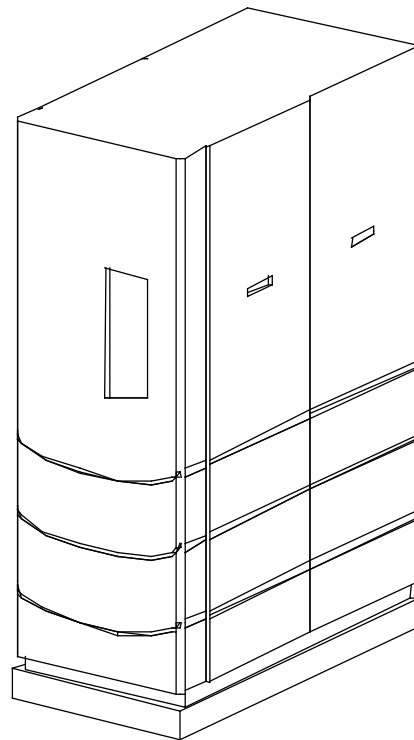


Used for Serial Numbers G-00-711 thru G-01-095

Benchmark™ Series Gas Fired Boiler System



*Condensing, Modulating
Forced Draft,
Natural Gas Fired, Hot Water Boiler
2,000,000 BTU/H Input*

GF-107 THE AERCO Benchmark 2.0 GAS FIRED BOILER Operating & Maintenance Instructions

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WARRANTIES

Foreword

The AERCO Benchmark boiler is a true industry advance that meets the needs of today's energy and environmental concerns. Designed for application in any closed loop hydronic system, the Benchmark's modulating capability relates energy input directly to fluctuating system loads. The Benchmark's 15:1 turn down ratio and condensing capability offers extremely high efficiencies and makes the Benchmark ideally suited for modern low temperature, as well as, conventional heating systems.

Whether used in singular or modular arrangements the Benchmark offers the maximum flexibility in venting with minimum installation space requirements. The Benchmark's advanced electronics are available in several selectable modes of operation offering the most efficient operating methods and energy management integration.

For service or parts, contact your local sales representative or AERCO INTERNATIONAL.

NAME: _____

ORGANIZATION: _____

ADDRESS: _____

TELEPHONE: _____

INSTALLATION DATE: _____

SAFETY PRECAUTIONS

Chapter 1

1.1 WARNINGS & CAUTIONS

Installing or operating personnel **MUST**, at all times, observe all safety regulations. The following warnings and cautions are general and must be given the same attention as specific precautions included in these instructions. In addition to all the requirements included in this instruction manual by AERCO, the installation of units **MUST** conform with local building codes, or, in the absence of local codes, ANSI Z223.1 (National Fuel Gas Code Publication No. NFPA-54). Where ASME CSD-1 is required by local jurisdiction, the installer must conform to CSD-1.

Where applicable, the equipment shall be installed in accordance with the current Installation Code for Gas Burning Appliances and Equipment, CGA B149, and applicable Provincial regulations for the class; which should be carefully followed in all cases. Authorities having jurisdiction should be consulted before installations are made.

WARNINGS!

***MUST BE OBSERVED TO PREVENT
SERIOUS INJURY.***

WARNING!

***BEFORE PERFORMING
MAINTENANCE ON THE UNIT, SHUT
OFF GAS ELECTRIC TO THE UNIT.***

WARNING!

***THE EXHAUST VENT PIPE
OPERATES UNDER A POSITIVE
PRESSURE AND MUST BE
COMPLETELY SEALED TO PREVENT
LEAKAGE OF COMBUSTION
PRODUCTS INTO LIVING SPACES.***

WARNING!

***DO NOT USE MATCHES, CANDLES,
FLAMES, OR OTHER SOURCES OF
IGNITION TO CHECK FOR GAS
LEAKS.***

WARNING!

***FLUIDS UNDER PRESSURE MAY
CAUSE INJURY TO PERSONNEL OR
DAMAGE TO EQUIPMENT WHEN
RELEASED. BE SURE TO SHUT OFF
ALL INCOMING AND OUTGOING
WATER SHUTOFF VALVES AND
CAREFULLY DECREASE ALL
TRAPPED PRESSURES TO ZERO
BEFORE PERFORMING ANY
MAINTENANCE.***

CAUTIONS!

***Must be observed to prevent equipment
damage or loss of operating
effectiveness.***

CAUTION!

***Many soaps used for gas pipe leak
testing are corrosive to metals. The
piping must be rinsed thoroughly with
clean water after leak checks have been
completed.***

CAUTION!

***Do not use this boiler if any part has
been under water. Call a qualified
service technician to inspect and
replace any part that has been under
water.***

NOTES:

***Notes must be observed for proper
operating procedures & conditions.***

SAFETY PRECAUTIONS

1.2 EMERGENCY SHUTDOWN

Should overheating occur or the gas supply fail to shut off, manually shut off the gas supply external to the boiler.

1.3 PROLONGED SHUTDOWN

After prolonged shutdown, it is recommended that the startup procedures in Section 4 and test procedures in Section 6 of this manual be performed, to verify system-operating parameters. If there is an emergency, turn off the electrical power supply to the Aerco boiler and close the manual gas valve located before the unit. The installer is to identify the emergency shut-off device

Chapter 2 - INSTALLATION

2.1 RECEIVING THE UNIT

Each Benchmark is shipped as a single crated unit. The shipping weight is approximately 1650 pounds, and must be moved with the proper rigging equipment for safety and to avoid damages. The unit should be completely inspected for shipping damage and completeness at the time of receipt from the carrier and before the bill of lading is signed.

NOTE:

AERCO is not responsible for lost or damaged freight.

Each unit has a Tip-N-Tell indicator on the outside of the crate. This indicates if the unit has been turned on its side. If the Tip-N-Tell indicator is tripped, do not sign for the shipment. Note the information on the carrier's paperwork and request a freight claim and inspection by a claims adjuster before proceeding. Any other visual damage to the packaging materials should also be made clear to the delivering carrier.

2.2 UNPACKING

Carefully unpack the unit by removing the packaging material. Take care not to damage the unit jacket when cutting away packaging materials. A close inspection of the unit should be made to determine if there has been any damage not indicated by the Tip-N-Tell. The freight carrier should be notified immediately if any damage is detected. The following accessories come standard with each unit and are packed separately within the unit's packing container or are factory installed on the boiler.

- Spare Spark Ignitor
- Spare Flame Detector
- ASME Pressure Relief Valve
- Ignitor Removal Tool (One per Site)
- Regulator Adjustment Tool (One per Site)
- Condensate Drain Trap and Fittings
- A Gas Supply Pressure Regulator

When ordered, optional accessories may be packed separately or with in the boiler shipping container, or may be installed on the boiler. Any standard or optional accessories shipped loose should be identified and put in a safe place until ready for installation or use

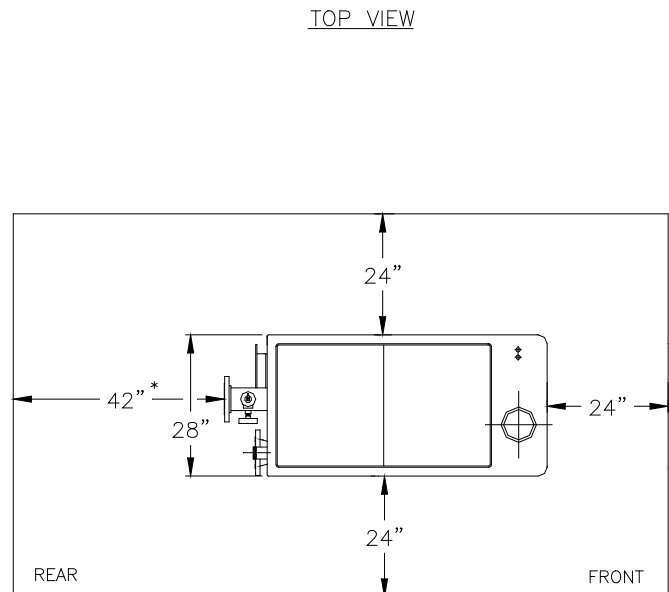
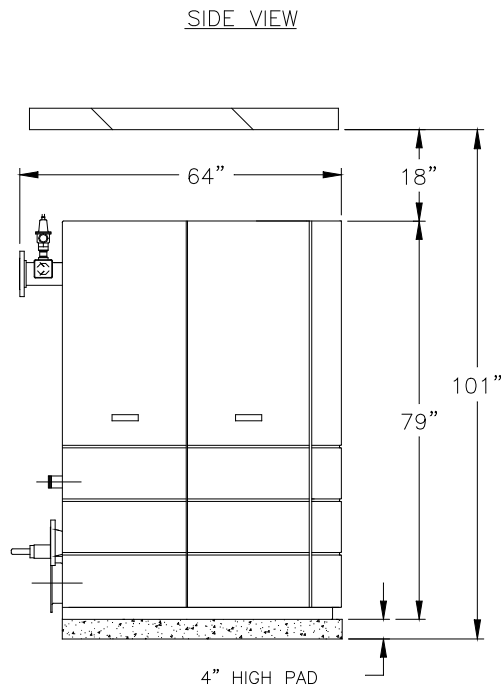


Figure 2.1
Boiler Clearances

INSTALLATION

2.3 INSTALLATION

The unit must be installed with the prescribed clearances for service as shown in Figure 2.1. The minimum clearance dimensions, required by AERCO, are listed below. Local building codes may require more clearance and take precedence

Minimum clearances required:

Sides	24"
Front	24"
Rear	36"
Top	18"

All gas piping, water piping and electrical conduit or cable must be arranged so that they do not interfere with the removal of any cover, or inhibit service or maintenance of the unit.

WARNING!

KEEP UNIT AREA CLEAR AND FREE FROM COMBUSTIBLE MATERIALS AND FLAMMABLE VAPORS AND LIQUIDS.

CAUTION!

While packaged on the shipping skid the boiler must be moved by pallet jack or forklift from the rear only.

2.3.1. SETTING THE UNIT

Lifting lugs are provided for moving the unit when it has been removed from the shipping skid (See Fig. 2.2). Remove the corrugated box and wrapping material from the unit. Remove the rear top panel from the unit to provide access to the lifting lugs. Remove the four- (4) lag screws securing the boiler to the shipping skid. Lift the unit off the shipping skid and position it on to the four-inch high mounting pad (required) in the desired location. If anchoring the unit, see the dimensional drawing in appendix F for their location. **USE ONLY THE LIFTING LUGS TO MOVE THE UNIT.**

In multiple unit installations, it is important to plan the position of each unit. Sufficient space for piping connections and future maintenance requirements must be given. All piping must include ample provision for expansion.

If installing a Combination Control, (CCP), system, it is important to identify and place the Combination Mode units in the proper physical location. If these boilers are not properly located, it will be necessary to reprogram them.

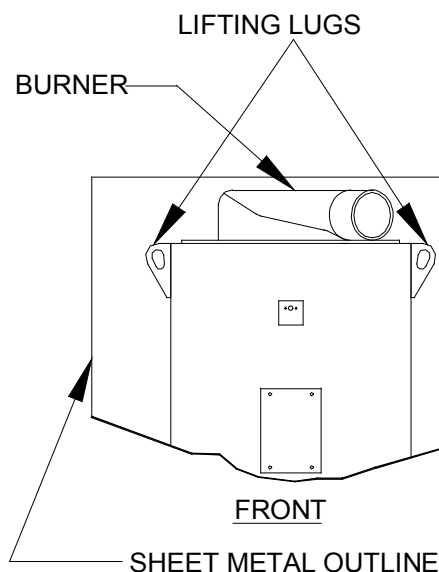


Figure 2.2
Lifting Lug Location

2.3.2 SUPPLY AND RETURN PIPING

The Benchmark 2.0 utilizes 4" 150# flanges for the water system supply and return piping connections. See appendix F for dimensional data. The physical location of the supply and return piping connections is on the rear of the unit (See Fig 2.3 For Details).

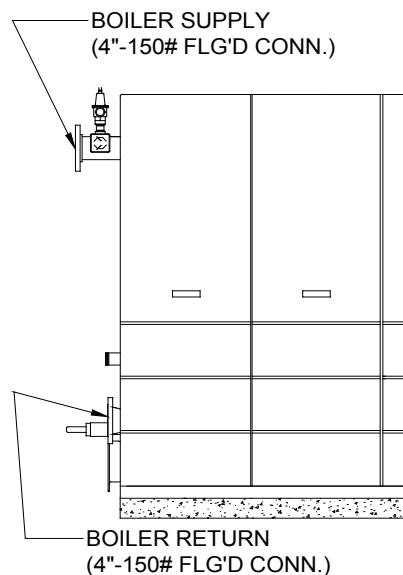


Figure 2.3
Supply and Return Location

INSTALLATION

2.3.3 CONDENSATE PIPING

The Benchmark boiler is designed to condense water vapor from the flue products and the installation must have provisions for suitable waste drainage or collection. A drain connection provided on the exhaust manifold, (see Fig 2.6) directs condensate from the exhaust manifold to a 3/4 inch NPT condensate drain trap. The condensate drain trap and associated fittings are shipped loose and should be installed on the exhaust manifold in rear of the unit. (See Fig. 2.6 for installation details.) Condensate drainage from the condensate drain trap must be by gravity to a nearby floor drain via a polypropylene hose or suitable piping. If a floor drain is not available, a condensate pump can be used to remove the condensate to drain. The maximum condensate flow rate is 11 GPH. The condensate drain trap, associated fittings and drain line must be removable for routine maintenance. Do not hard pipe.

2.4. GAS SUPPLY PIPING

The AERCO Gas Fired Equipment Gas Components and Supply Design Guide (GF-

1030) must be consulted before any gas piping is designed or started.

WARNING!

DO NOT USE MATCHES, CANDLES, FLAMES OR OTHER SOURCES OF IGNITION TO CHECK FOR GAS LEAKS.

CAUTION!

Many soaps used for gas pipe leak testing are corrosive to metals. The piping must be rinsed thoroughly with clean water after leak checks have been completed.

NOTE:

All gas piping must be arranged so that it does not interfere with removal of any cover, inhibit service or maintenance, or prevent access between the Unit and walls, or another unit.

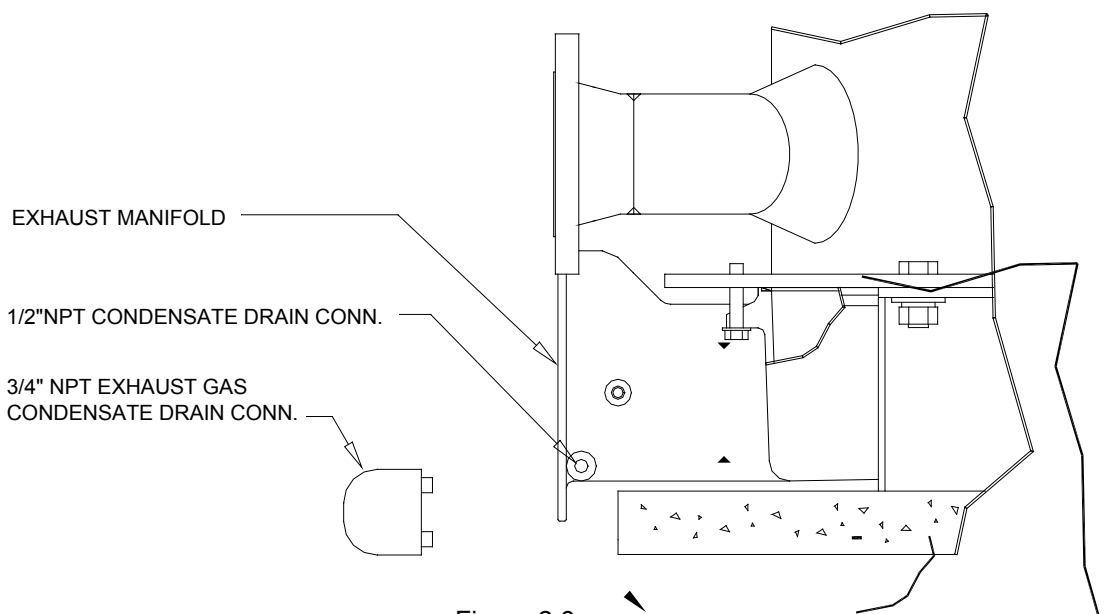


Figure 2.6
Condensate Drain Connection Location

The location of the 2" inlet gas connection is located on the rear of the unit as shown in Figure 2.7.

All pipes should be de-burred and internally cleared of any scale or iron chips before installation. No flexible connectors or non-approved gas fittings should be installed. Piping

should be supported from floor, ceiling or walls only and must not be secured to the unit.

A suitable piping compound, approved for use with natural gas, should be used sparingly. Any excess must be wiped off to prevent clogging of components.

INSTALLATION

To avoid damage to the unit, when pressure testing gas piping, isolate the unit from the gas supply piping. At no time should there be more than 14" W.C. to the unit. Leak test all external piping thoroughly for leaks using a soap and water solution or suitable equivalent. The gas piping must meet all applicable codes.

2.4.1 GAS SUPPLY SPECIFICATIONS AND GAS SUPPLY REGULATORS

The maximum static pressure to the unit must be no more than 14" W.C. Minimum operating gas pressure is 7" W.C. when the unit is firing at maximum input. Proper sizing of the gas supply regulator in delivering the correct gas flow and outlet pressure is mandatory. The gas supply pressure regulator must be of sufficient capacity volume to provide 2000 cfh while maintaining the gas pressure at 7" W.C., for natural gas, and should have no more than 1" drop from minimum to full fire.

A Maxitrol RV-91 gas supply regulator is supplied by AERCO and must be positioned as shown in figure 2.7. Maximum gas pressure to the RV-91 is 14" W.C. If the gas supply pressure will exceed 14" W.C., a lock-up style regulator is required up stream of the RV-91.

When installing the gas supply regulator(s), union connections should be placed in the proper locations to allow for maintenance.

The gas supply regulator must be properly vented to outdoors. Consult the local gas utility for exact requirements concerning venting of supply gas regulators.

NOTE:

If a regulator other than the Maxitrol RV-91 supplied with the boiler is used it must be capable of regulating 2,000,000 BTU/HR of natural gas while maintaining 7" W.C. to the boiler.

CAUTION!

A lockup style regulator must be used when gas supply pressure exceeds 14" W.C.

2.4.2 MANUAL GAS SHUTOFF VALVE

A 2" manual gas shut-off valve is furnished with each unit. The valve should be positioned as shown in Figure 2.7 upstream of the supply regulator in a readily accessible location.

2.4.3 IRI GAS TRAIN KIT

The IRI gas train is an optional gas train required in some areas by code or for insurance

purposes. The IRI gas train is factory pre-piped and wired.

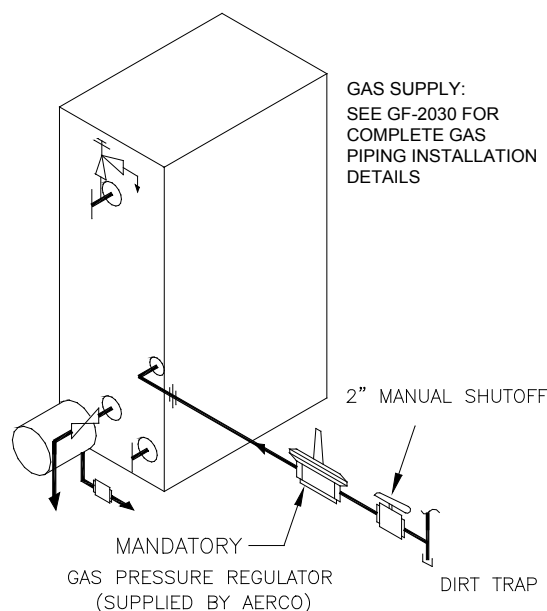


Figure 2.7
Gas Supply Regulator and Manual Shut-Off Valve Location

2.5 ELECTRICAL SUPPLY

The AERCO Gas Fired Equipment Electrical Power Wiring Guide, (GF-2060), must be consulted in addition to the following material before wiring to the unit is started. The location of the A.C. electrical wiring connections are inside the control box as shown in Figure 2.8.

NOTE:

All electrical conduit and hardware should be installed so that it does not interfere with the removal of any cover, inhibit service or maintenance, or prevent access between the unit and walls or another unit.

INSTALLATION

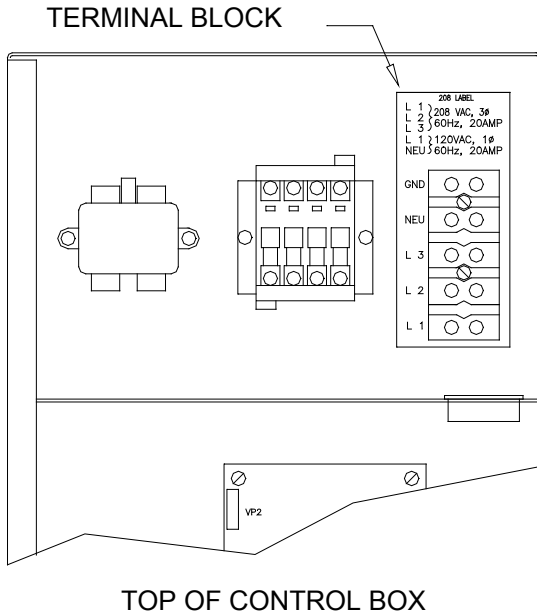


Figure 2.8
AC Input Terminal Location

2.5.1 ELECTRICAL REQUIREMENTS

The Benchmark boiler is available in one of the three following electrical configurations:

220/10/60 ---@ 20 amps
208-230/30/60---@15 amps

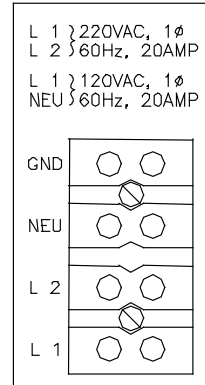
Each Benchmark boiler must be supplied by a dedicated electrical circuit. No other devices should be on the same electrical circuit as the BENCHMARK boiler. A means for disconnecting AC power from the unit (such as a service switch) must be installed near the unit for normal operation and maintenance. All electrical connections should be made in accordance with the National Electrical Code and/or with any applicable local codes.

For electrical power wiring diagrams, see the Benchmark Electrical, Power Wiring Guide, GF-2060. When wiring, conduit should be run from the knockouts provided on the control box in such a manner that it does not interfere with the removal of any sheet metal covers (see figure 2.9 for knockout location).

2.6 MODE OF OPERATION and FIELD CONTROL WIRING

The BENCHMARK Boiler is available in several different modes of operation. While each unit is factory configured and wired for a particular mode, some field wiring may be required to

complete the installation. This wiring is typically run to the Control Box located on the front of the unit behind the removable Front Door (see Fig. 2.10). Field wiring for each particular mode of operation is described in the following sections.



ELECTRICAL POWER WIRING DIAGRAM

Figure 2.9
AC Power Knockout Locations

LOWER PART OF CONTROL BOX

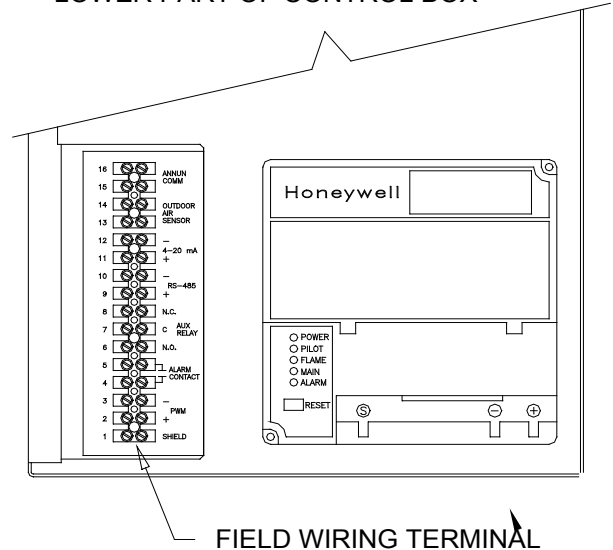


Figure 2.10
Control Wiring Terminal Location

2.6.1 CONSTANT SETPOINT MODE

No wiring connections other than electrical supply connections are required for this mode. Although fault monitoring or enable/disable interlock wiring can be utilized (see sections 2.7 and 2.8).

INSTALLATION

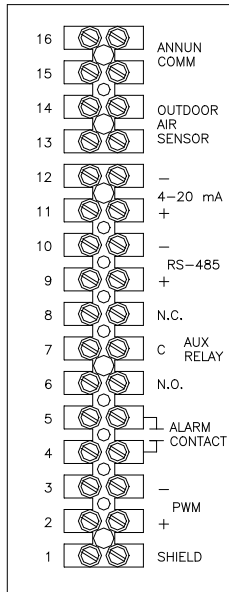


Figure 2.11
Control Wiring Terminal Strip

2.6.2 INDOOR/OUTDOOR RESET MODE

This mode of operation increases supply water temperature as outdoor temperatures decrease. An outside air temperature sensor (AERCO PN 122790) **MUST BE** wired to the control wiring terminals using a twisted shielded pair of 18-22 AWG wire (see Fig. 2.11). The cable shield is connected only at the terminals provided at the control wiring terminal strip located at the bottom left hand corner of the control panel. The sensor end of the shield must be left free and ungrounded. There is no polarity in terminating the sensor wires. When mounting the sensor, it must be mounted on the north side of the building in an area where the average outside air temperature is expected. The sensor must be shielded from the sun's direct rays, as well as direct impingement by the elements. If a cover or shield is used, it must allow free air circulation. The sensor may be mounted up to two hundred feet from the unit.

2.6.3 BOILER MANAGEMENT SYSTEM MODE

When using an AERCO Boiler Management System Panel, Model 168, the field wiring is between the BMS Panel and each unit's control wiring terminal (see Fig. 2.11). A twisted shielded pair of 18 to 22 AWG wire must be utilized for the connections. Connections are made from the AERCO boiler management system to terminals 2 and 3 of the boiler's control terminal wiring strip. Polarity must be maintained and the shield is to be connected

only at the AERCO boiler management system and must be left floating at the boiler. For further wiring instructions see the GF-108, BMS Operations Guide.

