solution.	2.2, 2.4, 4.9
<input type="checkbox"/> System is filled with water and all air has been purged. Only oxygen barrier tubing has been used.	4.2, 4.5
<input type="checkbox"/> A manometer has been used to check the manifold pressure and gas supply pressure against requirements printed on boiler rating plate.	4.2, 4.5
<input type="checkbox"/> Bypass or mixing valve has been used to prevent return water less than 135°F.	2.10
<input type="checkbox"/> All applicable venting codes have been met. Air openings sized to provide adequate supply air for combustion, flue gas dilution and ventilation and will not be blocked off.	2.2, 2.5, 2.6, 2.7
<input type="checkbox"/> Check for spillage at draft hood and other areas susceptible to spillage	4.7
<input type="checkbox"/> Operate the boiler for 15 minutes, then clock and calculate Btu/h input rate. The input rate must not exceed that specified on the boiler rating plate. Clocked BTU/H Input Rate: _____	4.6
<input type="checkbox"/> Set BC-1 Controller mode of operation and other applicable parameters. See <i>BC-1 Controller Manual</i> for detailed information.	3.1, 3.2, 3.3, 3.4
<input type="checkbox"/> Perform check of temperature controls: aquastat, high limit aquastat, and thermostat.	4.4, 4.8
<input type="checkbox"/> Test any other controls as specified by the manufacturer.	
<input type="checkbox"/> Visually inspect main burners and pilot to ensure proper flame operating characteristics and ignition/extinction is ok.	4.3
<input type="checkbox"/> Allow the boiler to cycle a few times to ensure functions are operating correctly.	
<input type="checkbox"/> Close main shut-off valve and check that burners and pilot flame extinguish.	
<input type="checkbox"/> Clearly identify emergency shut-off devices and make the user or owner aware of their location and method of operation.	
<input type="checkbox"/> Fill in the contact information on the cover of the User's Information Manual and leave both manuals in the envelope adjacent to the boiler.	

NOTE: INSTALLER'S RESPONSIBILITY

"Before leaving installations, installers shall ensure that an appliance, accessory, component, or equipment installed by them comply with the Code requirements, and the person initially activating the appliance shall ensure that the appliance is in safe working order."

CSA B149.1-00 Natural Gas and Propane Installation Code

**Service & Maintenance Instructions****Section 5****5.1 SERVICE & MAINTENANCE INSTRUCTIONS****WARNING**

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

WARNING

If any part of this boiler has been under water, inspect the boiler and replace any part of the control system and any gas control which has been under water.

This boiler has been designed to provide years of trouble-free performance in normal installations. The owner or user should conduct a general external examination covering all items on the "User Checklist" at the beginning of each heating season and in mid-heating. In addition, the owner or user will have the boiler inspected by qualified service technician or gas supplier's service person at least **once every year** at the beginning of the heating season for continued safe operation. Note that some operating conditions may require more frequent inspections.

The qualified service technician or gas supplier's service person should follow the "Service Checklist". The "Service Checklist" must only be used by a qualified service technician or gas supplier's service person.

Verify proper operation after servicing.

5.2 CLEANING PROCEDURE

1. Shutdown the boiler as described in the lighting instructions in *Section 1.4*.
2. Inspect flue gas passages and burners for the presence of soot, rust or scale.
3. If necessary, use a wire brush and vacuum to clean and remove any blockages. Plugged burner ports must be cleared.
4. Replace any parts which have severely corroded.
5. Reassemble parts removed during cleaning as they were before, ensuring air tightness of flue gas passages.
6. Corrosion can be caused by low return water temperature or a contaminated air supply. Sooting can be caused by improper burner adjustment. Check and adjust as necessary.
7. Return boiler to operation following lighting instructions in *Section 1.4*.



