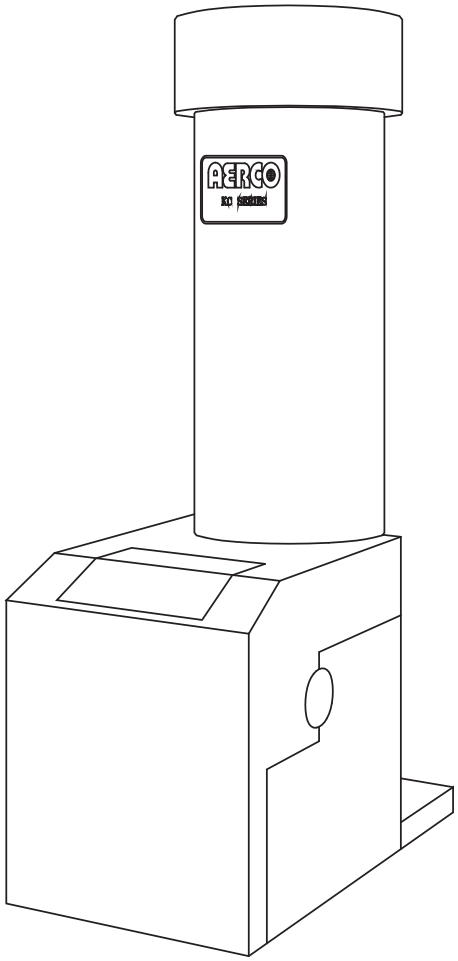
Applicable for Serial Numbers G-01-026 to G-09-XXX

KC Series Gas Fired Boiler System



Semi-Instantaneous, Condensing, Forced Draft, Natural Gas and Propane Fired, Hot Water Boiler 1,000,000 BTU/HR Input

Patent No. 4,852,524

Printed in U.S.A.
10/8/01

Telephone Support

Direct to Aerco technical support
(8 to 5 pm EST, Monday through Friday)
(800) 526-0288

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Aerco International, Inc.
100 Oritani Drive
Blauvelt, NY 10913

GF-106 THE AERCO KC1000 GAS FIRED BOILER
Operating & Maintenance Instructions

Foreword

The AERCO KC 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 load tracking capability relates energy input directly to fluctuating system loads through a 14:1 modulating turndown ratio. The boiler's condensing capability offers extremely high efficiencies and makes the KC boiler ideally suited for modern low temperature, as well as, conventional heating systems.

The KC boiler can be used singular or in modular arrangements for inherent standby with minimum space requirements. Venting capabilities offer maximum flexibility and allow installation without normal restrictions. The advanced electronics of each boiler module offer selectable modes of operation and interface capabilities.

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 or close the manual gas valve located before the unit. The installer is to identify the emergency shut-off device. FOR SERVICE OR PARTS, contact your local sales representative or AERCO INTERNATIONAL.

NAME: _____

ORGANIZATION: _____

ADDRESS: _____

TELEPHONE: _____

INSTALLATION DATE: _____

SECTION 1 - SAFETY PRECAUTIONS

Installing or operating personnel MUST, at all times, observe all safety regulations. The following warnings 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 unit's MUST conform with local building codes, or, in the absence of local codes, ANSI Z223.1 (National Fuel Gas Code Publication No. NFPA-54) for gas-fired units, and ANSI/NFPA58 for LP gas-fired units. Where applicable, the equipment shall be installed in accordance with CGA B149. Where ASME CSD-1 is required by local jurisdiction, the installer must conform to CSD-1.

WARNINGS!
MUST BE OBSERVED TO PREVENT SERIOUS INJURY.

WARNING !
BEFORE PERFORMING ANY MAINTENANCE ON THE UNIT, SHUT OFF THE GAS SUPPLY AND THE ELECTRICAL POWER SUPPLY TO THE UNIT.

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.

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

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

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

CAUTION !
Soaps used for gas pipe leak testing can be corrosive to metals. 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:
Must be observed for effective operating procedures & conditions.

SECTION 2 - INSTALLATION PROCEDURES

2.1. RECEIVING THE UNIT

Each KC unit is shipped as a single crated unit. The shipping weight is approximately 1500 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. Each unit has Tip-N-Tell indicator on the outside of the crate, that indicates if the unit has been turned on its side. If the Tip-N-Tell indicator is tripped, do not sign for the shipment. Request a freight claim and inspection by a claims adjuster before proceeding or refuse delivery of the equipment.

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. An inspection of the unit should be made to determine if damage during shipment occurred that was 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

- Spare Spark Ignitor
- Spare Flame Detector
- Manual 1-1/4" Gas Shutoff Valve
- Drain Valve Assembly
- ASME Pressure Relief Valve
- Ignitor Removal Tool (One per Site)
- Regulator Adjustment Tool (One per Site)
- Temperature/Pressure Gauge and Fittings
- 2 Lifting Lugs
- Stainless Steel Condensate Cup

Optional accessories are also separately packed within the unit's packing container. Standard and optional accessories shipped with the unit should be identified and put in a safe place until installation or use.

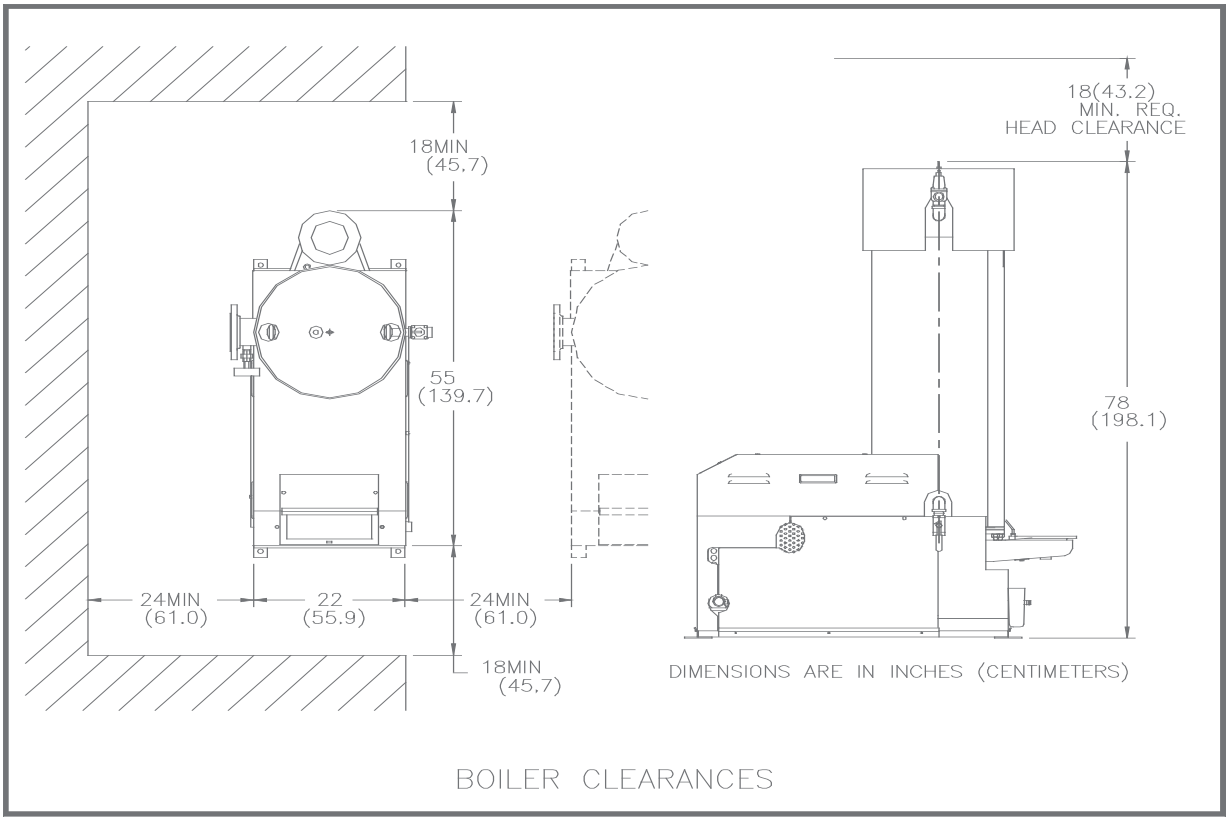

Figure 2.1
Boiler Clearances

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	18"
Rear	18"
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.

2.3.1. SETTING THE UNIT

Locate the lifting lugs, shipped with the unit and attach them to the 5/8" x 11 studs at the top of the unit. Remove the unit from the wooden skid and place in position using a block and tackle or hoist attached to the lifting lugs, (see Fig. 2. 2). USE ONLY THE LIFTING LUGS TO MOVE THE UNIT.

The KC-1000 is U/L approved for installation on combustible flooring. A 4" to 6" high housekeeping concrete pad is recommended and allows for sufficient drainage of the condensate.

It is suggested that units be secured using the holes provided in the frame base. Piping must not be used to secure the unit in place. See drawing AP-A-568 in Appendix F for the base frame dimensions.

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.