2.6.4 4 to 20mA REMOTE SETPOINT and DIRECT DRIVE MODES

The BENCHMARK boiler can be controlled with a 4-20mA signal from an energy management system or an external controller. The 4-20mA is linearly mapped to a 40-220° F set point or to 0 to 100% input.

All supplied 4-20mA signals must be a floating (ungrounded) signal. Connections between the 4-20mA source and the unit's control wiring terminals must be made using a twisted shielded pair of 18-22 AWG wire such as Belden 9841 (see Fig. 2.11). The shield is connected only at the terminal provided on the control wiring terminals. The shield must be left free and ungrounded at the source end. Polarity must be maintained when connecting the wires.

2.6.5 COMBINATION MODE

With a Combination Mode unit, field wiring is between the unit's control wiring terminals, the CCP (Combination Control Panel), and the BMS (Boiler Management System). The wiring must be done using a shielded twisted pair of 18- 22 AWG wire and polarity must be maintained. For further instructions and wiring diagrams, consult the GF-108, Boiler Management System Operations Guide and the CCP-1 data sheet.

2.7 AUXILLIARY CONTACTS

Each boiler is equipped with a SPDT relay that is powered when there is a demand for heat. The relay is provided for the control of auxiliary equipment such as pumps and louvers. Its contacts are rated for 120 VAC @ 5 amps (see figure 2.11 terminals 5,6 and 7 for wiring location).

2.8 INTERLOCKS

The Benchmark boiler offers two interlock circuits for interfacing with energy management systems and auxiliary equipment such as pumps or louvers (see figure 2.12). These interlocks are located on the inside of control panel door and are labeled *Enable/Disable* and *Delayed Interlock*. Both interlocks, described below, are factory wired closed and must be closed, (jumped), to allow the unit to fire.

2.8.1 DELAYED INTERLOCKS

The delayed interlocks are typically used in conjunction with the auxiliary relay described above in section 2.7. This interlock circuit is located in the purge control section of the start

INSTALLATION

string. It therefore does not need to be closed for the boiler start sequence to begin but does need to be closed within 30 seconds for the boiler to fire. The delayed interlock is usually connected to the proving device of the auxiliary equipment started by the auxiliary relay. These interlocks are labeled *Delayed Int'lock* and their location is on the inside of the control panel door. The interlock circuit is 120 VAC, and comes factory pre-wired closed. See figure 2.12.

2.8.2 REMOTE ENABLE/ DISABLE

An enable/disable circuit is provided for remote start and stop. The circuit is labeled *Enable/Disable* and is located on the inside of the control panel door. The circuit is 120 VAC, and comes factory pre-wired closed (jumped). See figure 2.12.

2.9 FAULT RELAY WIRING

The fault relay contains a set of normally open dry contacts, rated for 5 amps at 120 VAC and 5 amps at 30 VDC that close on any fault condition. The relay will remain energized until the fault is cleared and the CLEAR button is depressed. The fault relay connections are shown in Figure 2.11.

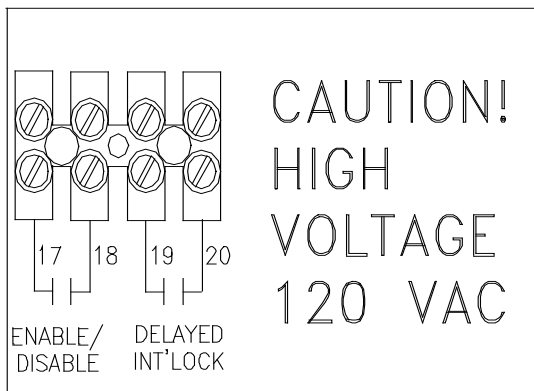


Figure 2.12
Interlock Wiring

2.10 FLUE GAS VENT INSTALLATION

The AERCO Venting and Combustion Air Guide, GF-2050, must be consulted before any flue gas vent or inlet air venting is designed or installed. U/L listed, positive pressure, watertight vent materials as specified in AERCO's GF-2050, must be used for safety and code compliance. Because the unit is capable of discharging low temperature exhaust gases, the flue must be pitched back to the unit a minimum of 1/4" per foot to avoid any condensate pooling and to allow for proper drainage.

The combined pressure drop of vent and combustion air systems must not exceed 140 equivalent feet of 8" inch ducting. Fittings as well as pipe lengths must be calculated as part of the equivalent length.

For a natural draft installation the draft must not exceed $-0.25"/+0.25"$ W.C. These factors must be planned into the vent installation. If the maximum allowable equivalent lengths of piping are exceeded, the unit will not operate properly or reliably.

2.11 COMBUSTION AIR

The AERCO Venting and Combustion Air Guide, GF-2050, MUST be consulted *before* any flue or combustion supply air venting is designed or started. Combustion air supply is a direct requirement of ANSI 223.1, NFPA-54, and local codes. These codes should be consulted before a permanent design is determined.

The combustion air must be free of chlorine, halogenated hydrocarbons, or other chemicals that can become hazardous when used in gas-fired equipment. Common sources of these compounds are swimming pools, degreasing compounds, plastic processing and refrigerants. Whenever the environment contains these types of chemicals, combustion air must be supplied from a clean area outdoors for the protection and longevity of the equipment.

The Benchmark is UL listed for 100% sealed combustion and can be ordered with a sealed combustion option, or can be installed using room air as long as there is an adequate supply. (See section 2.11.3 for more information concerning sealed combustion air.)

If the sealed combustion air option is not being used, an inlet screen will be attached at the blower suction and the knockout at the top of the unit will be and should remain in place.

The more common methods of supplying combustion air are outlined below. For more information concerning combustion air, consult the AERCO GF-2050, Venting and Combustion Air Guide.

2.11.1 COMBUSTION AIR FROM OUTSIDE THE BUILDING

Air supplied from outside the building must be provided through two permanent openings. Each opening must have a free area of not less than one square inch for each 4000 BTU boiler input. The free area must take into account restrictions such as louvers and bird screens.

2.11.2 COMBUSTION AIR FROM INSIDE THE BUILDING

When combustion air is provided from within the building, it must be supplied through two permanent openings in an interior wall. Each opening must have a free area of not less than one square inch per 1000 BTUH of total boiler input. The free area must take into account any restrictions such as louvers.

2.11.3 SEALED COMBUSTION

The BENCHMARK boiler is UL listed for 100%-sealed combustion and can be ordered with a sealed combustion option or without. Units ordered in the sealed combustion configuration will come with an air inlet assembly installed on the blower. The knockout at the top of the boiler must be removed and the combustion air ductwork must be attached to the 6" x 8" adapter that is provided just below the knockout.

In a sealed combustion air application, the combustion air ducting pressure losses must be taken into account when calculating the total maximum allowable venting run. See the AERCO Venting and Combustion Air Guide, GF-2050. When using the boiler in a sealed combustion air configuration, each unit must have a minimum 8" diameter connection at the unit.

2.12 UNIT INITIAL FILL

Before filling the unit's shell for the first time, blow out all the connecting water and gas piping and check thoroughly for leaks. Rinse all soapsuds from the gas piping with clean water. Do not allow water to get on the control panel or electrical connections. Check that all installation procedures have been completed before filling the unit.

The following steps should be followed when filling the unit:

1. Close the unit's drain valve.
2. Open the system return and supply valves to the boiler.
3. Make certain that the system pressure reducing fill valve is open to replenish pressure in the system as the unit fills.
4. Observing the pressure/temperature gauge, supplied with the unit, allow pressure to slowly build up in the unit.

CONTROL PANEL OPERATING PROCEDURES

Chapter 3 - CONTROL PANEL OPERATING PROCEDURES

The following is a guide to the operation of the control panel. Initial start-up of this unit must be performed by factory trained start-up personnel. Operation prior to initial start-up by factory trained personnel will **void** the warranty.

CAUTION:

All initial installation procedures must be satisfied before attempting to start the unit.

WARNING:

DO NOT ATTEMPT TO DRY FIRE THE BOILER. STARTING THE UNIT WITHOUT A FULL WATER LEVEL CAN SERIOUSLY DAMAGE THE UNIT AND MAY RESULT IN PERSONNEL INJURY OR PROPERTY DAMAGE. THIS SITUATION WILL VOID ANY WARRANTY.

3.1 THE CONTROL PANEL

The Benchmark Control Panel has been designed to provide the operator with all the necessary information required to effectively operate and troubleshoot this unit. A 4amp circuit breaker is provided to protect the control

circuits. There are six separate accessible controls or displays available to the operator, (see Fig. 3.1). These are:

1. The Temperature Controller
2. The Annunciator & Function Switches
3. Circuit Breaker
4. The Combustion Safeguard Controller
5. Water Level Test and Reset Switches
6. On/Off Switch
7. Fault Indicator Light

The following sections will describe the above components in more detail.

WARNING

CONTROL BOX INTERNALS MUST NOT BE SERVICED OR ACCESSED BY OTHER THAN FACTORY CERTIFIED SERVICE TECHNICIANS. ALL CONTROL BOX INTERNALS HAVE THE CAPABILITY OF HOLDING AN ELECTRICAL VOLTAGE OF 220 AND 120 VOLTS AC.

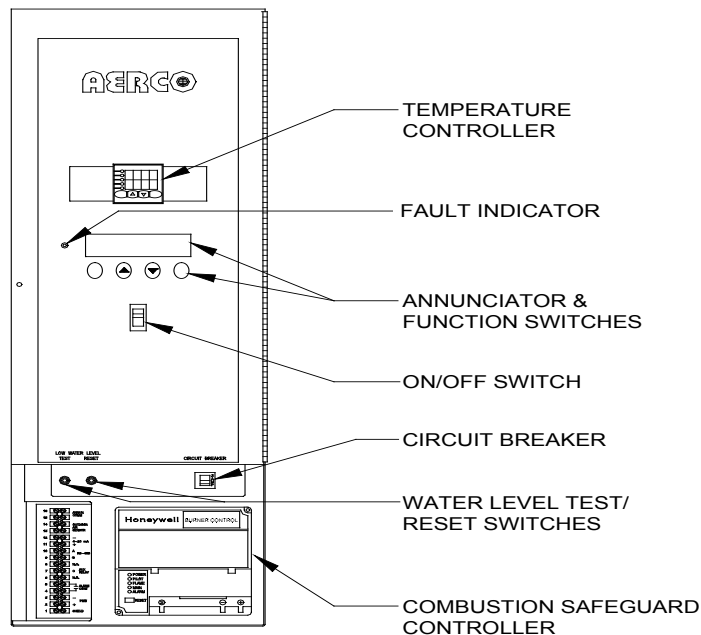


Figure 3.1
Front Panel Controls Location

CONTROL PANEL OPERATING PROCEDURES

3.2 THE TEMPERATURE CONTROLLER

The temperature controller is a PID programmable controller that utilizes feedback information to accurately maintain a desired set point. It is the primary source for programming and viewing operating parameter settings. It plays a part in the start sequence and includes other features such as:

- LED display
- 5 indicator status lights
- 3 menu levels
- RS-485 communications capability

3.2.1 LED DISPLAY

The display consists of a two line, four character seven segment LED's, (see Fig. 3.2). When an operating parameter is chosen to be changed or looked at, the lower LED display indicates the parameter being looked at in the form of a code. The upper display indicates the parameter's value. For a complete listing of the operating parameters see Appendix A of this manual.

3.2.2 INDICATOR STATUS LIGHTS

The first LED indicator light, "MAN" indicates whether the controller is in auto or manual mode, (see Fig 3.2). When lit, the controller is in manual mode and the operator is responsible for operation of the unit. When the LED is not lit, the controller is in auto mode. In auto mode the controller is operating the unit from signals generated by sensors located on the unit or in the system, or by signals from an energy management system.

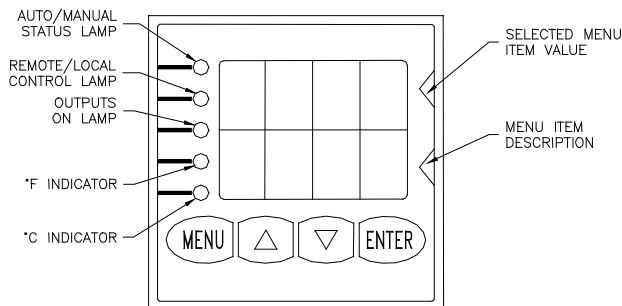
The second LED, "REM", designates whether the controller is being controlled locally or remotely, (see Fig. 3.2). When lit the controller is in remote mode and it can accept commands from an external source. When this LED is not lit, the controller is in local mode and it will respond to its current internal settings are. All external commands are ignored.

The third LED, "Demand for Heat " indicates whether the temperature controller's internal start relay is open or closed (see Fig. 3.2). The start relay is part of the start sequence, closing when the control signal reaches 25% or higher. This lights the "Demand for Heat" LED and begins the combustion process. The start relay opens when the control signal is 19.9% or lower, shutting the "Demand for Heat" LED and stopping the combustion process.

The last two LED's, "°F" and "°C", indicate whether the temperature displayed is °Fahrenheit or °Celsius, (see Fig. 3.2).

NOTE:

When the temperature controller is displaying in °C only the temperature being displayed is affected. All other values remain in °F.



3.2

Temperature Controller Operating Status Lights

3.2.3 MENU LEVELS

The temperature controller has two menu levels that are operator accessible for programming the unit functions and parameters. These are the Primary and Secondary menus:

To change from the primary menu to the secondary menu, simultaneously depress the ↑ arrow key and ENTER button. To change from the secondary to the primary menu simultaneously press the ↓ arrow key and the MENU button.

To scroll through a menu, depress the MENU button. To change a parameter scroll through the menu until the desired parameter is indicated on the controller's lower LED display. Then use the ↑ and ↓ arrow keys to change the parameters value. Once a parameter's value has been changed the ENTER key must be depressed for the change to be recognized by the controller. Leaving the desired parameter without entering the new value will result in that parameter value defaulting back to the previous value. Detailed descriptions and instructions for accessing each menu parameter are listed within this section. For more data concerning the minimum and maximum range, and factory defaults of menu parameters, see Appendix E of this manual. Each menu level is described below.

CONTROL PANEL OPERATING PROCEDURES

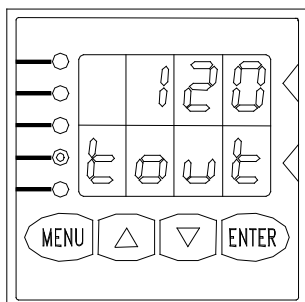
3.3 THE PRIMARY MENU

The primary menu is the default menu. When in another menu level and there is no activity for 5 minutes the temperature controller will default back to the primary menu. The Primary menu allows the operator access to the following temperature controller parameters:

Code	Meaning
tout	Outlet water temperature.
pct	Firing rate percentage.
Setp	Desired set-point temperature.
Auto	Automatic controlling mode ON or OFF.

3.3.1 OUTLET TEMPERATURE (tout)

Outlet temperature is the actual outlet water temperature of the unit. To access outlet temperature press the MENU button until (tout) is displayed in the lower LED. The variables under this feature may not be manually changed. Fig. 3.3 below shows an outlet temperature of 120° F



3.3

Outlet Temperature Display

3.3.2 FIRING RATE PERCENTAGE (Pct)

Percentage of firing rate is a number, in percent, that is directly related to the input BTU's of the unit. For instance a 50% firing rate equals approximately 1,000,000 BTU gas input while a 75 % firing rate equals approximately 1,500,000 BTU gas input and so on.

CAUTION:

Do not leave the unit unattended while in the manual mode of operation.

WARNING:

WHEN SWITCHING FROM AUTO TO MANUAL MODE, THE UNIT WILL CONTINUE TO OPERATE AT THE SAME FIRING RATE PERCENTAGE AS WHEN THE UNIT WAS IN AUTO MODE.

To access the firing rate percentage, press the MENU button while in the primary menu until (Pct) is displayed in the lower LED. While in manual mode, (see section 3.3.4); use the ↑ or ↓ arrow key to increase or decrease the percentage of firing rate. Press the ENTER button to accept the desired change. Figure 3.4 shows the temperature controller displaying a 100% firing rate.

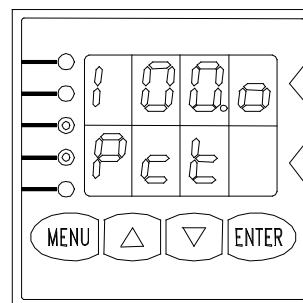


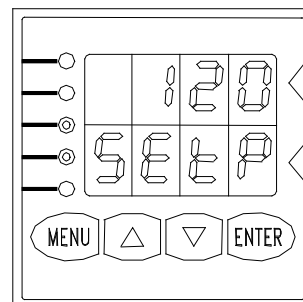
Figure 3.4

Percent of Firing Rate Display

3.3.3 SETPOINT (Setp)

Setpoint is the desired outlet water temperature that is to be maintained by the unit when in automatic mode. Fig 3.5 shows the controller with a setpoint of 120° F.

To access the unit's setpoint press the MENU button until (Setp) is displayed in the lower LED. To increase or decrease the unit's setpoint press the ↑ or ↓ arrow keys. Press the ENTER button to accept the change.



3.5

Setpoint Display

3.3.4 AUTOMATIC / MANUAL (Auto)

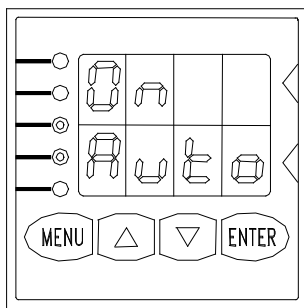
When set to automatic mode the controller is receiving and processing inputs from temperature sensor(s) located externally or on the unit. The controller uses these inputs to automatically decrease or increase the firing rate to match the load.

CONTROL PANEL OPERATING PROCEDURES

In manual mode, the controller no longer automatically controls the firing rate of the unit. It is up to the operator to control the outlet temperature and firing rate. Manual mode is commonly used for service and troubleshooting the unit. All safety controls remain functional whether the controller is in automatic or manual mode.

To place the controller in automatic mode press the MENU button until (Auto) is displayed in the lower LED.

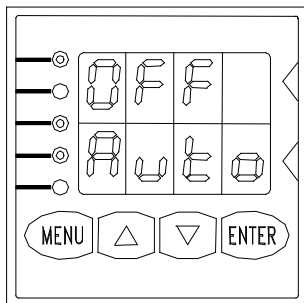
Now press the \uparrow or \downarrow arrow keys until ON is displayed in the upper LED (see fig 3.6). Press the enter button to accept the change. The MAN LED should not be lit.



3.6

Auto/ Manual Display with Auto On

To place the temperature controller in manual mode, press the \uparrow or \downarrow arrow keys until OFF is displayed in the upper LED. (See Fig 3.7). Press the enter button to accept the change. The MAN LED should now be lit.



3.7

Auto/Manual Display with Manual On

3.4 THE SECONDARY MENU

The secondary menu is used to set temperature control parameters. It is necessary to access this menu when setting PID values or changing the unit mode of operation.

To access the secondary menu, press the \uparrow arrow key and ENTER simultaneously. To scroll through the menu press the MENU button.

The secondary menu allows access to the following temperature control features:

<i>Func</i>	Mode of Operation
<i>REFT</i>	Building reference temperature
<i>RR</i>	Reset Ratio
<i>OSAT</i>	Outside air sensor feature
<i>Oat</i>	Maximum outside air temperature that unit is enabled to run
<i>LLT</i>	Low temperature alarm setpoint
<i>HLt</i>	High temperature alarm setpoint
<i>Pb1</i>	Proportional Band
<i>Int</i>	Integral Rate
<i>Drt</i>	Derivative Time
<i>Addr</i>	Controller address for external communication
<i>Lore</i>	Local/ remote status of the control

For a complete explanation of the secondary menu parameters see Appendix A of this manual.

3.5 STATUS ANNUNCIATOR

The status annunciator consists of the annunciator circuit board, the front panel LCD display, and four function switches. Figure 3.8 show the location of the LCD and four function switches. The annunciator circuit board is the interface between the LCD display and the combustion safeguard system. It monitors the unit during every phase of operation and displays start sequence and fault messages. The function switches are used to reset the annunciator and gain access to the annunciator's three function menus.

CONTROL PANEL OPERATING PROCEDURES

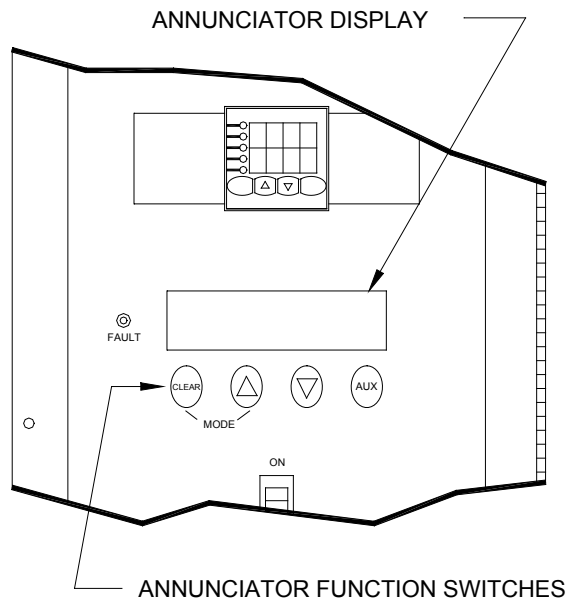


Figure 3.8

Annunciator Function Switches and LCD Display

The status annunciator only monitors the boilers control system. If any portion should fail, the boiler will still operate with no adverse effects.

3.5.1 ANNUNCIATOR FUNCTION SWITCHES and DISPLAYS

The Annunciator has three function displays that are available to the operator. These are the MAIN, the CYCLES, and the SET DATE displays. These displays are accessed using the four membrane switches located directly under the LCD display on the front of the control panel. They are labeled CLEAR, \uparrow , \downarrow , and AUX. The MAIN display is used during normal operation of the unit. In the MAIN display, start sequence and fault messages can be viewed. To return to the MAIN display from any other display, simultaneously press CLEAR and the \uparrow arrow key. To reset the MAIN display after a fault has occurred press the CLEAR button.

The CYCLES display indicates the date and time, and the number of cycles the unit has started since it was reset. When in the CYCLES display only the number of cycles can be reset. To reset the number of cycles to 0, simultaneously press the \uparrow , and \downarrow arrow keys and hold them for approximately four seconds.

In the SET DATE display, both the time and date are displayed and can be changed. To access the SET DATE display, press the CLEAR button while in the CYCLES display. Continue pressing the CLEAR button to move through the SET DATE display fields. Use the \uparrow and \downarrow arrow keys to set the date and time.

The following table shows the messages displayed after accessing the CYCLES and SET DATE displays.

# CYCLES = "DATE" "TIME"	The number of times the controller has completed it's start cycle, and the time and date of the last reset
SET DATE: "DATE" "TIME"	Displays and allows setting of the date and time

3.5.2 ANNUNCIATOR FAULT MESSAGES

The following table lists the Annunciator MAIN display fault messages and their meanings.

MESSAGE	MEANING
RESET MAIN POWER	AC power has been interrupted. Power must be shut off for 20 seconds then restored to reset the display.
HIGH WATER TEMP	The unit has locked out due to the outlet water temperature exceeding the high temperature limit setting.
LOW GAS PRESSURE	The unit has tripped due to low gas pressure.
HIGH GAS PRESSURE	The unit has tripped due to high gas pressure
LOW WATER LEVEL	The shell water level is below the probe level.
INTERLOCK OPEN	The interlock terminals, in the relay box, are not closed.
PURGE INTLK OPEN	The proof of closure or the purge switch did not prove closed during the start sequence.
LOW AIR FLOW	The airflow switch did not prove closed during the start sequence.
SYSTEM FAULT PURGE INTERLOCKS	The proof of closure or purge switch did not prove closed 45 seconds after the unit attempted to start.
SYSTEM FAULT LOW AIR PRESSURE	The air pressure switch did not prove closed 45 seconds after the unit attempted to start.
FLAME FAULT	Flame did not prove at

CONTROL PANEL OPERATING PROCEDURES

<i>DURING IGNITION TRIAL</i>	the end of the trial for ignition period.
<i>LOCKOUT RUN AIR FLOW</i>	The air pressure switch opened after flame was proven.
<i>LOCKOUT RUN FLAME</i>	Flame signal was lost after flame was proven.
<i>LOCKOUT RUN</i>	The combustion safeguard is locked out.

3.5.3 ANNUNCIATOR START SEQUENCE MESSAGES

The following table lists the annunciator MAIN display start sequence messages.

<i>STANDBY</i>	The unit is in standby mode waiting for a call for heat
<i>PURGING</i>	The unit is in the 7-sec. purge.
<i>IGNITION TRIAL</i>	The unit is in 10 second ignition position, attempting to light the burner
<i>FLAME PROVEN</i>	The unit has established flame and is firing.

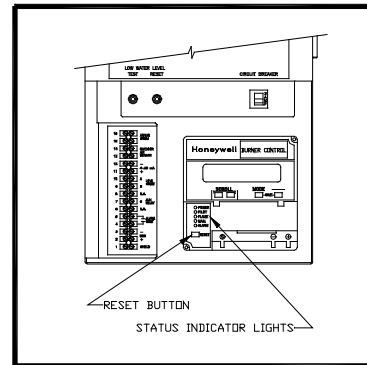
3.6 THE COMBUSTION SAFEGUARD

The Combustion Safeguard is responsible for monitoring the safety components during the start sequence and after flame is established. It is also responsible for the timing of the start sequence, including the purge and ignition cycles.

The combustion safeguard is located in the bottom of the control panel as shown in Figure 3.9. There are five status LED's that indicate the status of operation. These lights are redundant to messages displayed by the annunciator. and are useful as a double check on the annunciator. The table below defines the function of each LED's. A reset button located on the combustion safeguard is used to reset it after a lockout. The combustion safeguard will shut the unit down if one of the following occurs:

DESCRIPTION	FUNCTION
POWER	Lights when the limit string is satisfied and there is a call for heat.
PILOT	Lights when the air flow circuit is satisfied.
FLAME	Lights during the trial for ignition period.
MAIN	Lights once flame has been detected.