5.3 SERVICE CHECKLIST

	Reference Section
<input type="checkbox"/> Do not store anything against the boiler or allow dirt or debris to accumulate in the area immediately surrounding the boiler. The flow of supply and exhaust air must not be obstructed.	2.5
<input type="checkbox"/> Check air openings are not restricted and complies with applicable code(s). Adequate supply air is necessary for combustion, flue gas dilution and ventilation.	2.2, 2.5, 2.6, 2.7
<input type="checkbox"/> When the boiler has operated for several minutes, check for spillage at draft hood, venting ducts, and other areas susceptible to spillage.	4.7
<input type="checkbox"/> Check externally the draft hood and vent system for soot, rust scale or corrosion. Check for dislodged venting or possible leaks in venting ducts.	
<input type="checkbox"/> Remove the draft hood from the boiler and inspect the flueways for the presence of soot or rust scale. Inspect the draft hood and smoke pipe connecting the draft hood to the flue for rust or corrosion before replacing the draft hood. The presence of soot, rust scale or corrosion indicates misadjustment.	5.2
<input type="checkbox"/> Inspect and, if necessary, clean the pilot burner and main burner. Check burners to see that they are not cracked or dislodged.	4.3, 5.2
<input type="checkbox"/> Visually check the pilot and main burner flames. A yellow flame caused by improper adjustment is always accompanied by formation of soot which, if allowed to continue, will partially restrict free passage of products of combustion to the flue.	4.3
<input type="checkbox"/> Check that gas piping is secured. Smell for gas leaks around boiler and gas piping connections. Gas leaks can also be checked for using a soap solution; do not use an open flame to check for leaks. Note: Propane is heavier than air and pools in a low area in the event of a leak.	4.9
<input type="checkbox"/> Inspect for leaks in the water piping and at water piping connections.	
<input type="checkbox"/> Circulating pumps used with hot water heating systems should be inspected for water leaks.	
<input type="checkbox"/> Check for weeping at pressure relief valve outlet during normal operation.	2.11
<input type="checkbox"/> Listen for unusual audible sounds in the boiler. Any audible sounds in the boiler system may be indications of scaling or lack of sufficient water flow and the system should be checked without delay. Scaling is due to improper maintenance and it is not the fault of the boiler. Scale damage is not covered by warranty.	2.10
<input type="checkbox"/> Check the temperature and pressure gauge and expansion tank pressure is within an acceptable range for the heating system.	
<input type="checkbox"/> Keep boiler area clear and free from combustible materials, gasoline and other flammable vapors and liquids. Combustible materials, gasoline and other flammable vapors and liquids should not be stored in the area of the boiler.	
<input type="checkbox"/> Checks should be made on the ignition system, operation controls and safety shut-off valves for gas tightness.	2.9
<input type="checkbox"/> If applicable, inspect low water cutoff and flow switch for proper operation.	
<input type="checkbox"/> The emergency shut-off devices are identified the owner is aware of their location and method of operation.	



5.4 CAUTION: WATER REPLENISHMENT

Avoid unnecessary replenishment of system water. It can allow oxygen to enter the system and cause serious corrosion problems. As well, an excessive amount of minerals may be deposited in the heat exchanger. Do not draw water from the heating system for cleaning, flushing, etc.

Any audible sounds in the boiler system may be indications of scaling or lack of sufficient water flow and the system should be checked without delay. Scaling is due to improper maintenance. It is not the fault of the boiler. Scale damage is not covered by warranty.

5.5 REFRACTORY HANDLING PROCEDURE

WARNING

The mineral block and fiberglass wool used in this product are RCFs (Refractory Ceramic Fibers). RCFs pose a possible cancer hazard by inhalation and can cause respiratory, skin and eye irritation.

After mineral block has been fired, it will produce increased levels of nuisance dust and poses increased carcinogenic risk.

Follow the precautionary measures below before attempting service or access.

PRECAUTIONARY MEASURES:

- Avoid breathing fibers and contact with skin and eyes.
- Use a National Institute for Occupational Safety and Health (NIOSH) approved dust/mist respirator.
- Wear long-sleeved, loose fitting clothing, gloves and eye protection.
- Wash work clothes separately from other clothing. Rinse washer thoroughly.
- Operations such as sawing, blowing, tearout and spraying may generate airborne fiber concentration requiring additional protection.
- Use a vacuum with a HEPA filter for clean up.
- Dispose of all RCF scrap and dust in a closed airtight plastic bag.

FIRST AID MEASURES:

- Eye contact – Flush eyes with water to remove dust for at least 15 minutes. If irritation persists, seek immediate medical attention.
- Skin contact – Wash affected area gently with soap and warm water after handling.
- Difficulty breathing – Move to an area of clean fresh air. Seek immediate medical attention if difficulties persist.
- Ingestion – Do not induce vomiting. Drink plenty of water. Seek immediate medical attention.

Replacement Parts

Section 6

NOTE: To supply the correct part it is important that you state the boiler model number, serial number and type of gas when applicable.