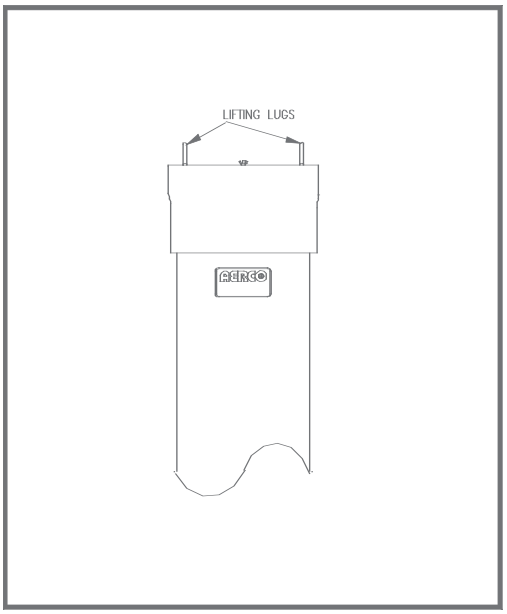

Figure 2.2
Lifting Lug Location

2.3.2 SUPPLY AND RETURN PIPING

The locations of the 4" flanged system supply, and return piping connections, to the unit are shown in figure 2.3. The return connection is located on the left side near the base of the unit's shell. The supply connection is located on the left side near the top of the unit's shell.

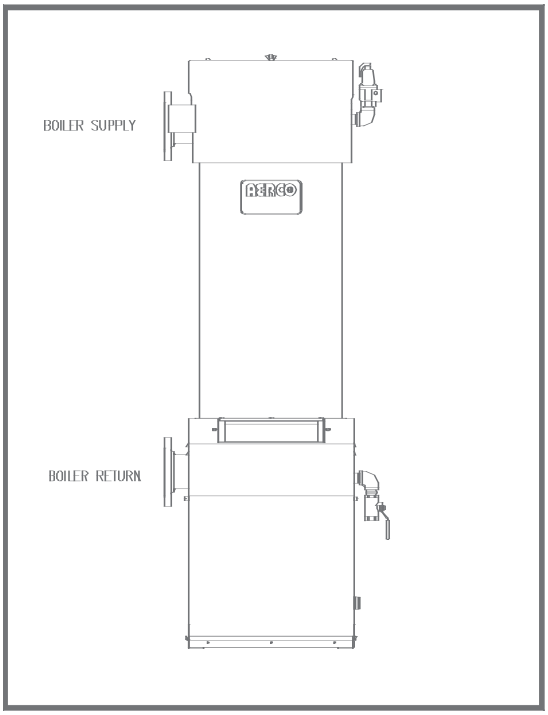

Figure 2.3
Supply and Return Location

Whether installing single or multiple units, install the piping and accessories as shown in the appropriate piping diagram located in the Appendix G.. For applications other than standard space heating, consult the AERCO Boiler Application Guide, GF-1070, or AERCO for the appropriate piping schematics.

The minimum flow rate through the unit is 25 GPM and the maximum flow rate is 150 GPM. Each unit is fitted with 4" flanges for high flow application and the system velocity at the unit return should not exceed 5 feet per second. Each unit must have individual valves on the supply, and return, for maintenance. In multiple unit installations, the flow through each unit must be balanced.

Every boiler plant must have a source of make-up water to it. As with any closed loop hydronic system, air elimination and expansion equipment must be provided as part of the overall installation. All piping MUST include ample provision for expansion.

2.3.3 PRESSURE RELIEF AND DRAIN VALVE INSTALLATION

An ASME rated Relief Valve is supplied with each unit. The supplied pressure relief valve setpoint will be 30, 50, 75, 100, or 150 psig as ordered from the factory. Install the pressure relief valve in the tapping provided opposite the system supply connection, (see figure 2.4). The pressure relief valve should be piped in the vertical position using the fittings supplied. A suitable pipe compound should be used on the threaded connections, and excess should be wiped off to avoid getting any into the valve body. The discharge from the relief valve should be piped to within 12 inches of the floor to prevent injury in the event of a discharge.

The relief piping must be full size without reduction. No valves, restrictions, or other blockages should be allowed in the discharge line. In multiple unit installations the relief valve discharge lines must not be manifolded, (connected), together. Each must be individually run to a suitable discharge location. The drain valve provided should be installed on the right hand side of the unit towards the bottom of the shell. The valve should be pointed in the down position, (see Fig. 2.4).

2.3.4 TEMPERATURE/PRESSURE INDICATOR

The unit is supplied with one of two styles of Temperature/Pressure Indicators that must be installed in the tapping on the supply flange of the unit (see Figs. 2.5a and 2.5b). A suitable pipe compound should be used sparingly to the threaded connection.

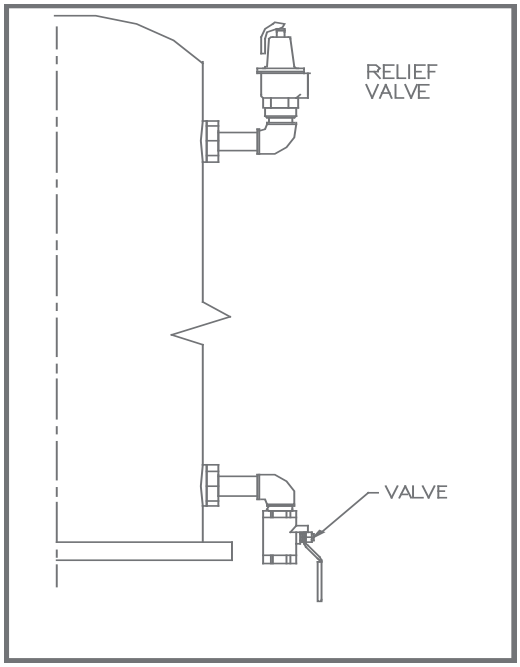

Figure 2.4
Relief and Drain Valve Location

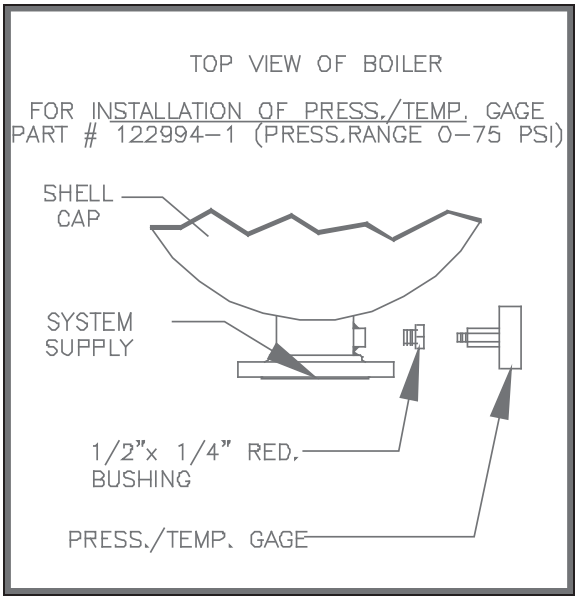

Figure 2.5a
Pressure /Temperature Gauge Installation

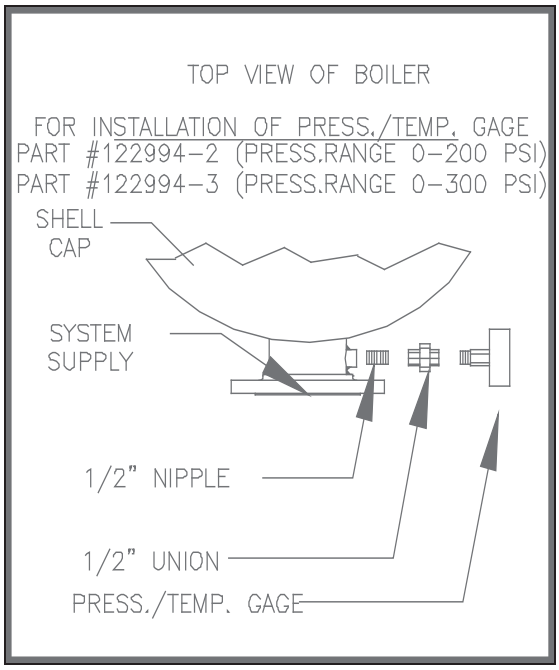

Figure 2.5b
Pressure/Temperature Gauge Installation

2.3.5 CONDENSATE PIPING

The KC Boiler is designed to condense and the installation must have provisions for drainage to a suitable waste. A 1-3/4" inch O.D. silicone hose, supplied with the unit, directs condensate from the exhaust manifold to a stainless steel condensate cup. The condensate cup is shipped loose and should be installed inside the unit directly under the manifold's condensate drainage hole (see FIG. 2.6). A 5/8-inch O.D. flexible polypropylene tubing (or suitable equivalent) can be used to carry the condensate by gravity to a nearby floor drain. 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 5 GPH. The condensate cup and 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.

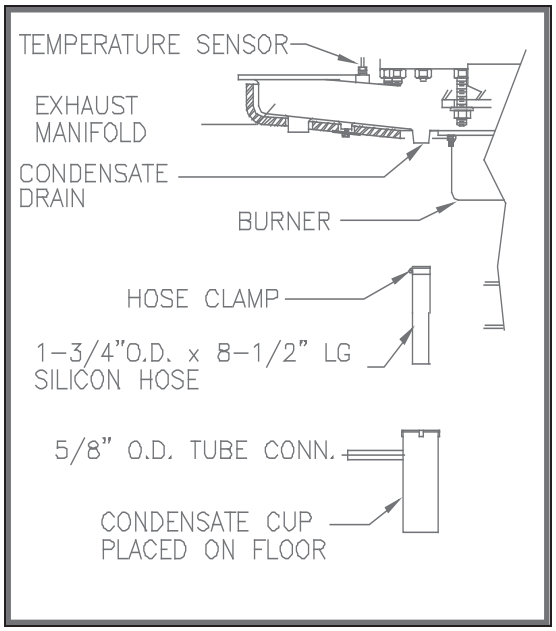

Figure 2.6
Condensate Drain System Location

CAUTION!
Soaps used for gas pipe leak testing can be corrosive to metals. 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.