ALARM	This lights when the controller is in a LOCKOUT condition.
-------	--



3.9

Combustion Safeguard Status Indicator LED Location

Note:

After resetting the combustion safeguard the Annunciator must also be reset using the CLEAR button.

3.7 WATER LEVEL TEST and RESET SWITCHES

The water level switches are located on the left side of the control box (see Fig. 3.10). When depressed, the TEST switch simulates a low water level condition by breaking the connection between the water level probe and the sensing circuitry. To test the low water level circuitry depress the test switch for 3 seconds. The unit should fault resulting in the red fault light blinking and the LED display showing LOW WATER LEVEL.

Note:

Only water level circuitry is tested during the above test. The water level probe is not tested. To determine if the probe is functioning properly, the water level must be reduced below the level of the probe.

To reset the unit, depress the water level reset switch, the annunciator CLEAR button, and if necessary, the reset button on the combustion safeguard.

CONTROL PANEL OPERATING PROCEDURES

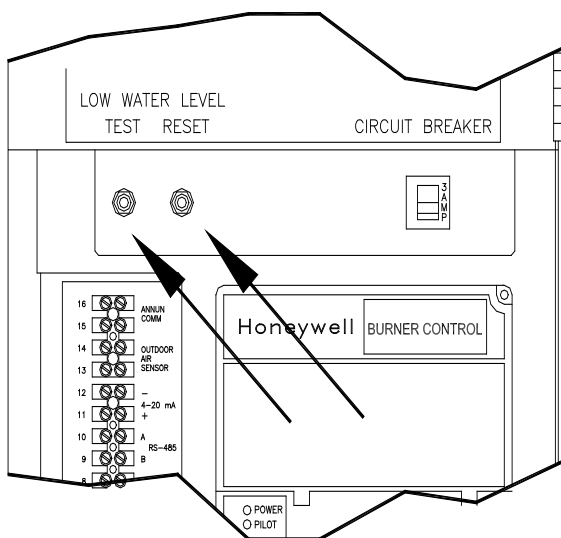


Figure 3.10
Water Level Test and Reset Switch Locations

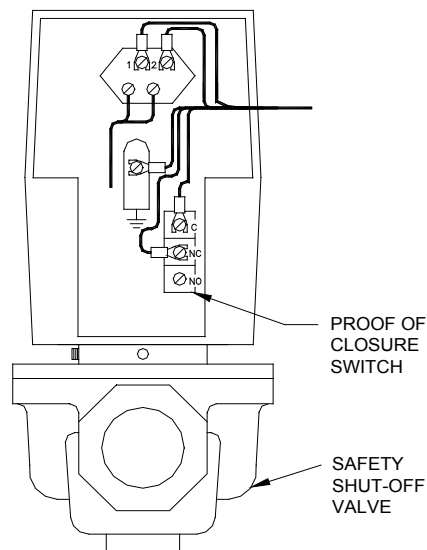


Figure 3.11
Proof of Closure Switch Location

3.8 ON/OFF SWITCH

The ON/OFF switch is located on the front of the control panel below the annunciator. (See Fig. 3.1). It is part of the start sequence and must be in the ON position to enable the unit to fire. When the switch is in the ON position and illuminated, it is indicating that the start limit string, consisting of water temperature, gas pressure, water level, and the interlock is satisfied, and that the alarm relay is not activated. The unit at this point is in standby mode and ready to run.

Note:

The On/Off switch only interrupts the start sequence. **It does not shut off power to the boiler's safety controls.**

3.9 STARTING SEQUENCE

When the unit is in the standby mode, and there is a demand for heating, the following will occur:

1. Upon demand the temperature controller's ON status indicator will light.
2. The combustion safeguard's OPR CTRL LED lights, and the blower contactor energizes, starting the blower.

3. The system next checks for proof of closure of the safety shut-off valve, (see Fig. 3.11), and the air fuel valve rotates open engaging the purge position switch (see Fig. 3.12).
4. The LCD display shows PURGE INTLK OPEN until the above conditions are met. Once met the LCD display will show LOW AIR FLOW.

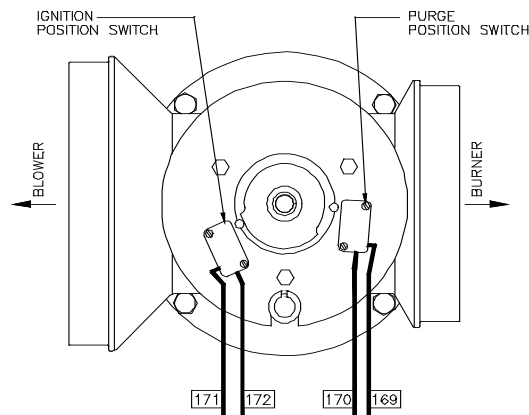


Figure 3.12
Air/Fuel Valve Open and Engaging the Purge Position Switch

5. The blower proof switch closes, (See Fig. 3.13), and the LCD display will show PURGING.

CONTROL PANEL OPERATING PROCEDURES

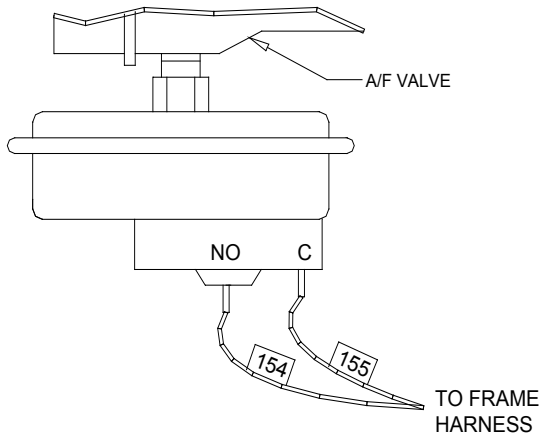


Figure 3.13
Blower Proof Switch Location

6. Simultaneously, the AIR FLOW LED on the combustion safeguard lights, and the unit begins its 7-second purge cycle.
7. At the end of the purge cycle, the combustion safeguard initiates a 10 second trial for ignition and the following simultaneously occurs:
 - The LCD displays the message IGNITION TRIAL.
 - The combustion safeguard PTFI LED lights
 - The ignition transformer energizes.
 - The air/fuel valve rotates to ignition position, engaging the Ignition position switch and energizing the safety shut-off valve, (see Fig. 3.14).
8. Once the combustion safeguard detects flame, a flame stabilization period of 10 seconds is begun. If at the end of the flame stabilization period the flame sensor still detects a flame, the unit is released to modulate.

At this point, with the unit firing properly, the FLAME, OPR CNTRL and AIR FLOW LED's on the combustion safeguard will be lit and the LCD display shows the message FLAME PROVEN.

The unit, provided it is in the automatic mode, will now be controlled by the temperature control system.

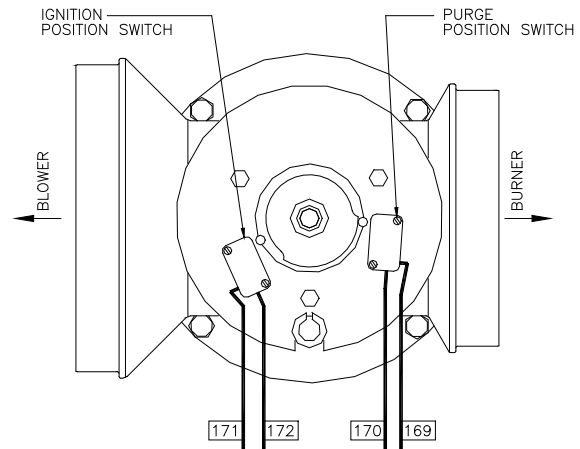


Figure 3.14
Air/Fuel Valve in Ignition Position, Engaging the Ignition Position Switch

3.10 AFTER FLAME

Once the control signal has dropped below the stop level (see section 3.12 for Stop Level explanation), the combustion safeguard closes the safety shut-off valve extinguishing the flame. The LED's on the combustion safeguard will extinguish. The annunciator display will show the message STANDBY. The green ON status indicator light, on the temperature controller, extinguishes indicating there is no longer a call for heat.

3.11 START / STOP LEVELS

The start and stop levels are firing rate percentages that start and stop the unit based on load. These levels are determined either manually or automatically through PID controls. The start level is preset to 25% and the stop level is preset to 20%. These levels are factory preset and should not require adjustment.

3.12 AUTO RESTARTS

The unit will automatically restart after the following faults have occurred:

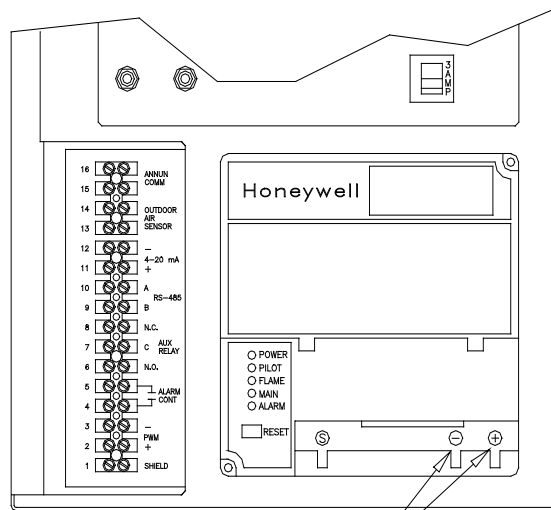
- Power failure
- Water over-temperature
- High or Low Gas pressure

CONTROL PANEL OPERATING PROCEDURES

minimum required flame signal for operation of the burner is 6 VDC.

3.13 FLAME TEST JACKS

The front of the combustion safeguard has two test jacks marked + and - for flame monitoring, (see Fig. 3.15). To access the test jacks remove the combustion safeguard cover by turning the center screw counterclockwise. A standard voltmeter is required to monitor the flame signal strength. The combustion safeguard will output a 0-15VDC signal from the test jacks. The



FLAME TEST JACKS

Figure 3.15
Flame Test Jack Location

BURNER CONTROL

Chapter 4 - INITIAL START- UP

4.1 INITIAL START- UP REQUIREMENTS

The initial start-up of the Benchmark Boiler is comprised of the following steps:

- installation completed
- combustion calibration
- proper setting of controls and limits
- mode of operation settings (see Section 5)
- safety device testing (see Section 6)

Installation should be completed 100% before performing initial start-up; and the start-up must be complete prior to putting the unit into service. Starting a unit without the proper piping, venting, or electrical systems can be dangerous and voids the product warranty. The following start-up instructions should be precisely followed in order for the unit to operate safely, at a high thermal efficiency, and with low flue gas emissions.

Initial unit start-up is to be performed ONLY by AERCO factory trained start-up and service personnel. After following the steps in this section, it will be necessary to perform the mode of operation settings in section 5, and the safety control test procedures in section 6 to complete the initial unit start-up.

An AERCO Gas Fired Startup Sheet included with each BENCHMARK must be completed for each unit for warranty validation and a copy must be returned promptly to AERCO at:

AERCO International, Inc.
159 Paris Ave.
Northvale, NJ 07647

WARNING!

DO NOT ATTEMPT TO FIRE THE BOILER WITHOUT FULL WATER LEVEL. THIS CAN SERIOUSLY DAMAGE THE UNIT AND MAY RESULT IN PERSONAL INJURY OR PROPERTY DAMAGE. THIS IS NOT COVERED BY WARRANTY.

CAUTION!

All installation procedures in Section 2 must be completed before attempting to start the unit.

4.2 TOOLS AND INSTRUMENTATION FOR COMBUSTION CALIBRATION

To properly perform combustion calibration, the proper instruments and tools must be used and

correctly installed on the unit. The following sections outline the necessary tools and instrumentation as well as their installation.

4.2.1 REQUIRED TOOLS AND INSTRUMENTATION

The following tools and instrumentation are necessary to perform combustion calibration of the unit:

1. A digital combustion analyzer with oxygen accuracy to +/- 0.2%, and carbon monoxide in PPM.
2. A 16" W.C. manometer and plastic tubing.
3. Three, 1/8" NPT to barbed fittings for use with the gas supply and differential manometers (two fitting will be used if differential pressures are taken).
4. AERCO differential gas pressure regulator adjustment tool P/N 123643 (one supplied per installation)
5. Small and large flat blade screwdrivers.
6. Tube of silicone adhesive
7. * Digital multimeter with 10 amp and AC/DC volt capability.

**Although not necessary for actual start-up procedures, recommended for troubleshooting.*

4.2.2 INSTALLING THE SUPPLY GAS MANOMETER

1. Close the manual gas supply valve up stream of the unit.
2. Remove the 1/8" NPT pipe plug from the port on the inlet side of the safety shut off valve (see Fig. 4.1).
3. Install a barbed fitting into the pipe plug tapping.
4. Attach one end of a length of plastic tubing to the barbed fitting and one end to the 16" W.C. manometer.

INITIAL START-UP

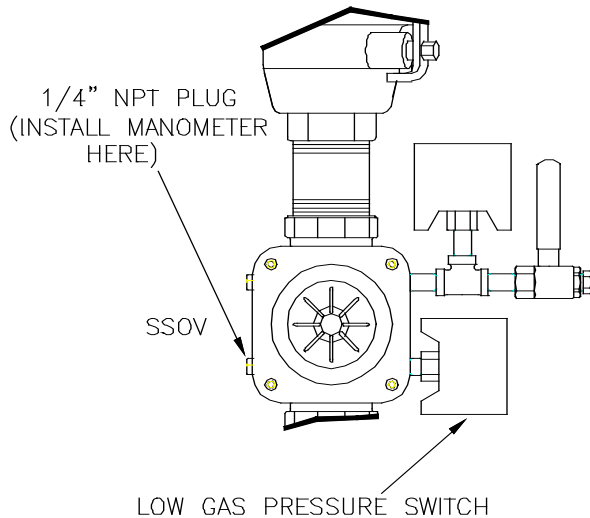


Figure 4.1
1/8" Gas Plug Location

4.2.3 PREPARING THE FLUE VENT PROBE HOLE

1. If the unit has been installed using the recommended AL29-4C vent, there will be a 3/8" hole, in the center of the starter section (Part #123679). The outer vent section, that covers the vent section connections must be loosened and slid down to uncover the hole (see Fig. 4.2)
2. Adjust the stop on the combustion analyzer probe, if so equipped, so that it extends approximately midway into the flue gas flow. Do not insert the probe at this time.

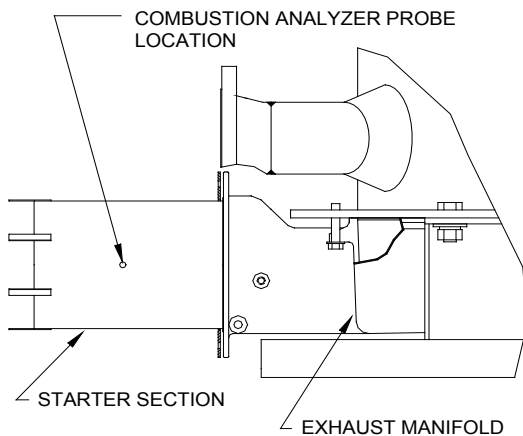


Figure 4.2
Analyzer Probe Hole Location

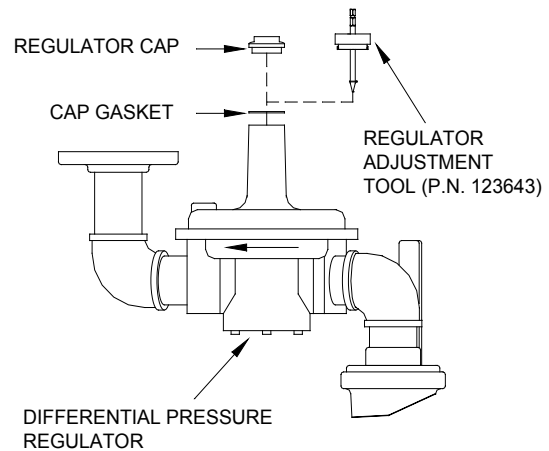


Figure 4.3
Differential Regulator Adjustment Tool Installation

4.2.4 INSTALLING THE DIFFERENTIAL REGULATOR ADJUSTMENT TOOL

1. Remove the cap from the differential pressure regulator (see Fig. 4.3).
2. Place the gasket from the regulator cap onto the regulator adjustment tool.
3. Prior to installing the tool on the regulator, pull up the screwdriver blade of the tool. Then thread the tool into the regulator.
4. Engage the tool's screwdriver blade into the regulator's adjustment screw slot.

4.3 COMBUSTION CALIBRATION

The Benchmark ships combustion calibrated from the factory. Recalibration as part of a start-up is necessary due to altitude, gas BTU content, gas supply piping and supply regulators. Factory test data sheets are shipped with each unit as a reference.

It is important to perform the following procedure as outlined. Following this procedure as outlined will keep readjustment to a minimum and provide for optimum performance.

1. Open the water supply and return valves to the unit and ensure that the system pumps are running.
2. Open the gas supply valve(s) to the unit.
3. Using the 16" manometer ensure that there is adequate supply gas pressure. If using a non-lock up regulator, static pressure should be between 9" to 14" WC, but no higher than 14" WC. If using a lock-up style regulator adjust the static supply gas pressure for approximately 9" WC.

INITIAL START-UP

4. Place the green ON/OFF switch in the OFF position. Turn on AC power to the unit. The temperature controller and annunciator displays should light.
5. Set the temperature controller to manual mode and change the firing rate to (Pct) to 0.0 percentage.
6. Place the green ON/OFF switch in the ON position and change the firing rate (Pct) to 30%. The unit should begin its start sequence and fire.

NOTE:

On initial start-up, or return to service from a fault condition, a two-minute warm-up timer is activated, preventing the BTU input from exceeding 800,000 BTU/H although the control signal may indicate a greater input.

7. Following the warm-up period, gradually increase the firing rate to 100% and adjust the supply gas pressure between 7.0 to 7.3" water column.
8. Lower the firing rate to 40%. Insert the combustion analyzer probe into the stack and allow enough time for the combustion analyzer to settle. Compare the measured oxygen level to the oxygen range for inlet air temperature in Table 1.

Combustion Oxygen Levels for a 40% Firing Rate

Inlet Air Temp	Oxygen	Carbon Monoxide
80 °F	7.2%	<50ppm
70°F	7.6%	<50ppm
60°F	8.0%	<50ppm
50°F	8.4%	<50ppm
40°F	8.8%	<50ppm
30°F	9.2%	<50ppm
20°F	9.6%	<50ppm
10°F	10.0%	<50ppm
0°F	10.4%	<50ppm
-10°F	10.8%	<50ppm
-20°F	11.3%	<50ppm

Table 1

9. Adjust the differential regulator until the Oxygen is within the specified range in Table 1.

NOTE:

Adjust only the differential regulator at 40% control signal; do not adjust the iris air damper.

10. Once the oxygen level is within the specified range at 40%, lower the firing rate to 20%.
11. Oxygen levels at the 20% firing rate should be as shown in Table 2.

Combustion Oxygen Levels for a 20% Firing Rate

Inlet Air Temp	Oxygen	Carbon Monoxide
80°F	12% or less	<100ppm
70°F	12% or less	<100ppm
60°F	12% or less	<100ppm
50°F	12% or less	<100ppm
40°F	12% or less	<100ppm
30°F	12% or less	<100ppm
20°F	12% or less	<100ppm
10°F	12% or less	<100ppm
0°F	12% or less	<100ppm
-10°F	12% or less	<100ppm
-20°F	12% or less	<100ppm

Table 2

12. Raise the firing rate to 100%. Gas pressure should still be between 7.0 and 7.3" WC. If it is not readjust as necessary.
13. Allow the combustion analyzer to settle. Compare the measured oxygen level with the levels in Table 3.
14. If the measured oxygen reading is within the specified level in Table 3, no further adjustment is necessary. If the measured oxygen level is not within specified range in Table 3 adjust the iris damper as necessary until the measured oxygen reading is within specification.

Combustion Oxygen Levels for 100% Firing Rate

Inlet Air Temp	Oxygen	Carbon Monoxide
80°F	4.4%	<100ppm
70°F	4.8%	<100ppm

INITIAL START-UP

60°F	5.2%	<100ppm
50°F	5.6%	<100ppm
40°F	6.0%	<100ppm
30°F	6.4%	<100ppm
20°F	6.8%	<100ppm
10°F	7.2%	<100ppm
0°F	7.6%	<100ppm
-10°F	8.0%	<100ppm
-20°F	8.5%	

Table 3

- Change the firing rate to 40%. Allow time for the combustion analyzer to settle. Check the measured oxygen reading to insure that it is still within the range as per Table 1.
- Continue this procedure until oxygen levels at 100%, 40% and 20% firing rates are within the ranges specified in Tables 1, 2, and 3.

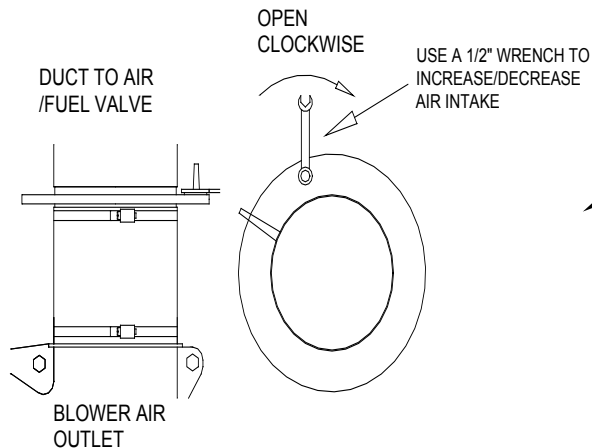


Figure 1.4

Iris Air Damper Locking Screws Location

4.4 UNIT REASSEMBLY

Once combustion calibration is set properly, the unit can be re-assembled for permanent operation.

- Put the green ON/OFF switch in the off position. Disconnect the AC power supply to the unit.
- Shut off the gas supply to the unit.
- Remove the regulator adjustment tool by first pulling up the screwdriver blade to disengage it from the regulator adjusting

screw, and then turning the tool out of the top of the regulator.

- Remove the gasket from the tool and place it back onto the regulator cap.
- Apply a drop of silicone to the regulator adjusting screw to lock its setting.
- Reinstall the cap and gasket back on the regulator. Tighten the cap using a screwdriver or wrench.
- Remove all of the manometers and barbed fittings and reinstall the pipe plugs using a suitable thread compound.
- Replace the unit's panels.
- Remove the combustion analyzer probe from the vent hole. Seal the probe hole and replace the vent connection cover.

4.5 OVER-TEMPERATURE LIMIT SWITCH

The Over-temperature limit switch is located on the front center of the boiler shell. It is a fixed manual reset switch that will shutdown and lock out the boiler if the water temperature reaches 210 F. Figure 4.6 shows the location of the over temperature limit switch.

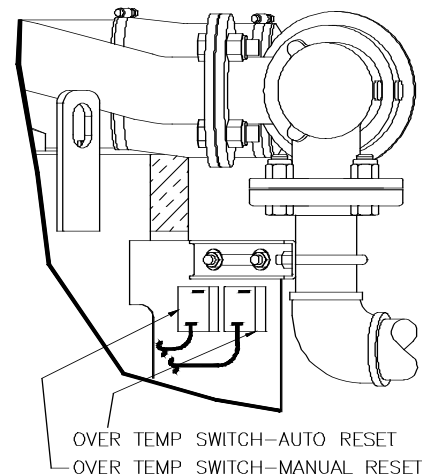


Figure 4.6

Over Temperature Limit Switch Location

Chapter 5 - MODE OF OPERATION

The following is a detailed description of the 6 different modes of operation for the Benchmark Boiler. Each unit is shipped from the factory tested and configured in the mode of operation it was ordered. All temperature related parameters are at factory defaults and work well in most applications. However it may be necessary to change certain parameters to customize the unit to the system. A complete listing and description of the temperature related parameters is located in Appendix A. Factory defaults are located in Appendix E. After reading this section, parameters can be customized to suit the needs of the application.

5.1 INDOOR/OUTDOOR RESET MODE

This mode of operation is based on outside air temperatures. As the outside air temperature decreases, the supply header temperature will increase and vice versa. For this mode it is necessary to install an outside air sensor as well as select a building reference temperature and a reset ratio.

5.1.1 RESET RATIO

Reset ratio is an adjustable number from 0.1 to 9.9. Once adjusted, the supply header temperature will increase by that number for each degree that the outside air temperature decreases. For instance, if a reset ratio of 1.6 is used, for each degree that outside air temperature decreases the supply header temperature will increase by 1.6 degrees.

5.1.2. BUILDING REFERENCE TEMPERATURE

This is a number from zero to 300 and once chosen, is the temperature that the system references to begin increasing its temperature. For instance if a reset ratio of 1.6 is used, and we choose a building reference temperature of 70 degrees, then at 69 degrees outside temperature, the supply header temperature will increase by 1.6 degrees to 71.6 degrees.

5.1.3 OUTDOOR AIR TEMPERATURE SENSOR INSTALLATION

The outdoor air temperature sensor must be mounted on the north side of the building in an area where the average outside air temperature is expected. The sensor must be shielded from the sun's direct rays, as well as direct impingement by the elements. If a cover or shield is used, it must allow free air circulation. The sensor may be mounted up to two hundred feet from the unit and is connected to the unit at

the control wiring terminal strip located at the bottom left hand corner of the control panel. Connections are to be made to terminals 13 and 14 using a shielded wire of 18 to 22 AWG. For further wiring outside air sensor wiring details see section 2.6.2.

5.1.4 INDOOR/ OUTDOOR STARTUP

1. Refer to the indoor/outdoor reset ratio charts in Appendix D.
2. Choose the building reference temperature.
3. Go down the left column of the chart to the coldest design outdoor air temperature.