Any part returned for replacement under standard company warranties must be properly tagged with Return Goods Authorization Form (R.G.A.), completely filled in with the boiler serial number, model number, etc., and shipped to the Company freight prepaid.

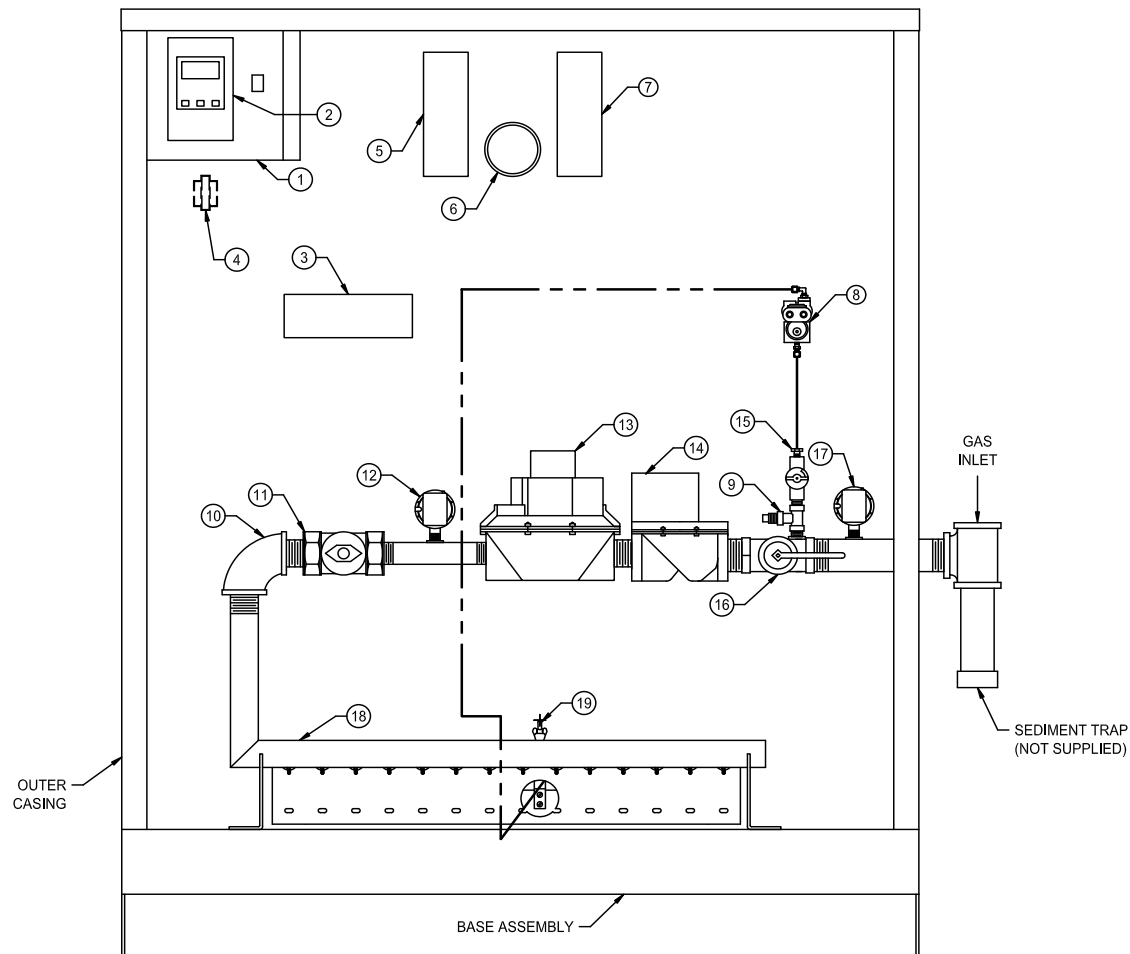
If determined defective by the Company and within warranty, the part will be returned in kind or equal substitution, freight collect. Credit will not be issued. Refer to Figures 7 and 8 for replacement parts.