The location of the 1-1/4" inlet gas connection is on the right side of the unit as shown in Figure 2.7.

All pipe 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 or walls only and must not be secured to the unit.

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

To avoid damage to the unit, when pressure testing gas piping, isolate the unit from the supply gas piping. At no time should there be more than 14” W.C. the unit. Bubble 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 PRESSURE REGULATOR

An external, in-line, supply gas regulator (supplied by others) should be positioned as shown in figure 2.7. Union connections should be placed in the proper locations to allow maintenance of the regulator if required

NOTE:
An individual gas pressure regulator must be installed upstream of each KC1000. The regulator must regulate gas pressure to 8.5” W.C. at 1,000,000 BTU/H for natural gas and propane units.

The maximum static inlet pressure to the unit must be no more than 14” water column. Minimum gas pressure is 8.5” W.C. for FM gas trains and 8.9” W.C. for IRI gas trains when the unit is firing at maximum input. Gas pressure should not exceed 10.5” W.C. at any time when firing. Proper sizing of the gas supply regulator in delivering the correct gas flow and outlet pressure is mandatory. The gas supply pressure regulator must maintain the gas pressure at a regulated 8.5” W.C. minimum for FM gas trains and 8.9” W.C. for IRI gas trains at maximum BTU input (1,000,000 BTU/HR) for natural gas and propane installations. The supply gas regulator must be of sufficient capacity volume, (1000 cfh), for the unit and should have no more than 1" droop from minimum to full fire. The supply gas regulator must also be rated to handle the maximum incoming gas pressure to it. When the gas supply pressure will not exceed 14” W.C. a non-lock up or flow through style regulator may be used. When supply gas pressure will exceed 14” W.C. a lock up style regulator must be used. The gas supply regulator must be propery vented to outdoors. Consult the local gas utility for exact requirements concerning venting of supply gas regulators.

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

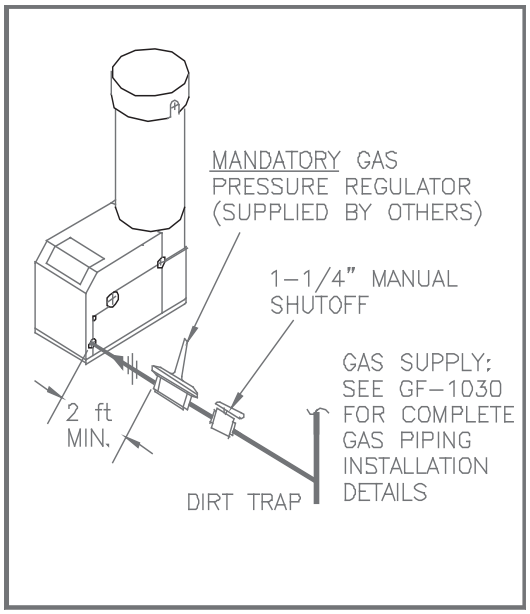

Figure 2.7
Gas Supply Regulator and Manual Shut -Off Valve Location

2.4.2 MANUAL GAS SHUTOFF VALVE

A 1-1/4” manual gas shut-off valve is furnished with each unit. The valve should be positioned as shown in Figure 2.7. The manual gas shut-of valve must be installed 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 may be ordered pre-assembled or as separate components. If either IRI gas train option is ordered a complete instructional package, detailing field installation will be included. To obtain a copy of an IRI instructional package prior to the equipment shipping contact your local representative or AERCO. (See appendix F)

2.5 ELECTRICAL SUPPLY

The AERCO Gas Fired Equipment Electrical Power Wiring Guide, (GF-1060), must be consulted in addition to the following material before wiring to the unit is started. The location of the electrical wiring box is on the front right side of the unit as shown in Figure 2.8.

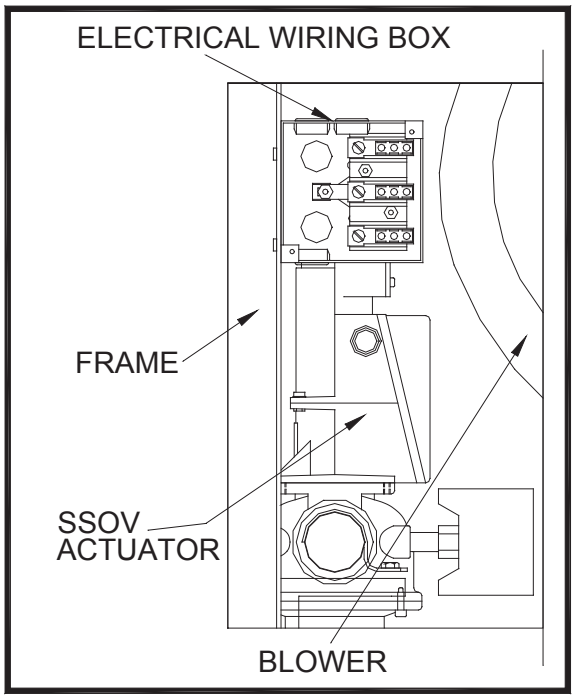

Figure 2.8
AC Wiring Box Location

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.

2.5.1 ELECTRICAL REQUIREMENTS

Electrical requirements for each unit are 120 VAC, 1 Phase, 60 Hz, 20 Amps from a dedicated electrical circuit. No other devices should be on the same electrical circuit as a KC unit. A disconnecting means 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.

The electrical wiring diagram is shown in Figure 2.9. Conduit should be run from the knockouts in the side of the box in such a manner that it does not interfere with the removal of any sheet metal covers. A flexible electrical connection may be utilized to allow the covers to be removed easily.

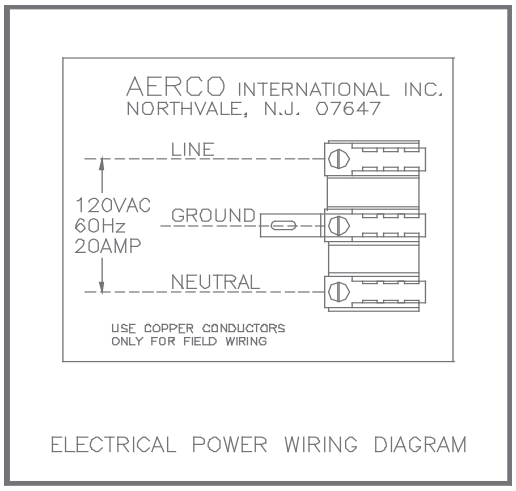

Figure 2.9
Electrical Wiring Diagram

2.6 MODE OF OPERATION and FIELD CONTROL WIRING

The KC 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 to the Field Control Wiring Box located on the left side of the unit beneath the removable side panel (see Fig. 2.10). Field wiring for each particular mode of operation is described in the following sections.

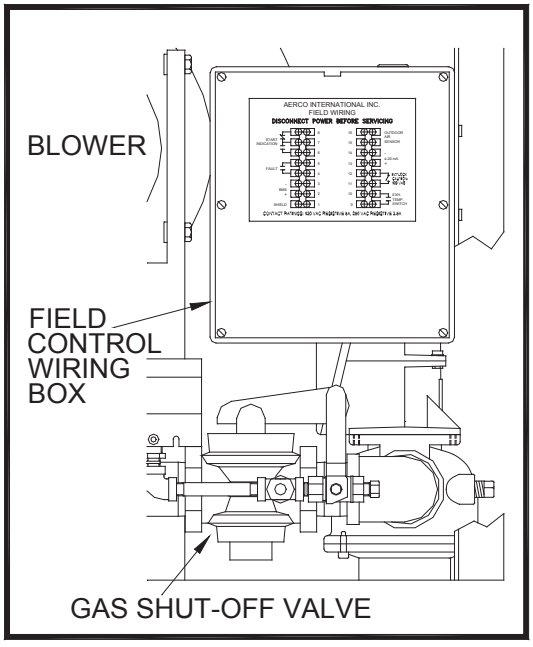

Figure 2.10
Field Control Wiring Box Location

2.6.1 CONSTANT SETPOINT MODE

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

2.6.2 INDOOR/OUTDOOR RESET MODE

This mode of operation increases supply water temperature as outdoor air temperature decreases. An Outside Air Temperature Sensor (AERCO PN 123525 MUST BE wired to the Field Control Wiring Box using a two wire shielded cable having a minimum of 22 AWG (see Fig. 2.11). The cable shield is connected only at the terminals provided in the field wiring box. The sensor end of the shield must be left free and ungrounded. There is no polarity in terminating the sensor wires. When mounting the Outdoor Air Temperature Sensor, it should be mounted on the north side of the building in an area where the average outside air temperature is expected. The sensor should be shielded from 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 multiple units, with an AERCO Boiler Management System Panel, Model 168, the field wiring is between the BMS Panel and each unit's field wiring box (see Fig. 2.11). A twisted pair of 18 to 22 AWG wire must be utilized for the connections. No shield is utilized and polarity must be maintained. The Supply Header Temperature Sensor (AERCO P/N 122790) must be wired back to the BMS Panel, regardless of mode of operation. See the instructions provided with the BMS for proper location and wiring instructions.