NOTE:

A design engineer typically provides design outdoor air temperature and supply header temperature data

4. Once the design outdoor air temperature is chosen go across the chart to the desired supply header temperature for the design temperature chosen in step three.
5. Now go up that column to the reset ratio row to find the reset ratio.
6. Access the secondary menu of the temperature controller and scroll through it until the display shows REFT. This is the building reference temperature.
7. Use the \uparrow and \downarrow arrow keys to set the desired building reference temperature.
8. Press ENTER to accept any changes.
9. Now scroll through the secondary menu until it displays RR. This is the reset ratio.
10. Use the \uparrow and \downarrow arrow keys to set the desired reset ratio.
11. Press ENTER to accept the change.

The unit is now ready to run. Return to the primary menu and start the unit (see section 3.3.4 for instructions on menu changing).

5.2 CONSTANT SETPOINT MODE

Constant setpoint mode is used when a fixed header temperature is desired. Common uses of this mode of operation include water source heat pump loops, and indirect heat exchangers for potable hot water systems or processes.

There are no external sensors necessary to operate in this mode. While it is necessary to set the desired setpoint temperature it is not necessary to change any other temperature-related functions. The unit is factory preset with settings that work well in most applications. Prior to changing any temperature-related parameters, other than the setpoint, it is suggested that an AERCO representative be contacted. For a complete listing of factory defaults and a description of temperature related functions see Appendices A and E.

5.2.1 SETTING THE SETPOINT

The setpoint of the unit is adjustable from 40 to 200 degrees. To adjust the setpoint do the following:

1. While in the Primary menu, scroll through it until "Setp" is displayed.
2. Use the \uparrow and \downarrow arrow keys to set the desired setpoint.
3. Press enter to accept any changes.
4. The unit is now ready to run.

5.3 4 -20mA REMOTE SETPOINT MODE

In this mode of operation, a 4-20mA signal, sent by an energy management system, is used to change the unit's setpoint. The 4mA signal is equal to a 40-degree setpoint while a 20mA signal is equal to a 220 -degree setpoint. This mode of operation can be used to drive single as well as multiple units.

An external interface board, located in the control box, is used for this mode. The board is factory configured and converts the 4 -20mA signal to an RS-485 signal. The RS-485 signal is then used to communicate with the temperature controller. The temperature must have the following functions set as shown to properly operate in the 4 - 20mA remote setpoint mode.

MENU	FUNCTION	SETTING
Secondary	Lore	Re
Secondary	FUNC	Cont
Primary	Auto	ON

While it is possible to change the settings of temperature related functions, the unit is factory preset with settings that work well in most applications. It is suggested that an AERCO representative be contacted prior to changing any temperature related function settings. For a complete listing of factory defaults and a description of temperature related functions see Appendices A and E.

5.3.1 4-20mA REMOTE SETPOINT FIELD WIRING

The only wiring necessary is the 4-20mA external control wiring from the source, to terminals 11 and 12 at the control box control-wiring terminals. The signal must be floating (ungrounded), and the wire used must be a two wire shielded cable of 18 to 22 AWG. Polarity must be observed and the shield must be connected to terminal 1 at the control wiring terminals. The source end of the shield must be left floating and not connected. When driving multiple units, each unit's wiring must conform to the above.

5.3.2 4-20mA REMOTE SETPOINT STARTUP

Since this mode of operation is factory preset and the setpoint is being externally controlled, no startup instructions are necessary. To operate the unit in manual mode, the temperature controller must be taken out of REMOTE and set to LOCAL, and Auto must be set to OFF.

To set the unit to manual mode do the following:

1. Access the temperature controller's secondary menu.
2. Scroll through the menu until "lore" is displayed.
3. Use the \uparrow and \downarrow arrow keys to set the temperature controller to local. Press ENTER to accept the change. The yellow REM light, on the temperature controller, should extinguish.
4. Access the Primary menu and scroll through until "Auto" is displayed.

MODE OF OPERATION

5. Use the ↑ ↓ arrow keys to change "Auto" from ON to OFF. The red "MAN" LED should now be lit, indicating that the unit is in manual mode.
6. Follow the above directions to change the temperature controller back to operate from the remote source.

NOTE:

The temperature controller automatically defaults to remote mode upon AC power being applied. This is due to the presence of the external interface board.

5.4 4 to 20mA DIRECT DRIVE MODE

In this mode of operation the 4 to 20mA signal sent to the unit changes the unit's percentage of firing rate. The signal is typically sent from an energy management system that, through PID controls, determines the rate of change necessary in the supply header. The 4 to 20mA signal sent from the energy management system equals a firing rate between 0 to 100%. In this mode 4mA equals 0% firing rate and 20mA equals 100% firing rate. The unit is a slave to the energy management system and does not have a role in temperature control. This mode of operation can be used to drive single as well as multiple units.

In this mode the external interface board is utilized. The interface board, located in the control box, is factory configured and converts the 4-20mA signal to an RS-485 signal. The RS-485 signal is in turn sent to the temperature controller. For the temperature controller to recognize a signal, from an external source, the following functions must be correctly set.

MENU	FUNCTION	SETTING
Secondary	Lore	re
Secondary	FUNC	Cont
Primary	Auto	OFF

5.4.1 4-20mA DIRECT DRIVE FIELD WIRING

The only wiring necessary is the 4-20mA signal from the source to control wiring terminals 11 and 12 at the control box. The signal must be floating, (ungrounded), and the wire used must be a two wire shielded cable of 18 to 22 AWG. Polarity must be observed and the shield must be connected to terminal 1 at the control wiring terminals. The source end of the end must be left floating and not connected. When driving multiple units, each unit's wiring must conform to the above.

5.4.2 4 to 20 MA DIRECT DRIVE STARTUP

Since this mode of operation is factory preset, and the percentage of firing rate is being externally controlled, there are no startup instructions necessary. *To run the unit in manual mode, the temperature controller must be taken out of REMOTE mode and set to LOCAL mode.*

To set the unit to Manual mode do the following:

1. Access the temperature controller's secondary menu.
2. Scroll through the menu until "lore" is displayed.
3. Use the ↑ and ↓ arrow keys to set the temperature controller to local. The yellow REM light, on the temperature controller, should extinguish
4. Press ENTER to accept the change.
5. The unit is now in manual mode.
6. Follow the above directions to change the temperature controller back to operate from the remote source.

NOTE:

The unit automatically defaults to remote mode whenever AC power is removed and then applied. This is due to the presence of the external interface board.

5.5 BOILER MANAGEMENT SYSTEM (BMS)

The BMS mode of operation is used in conjunction with an AERCO boiler management system and it is desired to operate multiple units in the most efficient manner possible. Eight boilers can be managed by a single AERCO BMS 168 system using pulse width modulation. The AERCO BMS monitors all system-related parameters and modulates the firing rates of the units. For BMS programming and operation see the GF-108 BMS Operations Guide.

MENU	FUNCTION	SETTING
Secondary	Lore	re
Secondary	FUNC	Cont
Primary	Auto	OFF

5.5.1 BOILER MANAGEMENT SYSTEM EXTERNAL FIELD WIRING

Wiring for this system is from the BMS panel, boilers 1 through 8, to terminals 2 and 3 at the boiler control wiring terminal strip located at the bottom left hand corner of the control panel. Wire the units using a shielded twisted pair of 18 to 22 AWG wire while observing polarity. The shield is connected at the BMS to any minus (-) boiler terminal and the boiler end of the shield must be left floating. Each unit's wiring must conform to the above. For a complete BMS wiring diagram, see wiring schematic #18973 located in Appendix H.

5.5.2 BOILER MANAGEMENT SYSTEM SETUP AND STARTUP

This mode of operation is factory preset and the AERCO BMS Model 168 controls the firing rate. There are no setup instructions for each individual unit. To operate **the unit in manual mode, the temperature controller must be taken out of REMOTE mode and set to LOCAL mode**

To set the unit in manual mode do the following:

1. Access the temperature controller's secondary menu.
2. Scroll through the menu until "lore" is displayed.
3. Use the ↑ and ↓ arrow keys to set the temperature controller to local. The yellow REM light, on the temperature controller, should extinguish
4. Press ENTER to accept the change.
5. Follow the above directions to set the unit for up to be controlled by the BMS.

NOTE:

The unit automatically defaults to remote mode whenever AC power is removed and then applied. This is due to the presence of the external interface board.

5.6 COMBINATION CONTROL SYSTEM (CCP)

A Combination Control System is a system where multiple boilers are used to cover both space heating and domestic hot water needs. An AERCO Boiler Management System and Combination Control Panel are necessary for this system. Typically enough boilers are installed to cover the space-heating load on the design day, however one or more units are used for the domestic load.

The theory behind this system is that the maximum space-heating load and the maximum domestic hot water load do not occur simultaneously. The boilers used for the domestic hot water are capable of switching between constant setpoint and BMS modes of operation. These boilers are the combination units and are referred to as the combo boilers. The combo boilers heat water to a constant setpoint temperature. That water is then circulated through a heat exchanger in a domestic hot water storage tank.

When the space-heating load is such that all the space-heating boilers are at 100% firing rate, the BMS will then ask the Combination Control Panel for the domestic boiler(s) to become space-heating boilers. Provided the domestic hot water load is satisfied the domestic boilers will then become space-heating boilers. If the domestic hot water load is not satisfied, the combo boilers remain on the domestic load. If the combo boilers switch over to space heating but there is a call for domestic hot water, the CCP switches the combo units back to the domestic load.

When the combo units are satisfying the domestic load they are in constant setpoint mode of operation. When the combo units switch over to space heating, their mode of operation becomes BMS mode. For more information concerning the operation of the Combination Control Panel see the AERCO CCP-1 literature.

MENU	FUNCTION	SETTING
Secondary	Lore	Re
Secondary	FUNC	Cont
Primary	Auto	ON

5.6.1 COMBINATION CONTROL SYSTEM FIELD WIRING

Wiring for this system is between the BMS panel, the CCP and terminals 2 and 3 on the control wiring terminals located in the control box. Wire the units using a shielded twisted pair of 18 to 22 AWG wire. When wiring multiple units, each unit's wiring must conform to the above. For a complete CCP system-wiring diagram see the AERCO CCP-1 literature.

5.6.2 COMBINATION CONTROL SYSTEM SETUP AND STARTUP

Setup for the Combination mode unit is limited to setting the desired setpoint of the unit. This must be done when the unit is in combination (constant setpoint) mode.

The setpoint is adjustable from 50 to 210 degrees.

To set the setpoint do the following:

1. While in either the primary or secondary dimenus, scroll through until "Setp" is displayed.
2. Use the ↑ and ↓ arrow keys to set the desired setpoint.
3. Press ENTER to accept the changes.

While it is possible to change other temperature-related functions for combination mode, the unit is factory preset. These preset settings work well in most applications. It is suggested that AERCO be contacted prior to changing settings other than the unit's setpoint. For a complete listing and description of temperature related functions see Appendix E.

When the boiler(s) are in constant mode (satisfying domestic load), the temperature controller is in LOCAL mode and AUTO is ON. To operate the unit in manual mode the **temperature controller must be taken out of REMOTE and set to LOCAL, and AUTO must be set to OFF.**

To set the unit to manual mode do the following: Access the temperature controller's secondary menu.

1. Scroll through the menu until "lore" is displayed.
2. Use the ↑ and ↓ arrow keys to set the temperature controller to local. The yellow REM light, on the temperature controller, should extinguish.
3. Press ENTER to accept the change.
4. Access the Primary menu and scroll through it until "Auto" is displayed.
5. Use the ↑ and ↓ arrow keys to change "Auto" from ON to OFF. The red "MAN" LED should now be lit.
6. The unit is now in manual mode.

7. Follow the above directions to change back to remote mode and auto ON.

When the boiler is switched to BMS mode, the AERCO BMS controls the firing rate. There are no setup requirements to the boiler(s) in this mode. To operate the boiler in manual mode, the temperature controller must be taken out of REMOTE mode and set to LOCAL mode

To set the unit in manual mode do the following:

1. Access the temperature controller's secondary menu.
2. Scroll through the menu until "lore" is displayed.
3. Use the ↑ and ↓ arrow keys to set the temperature controller to local. The yellow REM light, on the temperature controller, should extinguish
4. Press ENTER to accept the change.
5. Follow the above directions to change back to remote mode.

5.7. USING THE OUTSIDE AIR SENSOR FEATURE

This feature allows the unit to be enabled or disabled based on outside air temperature. To use this feature an outside air temperature sensor must be installed, the feature must be turned on, and a temperature setting must be chosen. Air temperatures below this setting allow the unit to fire. Air temperatures above this setting prevent the boiler from firing.

To initiate this feature:

1. Access the secondary menu in the temperature controller.
2. Scroll through the secondary menu until OAST is displayed.
3. Use the ↑ ↓ **arrow** keys to turn this feature on or off.
4. Press ENTER to accept the change
5. Now scroll through the secondary menu until OAT is displayed.
6. Use the ↑ ↓ **arrow** keys to set the desired maximum outside air temperature that the boiler is operational.
7. Press ENTER to accept the change

SAFETY DEVICE TESTING

Chapter 6 SAFETY DEVICE TESTING PROCEDURES

6.1 TESTING OF SAFETY DEVICES

Periodic testing of all controls and safety devices is required to ensure that they are operating as designed. Precautions must be taken while tests are being performed to protect against bodily injury and property damage.

Systematic and thorough testing of the operating and safety controls should be performed on a scheduled basis, or whenever a control component has been serviced or replaced. All testing must conform to local jurisdictions or codes such as ASME CSD-1.

NOTE:

MANUAL and AUTO modes are required to perform the following tests. For a complete explanation of these modes, see Section 3.

NOTE:

It will be necessary to remove the sheet metal covers from the unit to perform the following tests.

WARNING!

THIS IS A 120-VOLT AC COMBUSTION SAFEGUARD SYSTEM. POWER MUST BE REMOVED PRIOR TO PERFORMING WIRE REMOVAL OR OTHER TESTING PROCEDURES THAT CAN RESULT IN ELECTRICAL SHOCK.

6.2 GAS PRESSURE FAULT TEST

1. Referring to figure 6.1, ensure that the 1/4" ball valve located at the low-pressure gas switch is closed.
2. Remove the 1/4" plug from the 1/4" ball valve.
3. Install a 0-16" W.C. manometer or W.C. gauge where the 1/4" plug was removed.
4. Slowly open the 1/4" ball valve.
5. Place the unit in manual mode and fire between a 25% and 30% firing rate.
6. Slowly close the manual gas shut-off valve while monitoring gas pressure. The unit should shut down and fault on "LOW GAS PRESSURE" at 6" W.C.

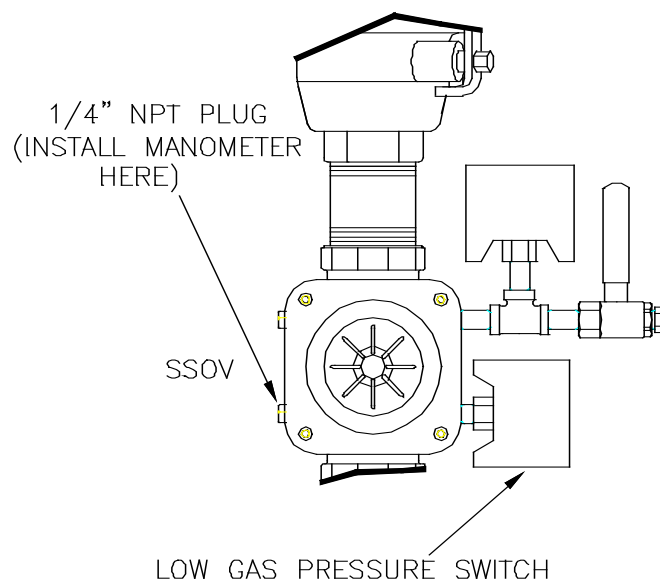


Figure 6.1
1/8" Pipe Plug Position for Manometer Installation

7. Fully open the manual gas shut-off valve.
8. Depress the low gas pressure switch reset button and clear the annunciator display.
9. The unit should restart.

NOTE:

After faulting the unit, the fault message will be displayed and the fault indicator light will flash until the CLEAR button is pressed.

6.3 LOW WATER LEVEL FAULT TEST

1. Place the ON/OFF switch in the OFF position.
2. Close shut-off valves in the supply and return piping to the unit.
3. Slowly open the drain valve on the unit.
4. Allow air flow into the unit by either opening the relief valve or by removing the 1/4" plug in the head of the pressure vessel.
5. The LOW WATER LEVEL message will be displayed and the fault LED will flash after the water level has gone below the level of the probe.

SAFETY DEVICE TESTING

6. The ON-OFF switch should not illuminate when placed in the ON position and the unit should not start.
7. Close the drain and pressure relief valve or reinstall the plug in the top of the unit if removed.
8. Open the water shut-off valve in the return piping to the unit to fill the shell.
9. Open the water shut-off valve in the supply piping to the unit.
10. Press the LOW WATER LEVEL RESET button to reset the low water cutoff and press the CLEAR button to reset the Annunciator and LCD displays once the shell is full.
11. Place the ON-OFF switch in the ON position. The unit is now ready for operation.

6.4 WATER TEMPERATURE FAULT TEST

1. In normal operating mode, allow the unit to stabilize at its setpoint.
2. Lower the operating temperature limit switch setting to match the outlet water temperature. (See Fig. 6.2).

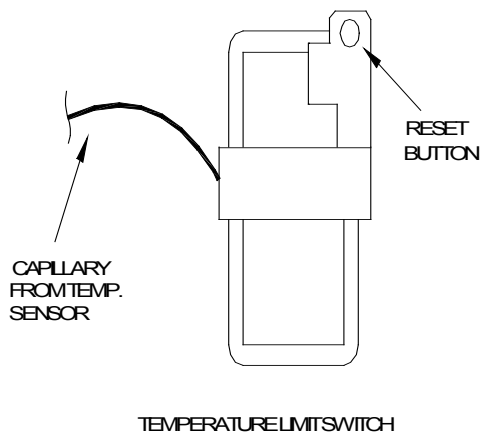


Figure 6.2
Temperature Limit Switch Setting

3. Once the limit switch setting is approximately at the actual water temperature indicated by tout, the unit should shutdown. The fault light should be flashing and the message "HIGH WATER TEMP" should be displayed. The ON/OFF

switch should not be illuminated and the unit should not start.

4. Reset the temperature limit switch setting to its prior setting.
5. The unit should start once the temperature limit switch setting is above the actual outlet water temperature.

6.5 FLAME FAULT TEST

1. Start the unit.
2. Once the unit is firing, close the manual leak detection valve. This is the valve located between the safety shut off valve and the differential gas pressure regulator (See Fig. 6.3).
3. The unit should shut down within 1-2 seconds and indicate a LOCKOUT RUN FLAME fault on the LCD display.
4. Leaving the manual leak detection valve closed, reset the combustion safeguard and CLEAR the Annunciator
5. Restart the unit.
6. The unit should lockout and display the message FLAME FAULT DURING IGN TRIAL".
7. Open the leak detection valve.

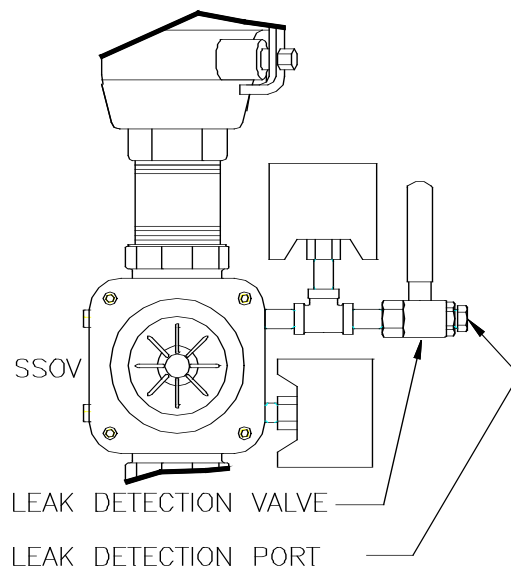


Figure 6.3
Manual Leak Detection Valve

SAFETY DEVICE TESTING

9. Reset the Combustion safeguard and CLEAR the Annunciator.
10. Start the unit.

6.6 AIR PRESSURE FAULT TEST

1. Disconnect AC power from the unit.
2. Disconnect wire #155 from the air pressure switch located on the air/fuel valve (See Fig. 6.4).
3. Restore AC power to the unit.
4. Produce a "call for heat" to start the unit. The unit should fault and display the message "LOCKOUT RUN"

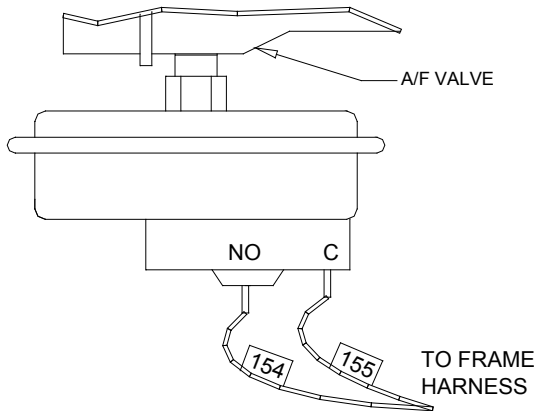


Figure 6.4

Blower Proof Switch Location and Wiring

5. Disconnect AC power from the unit.
6. Replace wire #155.
7. Restore AC power to the unit.
8. Reset the combustion safeguard and clear the annunciator display.

6.7 LOCKOUT RUN FAULT TESTING

1. Turn the ON/OFF switch to the OFF position.
2. Remove SSOV cover by removing the screws securing the actuator to the valve body. (See Fig. 6.5).
3. Remove wire 149 or 148 from terminal 4 or 6. (See Fig. 6.6).

4. Start the unit.
5. The unit should shutdown and displays the message "LOCKOUT RUN".
6. Clear the Annunciator. Turn the ON/OFF switch to the OFF position.
7. Disconnect AC power to the unit.
8. Remove the air/fuel valve cover by loosening the 3 screws securing it in place. (See Fig. 6.7).

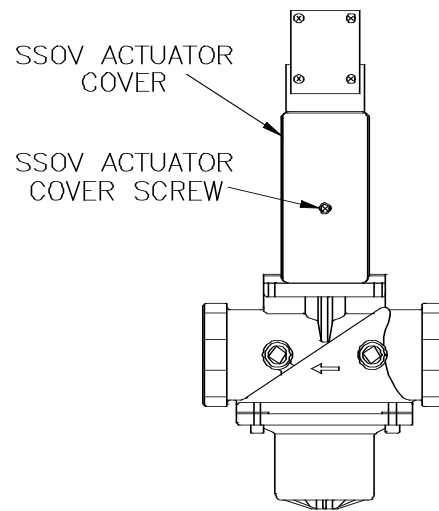


Figure 6.5

SSOV Actuator Set Screw Location

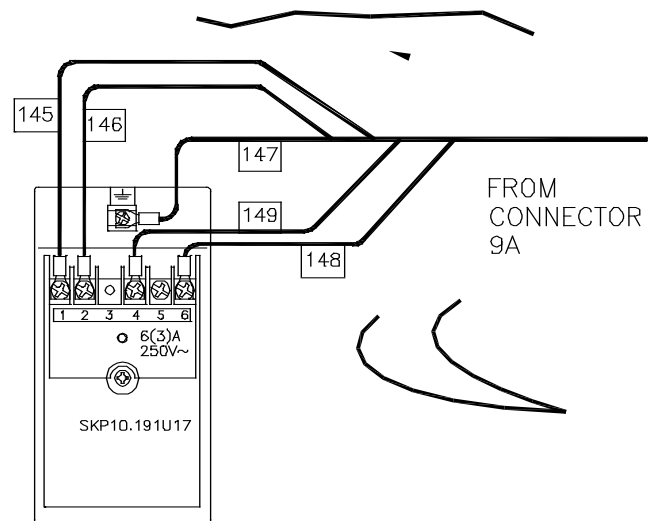


Figure 6.6

SSOV Terminal Connections

SAFETY DEVICE TESTING

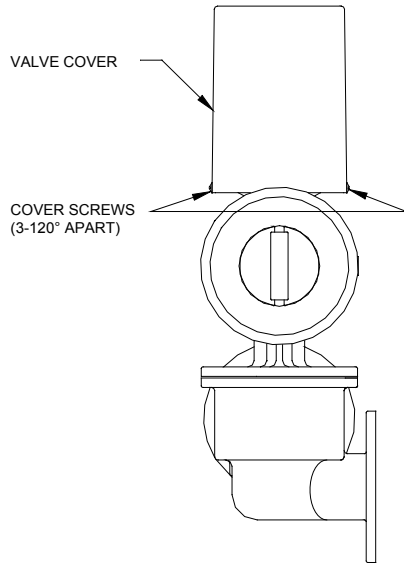


Figure 6.7

Air/Fuel Valve Cover Screw Locations

9. Disconnect wire #172 from the air/fuel valve purge position switch. This is the switch closest to the blower (See Fig. 6.8).
10. Restore AC power to the unit.
11. Start the unit.

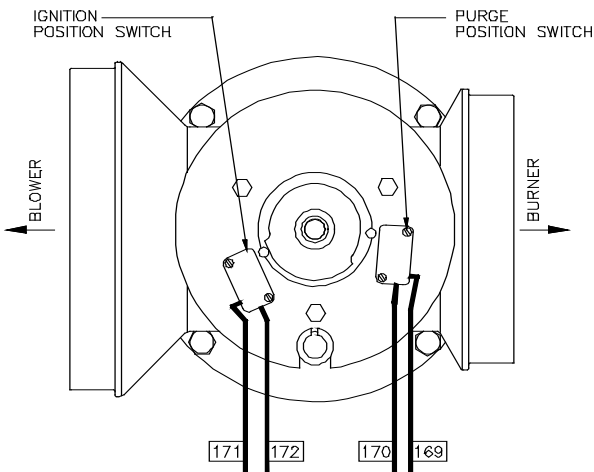


Figure 6.8

Air/Fuel Valve Purge Position and Ignition Switch Locations

13. Reconnect wire #172 to the air/fuel valve purge position switch.
14. Disconnect wire #170 from the ignition position switch. This is the switch closest to the blower of the unit (See Fig. 6.8).
15. Restore AC power to the unit, and reset the combustion safeguard.
16. Start the unit in manual mode.
17. The unit should lockout and display the message "FLAME FAULT DURING IGN TRIAL".
18. Disconnect AC power from the unit.
19. Reconnect wire #170 to the ignition position switch.
20. Replace the air/fuel valve cover.
21. Restore AC power to the unit.
22. Set the unit to auto mode to resume normal operation.