ITEM	DESCRIPTION	ITEM	DESCRIPTION
1	MAIN ON/OFF SWITCH & CONTROLLER MOUNTING PANEL	11	MANUAL SHUT-OFF VALVE (FIRING VALVE)
2	BC-1 CONTROLLER *	12 †	HIGH GAS PRESSURE SWITCH (WHEN USED)
3	IGNITION CONTROL MODULE (ELECTRONIC IGNITION ONLY)	13	MAIN GAS VALVE
4	TRANSFORMER	14	REDUNDANT GAS VALVE
5	OPERATING / HIGH LIMIT AQUASTAT	15	P2S PILOT SHUT-OFF VALVE
6	TEMPERATURE / PRESSURE GAUGE	16	MANUAL MAIN SHUT-OFF VALVE (AB COCK)
7	SAFETY HIGH LIMIT AQUASTAT	17 †	LOW GAS PRESSURE SWITCH (WHEN USED)
8	PILOT REGULATOR/SOLENOID	18	MANIFOLD ASSEMBLY
9	1/4" TEE & PLUG	19	PILOT BURNER UNIT
10	90° ELBOW		

* ITEM 2 IS PROVIDED ON SINGLE AND TWO STAGE BOILERS

† ITEM 12 IS REQUIRED ON BOILERS WITH AN INPUT OVER 2500 M.B.H.

‡ ITEM 12 & 17 ARE REQUIRED ON U.S. BOILERS (CSD-1) WITH AN INPUT OVER 2500 M.B.H.



NOTES:

1. SOME MODELS MAY BE SUPPLIED WITH A COMBINATION GAS VALVE.
2. SOME MODELS MAY BE SUPPLIED WITH A DUAL OPERATING / SAFETY HIGH LIMIT AQUASTAT.
3. ITEMS SHOWN MAY NOT BE PRESENT ON ALL MODELS.

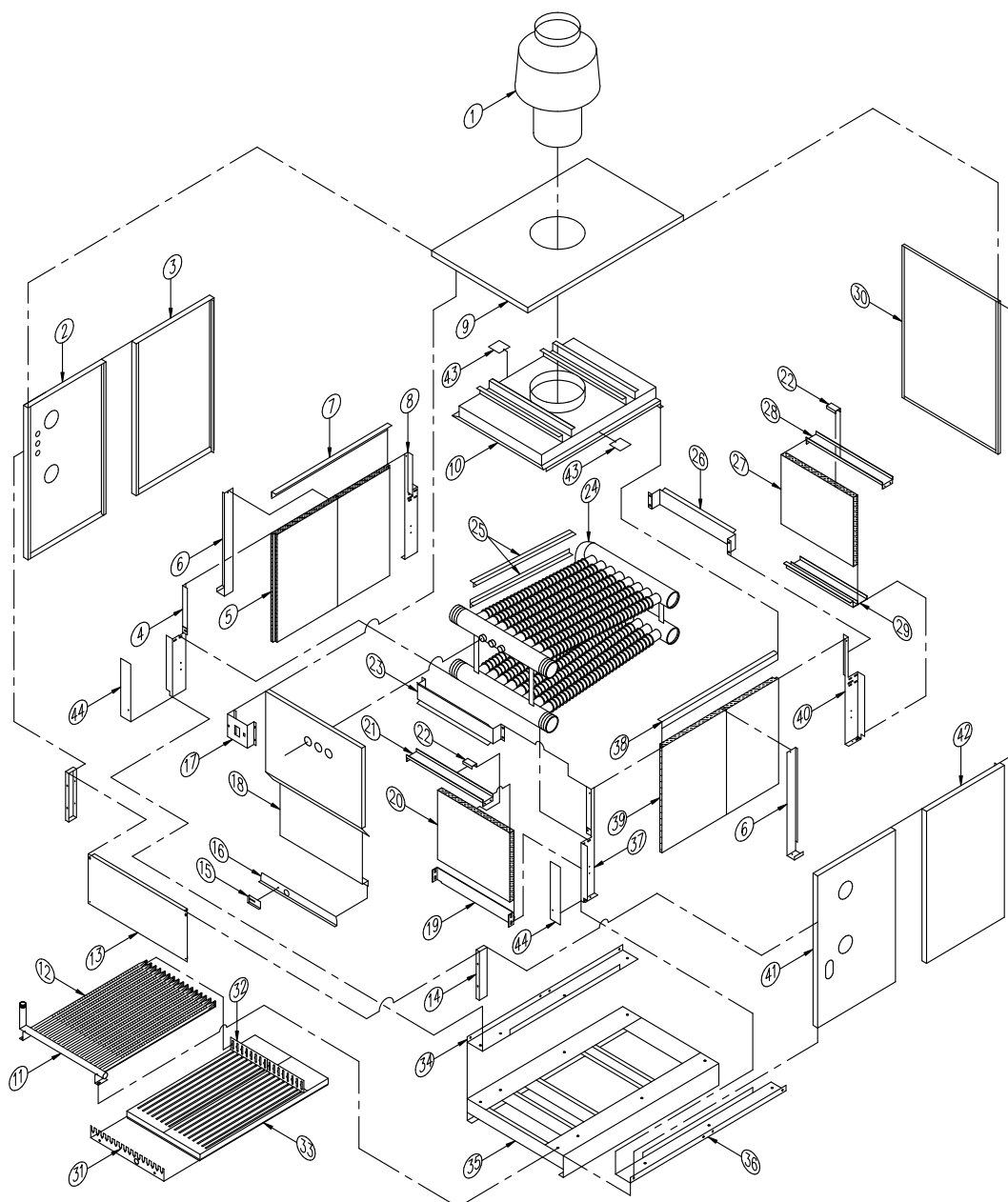
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FIGURE 7 - TYPICAL GAS TRAIN ASSEMBLY AND CONTROL COMPONENT LAYOUT FOR COMMERCIAL INSTALLATIONS