2.6.4 4 to 20 ma REMOTE SETPOINT MODE

The KC1000 can be controlled with a 4-20 ma signal from a Building Management System or an external controller. The supplied 4-20 ma signal must be a floating (ungrounded) signal. Connections between the 4-20 ma source and the unit's field wiring box must be made using a two wire shielded cable having a minimum gauge of 22 AWG (see Fig. 2.11). The shield is connected only at the terminal provided in the field wiring box. 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 field wiring box, the CCP (Combination Control Panel), and the BMS (Boiler Management System). The wiring must be done using a shielded twisted pair of 22 gauge wire and polarity must be maintained between the unit, the CCP, and the BMS. Control wire shielding should be secured at each end of the wiring connections to the terminals provided. For further instructions and wiring diagrams consult the BMS and CCP instructions

2.7 ENABLE/DISABLE INTERLOCK

Each unit has an enable/disable interlock circuit located in the field wiring box. This interlock must be closed,(jumped), to allow the unit to fire. When the interlock is open, the control panel Annunciator will display 'INTERLOCK DISABLED' and the unit will not fire. The unit comes factory wired with the interlock closed.

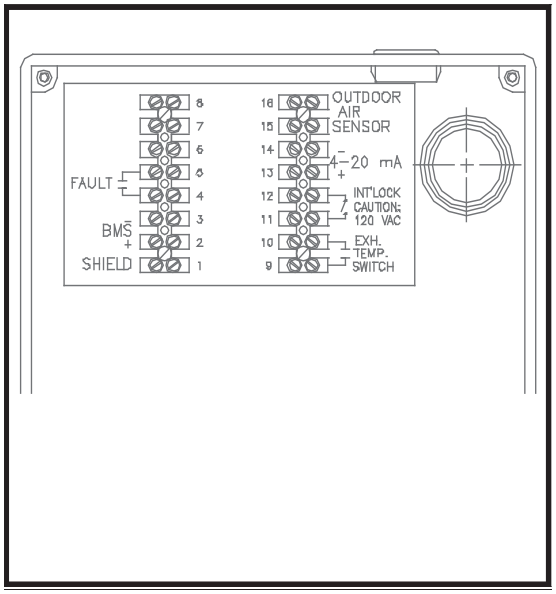

Figure 2.11
Field Control Box Wiring

2.8 FAULT RELAY WIRING

The fault relay is a normally open, single pole, single throw relay, that is energized upon any fault condition. The relay will remain energized until the fault is cleared and the CLEAR button is pushed. The normally open field connections are shown in Figure 2.11. The relay contacts are rated for 5 amps at 250 VDC and 5 amps at 30 VDC.

2.9 FLUE GAS VENT INSTALLATION

The AERCO Venting and Combustion Air Guide, GF-1050, must be consulted before any flue or inlet air venting is designed or installed. Suitable, U/L approved, positive pressure, watertight vent materials as specified in AERCO's GF-1050, must be used for safety and UL certification. 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.

While the has a positive flue pressure during operation, the combined pressure drop of vent and combustion air systems must not exceed 140 equivalent feet of 0.81" W.C.. 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" 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.

2.10 COMBUSTION AIR

The AERCO Venting and Combustion Air Guide, GF-1050, 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 more common methods of combustion air supply venting are outlined below. For combustion air supply from ducting, consult the AERCO GF-1050, Venting and Combustion Air Guide.

2.10.1 COMBUSTION AIR FROM OUTSIDE THE BUILDING

Air supplied from outside the building must be provided through two permanent openings. For each unit these two openings must have a free area of not less than one square inch for each 4000 BTUs input of the equipment or 250 square inches of free area. The free area must take into account restrictions such as louvers and bird screens.

2.10.2 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 input or 1000 square inches of free area. The free area must take into account any restrictions such as louvers.

2.10.3 SEALED COMBUSTION

The KC Boiler is UL approved for 100% sealed combustion application when installed properly. When a sealed combustion air application is installed, the sealed combustion air piping must be deducted from the maximum allowable discharge piping amounts. Each unit must have a minimum 6" diameter connection made to the special Inlet Air Adapter # GP-18917 available from AERCO. This adapter bolts directly on to the air inlet of the unit's blower. See installation instructions with adapter. All inlet air ducts must be sealed air tight.

2.11 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 soap suds 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 connection on the bottom of the unit.
3. Make certain that the system pressure reducing fill valve is on to replenish pressure in the system as the unit fills.
4. Using the pressure/temperature gauge, supplied with the unit, as a guide, allow pressure to slowly build up in the unit.
5. Slowly open either the manual vent valve or the supply valve off its seat, allowing air to vent from the unit's shell.

SECTION 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 KC 1000. 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 KC 1000 Control Panel has been designed to provide the operator with all the necessary information required for operating and troubleshooting this unit. 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. The Combustion Safeguard Controller
4. Water Level Test and Reset Switches
5. On/Off Switch
6. 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 120 VOLTS AC.

3.2 THE TEMPERATURE CONTROLLER

The temperature controller is a PID programmable controller that utilizes feed forward and 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:

- 2- eight segment LED displays
- 5 indicator status lights
- 3 menu levels
- RS-485 communications capability

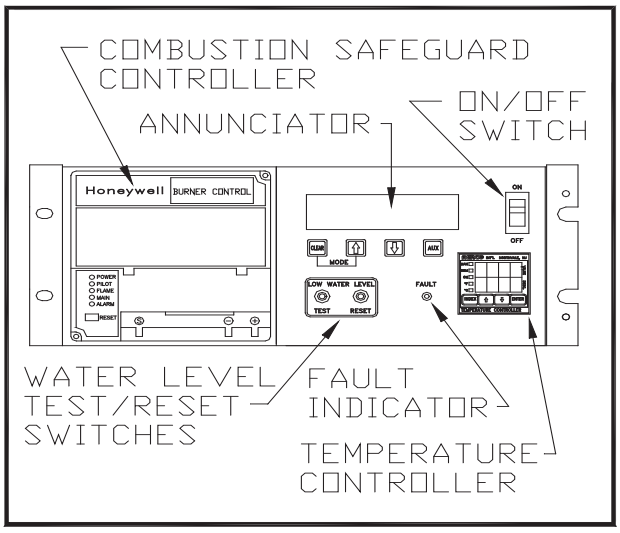

Figure 3.1
Front Panel Controls Location

3.2.1 LED DISPLAYS

The upper and lower displays each consists of four, 8 segment LED's (see Fig. 3.2). When choosing an operating parameter 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 can accept commands from an external source via the RS-485 interface. When this LED is not lit the controller is in local mode and will respond to whatever the current internal settings are. All external commands are ignored.

The third LED, “ON”, indicates the status of the start relay, (see Fig. 3.2). The start relay is internal to the controller and is part of the start string for the unit. When this LED is lit there is a demand for heat and the start relay is closed.

The last two LED’s, **“°F” and “°C”,** indicate whether the temperature displayed is °F or °C, (see Fig. 3.2).

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

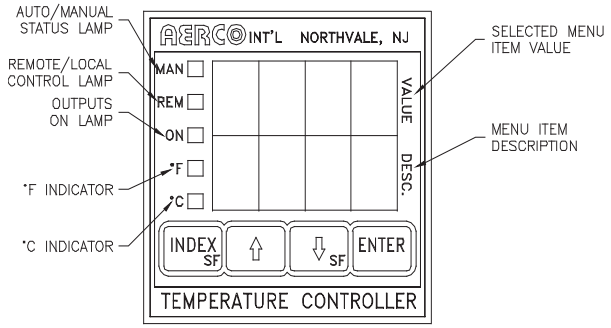

Figure 3.2
Temperature Controller Operating Status Lights

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 INDEX button.

To scroll through a menu, depress the INDEX 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 ⇧ ⇩ arrow keys to change the parameters value. Once a parameters 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 parameters value defaulting back to the original 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.

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	Actual unit outlet water temperature.
pct	Current firing rate of the unit in percent.
Setp	The desired set point of outlet water 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 INDEX 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 120º F

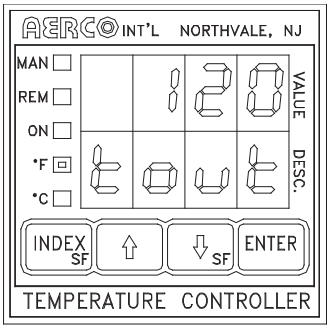

Figure 3.3
Outlet Temperature Display

3.3.2 PERCENTAGE OF FIRING RATE (Pct)

Percentage of firing rate is a number, in percent, that is related to the input BTU’s of the unit. For instance a 50% firing rate equals approximately 500,000 BTU gas input while a 75 % firing rate equals approximately 750,000 BTU gas input.

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

To access the percent of firing rate press the INDEX button while in the primary menu until (Pct) is displayed in the lower LED. Use the ⇧ ⇩ 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.

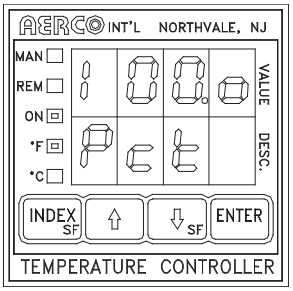

Figure 3.4
Percent of Firing Rate Display

WARNING:
WHEN SWITCHING FROM AUTO TO MANUAL MODE, THE FIRING RATE DOES NOT CHANGE. THE UNIT WILL CONTINUE TO OPERATE AT THE SAME FIRING RATE PERCENTAGE AS WHEN THE UNIT WAS IN AUTO MODE.

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 120º F.

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

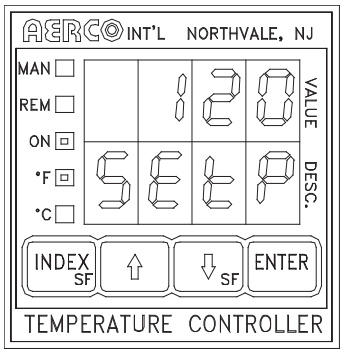

Figure 3.5
Setpoint Display

NOTE:
Changing the setpoint will only be recognized when the unit is in the automatic mode.