6.8 SAFETY PRESSURE RELIEF VALVE TEST

Test the safety Pressure Relief Valve in accordance with ASME Boiler and Pressure Vessel Code, Section VI.

12. The unit should shutdown and displays the message "LOCKOUT RUN".
12. Disconnect AC power from the unit.

Chapter 7 - MAINTENANCE

7.1 MAINTENANCE SCHEDULE

The unit requires regular routine maintenance to keep up efficiency and reliability. For best operation and life of the unit, the following routine maintenance procedures should be carried out in the time periods specified.

See Appendix I for complete CSD-1 inspection check list

WARNING!

TO AVOID PERSONAL INJURY, BEFORE SERVICING:

- (A) DISCONNECT THE AC SUPPLY BY TURNING OFF THE SERVICE SWITCH AND AC SUPPLY CIRCUIT BREAKER**
- (B) SHUT OFF THE GAS SUPPLY AT THE MANUAL SHUT-OFF VALVE PROVIDED WITH THE UNIT**
- (C) ALLOW THE UNIT TO COOL TO A SAFE TEMPERATURE TO PREVENT BURNING OR SCALDING**

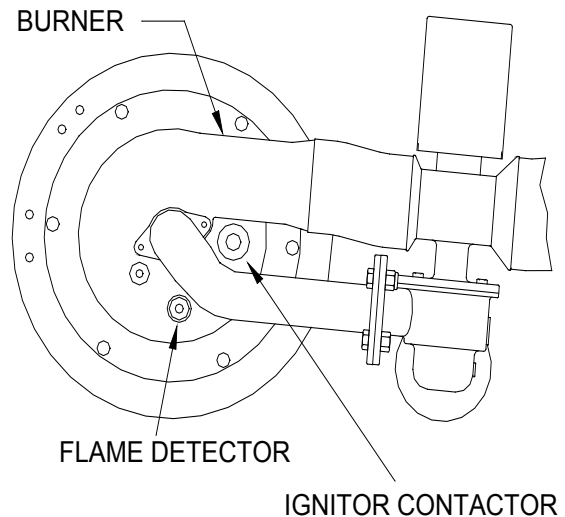


Figure 7.1A

Spark Ignitor and Flame Detector Location
Top View

CAUTION!

The ignitor may be hot

7.2 SPARK IGNITOR

The spark ignitor assembly is located in the body of the burner (see Fig. 7.1A). The ignitor may be HOT. Care should be exercised. It is easier to remove the ignitor from the unit after the unit has cooled to room temperature.

To inspect/replace the Ignitor:

1. Put the green ON/OFF button on the control panel, to the OFF position and disconnect AC power to the unit.
2. Remove the rear, side and top panels from the unit.
3. Disconnect the ignitor cable from the ignitor contactor and unscrew the ignitor bushing from the burner shell.
4. Insert the ignitor removal tool into the burner shell, where the ignitor bushing was removed. Fit the hexagonal end of the tool over the ignitor. (See Fig. 7.1B) Unscrew the ignitor from the burner head. Remove the ignitor from the burner shell, by grasping the contact end of the ignitor.

5. The ignitor is gapped at 1/8-inch. If there is a substantial erosion of the spark gap or ground electrode, the ignitor should be replaced. If carbon build-up is present, clean the ignitor using fine emery cloth. Repeated carbon build-up on the ignitor is an indication that a check of the combustion settings is required (see Sections 4.2 and 4.3 for Combustion Calibration).
6. Prior to reinstalling the ignitor, an anti-seize compound must be applied to the ignitor threads.

CAUTION!

The ignitor must be removed and installed using the ignitor removal tool provided with the unit(s). Damage to the burner due to using a socket for removal and installation of the ignitor is not covered under warranty.

7. Reinstall the ignitor using the ignitor removal tool. Do not over tighten the ignitor. A slight snugging up is sufficient. Reinstall the ignitor contactor (hand tight only) and reconnect the ignitor cable.
8. Install the side and top panels on the unit.

MAINTENANCE

Table1 - Maintenance Schedule

SECTION	ITEM	6 Mos.	12 Mos.	24 Mos.	Labor Time
7.2	Spark Ignitor	Inspect	Replace		15 mins.
7.3	Flame Detector	Inspect	Replace		15 mins.
7.4	Combustion Adj.	Check	Check		1 hr.
7.5	Testing of Safety Devices		See CSD-1 Chart in Appendix		20 mins.
7.6	Burner			Inspect	2 hrs.
7.7	*Manifold & Tubes			Inspect & clean if necessary	4 hrs.

** Recommended only when unit will be run in an extreme condensing mode for prolonged periods of time.*

7.3 FLAME DETECTOR

The flame detector assembly is located in the body of the burner (see Fig. 7.1A). The flame detector may be HOT. Allow the unit to cool sufficiently before removing the flame detector.

To inspect or replace the flame detector:

1. Put the green ON/OFF button on the control panel, to the OFF position and disconnect AC power to the unit.
2. Remove the side and top panels from the unit.
3. Disconnect the flame detector lead wire. Unscrew the flame detector and remove it. (See Fig 7.1B)
4. Inspect the detector thoroughly. If eroded, the detector should be replaced. Otherwise clean the detector with a fine emery cloth.
5. Reinstall the flame detector hand tight only.
6. Reconnect the flame detector lead wire.
7. Reinstall the rear, side and top panels on the unit.

7.4 COMBUSTION CALIBRATION

Combustion settings must be checked at the intervals shown in Table 1 as part of the maintenance requirements. Refer to Sections 4.2 and 4.3 for combustion calibration instructions.

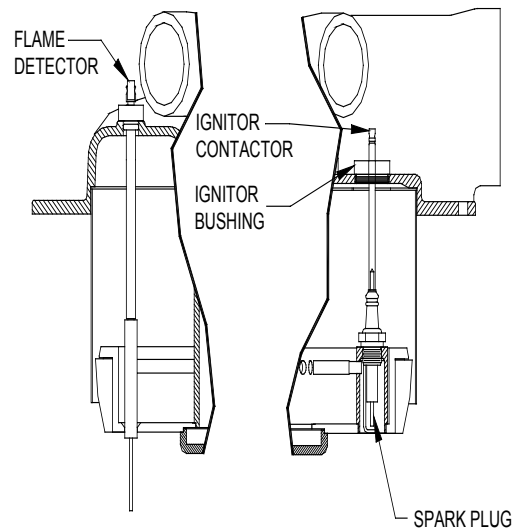


Figure 7.1B
Spark Ignitor and Flame Detector Location Cut-Away View

7.5 SAFETY DEVICE TESTING

Systematic and thorough tests of the operating and safety devices should be performed to ensure that they are operating as designed. Certain code requirements, such as ASME CSD-1, require that these tests be performed on a scheduled basis. Test schedules must conform to local jurisdictions. The results of the tests should be recorded in a logbook. See Section 6-Safety Device Testing Procedures.

7.6 BURNER

MAINTENANCE

The burner assembly is located at the top of the unit. The burner assembly may be HOT. Allow the unit to cool sufficiently before removing the burner assembly.

The following parts will be necessary for reassembly after inspection:

161432	Burner Gasket
161433	Burner Release Gasket

To inspect or replace the burner assembly:

1. Place the green ON/OFF button on the control panel, to the OFF position and disconnect AC power to the unit.
2. Remove the side and top panels from the unit.
3. Disconnect the lead wire from the flame detector.
4. Disconnect the ignitor cable from the ignitor contactor.
5. Disconnect the combustion air hose from the burner by loosening the hose clamp. (See Fig. 7.3)
6. Remove the four (4) 5/8-11 nuts and bolts from the gas outlet side of the Air/Fuel Valve. (See Fig 7.3).

NOTE:

It is best to leave the gas pipe attached to the burner, as it will assist you in removing the burner from the unit.

7. Remove the six (6) 5/16-16 bolts from the burner flange. (See Fig 7.3)
8. Remove the burner from burner flange by pulling straight up.
9. Remove and replace the burner release gasket.
10. Remove and replace the burner gasket.
11. Beginning with the burner removed in step 8 of this section reinstall all the components in the reverse order that they were removed.

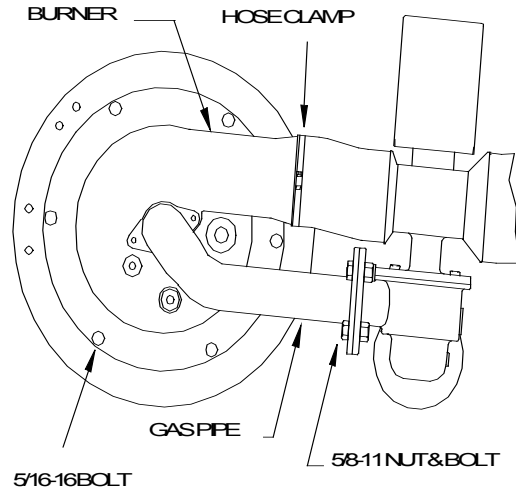


Figure 7.3
Burner Disassembly Diagram

NOTE:

The burner is heavy weighing approximately 25 pounds.

NOTE:

A complete inspection of the combustion chamber tubes can not be performed at this time. In order to completely inspect the combustion chamber tubes you must remove the exhaust manifold. (See Sect 7.7)

7.7 EXHAUST MANIFOLD AND COMBUSTION CHAMBER

The presence of even trace amounts of chlorides and/or sulfur, in the combustion air and fuel sources, can lead to the formation of deposits on the inside of the exchanger tubes, the exhaust manifold, and/or the condensate trap. The degree of deposition is influenced by the extent of the condensing operation and the chloride and sulfur levels. Even trace amounts of contaminants such as chlorides and sulfur void the warranty.

The following parts will be necessary for reassembly after inspection:

123612	Exhaust Manifold Gasket
--------	-------------------------

To remove the manifold for inspection:

1. Disconnect AC power and turn off the gas supply to the unit.

2. Disconnect and remove the condensate drain trap assembly from the exhaust manifold.
3. Disconnect the exhaust vent (flue) from the exhaust manifold outlet flange.

CAUTION!

The Exhaust Manifold Is Heavy. Do Not Drop The Exhaust Manifold While Removing The Mounting Bolts.

4. Remove the three (3) 1/2-13 mounting bolts from the exhaust manifold (See Fig 7.4).
5. Carefully lower the exhaust manifold and slide it out the rear of the unit

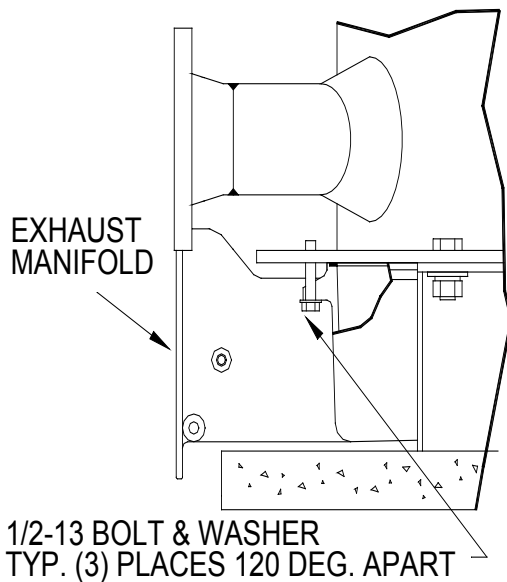


Figure 7.5

Exhaust Manifold Mounting Bolts

7. Remove and replace the exhaust manifold gasket.
8. Inspect the fire tubes for any signs of restriction or carbon build-up. Clean as necessary
9. Beginning with the exhaust manifold removed in step 7 of this section reinstall all the components in the reverse order that they were removed.

7.8 SHUTTING THE BOILER DOWN FOR AN EXTENDED PERIOD OF TIME

1. If the boiler is to be taken out of service for an extended period of time, one year or more, the following instructions must be followed.
2. Set switch on front panel to off to shut down the boiler's operating control.
3. Turn off main power supply to unit.
4. Close supply and return valves to isolate boiler.
5. Close external gas supply valve.
6. Open relief valve to vent water pressure.

7.9 PLACING THE BOILER BACK IN SERVICE AFTER A PROLONGED SHUTDOWN

1. After a prolonged shutdown, a year or more, the following procedures must be followed:
2. Review installation requirements as shown in section 2
3. Inspect all piping and connection to the unit
4. Inspect exhaust vent, air duct(if applicable) and
5. Gas regulator vent lines at their termination points. Check that they are clear and free of debris or pests.
6. Perform initial startup per section 4
7. Perform safety device and maintenance procedures per sections 6 and 7 of this manual.

Chapter 8 - TROUBLESHOOTING GUIDE

This troubleshooting section is intended to serve as a guideline to determining and solving faults on the Benchmark Series boiler. Whenever a fault occurs, proceed as follows:

1. Determine the cause of the fault by following the procedures within this section.
2. Once the fault has been determined, take the proper actions to remedy the fault.
3. Start the Benchmark Boiler in accordance with this manual.

In the event that a fault cannot be remedied, contact your local AERCO representative or the factory for technical assistance.

WARNING!

ELECTRIC SHOCK HAZARDS EXIST THAT CAN CAUSE SEVERE INJURY. DISCONNECT POWER BEFORE PERFORMING ANY MAINTENANCE AND/OR SERVICING.

WARNING!

NEVER JUMPER (BY-PASS) ANY SAFETY DEVICE. DAMAGE, OR PERSONAL INJURY COULD RESULT. USE AN OHMMETER FOR CHECKING CONTINUITY ON SAFETY DEVICES.

WARNING!

QUALIFIED SERVICE PERSONNEL MUST PERFORM TROUBLESHOOTING PROCEDURES, AS OUTLINED IN THIS SECTION.

8.1 LOW GAS PRESSURE

8.1.1 Low Supply Gas Pressure

8.1.2 Gas Pressure Switches

A LOW GAS PRESSURE message indicates that gas pressure has gone below 6" W.C., tripping the low gas pressure switch.

Recommended Troubleshooting Equipment

- 16" Manometer
- Analog or Digital Ohmmeter

8.1.1 LOW SUPPLY GAS PRESSURE

1. Install a manometer in the Benchmark Boiler supply gas manifold as per Section 4.2.2.

2. Check the static pressure to the unit. It should be between 9" to 14" W.C.
3. If the static pressure to the unit is lower than 9" W.C., readjust the supply regulator until it's output is between 9" to 14" W.C. If a static supply pressure of 9" to 14" W.C. cannot be obtained, proceed to step #8.
4. If static pressure is already 9" to 14" W.C. or has been readjusted, start the unit. It may be necessary to depress the reset button on units having manual reset gas switches before the unit will restart.
5. Observe the gas supply pressure during the ignition cycle. If gas pressure drops below 6" W.C. during the ignition cycle try to increase gas pressure at the gas supply regulator then re-start the unit. If gas pressure cannot be sufficiently increased, proceed to Step #8.
6. If gas pressure does not drop below 6" W.C. in any one of the above steps slowly increase the input percentage in 10% increments while monitoring gas pressure.
7. If gas pressure drops below 6" W.C. while increasing the firing rate, tripping the gas pressure switch, try to increase gas pressure at the supply regulator then repeat step #6. If gas pressure cannot be sufficiently raised, proceed to step eight.
8. Not being able to reach a desired gas pressure, while in a static or firing mode, is an indication of one of the following. 1) The gas supply regulator is not properly sized. 2) The gas pressure to the gas supply regulator is insufficient. 3) The gas supply piping has too many pressure drops. It will be necessary to contact one or more of the following when troubleshooting these conditions. Your local gas utility. The regulator manufacturer. The local AERCO representative.

8.1.2 LOW GAS PRESSURE SWITCH

1. If static pressure to the unit is correct, disconnect AC power to the unit. Remove

wires #152 & #153 from the low gas pressure switch.

2. Using an ohmmeter, check the gas pressure switch for continuity. Be sure the gas supply to the unit is on and that the static pressure is above 6" W.C. and reset the manual reset gas pressure by depressing the reset button prior to checking continuity.
3. Replace the low gas pressure switch if it does not show continuity.
4. If the switch shows continuity, locate and remove wire #116 from the temperature switch located on the unit's shell. Check for continuity from wire #116 to wire #153. Next, locate and remove wire #64 from the low water cut-off circuit board located inside the control box. Measure for continuity from wire #64 to wire #152 at the low gas pressure switch.

Note: *The procedures in step 4 test and ensure the integrity of wiring inside and outside of the control panel as well as the connections of the control box connectors.*

5. If there is no continuity, check for loose connectors at the switch end of the wires. Check the pins in the 1" diameter connector on the bottom of the control box for proper insertion and/or signs of wear. Make any necessary repairs.
6. If the wires and connectors are not defective, reconnect them. Reconnect electric power.
7. If the gas pressure fault still does not clear it will be necessary to troubleshoot the control panel. Contact a qualified service technician or your local AERCO representative for more information.

8.2 HIGH GAS PRESSURE

A HIGH GAS PRESSURE message indicates that gas pressure has exceeded 20" W.C., tripping the high gas pressure switch.

Recommended Troubleshooting Equipment

- 16" Manometer
- Analog or Digital Ohmmeter

1. Install a manometer in the unit's gas supply manifold as per Section 4.2.2. of this manual.

2. Check the static pressure to the unit. It should be between 9" to 14" W.C.
3. If the static pressure to the unit is higher than 14" readjust the supply regulator until it's output is less than 14" W.C.
4. Start the unit and raise the firing rate in 10% increments. If gas pressure is less than 7" W.C. after reaching 100% input percentage, readjust the gas the gas pressure to 7". (It may be necessary to depress the high gas pressure switches manual reset button prior to restarting the unit.)
5. Next, lower the input percentage to shut the unit down. Measure the static gas pressure. If it is above 14" it is an indication that there may be excessive pressure drops in the gas supply piping or other components in the gas supply system.
6. If gas pressure did not require adjustment and is higher than 14" W.C, it may be necessary to replace the gas supply regulator with a lock up style. Consult your local AERCO representative for more information.

8.2.3 HIGH GAS PRESSURE SWITCH

1. If static pressure to the unit is correct, disconnect AC power to the unit. Remove wires #151 & #150 from the high gas pressure switch.
2. Using an ohmmeter, check the gas pressure switch for continuity. Be sure the gas supply to the unit is on and that the static pressure is less than 20" W.C. If the unit has a manual reset gas pressure switch, be sure to depress the reset button prior to checking continuity.
3. Replace the high gas pressure switch if it does not show continuity.
4. If the switch shows continuity, remove wires #150 and #151 from the temperature switch. Locate wire #118 on the low water cut-off board located inside the control box. Check for continuity between wire #118 and wire #151. Next locate and remove wire #55. Wire #55 is located at the interlocks on the top left-hand side of the control panel door. Check for continuity between wire #55 and wire #150.

Note: The procedures in step 4 test and ensure the integrity of wiring inside and outside of the control panel as well as the connections of the control box connectors.

5. If there is no continuity, check for loose connectors at the switch end of the wires. Check the pins in the 1" diameter connector on the bottom of the control box for proper insertion and/or signs of wear.

8.3 LOW WATER LEVEL

A LOW WATER LEVEL message indicates that water level in the unit is too low. Check that the shut-off valves on the supply and return of the unit are open and that there is water in the shell. (Momentarily opening the relief valve and looking for a strong flow of water will verify that there is sufficient water level). If there is sufficient water level, try to reset the unit by pressing the low water level reset button and the Annunciator clear button. If the unit fires but the message will not clear, replace the Annunciator. If the unit does not fire and the message will not clear check the following.

- 8.2.1 Water Level Probe
- 8.2.2 Wiring & Connections
- 8.2.3 Water level Circuit

Recommended Troubleshooting Equipment

- Digital Volt/Ohmmeter (DVM)

8.3.1 WATER LEVEL PROBE

1. Disconnect the electric power to the unit.
2. Remove the unit side and top panels and remove wire #138 from the water level probe.

WARNING!

THIS WIRE HAS A POTENTIAL OF 12 VAC. BE SURE TO REMOVE POWER FROM THE UNIT BEFORE DISCONNECTING OR HANDLING THE WIRE.

3. Connect an AC voltmeter between wire #138 and the unit frame.
4. Reapply AC power to the unit. The AC voltmeter should read approximately 120 VAC. If approximately 120 VAC is not read on the AC voltmeter, proceed to section 8.3.2.

5. If 120 VAC is read on the AC voltmeter, disconnect power to the unit and ground the probe to the unit shell.
6. Reconnect AC power to the unit. If the fault still does not clear, proceed to section 8.3.2. If the fault clears, replace the probe.

8.3.2 WIRING AND CONNECTIONS

1. Disconnect AC power to the unit.
2. Remove the unit side and top panels disconnect wire #138 from the water level probe and unplug the one ¾" connector from the control box.
3. Referring to system schematic 161453 in Appendix H, locate wire #138.
4. Using an ohmmeter check wire #138 for continuity
5. If wire #138 does not have continuity, repair as necessary.
6. If wire #138 has continuity, check the probe end of the wire for a loose connector.
7. Check the pin in the 1 ¾" connector for proper insertion or signs of wear.
8. If the connector and pin are okay, reconnect wire #138 to the water level probe.
9. Reconnect the 1 ¾" connector to the control panel.
10. Reconnect electric power to the unit. If the water level fault still does not clear, see Section 8.3.2.

8.3.3 WATER LEVEL CIRCUIT

1. Remove AC power from the unit.
2. Open the control box to expose the wiring and internal components.

WARNING!

THE WIRES AND COMPONENTS IN THE CONTROL PANEL USE 120VAC POWER. DO NOT TOUCH ANY WIRES OR COMPONENTS IN THE CONTROL BOX WITH POWER APPLIED.

3. Remove wires #114 and #60 from terminals LLCO and G.
4. Using an ohmmeter, check continuity between wire #114 in the control box, and

wire #138 on the unit. Also check continuity between wire #60 in the control panel and the unit shell.

5. If there is no continuity repair as necessary. If there is continuity replace the low water level circuit board.

8.4 HIGH WATER TEMPERATURE

8.4.1 Determining the Cause

8.4.2 Over Temperature Limit Switches

8.4.3 Other Causes

All Benchmark units ship with a manual reset, temperature limit switch that is fixed at 210⁰. Only recently, as of unit S/N G-0-711 and above, have units begun shipping with an adjustable, auto restart, temperature switch as well as the manual reset switch. A high water temperature fault indicates that the unit's discharge water temperature has exceeded the setpoint of one or both temperature limit switches. The following procedure will help in troubleshooting and determining the source of the high discharge water temperature.

Recommended Troubleshooting Equipment

- Digital Voltmeter/Digital Ohmmeter (DVM)

8.4.1 DETERMINING THE CAUSE

1. To aid in troubleshooting, remove the unit's right and left side sheet metal panels to expose the over-temperature switches and their associated wiring
2. Using either the temperature controller or system thermometers, as indicators, determine if the unit's discharge water temperature is greater than 200⁰.
3. If the discharge water temperature is less than 200 degrees, depress the reset button on the manual over-temperature switch and then try to clear the annunciator display and restart the unit. If the display does not clear and the unit does not restart, proceed to step 5.
4. If the discharge water temperature is greater than 200 degrees, it will be necessary to wait until the discharge water temperature has dropped below 200 degrees. Once the temperature has dropped, depress the manual temperature switch reset button, clear the annunciator display, and restart the unit. If the display does not clear and the unit does not restart proceed to step #5.
(Note: It may be necessary to wait until the

temperature has dropped 20 degrees or more before the temperature switch will reset.)

5. Check to see if the unit has an adjustable temperature switch. If it does, ensure that it's setting is not less than the discharge water temperature.
6. If the adjustable temperature switch setting is lower than the current water temperature, raise its setting until it is above the current water temperature and try to clear the fault. If the fault persists, proceed to section 8.4.2

8.4.2 OVER TEMPERATURE LIMIT SWITCHES

1. Disconnect AC power to the unit.
2. Remove the boiler's right side and left side panels to expose the over temperature limit switches and their associated wiring.
3. Locate the over temperature limit switch or switches. Remove wires #136 and #137 from the temperature switch or switches.
4. If there are two temperature switches, check for continuity across the P and #2 terminals of each switch. If there a single temperature switch, check for continuity between the # 1 and #2 terminals. (Be sure that the discharge water temperature is well below the switches trip temperature before checking continuity.)
5. Replace any switch that does not show continuity.
6. If the switch or switches are okay, open the control panel door and locate the 120 VAC hot and neutral terminal blocks located under the shelf and just to the right of the transformer. Locate wire #117 on the hot terminal block. Perform a continuity check from wire #117 to wire #137 at the temperature switch or switches.
7. Next locate wire number #153 at the low pressure gas switch and measure continuity from wire #153 to wire # 136 at the temperature switch or switches.

Note: The procedures in steps 6 and 7 test and ensure the integrity of wiring inside and outside of the control panel as well as the connections of the control box connectors.

8. If there is no continuity in one or more of the wires above, check for loose connectors on the wires and check the pins of 1 ¼" connector for proper insertion and/or wear.
9. Reconnect all wires and connectors and reapply AC power to the unit.
10. If the over temperature fault persists, consult your local AERCO representative or qualified service technician.

8.4.3 OTHER CAUSES

While incorrect temperature switch settings or faulty wiring or connectors can result in water temperature faults, there are several other factors that can result in the boilers water temperature exceeding it's water temperature limit of 210 degrees. These include

1. Incorrect settings of PID control settings on the boilers temperature controller.
The PID settings are located in the Secondary menu of the boiler's temperature controller. Default values for this can be found in Appendix B of this manual. The settings to check are pb1, Int, and Drt.