AAE Series Gas Boiler – Installation and Service Manual



NO.	DESCRIPTION	NO.	DESCRIPTION	NO.	DESCRIPTION
1	DRAFT HOOD	16	ROLL-OUT SHIELD	31	FRONT BURNER SUPPORT
2	LEFT SIDE FRONT PANEL	17	MAIN ON/OFF SWITCH & CONTROLLER MOUNTING PANEL	32	REAR BURNER SUPPORT
3	LEFT SIDE REAR PANEL	18	CONTROL PANEL	33	BURNER TRAY
4	LEFT FRONT REFRACTORY HOLDER	19	BOTTOM REFRACTORY HOLDER - FRONT	34	BASE TOP PLATES - LEFT SIDE
5	SIDE REFRACTORY PANELS	20	FRONT REFRACTORY	35	BASE ASSEMBLY
6	SIDE SUPPORT	21	TOP REFRACTORY HOLDER - FRONT	36	BASE TOP PLATE - RIGHT SIDE
7	REFRACTORY TOP CHANNEL	22	REFRACTORY JOINT CLIP	37	RIGHT FRONT REFRACTORY HOLDER
8	LEFT REAR REFRACTORY HOLDER	23	FRONT SEAL	38	REFRACTORY TOP CHANNEL
9	TOP PANEL	24	HEAT EXCHANGER ASSEMBLY	39	SIDE REFRACTORY PANELS
10	FLUE COLLECTOR	25	BAFFLE	40	RIGHT REAR REFRACTORY HOLDER
11	MANIFOLD	26	REAR SEAL	41	RIGHT SIDE FRONT PANEL
12	BURNER	27	REAR REFRACTORY	42	RIGHT SIDE REAR PANEL
13	CONTROL PANEL ENCLOSURE	28	TOP REFRACTORY HOLDER - REAR	43	SIDE PANEL SUPPORT
14	SIDE EXTENSION (OPTIONAL)	29	BOTTOM REFRACTORY HOLDER - REAR	44	FRONT LOWER COVER PANEL
15	INSPECTION DOOR	30	REAR PANEL	45	INSULATION (NOT ILLUSTRATED)