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.

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 limits remain functional whether the controller is in automatic or manual mode.

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

Now press the ⇧ ⇩ 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.

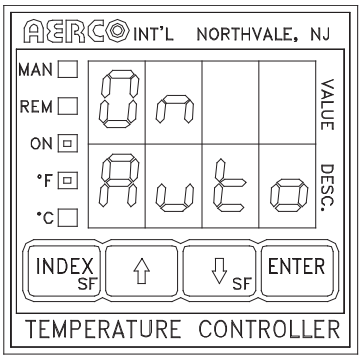

Figure 3.6
Auto/ Manual Display with Auto On

To place the KC 1000 in manual mode, press the ⇧ ⇩ 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.

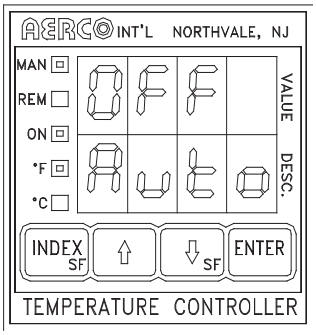

Figure 3.7
Auto/Manual Display with Manual On

3.4 THE SECONDARY MENU

The secondary menu is primarily related to temperature control. It is necessary to access this menu when setting PID values or changing the unit mode of operation. All the parameters accessible in the primary menu are also accessible in the secondary menu.

To access the secondary menu, press the ⇧ arrow key and ENTER simultaneously. To scroll through the menu press the INDEX button. For a complete explanation of the secondary menu parameters see Appendix A of this manual.

3.5 THE ANNUNCIATOR CIRCUIT

The annunciator consists of the annnciator circuit board, the front panel LCD display, and 4 function switches, (see Fig. 3.8 for the display and function switch locations and see Appendix I for the circuit board locations). 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 prompts the LCD display with start sequence and fault messages. The function switches are used to reset the annunciator and gain access to the annunciator's three function displays.

The annunciator circuit board and LCD display are not an integral part of the start sequence or combustion safeguard system.

The annunciator start sequence messages, fault messages, function switches and function displays are explained below.

3.5.1 ANNUNCIATOR FUNCTION SWITCHES and DISPLAYS

The Annunciator has three function displays 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, ⇧, ⇩, and AUX.

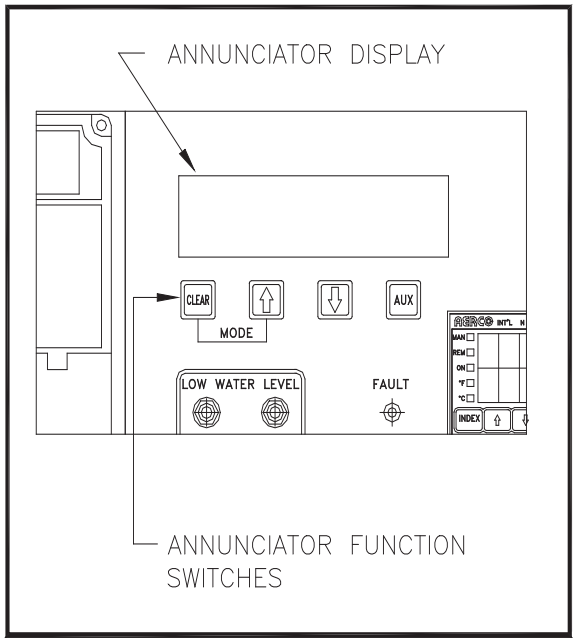

Figure 3.8
Annunciator Function Switches and LCD Display

The MAIN display is used during normal operation of the unit. In the MAIN display, start sequence and fault messages can viewed. To return to the MAIN display from any other display, simultaneously press CLEAR and the ⇧ 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. When in the CYCLES display only the number of cycles can be reset. To reset the number of cycles to 0, simultaneously press the ⇧, and ⇩ 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 ⇧ ⇩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
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 5 seconds to reset the display.
HIGH WATER TEMP	The unit has tripped due to the outlet water temperature exceeding the high temperature limit setting.
LOW GAS PRESSURE	The unit has tripped due to low gas pressure.
LOW WATER LEVEL	The shell water level is below the probe level.
REMOTE DISABLED	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 DURING IGNITION TRIAL	Flame did not prove at the end of the trial for ignition period.
LOCKOUT RUN AIR FLOW	The air pressure switch opened after flame was proven.
LOCKOUT RUN FLAME	Flame signal was lost after flame was proven.
LOCKOUT RUN	The combustion safeguard is locked out.
HI EXHAUST TEMP	The exhaust gas temperature has exceeded 500º F

3.5.3 ANNUNCIATOR START SEQUENCE MESSAGES

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

MESSAGE	MEANING
STANDBY	The unit is in standby mode waiting for a call for heat
PURGING	The unit is in the 7-sec purge.
IGNITION TRIAL	The unit is in ignition position attempting to light the burner
FLAME PROVEN	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 the purge and ignition cycles during the start sequence.

The combustion safeguard is located on the left side of the control panel as shown in Figure 3.9. There are five status LED’s that indicate the status of operation. Along with the annunciator, these are useful as a double check for proper system operation and troubleshooting.

The table below defines the function of each light. The reset button located under the LED’s is to reset the combustion safeguard a lockout.

DESCRIPTION	FUNCTION
POWER	Lights upon power up of the unit.
PILOT	Lights when the re is a call for heat.
FLAME	Lights once flame has been detected.
MAIN	Lights after flame has been detected and stabilized
ALARM	This lights when the controller is in a LOCKOUT condition.

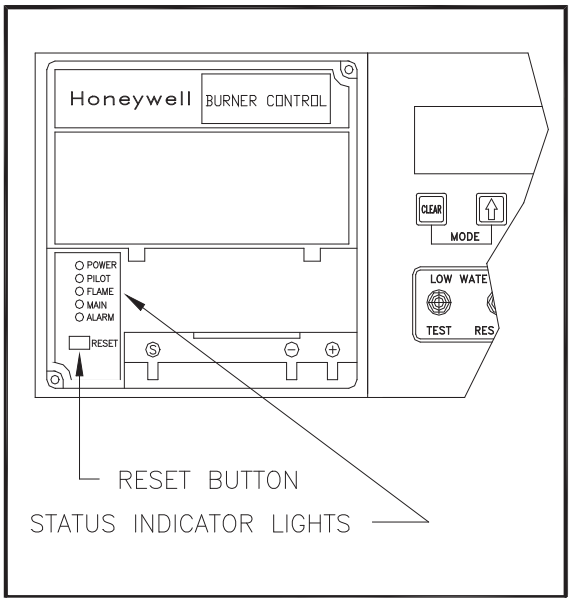

Figure 3.9
Combustion Safeguard Status Indicator LED Location

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. 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.

3.8 ON/OFF SWITCH

The ON/OFF switch is located on the right side of the control panel above the temperature controller (see Fig. 3.1). It is part of the start string 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.

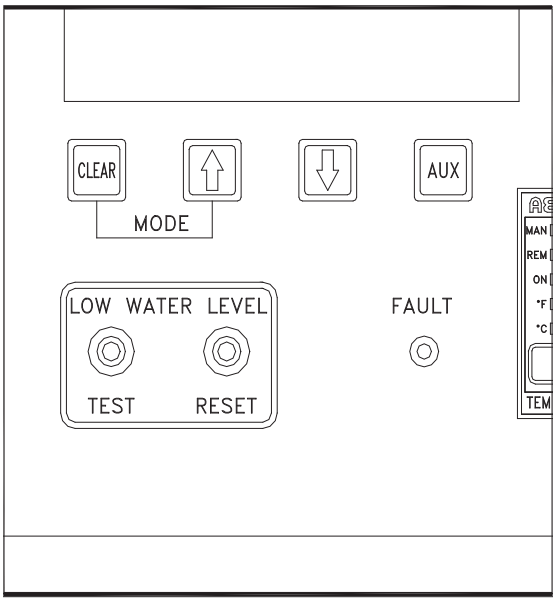

Figure 3.10
Water Level Test and Reset Switch Locations

3.9 STARTING SEQUENCE

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

1. Upon demand the temperature controller's ON status indicator will light.
2. The combustion safeguard's PILOT LED lights and the blower contactor energizes, starting the blower.
3. The system next checks for proof of closure from the safety shut-off valve, (see Fig. 3.11), and the air fuel valve rotates open engaging the air /fuel valve open 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.
5. The blower proof switch closes, (See Fig. 3.13), and the LCD display will show PURGING.
6. Closure of the blower proof switch signals the combustion safeguard to begin its 7-second purge cycle.