NOTE: *Incorrect PI D settings will only affect boilers in Constant Setpoint or Indoor /Outdoor Reset Modes of operation*

2. Incorrect or varying flow rates through the boiler(s). Check to ensure that the minimum flow rate through the Benchmark is not less than 25 GPM. In addition if variable speed pumping or two-way valve systems are used, fast flow rate changes can result in over-temperature conditions. It may be necessary to slow the rate at which flows vary or to limit the minimum system flow rate. If over-temperature conditions persist, contact an authorized AERCO representative.
3. Not interlocked to an external Energy Management System (EMS). The EMS system may be controlling system pumps and may not be sending a stop start signal to the AERCO boilers or BMS when the system pumps are not running.
4. If the boilers are being controlled by an AERCO Boiler Management System (BMS), the BMS may require tuning to the loop or the header sensor may be incorrectly installed. When setting up a BMS the HDR TEMP BW should be changed from 50 to 70. This will slow the rate at which the

boilers ramp up resulting in less temperature overshoot at each individual boiler.

When checking the header sensor, ensure that the sensor well is not bushed too far out of the supply header. Also, ensure that the actual sensing element that goes into the well is fully extended out of its electrical housing box as it can slip up into the electrical housing. The use of conductive grease in the sensor well is also recommended to aid in sensor response time. All the above can affect response time of the sensor to the BMS. A slow response time of the sensor to the BMS especially in a varying flow system can result in high water temperature faults on one or more of the boilers.

5. If all or some of the above conditions exist and have been checked and tried and over temperature faults still persist contact your local AERCO representative.

If one of the above is suspect contact your local AERCO representative for further assistance

8.5 LOCK OUT RUN FLAME

A LOCKOUT RUN FLAME message indicates that the flame signal was lost after the unit proved flame and was released to modulate. A FLAME FAULT DURING IGN TRIAL message indicates that flame was not recognized during the ignition trial period.

- 8.4.1 Flame Fault While Firing
- 8.4.2 Flame Fault During Ignition Cycle
- 8.4.3 Safety Shut-Off Valve
- 8.4.4 Spark Ignitor
- 8.4.5 Flame Detector
- 8.4.6 Ignition Circuit
- 8.4.7 Air Fuel Valve Ignition Position Switch
- 8.4.8 Flame Detector Voltage
- 8.4.9 Residual Flame

Recommended Troubleshooting Equipment

- Digital or Analog Voltmeter
- Combustion Analyzer
- 8" and 16" Manometers

8.5.1 FLAME FAULT WHILE FIRING

1. If the combustion control has a keyboard display module installed, the flame signal can be monitored directly, if not, proceed with the next step.
2. Install a voltmeter in the flame test jacks located on the front of the combustion safeguard and start the unit.

3. Once flame is established, a steady reading of greater than 1.25 VDC should be observed on the voltmeter.
4. Fire the unit at various firing rates (i.e., 20%, 30%, 50%, 100% etc.).
5. If flame signal is erratic at a particular firing rate or range of firing rates, check combustion calibration as per Sections 4.3, and 4.4 of this manual.

8.5.2 FLAME FAULT DURING IGNITION TRIAL

1. Check that all gas supply valves are open
2. If the gas supply valves were open, start the unit.
3. Remove the cover to the air/fuel valve. Ensure that the air/fuel valve rotates to the ignition position and engages the ignition position switch. If the air/fuel valve does not rotate to the ignition position proceed to Section 8.7.7.
4. If the air/fuel valve rotates and engages the ignition position switch during the trial for ignition then visually watch/inspect the safety shut-off valve, through the window on the actuator half to determine if it is opening.

NOTE:

At the ignition cycle, the low fire switch is made, and the safety shut-off valve is energized. The *OPEN* disk in the safety shut-off valve actuator window should slowly move downward indicating that the valve is operating correctly. If the valve does not open proceed to Section 8.5.3

5. If the safety shut-off valve opens check the spark ignitor as per Section 8.4.4 and the flame detector, as per Section 8.4.5.
6. If the spark ignitor and flame detector are okay, or require replacement and the flame fault still persists, check the ignition circuit as per Section 8.4.6.
7. If the flame fault still persists after checking the above, measure the flame detector lead voltage as per Section 8.4.7.
8. If the flame fault still persists after checking all of the above, remove the burner and inspect for debris.

If the flame fault still persists after the above, replace the combustion safeguard.

8.5.3 SAFETY SHUT-OFF VALVE

1. Start the unit.
2. When the starting sequence reaches the ignition trial cycle, observe the response of the safety shut-off valve through the window in the actuator portion
3. At the ignition cycle, the OPEN disc should slowly begin to descend down as the hydraulic actuator opens the valve.
4. If the actuator does not open the valve, disconnect AC power to the unit.
5. Remove the actuator portion from the valve body and inspect for signs of leaking hydraulic fluid.
6. If the actuator is not leaking, set it back on the valve body and remove the electrical cover plate exposing the control wiring.
7. Temporarily secure the actuator to the valve body with the control wiring facing outward for easy access.
8. Referring to system schematic 161453 in Appendix H, connect an AC voltmeter across wires #145 and #146.
9. Reconnect AC power to the unit.
10. Start the unit.
11. At the ignition trial cycle 120VAC should be observed on the AC voltmeter.
12. If 120VAC is observed on the voltmeter, replace the safety shut-off valve actuator.
13. If 120VAC is not observed on the AC voltmeter, disconnect AC power to the unit.
14. Disconnect the 1" diameter connector from the control panel, and remove the cover from the AC wiring box.
15. Referring to system schematic 161453 in Appendix H, locate wires #145 #146 and #147 and check each for continuity.
16. Check each wire for loose connectors at the safety shut-off valve end. Check wires #145 #146 and #147 for loose connectors in the Benchmark Control Box.

17. Check the pin on wire #145 at the 1" connector end, for proper insertion or wear.
18. Make any necessary repairs.
19. If all wires show continuity and all connections are okay, reconnect wires #145, #146 and #147 to the safety shut-off valve.
20. Replace the cover plates on the safety shut-off valve actuator and the AC wiring box.
21. Reconnect the connector 1" connector to the control panel.
22. Reconnect AC power to the unit and start the unit.
23. If the safety shut-off valve still does not open, proceed to section 8.5.6
24. Be sure to return the safety shut-off valve to its original position and replace all electrical cover plates.

8.5.4 SPARK IGNITOR

1. Disconnect AC power to the unit.
2. Remove the spark ignitor as per Section 7.2 of this manual.
3. Inspect the ignitor for signs of erosion.
4. Replace the ignitor if eroded.
5. Check for carbon build-up on the ignitor
6. If there is ignitor carbon build-up, the combustion calibration settings must be checked as per Sections 4.2 and 4.3. If the spark ignitor is not eroded, it may be cleaned and reused.

8.5.5 FLAME DETECTOR

1. Disconnect AC power to the unit.
2. Remove the flame detector as per Maintenance Section, 7.3.
3. Check the detector for signs of erosion or carbon build-up.
4. If the flame detector is eroded, replace it. Otherwise, clean it using emery cloth.
5. Carbon build-up on the flame detector indicates that unit may require combustion calibration.
6. Check the combustion calibration settings as per Sections 4.2 and 4.3.

8.5.6 IGNITION CIRCUIT

1. Disconnect AC power to the unit.
2. Close the manual leak detection valve, located between the safety shut-off valve and the differential pressure regulator, on the unit's gas manifold.
3. Using a spare ignitor, connect the ignition cable directly to the ignitor.
4. Ground the ignitor to the frame of the unit.
5. Reconnect AC power to the unit.
6. Start the unit.

WARNING!
ELECTRIC SHOCK HAZARD. THE SECONDARY OF THE IGNITION TRANSFORMER HAS A POTENTIAL OF 6000 VOLTS. DO NOT HOLD OR TOUCH ANY IGNITION CIRCUIT COMPONENTS WHILE TESTING.

7. At ignition an arc should be observed. It should last for approximately 10 seconds.
8. If there is no arc, disconnect AC power to the unit.
9. Remove the ignition cable and check it for continuity or loose connections.
10. Replace the cable if there is no continuity or if there is a loose connection.
11. If the ignition cable is okay, remove the ignition transformer cover plate.
12. Referring to system schematic 161453 in Appendix H, locate wires #140 and #141.
13. Connect an AC voltmeter across wires #140 and #141.
14. Reconnect AC power to the unit and start the unit.
15. At the ignition cycle check for 120VAC across wires #140 and #141.
16. If 120VAC is observed across wires #140 and #141, replace the ignition transformer.
17. If 120VAC is not observed on the AC voltmeter during the Ignition cycle, disconnect AC power to the unit.

18. Disconnect the 1 3/4" connector from the control panel, and wires #140 and #141 from the ignition transformer.
19. Remove the cover plate from the AC wiring box.
20. Referring to system schematic 161453 in Appendix H, check wires #140 and #141 for continuity.
21. If wires #140 and #141 have continuity, inspect the pin on wire #140 in the 1 3/4" connector for proper insertion or signs of wear.
22. Inspect the connector on wire #141 at 1 3/4" connector for a loose connection.
23. Make any necessary repairs.
24. After all wiring and connections have been inspected or repaired, reconnect wires #140 and #141 to the ignition transformer.
25. Reconnect 1 3/4" connector to the control panel.
26. Reinstall the cover plates on the ignition transformer and the AC wiring box.
27. Be sure to reinstall the spark ignitor and ignitor contactor if necessary and reconnect the ignition cable to the ignition transformer and the ignition contactor.
28. Reopen the leak detection valve.
29. Reconnect AC power to the unit and start the unit.
30. If the flame fault still persists, replace the combustion safeguard.

8.5.7 FLAME DETECTOR VOLTAGE

1. Disconnect AC power to the unit.
2. Remove the flame detector lead wire from the flame detector.
3. Connect an AC voltmeter from the flame detector lead wire to the frame of the unit.

WARNING!
***A SHOCK POTENTIAL EXISTS. THE
FLAME DETECTOR LEAD WIRE HAS A
POTENTIAL OF 230 VAC.***

4. Reconnect AC power to the unit.
5. An AC voltage reading of approximately 230 VAC should be observed.
6. If 230 VAC is observed, proceed to Section 8.4.2, Step 8.
7. If 230 VAC is not observed, disconnect AC power to the unit.
8. Disconnect the 1 3/4" connector from the control panel.
9. Referring to system schematic 161453 in Appendix H, locate wire #135.
10. Check wire #135 for continuity.
11. Check the flame detector end of wire #135 for loose connections. Inspect the pins in the 1 3/4" connector for proper insertion and/or signs of wear.
12. Repair if necessary.
13. If wire #135 has continuity and all connections are okay or a repair was performed, reconnect the flame detector lead to the flame detector. Reconnect the 1 3/4" connector to the control panel.
14. Reconnect AC power to the unit and start the unit.
15. If the flame fault still persists, replace the combustion safeguard.

8.5.8 RESIDUAL FLAME

Once the KC1000 has stopped firing, it continues to monitor the flame circuit. If a residual flame exists, the unit will indicate a LOCKOUT fault. The source of a residual flame is typically a leaking safety shut-off valve. To check for a leaking safety shut-off valve proceed as follows:

1. Shut the unit off by switching the ON-OFF switch to the Off position
2. Locate the leak detection valve, between the safety shut-off valve and the differential pressure regulator.
3. Close the valve and remove a setscrew from its 1/8" leak detection port.
4. Install an 8" or 16" manometer.
5. Monitor the manometer for signs of an increase in gas pressure.

6. If there is an increase in gas pressure, replace the gas train.

8.5 LOCK OUT RUN AIR PRESSURE

A LOCKOUT RUN AIR FLOW indicates that the air pressure, while firing, was too low for operation. Oscillations or rumbling of the unit is also a common cause this fault.

- 8.6.1 Determining the Cause of the Fault
- 8.6.2 Oscillations
- 8.6.3 Blower
- 8.6.4 Blower Proof Switch
- 8.6.5 Motor Contactor

Recommended Troubleshooting Equipment
AC Voltmeter
Ohmmeter

8.6.1 DETERMINING THE CAUSE OF THE FAULT

1. Clear the Annunciator and start the unit.
2. If the unit does not fault after proving flame, proceed to Section 8.5.2.
3. If the blower does not start, proceed to Section 8.5.3.
4. If the blower starts but the Annunciator displays LOW AIR FLOW, proceed to Section 8.5.4.
5. If the unit has sealed combustion air ducted in right up to the blower, check the ducting for blockage.
6. If combustion air is ducted into the room, or brought in through a louver, be sure that the size of the ducting or louver is adequate. Ensure that the louvers are open while the unit is firing.

8.6.2 OSCILLATIONS

Oscillations, also known as rumbling, typically occur when the air/fuel mixture is too lean. This causes the flame to burn at various distances from the burner at a rapid pace. Oscillations create pressure waves that can trip the air pressure switch, shutting the unit Off.

1. Start the unit.
2. Slowly increase the firing rate percentage while listening to the unit.
3. If a rumbling sound is heard, at higher firing rates, 60% to 100%, combustion calibrate the unit as per sections 4.3 and 4.4.

8.6.3 BLOWER

1. Locate wire #81 & #83 on the motor contactor located inside the control panel.
2. Connect an AC voltmeter between wire #81 and wire #83 and the unit frame.
3. Start the unit.
4. The AC voltmeter should measure between 200 and 230VAC.
5. If 200 to 230VAC is not measured, proceed to section 8.5.5
6. If 200 to 230VAC is measured, check for voltage between wire #131 and #132 at the blower motor.
7. If 200 to 230 VAC is present between wire #131 and #132 and the blower still does not start replace the blower assembly.

8.6.4 BLOWER PROOF SWITCH

1. Remove wires #154 and #155 from the blower proof switch
2. Connect an ohmmeter across the blower proof switch and start the unit.
3. The blower proof switch should show continuity with the blower running.
4. If the blower proof switch does not show continuity, remove the switch and check for signs of blockage. Remove any debris and reinstall the switch. Retest as per Steps 2 through 3 in this section.
5. If the blower proof switch shows continuity, disconnect AC power to the unit.
6. Disconnect the 1 3/4" connector from the control panel.
7. Referring to system schematic 161453 in Appendix H, locate wire #154 and #155 and check both for continuity.
8. Check the switch end of wires #154 and #155 for loose connections.
9. Check the pins on the 1 3/4" connector for proper pin insertion or wear.
10. If continuity, the connector and pins are okay, reconnect wires #154 and #155 to the blower proof switch.

11. Reconnect the 1 3/4" connector to the control panel.
12. Reconnect AC power to the unit and start the unit.
13. If the blower proof fault still persists, replace the combustion safeguard.

8.6.5 MOTOR CONTACTOR

1. Open the controls box and locate the motor contactor.
2. Locate wire #36. Measure the AC voltage on its terminal when the unit is attempting to start. There should be 120VAC at this point.
3. If 120VAC is measured on this terminal and the blower still does not start, replace the motor contactor.
4. If 120VAC is not measured, remove the cover from the combustion safeguard connect a voltmeter to terminal # 8 and the unit frame.
5. Start the unit. The voltmeter should measure 120VAC. If 120VAC is not measured, replace the combustion safeguard chassis.

8.7 SYSTEM FAULT LOW AIR PRESSURE OR PURGE INTERLOCKS

A system fault indicates when the unit faults during the starting sequence, but prior to ignition. An internal 30-second fault timer starts timing when the unit start sequence is initiated. If ignition is not reached within the specified time, the Annunciator displays the message SYSTEM FAULT LOW AIR PRESSURE or PURGE INTERLOCKS depending on the cause. A system fault usually occurs when the system does not acknowledge either the safety shut-off valve proof of closure switch, the blower proof switch, or the air/fuel valve open switch.

- 8.6.1 Determining the Cause
- 8.6.2 Blower
- 8.6.3 Combustion Air Supply and Blower Proof Switch
- 8.6.4 Purge Interlocks
- 8.6.5 SSOV Proof of Closure Switch
- 8.6.6 Air/fuel Valve Open Proving Switch
- 8.6.7 Air/Fuel Valve not Rotating
- 8.6.8 Air/Fuel Valve Ignition Position Switch

Recommended Troubleshooting Equipment DVM

8.7.1 DETERMINING THE CAUSE

1. Clear the Annunciator and start the unit.

2. If the blower does start and the message SYSTEM FAULT PURGE INTERLOCKS is displayed proceed to section 8.6.4
3. If the blower does not start, and the message SYSTEM FAULT LOW AIR PRESSURE is displayed, proceed to section 8.6.2.
4. If the blower starts and the message SYSTEM FAULT LOW AIR PRESSURE is displayed, proceed to section 8.6.3.
5. If the unit does not fire, and the message SYS FLT is displayed on the temperature controller and the Annunciator, proceed to section 8.6.8.

8.7.2. BLOWER

1. Locate wire #81 & #83 on the motor contactor located inside the control panel.
2. Connect an AC voltmeter between wire #81 and wire #83 and the unit frame.
3. Start the unit.
4. The AC voltmeter should measure between 200 and 230VAC.
5. If 200 to 230VAC is not measured, proceed to section 8.5.5
6. If 200 to 230VAC is measured, check for voltage between wire #131 and #132 at the blower motor.
7. If 200 to 230 VAC is present between wire #131 and #132 and the blower still does not start replace the blower assembly.

8.7.3 COMBUSTION AIR SUPPLY AND BLOWER PROOF SWITCH

1. If the unit has sealed combustion, check the ducting for any signs of blockage.
2. If combustion air is brought in through an opening in a wall, be sure that the size of the opening is adequate and that louvers are open while the unit is firing.
3. If the combustion air supply is okay, remove wires #154 and #155 from the blower proof switch.
4. Connect an ohmmeter across the blower proof switch and start the unit.

5. The blower proof switch should show continuity while the blower is running.
6. If the blower proof switch does not show continuity, remove the switch and check for signs of blockage. If there is blockage, clean the switch and retest.
7. If the blower proof switch shows continuity, disconnect AC power to the unit.
8. Disconnect the 1 3/4" connector from the control panel.
9. Referring to system schematic 161453 in Appendix H, locate wires #154 and #155 and check both for continuity.
10. Check the switch end of wires #154 and #155 for loose connections.
11. Check the connector end for worn pins and/or proper pin insertion.
12. If continuity, the connector and pins are okay, reconnect wires #154 and #155 to the blower proof switch.
13. Reconnect the 1 3/4" connector to the control panel.
14. Reconnect AC power to the unit and start the unit.
15. If the SYSTEM FAULT LOW AIR PRESSURE fault still persists, replace the control panel.

8.7.4 PURGE INTERLOCKS

If the SSOV proof of closure switch or the air/fuel valve open position switches fail to prove closed during the start up sequence, the unit will shut down and the Annunciator will display the message SYSTEM FAULT, PURGE INTERLOCKS. To determine the cause of the fault perform the following:

1. Remove the air/fuel valve cover.
2. Clear the Annunciator and start the unit.
3. If the Annunciator displays the message PURGE INTLK OPEN and the air/fuel valve does not rotate, proceed to section 8.6.7.
4. If the air/fuel valve rotates to its full open position and engages the air/fuel valve open proving switch, and the Annunciator still displays SYSTEM FAULT, PURGE INTERLOCKS, proceed to section 8.6.6.

8.7.5 SSOV PROOF OF CLOSURE SWITCH

1. Disconnect AC power to the unit.
2. Loosen the two setscrews securing the safety shut-off valve actuator to the safety shut-off valve body.
3. Rotate the actuator portion clockwise exposing the electrical cover plate and tighten the two previously loosened setscrews.
4. Remove the electrical cover plate exposing the control wiring
5. Referring to the system schematic 161453 in Appendix H, remove wires #148 and #149 from the proof of closure switch.
6. Connect an ohmmeter across the NC, normally closed, and the C, common, terminals.
7. The switch should show continuity. If it does show continuity proceed to step 16.
8. If the switch does not show continuity, remove the actuator from the valve body.
9. Looking at the actuator from the bottom, push on the lever closest to the bottom of the actuator.
10. Observe the ohmmeter while pushing on the lever. Pushing downward on the lever should make continuity. Releasing the lever should break continuity.
11. If continuity makes and breaks, slightly bend the arm toward the bottom of the actuator.
12. Reset the actuator onto the valve body while observing the ohmmeter.
13. If continuity is now okay, reconnect wires #148 and #149, replace the electrical cover plate and reassemble the actuator to the valve body.
14. If there is no continuity, replace the actuator or switch.
15. Start the unit. If the unit sequence resumes normal operation, proceed no further. If the Lockout still persists, proceed to Step 16.
16. Disconnect AC power and remove wires #148 and #149 from the proof of closure switch. Disconnect the 1" connector from the control panel.

17. Referring to system schematic 161453 in Appendix H, locate wires #148 and #149, check each for continuity using an ohmmeter.
18. Check for loose connectors at the proof of closure switch end.
19. Check wires #148 and #149 at the control panel connector end for worn pins and/or proper pin insertion.
20. Repair as necessary.
21. If connections and continuity are okay, reconnect wires #148 and #149 to the proof of closure switch and reconnect the 1 " connector to the control panel ensuring it locks into place.
22. Replace the cover plate on the actuator and reposition the actuator on the valve body and lock into place using the setscrews.
23. Reconnect AC power to the unit.
24. Start the unit. If the condition still persists, proceed to section 8.6.6.

8.7.6 AIR/FUEL VALVE OPEN, PROVING SWITCH

1. Remove the air/fuel valve cover.
2. Start the unit.
3. If the air/fuel valve rotates to its full open position, and engages the air/fuel valve open switch, proceed to step 5.
4. If the air/fuel valve does not rotate, proceed to section 8.6.7.
5. Disconnect AC power to the unit.
6. Referring to system schematic 161453, in Appendix H, locate wires #171 and #172. Remove wires #171 and #172 from the air/fuel valve open proving switch, noting their location. (The air/fuel valve open proving switch is the one closest to the blower.)
7. Connect an ohm meter across the terminals of the switch, where wires #171 and #172 were located
8. Manually depress the switch and check the ohmmeter for continuity.

9. If the switch shows continuity, proceed to Step 11.
10. If the switch does not show continuity, replace the switch.
11. Disconnect the 1 ¼" connector from the control panel.
12. Referring to system schematic 161453 in Appendix H, locate wires #171 and #172. Check wires #171 and #172 for continuity.
13. Check for loose connectors at the switch end of wires #171 and #172.
14. Check the 1 ¼" connector end of wire #171 and #172 for worn and/or improperly inserted pins.
15. If connections and continuity are okay, reconnect wire #171 and #172 to the air/fuel valve open switch. Reconnect the 1 ¼" connector to the control panel and start the unit.
16. If the fault still persists, remove the cover from the combustion safeguard.
17. Measure the AC voltage between terminal 6 and terminal 2 after starting the unit.
18. If 120VAC is present between terminals 6 and 2, but the fault persists replace the combustion safeguard.

8.7.7 AIR/FUEL VALVE NOT ROTATING

1. Disconnect AC power to the unit.
2. Remove the air/fuel valve cover.
3. Check for loose wires at the wire nuts connecting the air/fuel valve wiring harness to the stepper motor.
4. Holding the coupling between the top of the stepper motor and the potentiometer with your thumb and forefinger, rotate the valve.

NOTE:

Do not rotate the air/fuel valve with power applied to the unit.

5. If the air/fuel valve does not rotate or is extremely difficult to rotate, replace the air/fuel valve.
6. Disconnect the 1 ¼" connector from the control panel. Referring to schematic

- 161453 in Appendix H, check all wires for continuity.
7. Check all the pins in the 1 ¼" connector for proper insertion or signs of wear.
 8. If all connections, continuity, and the rotation of the air/fuel valve in Step 4 were okay, open the control box to expose the wiring and components.
 9. Locate the air/fuel valve stepper motor driver board.
 10. Ensure the connectors and wires are not loose and are making good contact.
 11. If the wiring to the driver board is okay, place a voltmeter across terminals 7 and 8 on the back of the temperature control.
 12. Apply AC power to the unit.
 13. Place the ON/OFF switch in the OFF position.
 14. Measure the DC voltage across these two terminals. It should be 15 volts \pm 2 volts.
 15. Place the ON/OFF switch in the ON position.
 16. Measure the DC voltage again. It should be approximately 3 volts DC during PURGE and 1 to 1.3 volts during ignition.
 17. If the voltage is correct, replace the air/fuel valve driver board.
 18. If the voltage remains at 15 volts \pm 2 volts during PURGE or remains at 3 volts during ignition replace the relay board.
 19. If the DC voltage is at 0 volts, replace the temperature controller.
4. Place an ohm meter across the terminals of the switch, where wires #169 and #170 were located
 5. Manually depress the switch and check the ohmmeter for continuity.
 6. If the switch shows continuity, proceed to Step 8.
 7. If the switch does not show continuity, replace the switch.
 8. Disconnect in the 1 ¼" connector from the control panel.
 9. Referring to system schematic 161453 in Appendix H, locate wires #169 and #170. Check wires #169 and #170 for continuity.
 10. Check for loose connectors at the switch end of wires #169 and #170.
 11. Check in the 1 ¼" connector ends of wires #169 and #170 for worn and/or improperly inserted pins.
 12. If continuity, pins and connections are okay, reattach wire #169 and #170 to the air/fuel valve ignition position. Reconnect in the 1 ¼" connector to the control panel and start the unit.
 13. If the system fault still persists, contact your local AERCO representative for further assistance.

8.7.8 AIR/FUEL VALVE IGNITION POSITION SWITCH

1. Disconnect AC power to the unit.
2. Remove the air/fuel valve cover
3. Referring to system schematic 161453 in Appendix H, locate wires #169 and #170. Remove wires #169 and #170 from the air/fuel valve ignition position switch, noting their position. (The air/fuel valve ignition position switch is the one closest to the shell of the unit.)