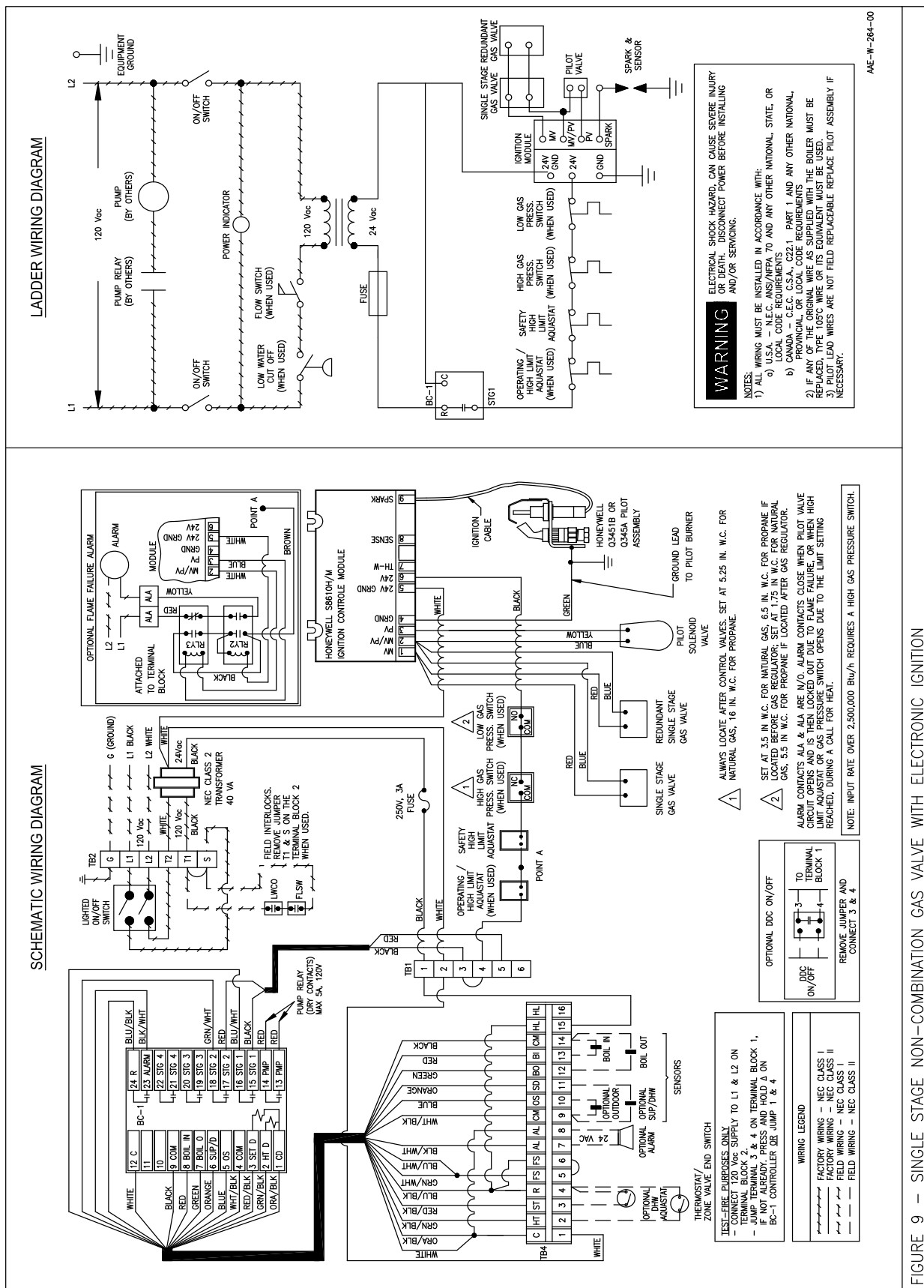


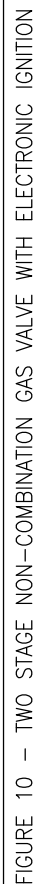
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FIGURE 8 - AAE SERIES BOILER - GENERAL ASSEMBLY PARTS LIST