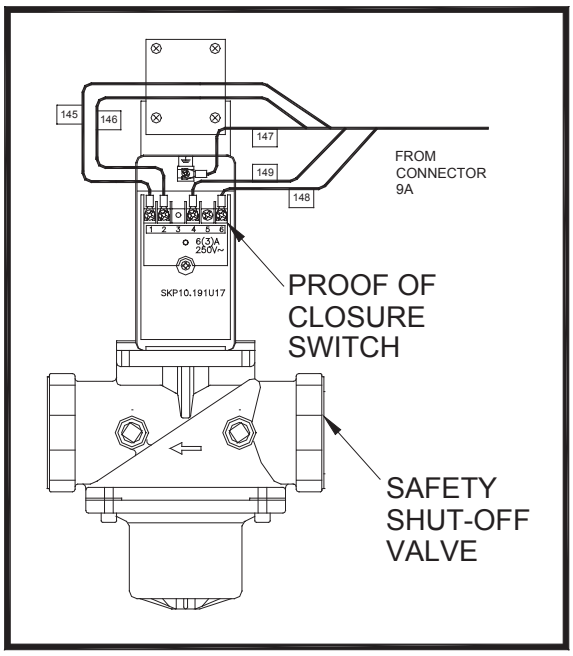

Figure 3.11
Proof of Closure Switch Location

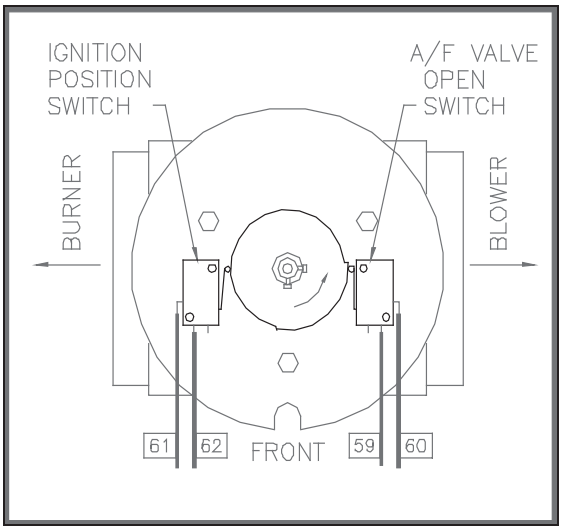

Figure 3.12
Air/Fuel Valve Open and Engaging the Air/Fuel Valve Open Microswitch

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 ignition transformer energizes.
- The air/fuel valve rotates to its low fire position. This engages the air-fuel valve closed switch, energizing the safety shut-off valve, (see Fig. 3.14).

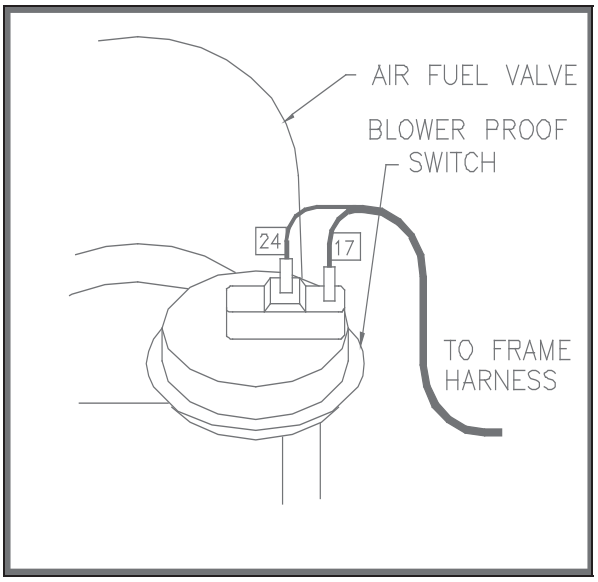

Figure 3.13
Blower Proof Switch Location

8. Once the combustion safeguard detects flame, its flame LED lights. Power is removed from the ignition transformer and the MAIN LED lights of the combustion safeguard.

At this point, the annunciator will display FLAME PROVEN. The unit, provided it is in the automatic mode, is released to modulate and will be controlled by the temperature control system.

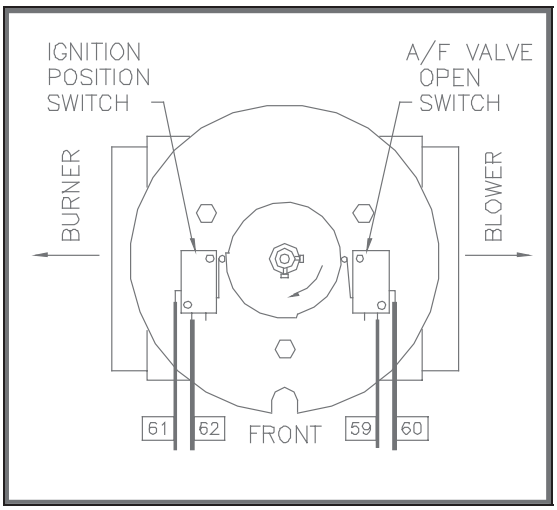

Figure 3.14
Air/Fuel Valve in Ignition Position, Engaging the Ignition Microswitch

3.10 AFTER FLAME

Once the control signal has gone below the stop level (see section 3.12 for Stop Level explanation), the temperature controller's green ON light extinguishes, indicating there is no longer a call for heat. This signals the combustion safeguard to shut down the burner. The POWER LED of the combustion safeguard remains illuminated and the annunciator displays the message STANDBY.

3.11 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. A flame signal of 5VDC is typical during proper operation of the unit.

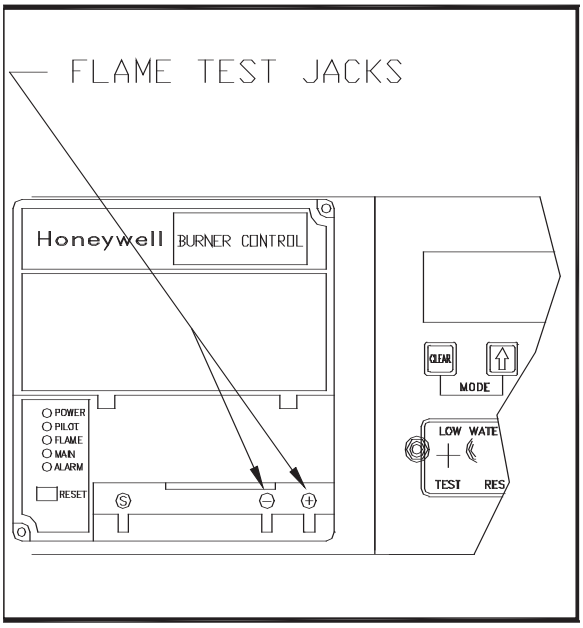

Figure 3.15
Flame Test Jack Location

3.12 START STOP LEVELS

The start and stop levels are the firing rate percentages that represent a call for heat and an indication that the call for heat has been satisfied. The start level is preset to 20% and the stop level is preset to 16%. These are factory preset and should not require adjustment.

SECTION 4 - INITIAL START- UP

4.1 INITIAL START- UP REQUIREMENTS

The initial start-up of the KC-1000 boiler is comprised of the following steps:

- installation completed 100%
- combustion calibration
- proper setting of controls and limits
- mode of operation settings (see Section 5)
- safety device testing (see Section 6)

Installation procedures should be completed 100% before performing initial start-up and initial 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 void the product's warranty. These 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 KC-1000 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 UNIT 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 0.4%, 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 manometers.
4. Aerco differential gas pressure regulator adjustment tool P/N GM-122643 (one supplied per installation)
5. Small and large flat blade screwdrivers.
6. 7/16" open end wrench and small adjustable wrenches.
7. Tube of silicone adhesive
8. * Digital multimeter with 10 amp and volt capability.

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

***For propane fired units: an additional 8" W.C. manometer and 1/2" NPT to barbed fitting is needed.*

4.2.1 INSTALLING THE SUPPLY GAS MANOMETER

1. Close the manual gas supply valve upstream of the unit.

2. Remove the 1/8" NPT pipe plug from the gas train assembly. This pipe plug is located below the low gas pressure switch before 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.

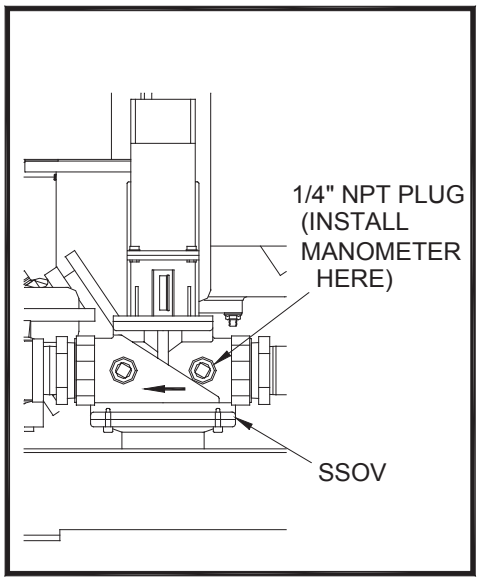

Figure 4.1
1/8” Gas Plug Location

4.2.2 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, 18” to 24” above the exhaust manifold. The outer vent section, that covers vent section connections must be loosened and slid down to uncover the hole (see Fig. 4.2).

2. If equipped with one, adjust the stop on the combustion analyzer probe so that it extends into the flue gas flow without hitting the opposite wall of the flue. Do not insert the probe at this time.

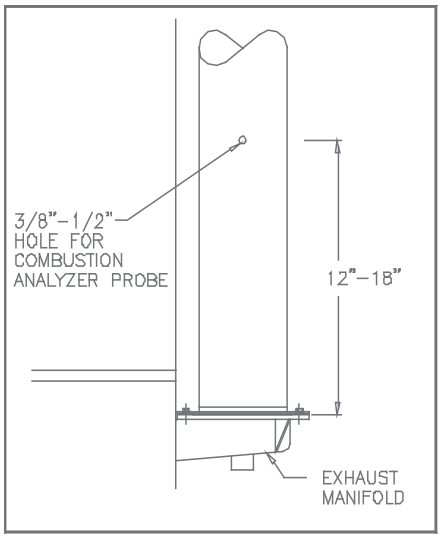

Figure 4.2
Analyzer Probe Hole Location

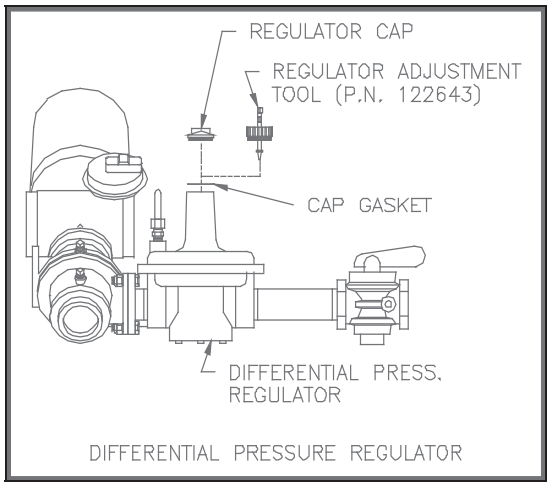

Figure 4.3
Differential Regulator Adjustment Tool Installation

4.2.3 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 tools on the regulator pull up the tool's screwdriver blade. 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 KC-1000 comes 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.