PRIMARY MENU ITEM DESCRIPTIONS

tout

This is the actual outlet water temperature of the heater. It is designated by the code (tout).

pct

Percentage of firing rate is a number, in percent, that is directly related to the input BTU's of the unit. For instance a 50% signal equals a 1,000,000 BTU gas input while a 75 % signal equals a 1,500,000 BTU gas input and so on.

Setp

Setpoint is the desired outlet water temperature that is to be maintained by the boiler when operating in automatic mode

Auto

When set to automatic mode (ON), the temperature controller receives and processes inputs from temperature sensor(s) located externally or on the unit. The controller uses these inputs to automatically decrease or increase the firing rate to match the load.

In manual mode, (OFF), the controller no longer automatically controls the firing rate of the heater. It is up to the operator who put it into manual mode to control the outlet temperature and firing rate.

SECONDARY MENU ITEM DESCRIPTIONS
CONSTANT SETPOINT

FUNC	This indicates the mode of operation the temperature controller is in. Common modes are Oart, indoor\outdoor reset, Cont, constant setpoint, and FDFO for a water heater.
OSAT	This menu item turns the outside air enable\disabl feature on or off. When ON, an ouside air temperature can be chosen to enable or disable the unit.
Oat	This displays the outside air temperature that the unit is enabled. This parameter is displayed only when OSAT is on.
LLT	This is Low Limit Temperature. It is the minimum value that the Setpoint, (SetP), can be set to. To adjust, use the↑ and ↓ arrow keys. Press ENTER to accept any changes.
Hlt	This is High Limit Temperature. It is the maximum value that the Set point (SetP) can be adjusted to. To adjust, use the↑ and ↓ arrow keys. Press ENTER after making changes.
Pb1	Proportional Band refers to the error between the setpoint and the actual water temperature.

Int

This is the integral rate, in minutes, for the feedback of the controller. It is adjusted with the \uparrow and \downarrow . Press ENTER to accept changes.

Drt

This is the derivative rate in % $/1^{\circ}/\text{sec}$. This adjusts response time to temperature changes at the outlet of the unit.

Addr

This displays the address for the controller. It is used for external communication with a computer.

LOre

This changes the local/remote status of the controller. In local mode all external computer write commands are ignored. Read commands still function. In remote both read and write commands from an external computer will function.

SECONDARY MENU ITEM DESCRIPTIONS
INDOOR-OUTDOOR RESET MODE

FUNC	This displays the mode of the temperature controller. Common modes are Oart, indoor\outdoor reset, Cont, constant setpoint, and FDFO for a water heater.
REFT	This is the building reference temperature. It is the desired temperature that the inside of the building is to maintained.
RR	Reset Ratio is a number that the header temperature will increase, per degree, with each degree change in outside air temperature
OSAT	This menu item turns the outside air enable\disable feature on or off. When ON, an outside air temperature can be chosen to enable or disable the unit.
Oat	Oat displays the outside air temperature that the unit is enabled. This parameter is displayed only when OSAT is on.
LLT	This is Low Limit Temperature alarm. This feature shuts down the unit and places the temperature controller into alarm if the outlet water temperature goes below this setting. Outlet water temperature must be higher than the low limit alarm setting for the unit to restart.

Hlt

This is High Limit Temperature alarm. This feature shuts down the unit and places the temperature controller into alarm if the outlet water temperature exceeds this setting. Outlet water temperature must be below this setting before the unit will restart

Pb1

Proportional Band refers to the error between the setpoint and the actual water temperature.

Int

This is the integral rate, in minutes, for the feedback of the controller. It is adjusted with the \uparrow \downarrow arrow keys. Press ENTER to accept changes.

Drt

This is the derivative rate in $\% /.1^{\circ}/\text{sec}$. This adjusts response time to temperature changes at the outlet of the unit.

Addr

This displays the address for the controller. It is used for external communication with a computer.

LOre

This changes the local/remote status of the controller. In local mode all external computer write commands are ignored. Read commands still function. In remote both read and write commands from an external computer will function.

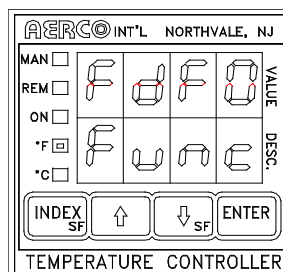
TEMPERATURE CONTROLLER QUICK REFERENCE PROGRAMMING GUIDE

The following is a “How To” guide that quickly shows how to access menu levels and their parameters, and how to make changes to them.

- **PRIMARY MENU to SECONDARY MENU**

Press *ENTER* and the \uparrow arrow key.

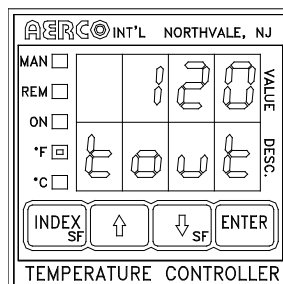
The display will indicate:



- **SECONDARY MENU to PRIMARY MENU**

Press *INDEX* and the \downarrow arrow key.

The display will indicate:



NOTE:

When in the Secondary menu the first menu parameter, (Func), must be displayed in order to switch to another menu.

NOTE:

The number 120, shown above, is arbitrary. This number is dependent on the actual outlet water temperature of the unit being serviced.

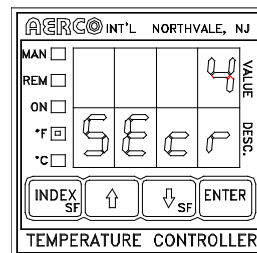
NOTE:

The temperature controller defaults back to the **PRIMARY** menu from the **SECONDARY** menu or the **SECURE** menu if there is no activity in either of those menus after 4 minutes.

- **TO CHANGE TO THE SECURE MENU**

While in the primary menu press the **INDEX** key and \downarrow arrow key.
OR while in secondary menu press and hold **ENTER** and \uparrow for 5 seconds.

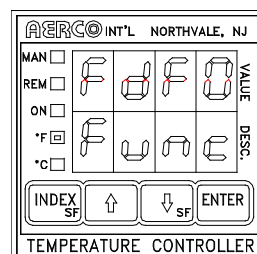
The display will indicate:



- **SECURE MENU to the SECONDARY MENU**

Pressing either **INDEX** and \downarrow arrow key or **ENTER** and the \uparrow arrow key will return you to the **SECONDARY** menu.

The display will indicate:

**NOTE:**

Anytime the **SECURE** menu is entered the unit will shut down. It will resume normal operation upon going back to the **PRIMARY** or **SECONDARY** menu.

- **SECURE MENU TO THE MAIN MENU**

While in the SECURE menu press INDEX and the ↓ arrow key. This will place you in the SECONDARY menu. Press INDEX and the ↓ arrow key again to return to the MAIN menu.

The display will indicate:

AERCO INT'L NORTHVALE, NJ			
MAN <input type="checkbox"/>		2	VALUE
REM <input type="checkbox"/>		2	
ON <input type="checkbox"/>		2	DESC.
*F <input type="checkbox"/>		2	
*C <input type="checkbox"/>		2	
INDEX SF	↑	↓ SF	ENTER
TEMPERATURE CONTROLLER			

• SCROLLING THROUGH MENU ITEMS

To scroll through Menu items, in any menu level, Press INDEX.

To scroll thru the PRIMARY, SECURE, or SECONDARY menus in reverse, simultaneously press INDEX and the ↓ arrow key.

To return to the first menu item of the SECONDARY menu from any other SECONDARY menu item, without scrolling, simultaneously press the INDEX and the ↓ arrow key.

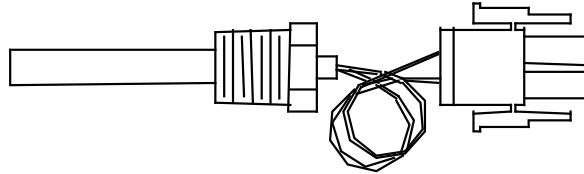
• CHANGING MENU ITEM VALUES

To change the value of a selected menu item press either the ↑ arrow key to increase the item value or the ↓ arrow key to decrease the item value. Press ENTER to accept the change.

NOTE:

ENTER must be pressed after changing the value of a parameter If ENTER is not pressed the controller will default to the value displayed prior to the change.

Temperature Sensor Resistance Chart (Balco)



TEMPERATURE SENSOR
AERCO PN 123449

TEMP. °F	Res. in Ohms	
-40	779.0	
-30	797.5	
-20	816.3	
-10	835.4	
0	854.8	
10	874.6	
20	894.7	
30	915.1	
40	935.9	
50	956.9	
60	978.3	
70	1000.0	
80	1022.0	
90	1044.4	
100	1067.0	
110	1090.0	
120	1113.3	
130	1137.0	
140	1160.9	
150	1185.2	
160	1209.5	
170	1234.7	
180	1260.0	
190	1285.6	
200	1311.4	
210	1337.7	
220	1364.2	
230	1391.0	
240	1418.2	
250	1445.7	

$$R(\text{Ohms}) = .00161T^2 + 1.961T + 854.841$$

T = °F

INDOOR\OUTDOOR RESET RATIO CHARTS

Header Temperature for a Building Reference Temperature of 50F

Air Temp	RESET RATIO									
	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4
50F	50	50	50	50	50	50	50	50	50	50
45F	53	54	55	56	57	58	59	60	60	62
40F	56	58	60	62	64	66	68	70	72	74
35F	59	62	65	68	71	74	77	80	83	86
30F	62	66	70	74	78	82	86	90	94	98
25F	65	70	75	80	85	90	95	100	105	110
20F	68	74	80	86	92	98	104	110	116	122
15F	71	78	85	92	99	106	113	120	127	134
10F	74	82	90	98	106	114	122	130	138	146
5F	77	86	95	104	113	122	131	140	149	158
0F	80	90	100	110	120	130	140	150	160	170
-5F	83	94	105	116	127	138	149	160	171	182
-10F	86	98	110	122	134	146	158	170	182	194
-15F	89	102	115	128	141	154	167	180	193	206
-20F	92	106	120	134	148	162	176	190	204	218

Header Temperature for a Building Reference Temperature of 60F

Air Temp	RESET RATIO									
	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4
60F	60	60	60	60	60	60	60	60	60	60
55F	63	64	65	66	67	68	69	70	71	72
50F	66	68	70	72	74	76	78	80	82	84
45F	69	72	75	78	81	84	87	90	93	96
40F	72	76	80	84	88	92	96	100	104	108
35F	75	80	85	90	95	100	105	110	115	120
30F	78	84	90	96	102	108	114	120	126	132
25F	81	88	95	102	109	116	123	130	137	144
20F	84	92	100	108	116	124	132	140	148	156
15F	87	96	105	114	123	132	141	150	159	168
10F	90	100	110	120	130	140	150	160	170	180
5F	93	104	115	126	137	148	159	170	181	192
0F	96	108	120	132	144	156	168	180	192	204
-5F	99	112	125	138	151	164	177	190	203	216
-10F	102	116	130	144	158	172	186	200	214	
-15F	105	120	135	150	165	180	195	210		
-20F	108	124	140	156	172	188	204			

Header Temperature for a Building Reference Temperature of 65F

Air Temp	RESET RATIO									
	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4
65	65	65	65	65	65	65	65	65	65	65
60	68	69	70	71	72	73	74	75	76	77
55	71	73	75	77	79	81	83	85	87	89
50	74	77	80	83	86	89	92	95	98	101
45	77	81	85	89	93	97	101	105	109	113
40	80	85	90	95	100	105	110	115	120	125
35	83	89	95	101	107	113	119	125	131	137
30	86	93	100	107	114	121	128	135	142	149
25	89	97	105	113	121	129	137	145	153	161
20	92	101	110	119	128	137	146	155	164	173
15	95	105	115	125	135	145	155	165	175	185
10	98	109	120	131	142	153	164	175	186	197
5	101	113	125	137	149	161	173	185	197	209
0	104	117	130	143	156	169	182	195	208	
-5	107	121	135	149	163	177	191	205	219	
-10	110	125	140	155	170	185	200	215		
-15	113	129	145	161	177	193	209			
-20	116	133	150	167	201	218				

Header Temperature for a Building Reference Temperature of 70F

Air Temp	RESET RATIO									
	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4
70F	70	70	70	70	70	70	70	70	70	70
65F	73	74	75	76	77	78	79	80	81	82
60F	76	78	80	82	84	86	88	90	92	94
55F	79	82	85	88	91	94	97	100	103	106
50F	82	86	90	94	98	102	106	110	114	118
45F	85	90	95	100	105	110	115	120	125	130
40F	88	94	100	106	112	118	124	130	136	142
35F	91	98	105	112	119	126	133	140	147	154
30F	94	102	110	118	126	134	142	150	158	166
25F	97	106	115	124	133	142	151	160	169	178
20F	100	110	120	130	140	150	160	170	180	190
15F	103	114	125	136	147	158	169	180	191	202
10F	106	118	130	142	154	166	178	190	202	214
5F	109	122	135	148	161	174	187	200	213	
0F	112	126	140	154	168	182	196	210		
-5F	115	130	145	160	175	190	205			
-10F	118	134	150	166	182	198	214			
-15F	121	138	155	172	189	206				
-20F	124	142	160	178	196	214				

APPENDIX D

Header Temperature for a Building Reference Temperature of 75F

Air Temp	RESET RATIO									
	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4
75F	75	75	75	75	75	75	75	75	75	75
70F	78	79	80	81	82	83	84	85	86	87
65F	81	83	85	87	89	91	93	95	97	99
60F	84	87	90	93	96	99	102	105	108	111
55F	87	91	95	99	103	107	111	115	119	123
50F	90	95	100	105	110	115	120	125	130	135
45F	93	99	105	111	117	123	129	135	141	147
40F	96	103	110	117	124	131	138	145	152	159
35F	99	107	115	123	131	139	147	155	163	171
30F	102	111	120	129	138	147	156	165	174	183
25F	105	115	125	135	145	155	165	175	185	195
20F	108	119	130	141	152	163	174	185	196	207
15F	111	123	135	147	159	171	183	195	207	219
10F	114	127	140	153	166	179	192	205	218	
5F	117	131	145	159	173	187	201	215		
0F	120	135	150	165	180	195	210			
-5F	123	139	155	171	187	203	219			
-10F	126	143	160	177	194	211				
-15F	129	147	165	183	201	219				

Header Temperature for a Building Reference Temperature of 80F

Air Temp	RESET RATIO									
	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4
80F	80	80	80	80	80	80	80	80	80	80
75F	83	84	85	86	87	88	89	90	91	92
70F	86	88	90	92	94	96	98	100	102	104
65F	89	92	95	98	101	104	107	110	113	116
60F	92	96	100	104	108	112	116	120	124	128
55F	95	100	105	110	115	120	125	130	135	140
50F	98	104	110	116	122	128	134	140	146	152
45F	101	108	115	122	129	136	143	150	157	164
40F	104	112	120	128	136	144	152	160	168	176
35F	107	116	125	134	143	152	161	170	179	188
30F	110	120	130	140	150	160	170	180	190	200
25F	113	124	135	146	157	168	174	190	201	212
20F	116	128	140	152	164	176	188	200	212	
15F	119	132	145	158	171	184	197	210		
10F	122	136	150	164	178	192	206			
5F	125	140	155	170	185	200	215			
0F	128	144	160	176	192	208				
-5F	131	148	165	182	199	216				
-10F	134	152	170	188	206					

APPENDIX D

Header Temperature for a Building Reference Temperature of 90F

Air Temp	RESET RATIO									
	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4
90F	90	90	90	90	90	90	90	90	90	90
85F	93	94	95	96	97	98	99	100	101	102
80F	96	98	100	102	104	106	108	110	112	114
75F	99	102	105	108	111	114	117	120	123	126
70F	102	106	110	114	118	122	126	130	134	138
65F	105	110	115	120	125	130	135	140	145	150
60F	108	114	120	126	132	138	144	150	156	162
55F	111	118	125	132	139	146	153	160	167	174
50F	114	122	130	138	146	154	162	170	178	186
45F	117	126	135	144	153	162	171	180	189	198
40F	120	130	140	150	160	170	180	190	200	210
35F	123	134	145	156	167	178	189	200		
30F	126	138	150	162	174	186	198	210		
25F	129	142	155	168	181	194	207			
20F	132	146	160	174	188	202	216			
15F	135	150	165	180	195	210				
10F	138	154	170	186	202	218				
5F	141	158	175	192	209					
0F	144	162	180	198	216					

BOILER DEFAULT SETTINGS

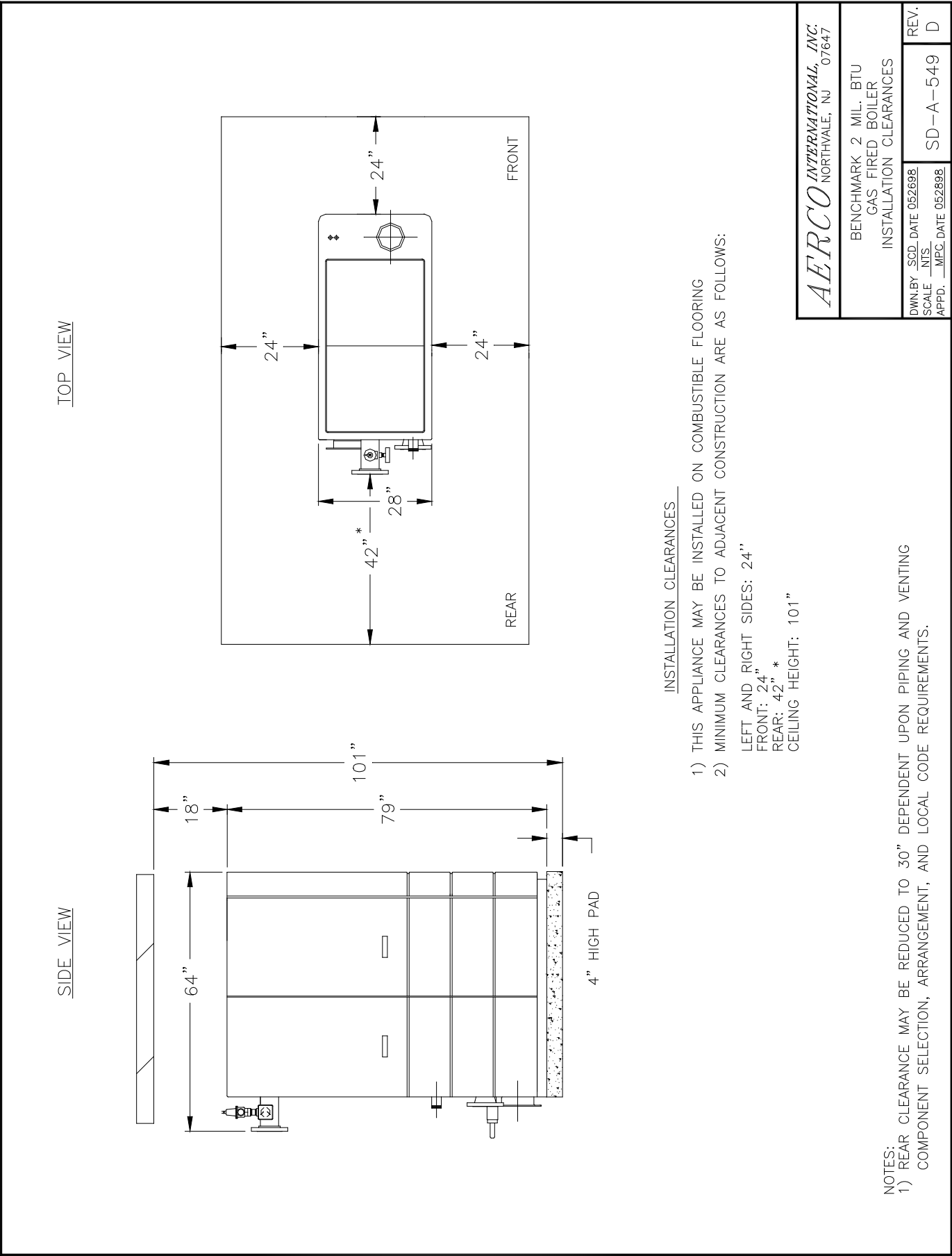
CONSTANT SET POINT MODE

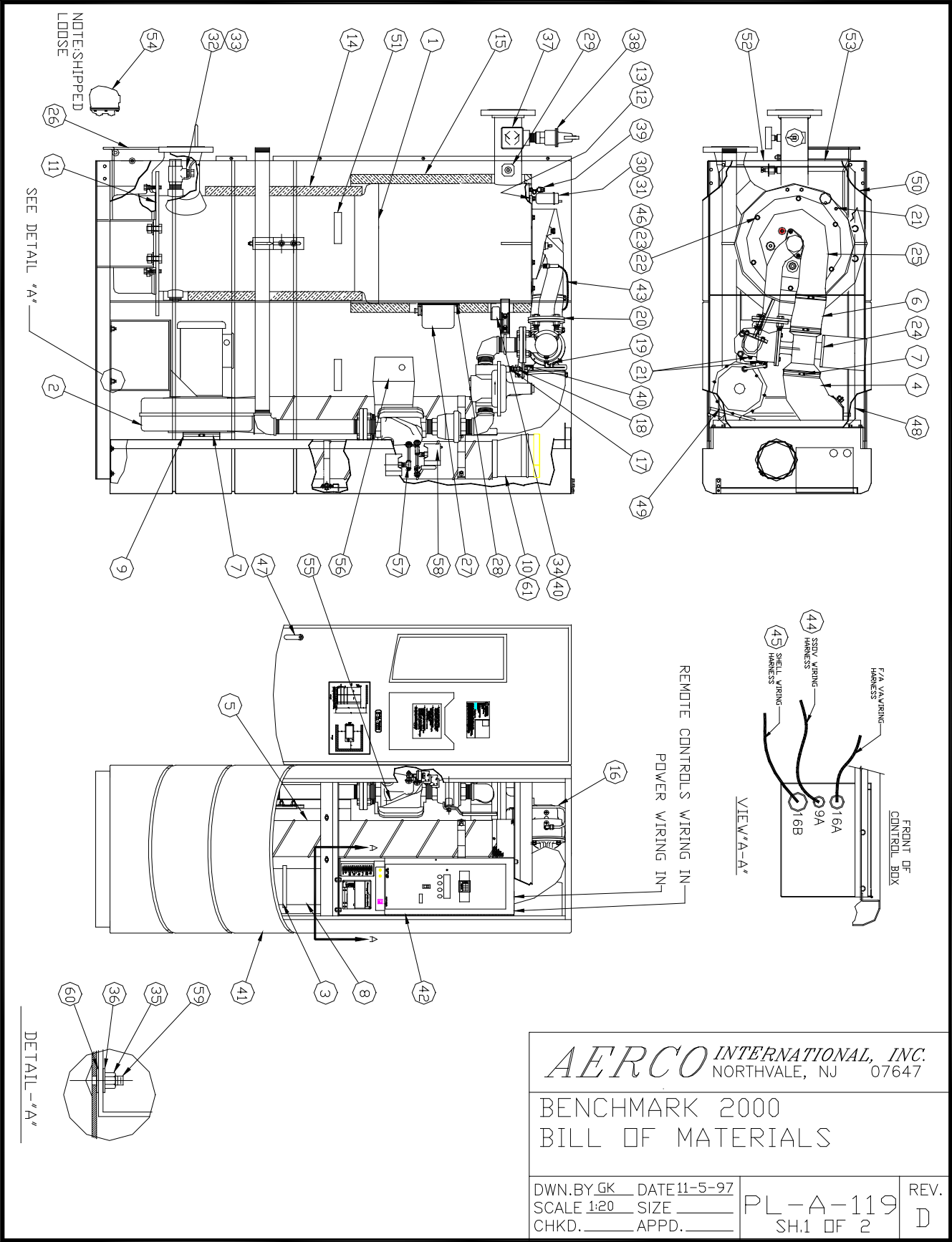
MENU LEVEL & CODE	DESCRIPTION OF CODE	FACTORY DEFAULT
PRIMARY MENU		
tout	OUTLET TEMPERATURE	ACTUAL
pct	PERCENTAGE OF FIRING RATE	ACTUAL
setp	UNIT'S SETPOINT TEMPERATURE	120
airt	OUTSIDE AIR TEMPERATURE	ACTUAL
auto	AUTOMATIC\MANUAL MODE	AUTO ON
SECONDARY MENU		
func	MODE OF OPERATION	CONT
OAST	OUTSIDE AIR SENSOR FEATURE	OFF
OAT	OUTSIDE AIR TEMP	0
LLT	LOW LIMIT TEMPERATURE	40
HLT	HIGH LIMIT TEMPERATURE	220
pb1	PROPORTIONAL GAIN	70
int	INTEGRAL	1
drt	DERIVATIVE	0 (off)
addr	ADDRESS	32
lore	LOCAL/REMOTE MODE	LOC
SECURE		
secr	SECURITY LEVEL	3
func	MODE OF OPERATION	CONT
gain	GAIN	1
pb3	PROPORTIONAL BAND	5000
lofi	LOW FIRE	29
lfti	LOW FIRE TIMER	0
purg	PURGE	100
O2-O	STOP LEVEL	20%
O2-C	START LEVEL	25%
FLTI	FAULT TIMER	40 SEC.
DFIL	DISPLAY FILTER	5
ARUP	ANTI RESET WINDUP	ON
PEA	PEAK(Highest Temp. Unit Has Seen Since Reset)	ACTUAL
VAL	VALLEY(Lowest Temp. Has Seen Since Reset)	ACTUAL
INPC	INPUT CORRECTION	0
INPT	INPUT TIMER	0.2
FILT	SENSOR FILTER	2
UNIT	UNIT OF DISPLAY	F
ADDR	ADDRESS	32
BAUD	BAUD RATE	9600
INP	INPUT	CAL