Wiring Diagrams

Section 7





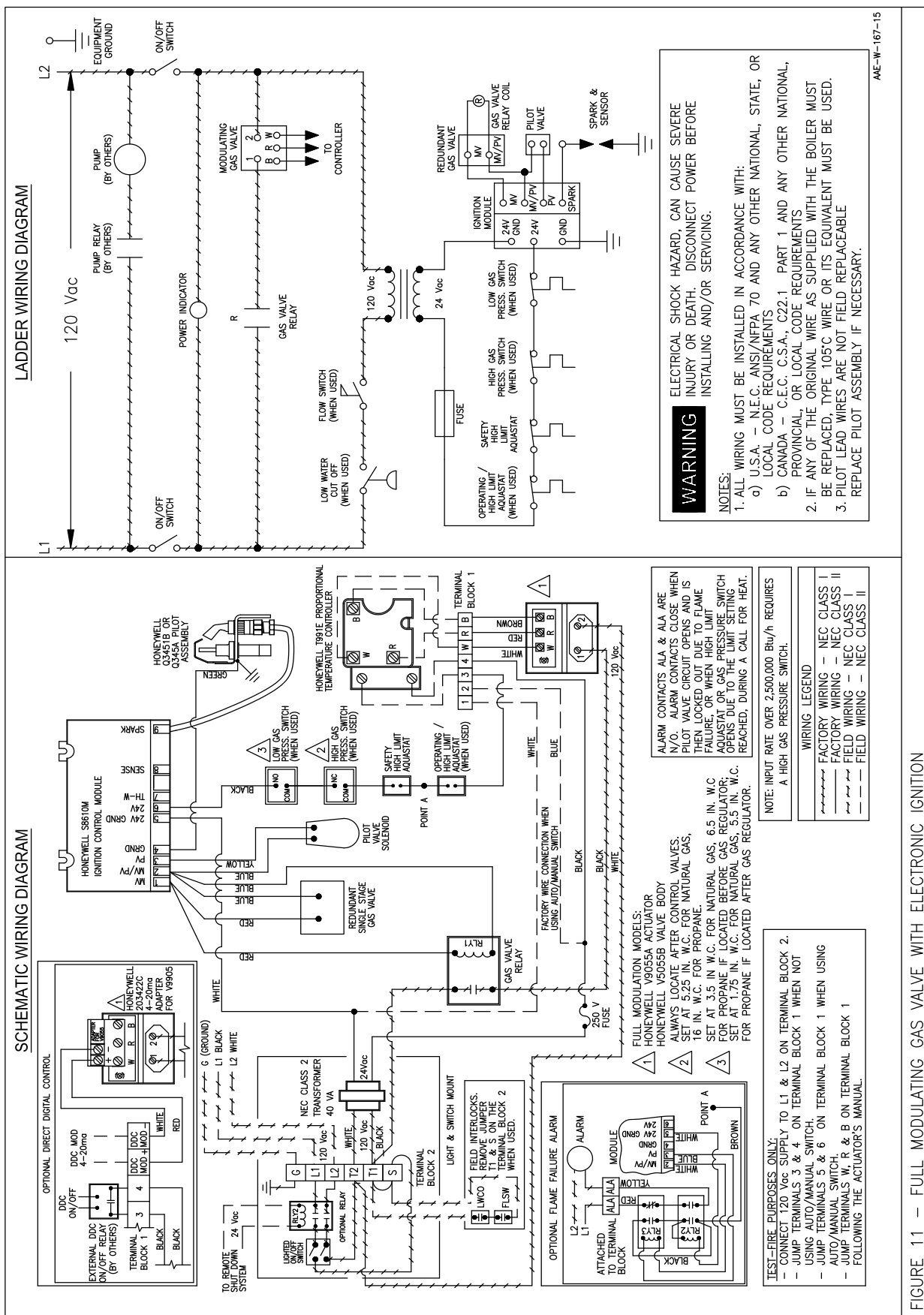


FIGURE 11 - FULL MODULATING GAS VALVE WITH ELECTRONIC IGNITION



Troubleshooting Guide

Section 8

Problem	Possible Cause	Solution
BC-1 display is blank.	• Incorrect supply power.	• Check for 115V (AC) across L1 and L2.
	• Faulty transformer.	• Check for 24V (AC) across terminals C-1 and HL-15.
	• Internal control fault.	• Replace controller.
BC-1 displays an error message.	• E01 – Controller unable to read from its EEPROM	• Verify all the settings in the adjust menu are correct.
	• Shr – Controller is unable to read from one of the sensors.	• Check for short circuit at the sensor which is displayed on the LCD.
	• OPn – Controller is unable to read from one of the sensors.	• Check for loose connection/open circuit at the sensor which is displayed on the LCD.
	• Defective sensor or controller.	• Perform "Test the Sensors" described in <i>BC-1 Controller Manual</i> .
Boiler will not fire.	• No power.	• Check power switches and wiring.
	• No gas supply to boiler.	• Check gas source and pressure.
	• Gas supply pipes are not purged of air.	• Purge gas line.
	• No heat demand.	• Check if thermostat setting is above room temperature and aquastat setting is above boiler water temperature.
	• Flow switch or low water cut off.	• Check pump capacity & flow direction. Check for correct water levels and air locks.
	• Gas valve failure (closed position).	• Check gas valve and replace if necessary.
	• Thermocouple failure.	• Check thermocouple and replace if necessary.
	• Faulty wiring.	• Check wiring of aquastats, zone valves, and thermostats for loose or broken wires and repair.
	• Faulty aquastat, thermostat, or zone valve.	• Check and replace if necessary.
Boiler goes on and off at frequent intervals.	• Pilot not lit.	• Relight standing pilot. (For electronic ignition, see "Pilot flame will not light on electronic ignition".)
	• Poor flow in boiler or circulator failure.	• Check pump for proper capacity & flow direction. Replace if necessary.
	• Thermostat, heat anticipator, or aquastat set too low.	• Check and adjust.
	• Boiler oversized or insufficient radiation.	• Check and adjust if necessary.
Boiler fires continuously.	• Wrong type of thermostat or controller.	• Check and replace if necessary.
	• Gas valve failure (open position).	• Check gas valve, replace if necessary.
	• Faulty wiring.	• Check wiring of aquastats, zone valves, and thermostats for short circuits or incorrect wiring.
Rumbling and moaning sound in boiler.	• Faulty aquastat, zone valve or thermostat.	• Check and replace if necessary.
	• Boiler is overheated and safety high limit aquastat fails to cut out.	• Check aquastats and adjust or replace if necessary.
	• Improper wiring.	• Check and correct.
	• Foreign matter in heat exchanger.	• Flush heat exchanger if necessary.
	• Poor circulation.	• Check pump for correct flow.
	• Air trapped in heating system.	• Purge air.