The following combustion calibration procedure closely follows the factory procedure. By following this procedure readjustment of combustion will be kept to a minimum.

NOTE:
If the instructions in section 4.2 have not yet been performed, go back and do so before continuing.

1. Open the 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 installed as per Section 4.2.1, adjust the gas supply regulator until a reading of 12” W.C. static pressure is obtained.

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. Put the temperature controller in manual mode

NOTE:
For a review of control panel operating procedures, see Section 3.

6. Change the firing rate (Pct) to 0.0%.

7. Place the green ON/OFF switch in the ON position.

8. Change the firing rate (Pct) to 25%. This will put the unit into the starting sequence.

NOTE:
On initial start-up or return to service from a fault condition, a warm-up timer of 2 minutes is activated by the controller. This prevents the BTU input from exceeding 400,000 BTUs/HR even though the control signal may indicate a greater input.

9. Observing the 2 minute warm-up period increase the firing rate in 10 % increments while monitoring the gas pressure after every increase. If gas pressure dips below 8.5” W.C. for FM gas trains and 8.9” for IRI gas trains at any input percentage, stop and raise the pressure. Once 100% is reached, adjust the gas pressure for 8.5” W.C. or 8.9” W.C.

NOTE:
If 8.5” W.C. for FM gas trains or 8.9” W.C. for IRI gas trains cannot be obtained at the 100% firing rate, it will be necessary to stop calibration and contact the local AERCO representative in your area. Running the unit on insufficient gas pressure will void the warranty

10. Once 8.5” W.C. or 8.9” W.C. is set at the 100% level change the firing rate (Pct) to 30%. Insert the combustion analyzer probe into the stack.

NOTE:
Always go to a percentage of firing rate from the same direction, (i.e., 100% to 30% or 30% to 20%). Whenever going to a firing rate from below (i.e., 20% to 30%), first go above then back down to the desired firing rate. This is necessary due to hysteresis in the air/fuel stepper motor. Hysteresis causes the air/fuel valve to stop in a slightly different position if the firing rate percentage is approached from below or above. This results in a difference in oxygen readings for the same firing rate percentage causing unnecessary recalibration.

11. Allow enough time for the combustion analyzer to settle. Compare the measured oxygen level to the oxygen range for intake air temperature in Table 1.

Table 1

Inlet Air Temp	Oxygen	Carbon Monoxide
20°F	5.7 %	<50ppm
40°F	5.5 %	<50ppm
60°F	5.2 %	<50ppm
80°F	5.0 %	<50ppm
100°F	4.9 %	<50ppm

Combustion Oxygen Levels for a 30% Firing Rate

12. If the measured oxygen level is within the range in Table 1, no adjustment is necessary. Proceed to step 17.

13. If the measured oxygen level is below the range in Table 1, rotate the differential regulator adjustment tool counter clockwise 1/4-1/2 revolution to decrease gas flow.

14. Wait for the combustion analyzer to settle, then compare the new oxygen reading to Table 1. Repeat adjustment until oxygen is within the specified range.

15. If the measured oxygen level is above the oxygen range in Table 1, rotate the differential regulator adjustment tool clockwise 1/4-1/2 revolution to increase gas flow.

16. Wait for the analyzer reading to settle, then compare the new reading to Table 1. Repeat adjustment until oxygen is within the specified range.

NOTE:
Adjust only the differential regulator at 30% control signal; do not adjust the air shutter.

17. Once the oxygen level is within the specified range at 30%, change the firing rate to 16%.

18. Oxygen levels at the 16% firing rate should be 10% or less as shown in Table 2. If the measured oxygen level is less than 10%, no adjustment is necessary. If the measured oxygen levels are greater than 10%, rotate the regulator adjustment tool clockwise 1/4 to 1/2 revolution to add gas.

19. Wait for the analyzer to settle. Repeat adjustment until the measured oxygen reading is 10% or less.

20. If the oxygen level cannot be brought to 10% or less, check the oxygen level in 1% increments above the 16% firing rate until an oxygen level of 10%, or less, is measured. Reset the unit' stop level at that firing rate. Go back and recheck the oxygen level at 30% before continuing.

Table 2

Inlet Air Temp	Oxygen	Carbon Monoxide
20°F	10% or less	<25ppm
40°F	10% or less	<25ppm
60°F	10% or less	<25ppm
80°F	10% or less	<25ppm
100°F	10% or less	<25ppm

Combustion Oxygen Levels for a 16% Firing Rate

21. Change the firing rate to 100%. After the combustion analyzer has settled, compare the measured oxygen level with the levels in Table 3.

22. If the measured oxygen reading is below the oxygen range in Table 3, loosen the two bolts that secure the inlet air shutter to the unit using a 7/16" wrench (see Fig. 4.4). Open the shutter 1/4" to 1/2", to increase the oxygen level then tighten the nuts.

23. Wait for the analyzer to settle then compare the new oxygen reading to Table 3. Repeat the inlet air shutter adjustment until the oxygen is within the specified range. Firmly tighten the inlet air shutter locking nuts when finished.

Table 3

Inlet Air Temp	Oxygen	Carbon Monoxide
20°F	5.4%	<150ppm
40°F	5.4%	<150ppm
60°F	5.2%	<150ppm
80°F	4.9%	<150ppm
100°F	4.7%	<150ppm

Combustion Oxygen Levels for a 100% Firing Rate

REMINDER:
At 30% firing rate adjust only the differential pressure regulator. At 100% firing rate, adjust only the inlet air shutter.

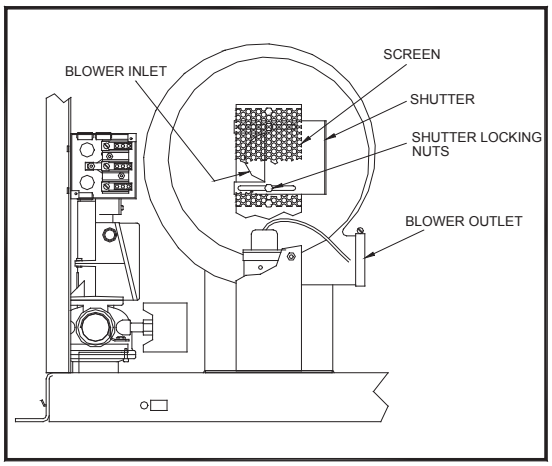

Figure 4.4
Air Shutter Locking Nut Location

24. If the measured oxygen reading is above the oxygen range in Table 3, loosen the two 7/16" locking nuts securing the inlet air shutter. Close the air shutter 1/4" to 1/2" to decrease the oxygen level and tighten the two nuts.

25. Allow the analyzer to settle then compare the new oxygen reading to Table 3.

26. Allow the analyzer to settle. Repeat the adjustment until the oxygen is within the

specified range. Firmly tighten the inlet air shutter locking nuts when finished.

NOTE:
Adjust the inlet air shutter only at 100% firing rate. Do not adjust the differential pressure regulator.

27. Change the firing rate to 30%. 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.

28. Continue this procedure until all oxygen levels are within the ranges specified in Tables 1,2, and 3.

29. Record all readings on the AERCO start-up sheet provided with each unit. Proceed to Section 4.5.

4.4 PROPANE COMBUSTION CALIBRATION

For propane units it will be necessary to install an additional 8" W.C. manometer as described below. This is used to measure the pressure drop across the air/propane-mixing orifice.

1. Referring to Fig. 4.5 remove the 1/8" NPT plug from the gas inlet pipe ahead of the burner and install a 1/8" NPT barbed fitting.

2. Remove the 1/2" NPT plug from the tee located after the air pressure regulator and install a 1/2" barbed fitting (see fig. 4.5).

3. Attach the 8" W.C. manometer to the barbed fittings installed in steps 1, and 2.

4. While following the combustion calibration procedure in Section 4.3 measure the pressure drop across the air/propane mixing orifice using the 0-8" W.C. manometer.

5. This reading should remain a constant 3.8" to 4" W.C. throughout the operating range.

6. If the pressure drop is not within this range, remove the cap from the air pressure regulator.

7. Using a flat blade screwdriver adjust the regulator until 3.8"-4.0" W.C. is obtained. Clockwise will increase the reading and counter-clockwise will decrease the reading.