BOILER DEFAULT SETTINGS

INDOOR /OUTDOOR RESET MODE

MENU LEVEL & CODE	DESCRIPTION OF CODE	DEFAULT VALUE
PRIMARY MENU		
tout	OUTLET TEMPERATURE	ACTUAL
Pct	PERCENTAGE OF FIRE RATE	ACTUAL
SEtP	UNIT'S SETPOINT TEMPERATURE	120
Airt	OUTSIDE AIR TEMPERATURE	ACTUAL
Auto	AUTOMANUAL MODE	AUTO ON
SECONDARY MENU		
Func	MODE OF OPERATION	OART
rEFt	BUILDING REFERENCE TEMPERATURE	70
rr	RESET RATIO	1.5
OASt	OUTSIDE AIR SENSOR FEATURE	OFF
OAt	OUTSIDE AIR TEMP	0
LLt	LOW LIMIT TEMPERATURE	40
HLt	HIGH LIMIT TEMPERATURE	220
Pb1	PROPORTIONAL GAIN	70
Int	INTEGRAL	1
drt	DERIVATIVE	0 (off)
Addr	ADDRESS	32
LOrE	LOCAL/REMOTE	LOC
SECURE MENU		
SECr	SECURITY LEVEL	3
Func	MODE OF OPERATION	OART
gAin	GAIN	1
Pb3	PROPORTIONAL BAND	5000
LoFi	LOW FIRE	29
LFti	LOW FIRE TIMER	0
Purg	PURGE	100
O2-O	STOP LEVEL	20%
O2-C	START LEVEL	25%
FLti	FAULT TIMER	40 SEC.
dFiL	DISPLAY FILTER	5
ArUP	ANTI RESET WINDUP	ON
PEA	PEAK	ACTUAL
VAL	VALLEY	ACTUAL
InPC	INPUT CORRECTION	0
InPt	INPUT TIMER	0.2
FiLt	SENSOR FILTER	2
Unit	UNIT OF DISPLAY	F
Addr	ADDRESS	32
bAUd	BAUD RATE	9600
InP	INPUT	CAL





APPENDIX F

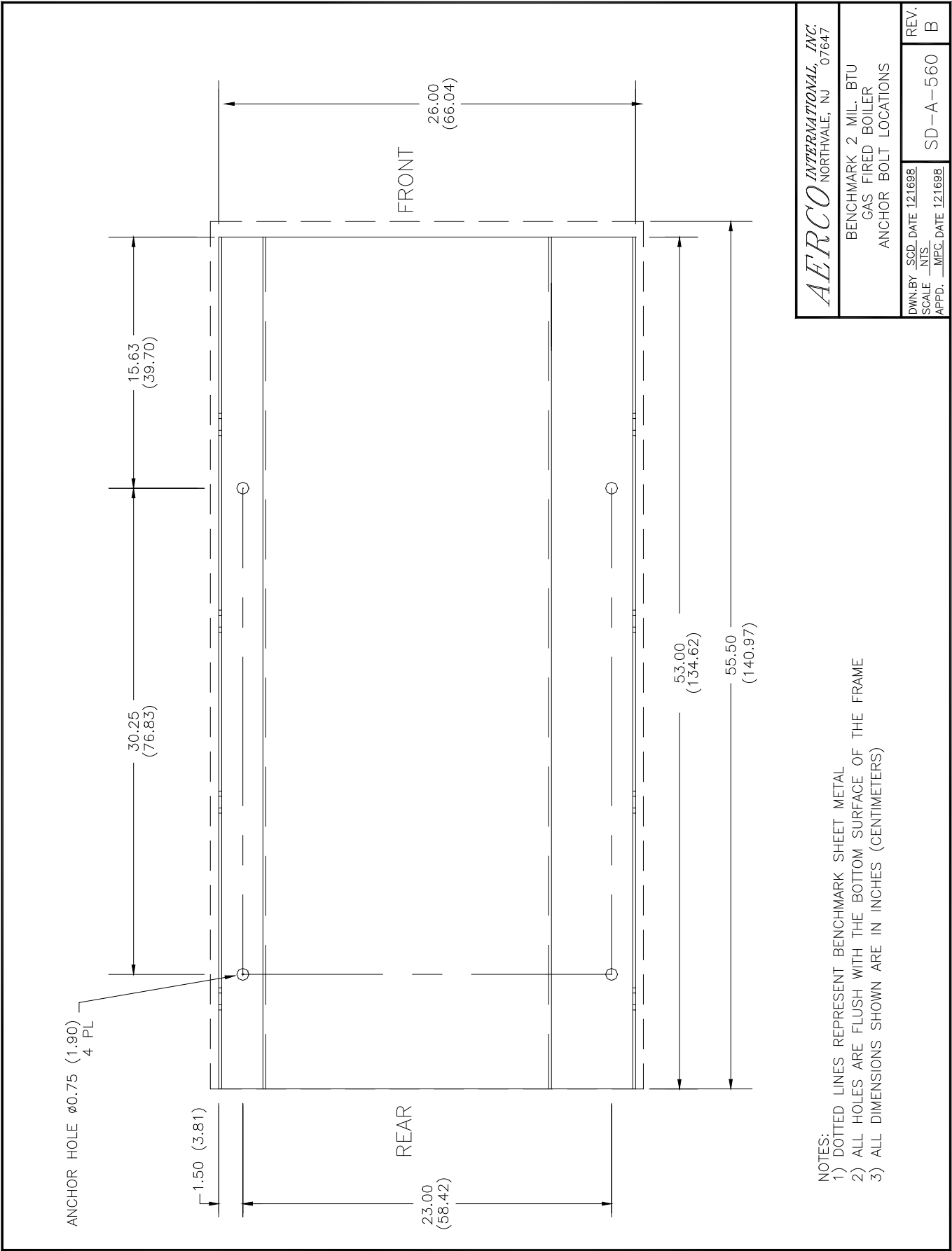
40	123966	1	OVERTEMP SWITCH-AUTORESET				
39	123449	1	TEMP. SENSOR				
38	123620-□	1	PRESS. RELIEF VA.				
37	123675-□	1	PRESS./TEMP. GAUGE				
36	123619	4	5/16 BOLT SIZE FLAT WASHER				
35	122539	4	5/16-18 ELASTIC LOCK NUT				
34	123552	1	OVER TEMP. SWITCH-MANUAL RESET				
33	9-421	1	1-1/2 NPT SHOULDER NIPPLE				
32	12820-11	1	1-1/2 NPT BALL VA.				
31	9-430	1	1/4 NPT CLOSE NIPPLE				
30	123582	1	1/4 FNPT AIR VENT				
29	122843	1	LOW WATER CUT-OFF PROBE	61	123681	1	8" INLET ADAPTOR
28	122528	4	1/4-20 X 3/8 LG. SPIDER LOCK M.S.	60	123802	4	5/16" SCREW SIZE PUSH NUT
27	122464	1	IGNITION TRANSFORMER	59	123706	4	5/16-18 X 1" LG. CARRIAGE BOLT
26	201099	1	EXHAUST MANIFOLD	58	124036	1	HIGH PRESS. GAS SWITCH
25	201071	1	BURNER ASS'Y	57	124037	1	LOW PRESS. GAS SWITCH
24	201096	1	F/A VA. ASS'Y	56	122556	1	SAFETY SHUT-OFF VALVE ACTUATOR
23	123617	6	3/8-16 X 5/8 LG. CAP SCREW	55	123516	1	SAFETY SHUT-OFF VALVE
22	123616	6	3/8 BOLT SIZE LOCK WASHER	54	123673	1	CONDENSATE DRAIN TRAP
21	9-23	3	1/4 NPT PLUG	53	181146	1	LEFT REAR PANEL
20	123545	2	GAS PIPE F/A VA. "O"-RING	52	181147	1	RIGHT REAR PANEL
19	123586	1	3/8 O.D. TUBE X 1/4NPT90°COMP. FITTING	51	181144	4	SIDE PANEL
18	122535	1	3/8 O.D. TUBE X 1/4NPT COMP. FITTING	50	181143	2	TOP PANEL
17	9-43	1	1/2 X 1/4 NPT RED. BUSHING	49	181151	1	LEFT SIDE PANEL SUPPORT
16	161447	1	GAS PRESS. CONTROL TUBE	48	181150	1	RIGHT SIDE PANEL SUPPORT
15	161422	1	COMBUSTION CHAMBER INSULATION	47	123634	1	DOOR LATCH
14	161423	1	HEAT EXCHANGER INSULATION	46	123614	6	3/8 BOLT SIZE FLAT WASHER
13	161432	1	BURNER GASKET	45	181149	1	SHELL WIRING HARNESS
12	161433	1	BURNER RELEASE GASKET	44	161450	1	SSDV WIRING HARNESS
11	123612	51"	EXHAUST MANIFOLD SEAL	43	122569	1	IGNITION CABLE ASS'Y
10	123990	1	OFFSET REDUCER COVER	42	201069	1	CONTROL BOX ASS'Y
9	123764	1	BLOWER AIR INLET HOSE	41	201113	1	FRONT SHEET METAL
8	123609	1	BLOWER OUTLET DUCT	40	161157	1	BLOWER PROOF SWITCH
7	123583	4	F/A VA. /BLOWER INLET HOSE CLAMP				
6	123584	1	F/A VA.Outlet HOSE				
5	123608	1	BLOWER INLET DUCT				
4	123585	1	F/A VA. INLET HOSE				
3	181141	1	AIR DAMPER ASS'Y				
2	161434	1	COMBUSTION AIR BLOWER				
1	201068	1	COMBUSTION CHAMBER				
ITEM	PART NO.	REQ	DESCRIPTION				

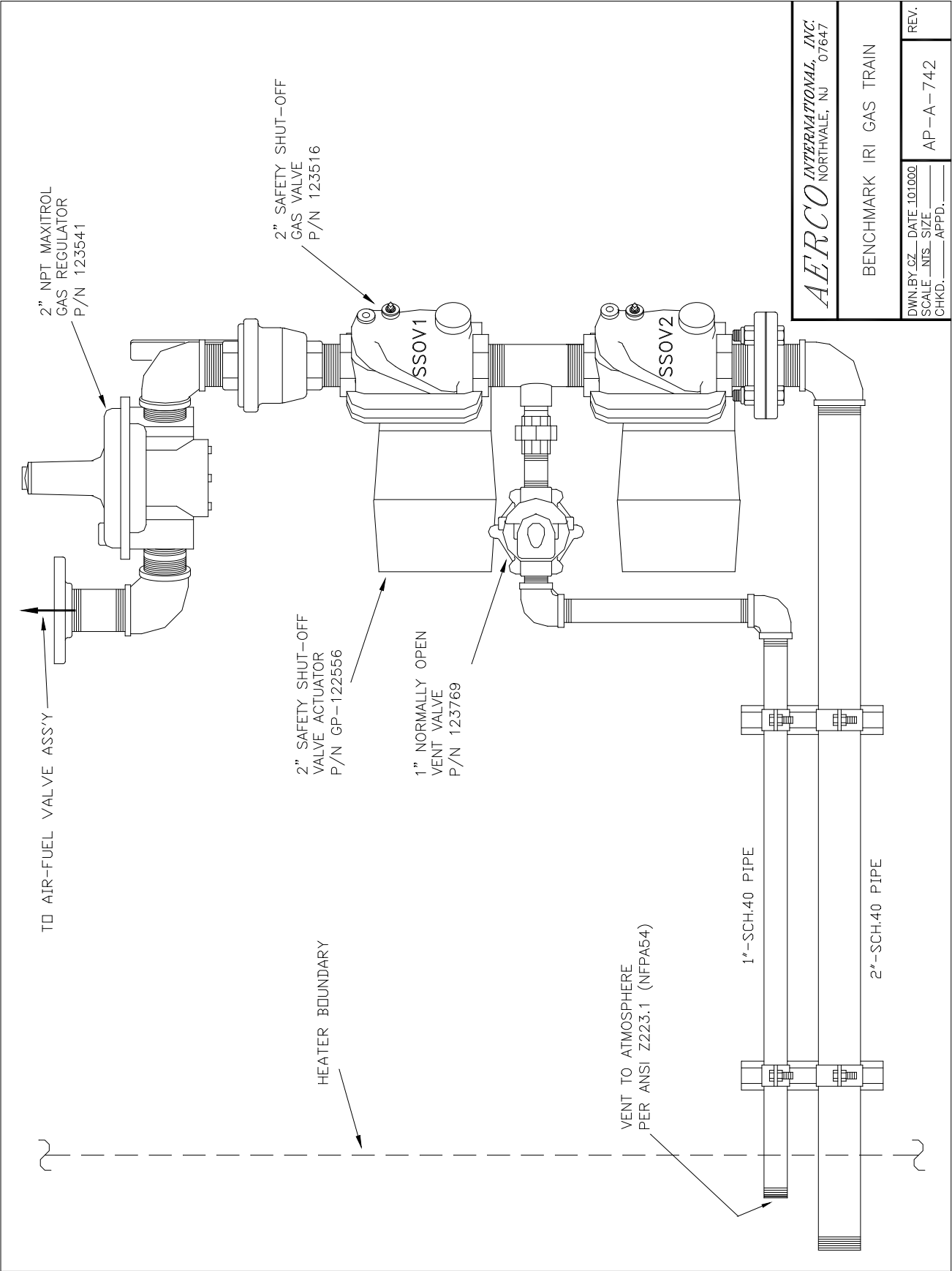
AERCO INTERNATIONAL, INC.
NORTHVALE, NJ 07647

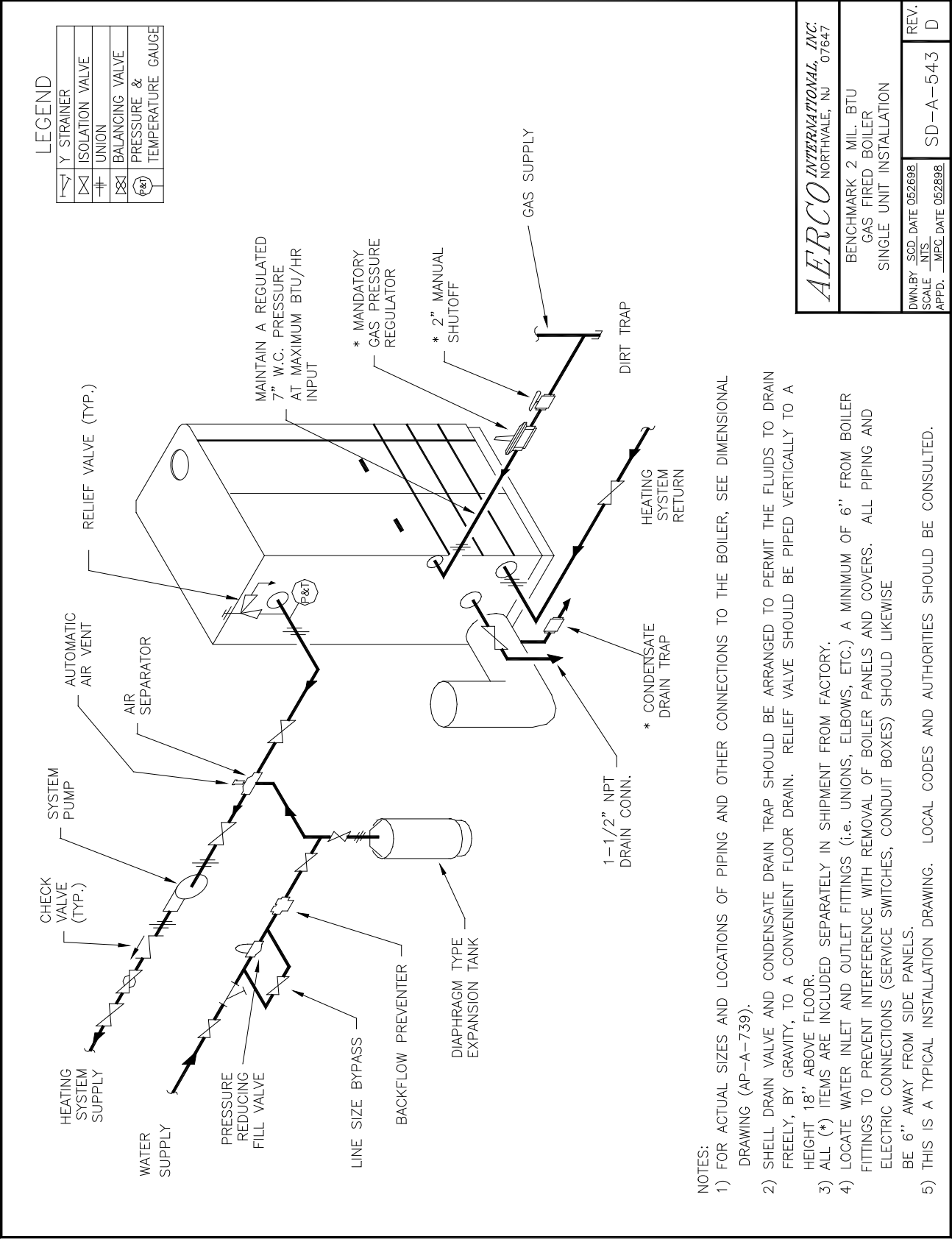
BENCHMARK 2000
BILL OF MATERIALS

DWN.BY GK	DATE 11-5-97	PL-A-119	REV. D
SCALE 1:20	SIZE		
CHKD.	APPD.		

SH.2 OF 2

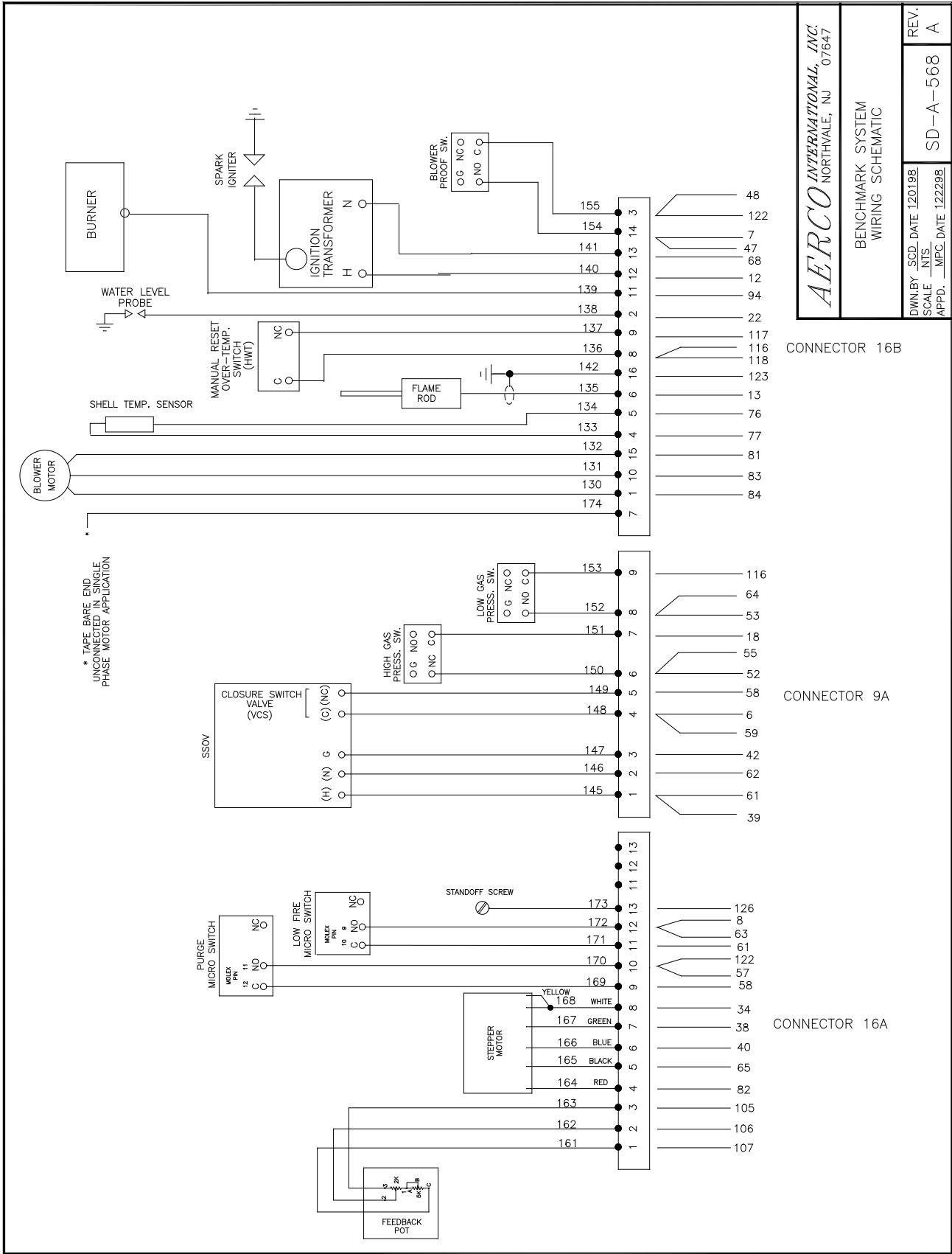








APPENDIX H



AERCO INTERNATIONAL, INC. NORTHVALE, NJ 07647	
BENCHMARK SYSTEM WIRING SCHEMATIC	
DWN.BY: SCD DATE 120198 SCALE: NTS APPD: MPC DATE 122298	REV: A SD-A-568

RECOMMENDED PERIODIC TESTING CHECK LIST**WARNING**

NOTE: Periodic testing of all boiler controls and safety devices is required to determine that they are operating as designed. Precautions shall be taken while tests are being performed to protect against bodily injury and property damage. The owner or user of an automatic boiler system should set up a formal system of periodic preventive maintenance and testing. Tests should be conducted on a regular basis and the results recorded in a log-book.

Item	Frequency	Accomplished by	Remarks
See indicated sections of this manual for detailed procedures			
Gages, monitors and indicators	Daily	Operator	Make visual inspection and record readings in operator log
Instrument and equipment settings	Daily		Make visual check against factory recommended specifications
	Weekly	Operator	Verify factory settings
Firing rate control	Semiannually	Service technician	Verify factory settings
	Annually	Service technician	Check with combustion test equipment- see section 7.4
flue, vent, stack or intake air duct	monthly	Operator	Visual inspection for condition or obstructions
Igniter	Weekly	Operator	see section 7.2
main fuel valve			
valve position	Weekly	Operator	Check position indicator
leakage test	annually	Service technician	Close manual fuel supply valve and test for pressure on down stream valve port
Combustion safety			
flame failure	weekly	Operator	Close manual fuel supply valve check safety shutdown timing
flame signal strength	weekly	Operator	Read signal with meter and log see section 7.3
low water fuel cut off and alarm	weekly	operator	See section 6.3
slow drain test	Semiannually	operator	Perform a slow drain test in accordance with ASME Boiler and Pressure Vessel Code section IV
high limit safety control test	annually	Service technician	See section 6.4
operating control	annually	Operator	See section 3.2
low air pressure	monthly	Operator	See section 6.6
high and low gas pressure interlocks	monthly	Operator	See section 6.2
air valve purge position switch	annually	Service technician	See section 6.6
low fire position switch	Annually	Service technician	See section 6.7
safety valves	as required	Operator	As per A.S.M.E. Boiler and Pressure Vessel Code section IV
inspect burner components	Semiannually	Service technician	See section 7.6



STANDARD WARRANTY: Benchmark Gas-Fired Hydronic Boiler

PRESSURE VESSEL/HEAT EXCHANGER

The pressure vessel/heat exchanger shall carry a seven year prorated, limited warranty against any failure due to condensate corrosion, thermal stress, mechanical defects or workmanship. Operation of the boiler using contaminated air will void the warranty. The pressure vessel/heat exchanger shall not be warranted from failure due to scaling, liming, corrosion, or erosion due to water or installation conditions. **AERCO** will repair, rebuild or exchange, at its option the heat exchanger/combustion chamber according to the following schedule:

<u>Year</u>	<u>Discount From Then Prevailing List Price</u>
5	100%
6	70%
7	40%

OTHER COMPONENTS: 1 YEAR OR 18 MONTHS FROM SHIPMENT

All other components, with the exception of the ignitor and flame detector, are conditionally guaranteed against any failure for 12 months from start-up or 18 months from shipment, whichever first occurs.

AERCO shall accept no responsibility if such item has been improperly installed, operated, or maintained or if the buyer has permitted any unauthorized modification, adjustment, and/or repairs to the item.

The warranty as set forth on the back page of the Operations & Maintenance Manual is in lieu of and not in addition to any other express or implied warranties in any documents, or under any law. No salesman or other representative of **AERCO** has any authority to expand warranties beyond the face of the said warranty and purchaser shall not rely on any oral statement except as stated in the said warranty. An Officer of **AERCO** must do any modifications to this warranty in writing. **AERCO MAKES NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE OR ANY OTHER EXPRESS OR IMPLIED WARRANTIES.** **AERCO** disclaims all responsibility for any special, incidental or consequential damages. Any claim relating to the product must be filed with **AERCO** not later than 14 days after the event-giving rise to such claim. Any claims relating to this product shall be limited to the sale price of the product at the time of sale. The sale of the product is specifically conditioned upon acceptance of these terms.



STANDARD WARRANTY: Benchmark Gas-Fired Hydronic Boiler

CONDITIONS OF WARRANTY

Should an AERCO gas-fired Hydronic boiler fail for any of the above reasons within the specified time period from the date of original shipment(s), AERCO shall at its option modify, repair or exchange the defective item. AERCO shall have the option of having the item returned, FOB its factory, or to make field replacements at the point of installation. In no event shall AERCO be held liable for replacement labor charges or for freight or handling charges.

AERCO shall accept no responsibility if such item has been improperly installed, operated, or maintained or if the buyer has permitted any unauthorized modification, adjustment, and/or repairs to the item. The use of replacement parts not manufactured or sold by AERCO will void any warranty, express or limited.

In order to process a warranty claim a formal purchase order number is required prior to shipment of any warranty item. In addition, the returned item must include a Returned Goods Authorization (RGA) label, attached to the shipping carton, which identifies the item's return address, register number and factory authorized RGA number.

Warranty coverage for all components and equipment mentioned in said warranty are not valid unless the Hydronic boiler is started up by a factory certified SST (Service, Start-Up and Troubleshooting) Technician. Also, AERCO, (Northvale, NJ) must receive a copy of the start-up sheets, whichever comes first.