Problem	Possible Cause	Solution
Gas odor.	• Negative draft.	• Incorrect vent size or blocked vent.
	• Insufficient combustion air to boiler.	• Check combustion and ventilation air opening in boiler room meets installation code requirements, and combustion air flow openings in the boiler base and burner tray are not blocked.
	• Leak in gas system.	• See "What to do if you smell gas" on cover. Have gas fitter test system and repair leaks.
Flame roll out on ignition or during operation.	• Carbon build up on the heat exchanger, caused by improper venting, ventilation air or low return water temperature.	• Have a qualified service technician inspect and clean the heat exchanger and check and adjust the system.
	• Negative draft.	• Check venting.
Pilot outages with standing pilot.	• Improper pilot flame.	• Adjust pilot flame.
	• Thermocouple lead to gas valve is loose.	• Check and tighten lead.
	• Thermocouple is defective.	• Replace thermocouple.
Pilot flame will not light on electronic ignition.	• No spark.	• High voltage wiring is loose, broken or grounded. Repair wiring.
	• Ignition electrodes are damaged.	• Replace electrodes.
	• Ignition electrodes improperly adjusted.	• Correct adjustment of electrode.
	• Faulty electronic ignition controller.	• Replace controller.
	• No gas.	• Confirm supply of gas to pilot and repair if necessary.
	• Gas supply pipes not purged of air.	• Purge gas line.
	• Low pilot gas pressure.	• Adjust pressure.
	• Dirt or foreign material in pilot.	• Clean.
Pilot lights but flame failure after trial for ignition.	• Incorrect pilot flame pressure.	• Set pilot pressure to correct pressure.
	• Poor connections in wiring to flame sensor.	• Repair wiring.
	• Electrodes are damaged.	• Replace electrodes.
	• Ignition electrodes improperly adjusted.	• Correct adjustment of electrodes.
Burner starts but flame will not stay established.	• Ignition electrodes are wet, dirty or improperly adjusted (for electronic ignition only).	• Check, clean, change and/or adjust the electrodes.
	• Poor connections in wiring to flame sensor.	• Repair wiring.
Boiler carbonizes (forms soot) quickly.	• Incorrect orifice sizing.	• Check orifice and replace if necessary.
	• Inadequate combustion and ventilation air.	• Check and adjust.
	• Dusty environment.	• Clean.
	• Low return water temperature.	• Adjust system.
	• Manifold pressure too high.	• Adjust manifold pressure.
Boiler overheats and system remains cold.	• Insufficient circulation.	• Check pump, clean and replace if necessary.
	• Air trapped in piping.	• Purge system.
	• Improper system wiring.	• Test and correct.
Boiler and heating system overheat.	• Faulty thermostat or controller.	• Check, adjust, and replace if necessary.
	• Faulty aquastat and/or safety high limit aquastat.	• Check, adjust, and replace if necessary.
	• Faulty wiring.	• Check wiring for short circuits and repair.



NOTES

Section 9



NOTES

Section 9



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