8. It adjustments are made to this regulator it will be necessary to recheck oxygen settings at 16%, 30%, and 100% firing rates

NOTE:
After an adjustment is made to the air regulator, the cap must be put back on securely to obtain an accurate reading

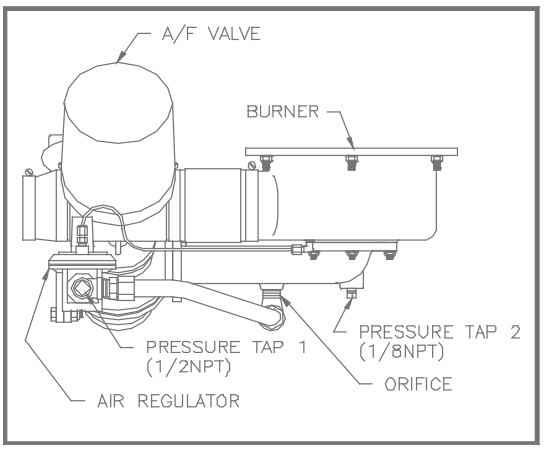

Figure 4.5
Propane Air Differential Pressure Taps

4.5 UNIT REASSEMBLY

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

1. Put the green ON/OFF switch in the off position. Disconnect the AC power supply to the unit.

2. Shut off the gas supply to the unit.

3. 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.

4. Remove the gasket from the tool and place it back onto the regulator cap.

5. Apply a drop of silicone to the regulator adjusting screw to lock its setting.

6. Reinstall the cap and gasket back on the regulator. Tighten the cap using a screwdriver or wrench.

7. Remove all of the manometers and barbed fittings and reinstall the pipe plugs using a suitable thread compound.

8. Replace the unit's panels and hood.

9. Remove the combustion analyzer probe from the vent hole. Seal the probe hole and replace the vent connection cover.

4.6 OVER TEMPERATURE LIMIT SWITCH ADJUSTMENTS

There are two Over-Temperature Limit switches that turn off the unit when the outlet water temperature becomes too hot. The lower over-temperature limit switch is adjustable and should be adjusted 20^0 to 40^o F above the operating header temperature. The upper over-temperature limit switch is a manual reset device and is not adjustable. It will shut the unit off if the water temperature reaches 240^o F. **DO NOT** attempt to adjust its set point.

To adjust the lower over temperature switch limit switch:

1. Remove the wing nut from the top center of the shell cap. Lift the cap off the shell.

2. The two over-temperature limit switches are located at the top of the shell (see Fig. 4.6). Do not adjust the upper switch it has been factory preset. Adjust the lower switch between 20^0 to 40^o F higher than the maximum header temperature the unit may see.

3. Replace the shell cap and wing nut.

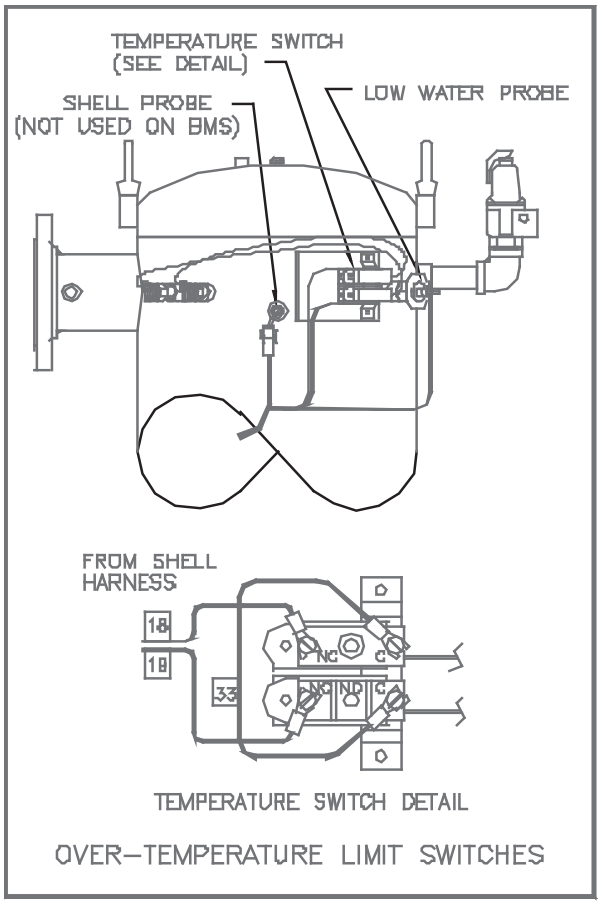

Figure 4.6
Over Temperature Limit Switch Location

SECTION 5- MODE OF OPERATION

The following is a detailed description of the KC1000's six modes of operation. 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 temperature related parameters is 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 increases and vice versa. For this mode of operation, 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

Building reference temperature is the temperature that the inside of the structure is to be maintained. This is a number from 0 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 SENSOR INSTALLATION

When mounting the Outdoor Air Temperature Sensor, it should be mounted on the north side of the building in an area where the average outside air temperature is expected. The sensor should 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.

The outdoor air sensor must be connected to the external field wiring box located under the control panel on the left-hand side of the unit. Connections are to be made to terminals 16 and 15.

5.1.4 INDOOR / OUTDOOR STARTUP

1. Refer to the indoor/outdoor reset ratio charts in Appendix D.

2. Choose the building reference temperature that the structure is to be maintained.

3. Go down the left column of the chart to the coldest degree day reachable in that area

NOTE:
Degree day and supply water temperature data are typically provided by a design engineer or your local AERCO representative.

4. Once the degree day is chosen go across the chart to the desired supply header temperature for the degree day 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 then scroll through it until the display shows REFT. This is the building reference temperature.

7. Use the ⇑ ⇓ 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 ⇑ ⇓ arrow keys to set the desired reset ratio.

11. Press ENTER to accept the change.

The unit is now ready to run. Go back to the primary menu and start the unit

5.2 CONSTANT SETPOINT MODE

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

There are no external hookups, other than AC power, 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 AERCO 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 50 to 220 degrees. To set the setpoint do the following:

1. While in the Primary menu, scroll through it until "Setp" is displayed.

2. Use the ⇑ ⇓ keys to set the desired setpoint.

3. Press enter to accept any changes.

4. The unit is now ready to run.

5.3 4 to 20 MILLIAMP REMOTE SETPOINT MODE

In this mode of operation a 4 to 20ma signal sent to the unit changes it's setpoint. The signal is typically sent from an energy management system that determines the appropriate setpoint based on outside air temperature. In this mode a 4ma signal is equal to a 50-degree setpoint while a 20ma signal is equal to a 220 setpoint. 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 field wiring box, is factory configured and converts the 4 to 20 ma 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	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 is 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 to 20 MA REMOTE SETPOINT FIELD WIRING

The only wiring necessary is the 4 to 20ma signal wires from the source, to terminals 13 and 14 in the field wiring box. The signal must be floating (ungrounded), and the wire used must be a two wire shielded cable of 22 gauge minimum. Polarity must be observed and the shield must be connected to terminal 1 in the external field wiring box. 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 to 20 MA REMOTE SETPOINT STARTUP

Since this mode of operation is factory preset and the setpoint is being externally controlled, no startup instructions are necessary. However the unit must be taken out of remote mode, and set to local mode, to manually run the unit. Once finished with manual mode it is necessary to set the unit back to remote mode for it to accept signals from an external source. The temperature controller must also be left in manual and not automatic mode.

To set the unit to local mode, do the following:

1. Access the temperature controller's secondary menu.

2. Scroll through the menu until "lore" is displayed.

3. Use the ⇑ ⇓ 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.

NOTE:
The unit 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 external field wiring box, is factory configured and converts the 4 to 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 to 20MA DIRECT DRIVE FIELD WIRING

The only wiring necessary is the 4 to 20 ma signal from the source, to terminals 13 and 14 in the external field wiring box. The signal must be floating, (ungrounded), and the wire used must be a two wire shielded cable of 22 gauge minimum. Polarity must be observed and the shield must be connected to terminal 1 in the external wiring relay box. 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. However the unit must be taken out of remote mode, and set to local mode, to manually run the unit. Once finished with manual mode, it is necessary to set the unit back to remote mode for it to accept signals from an external source. The temperature controller must also be left in manual and not automatic mode.

To set the unit to local mode do the following:

1. Access the temperature controller's secondary menu.
2. Scroll through the menu until "lore" is displayed.
3. Use the ⇑ ⇓ 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.

NOTE:
The unit automatically defaults to remote mode upon AC power being 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 when it is desired to operate multiple units in the most efficient manner possible. A total of eight units can be managed by a single AERCO BMS 168 system. In BMS mode, the Boiler Management System modulates the units firing rate. All temperature functions are monitored and controlled by the BMS panel. For BMS programming and operation see the BMS Operations Guide.

In BMS mode, the external interface board is utilized. The interface board, located in the field wiring box, is factory configured, and converts the pulse width modulation signal, sent from the BMS, to an RS-485 signal. The RS-485 signal is then 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

5.5.1 BOILER MANAGEMENT SYSTEM EXTERNAL FIELD WIRING

Wiring for this system is from the BMS panel to terminals 2 and 3 in the unit's external field wiring box. Wire the units using a twisted pair of 22 gauge minimum wire. No shield is necessary. When wiring multiple units, 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 firing rate is controlled by the AERCO BMS Model 168. There are no setup instructions for each individual unit. However the unit must be taken out of remote mode, and set to local mode, to manually run the unit. Once finished with manual mode it is necessary to set the unit back to remote mode for it to be controlled by the BMS.

To set the unit in local mode do the following:

1. Access the temperature controller's secondary menu.
2. Scroll through the menu until "lore" is displayed.
3. Use the ⇑ ⇓ 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.

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

5.6 COMBINATION CONTROL SYSTEM (CCP)

A Combination Control System is when enough units are installed to cover the space-heating load on the design day. However one or more of the units are used to heat domestic, water while the remaining units take care of the heating load. The units used for the domestic hot water are designated as the combination units and are referred to as the combo units. The combo units heat water to a constant setpoint temperature that is circulated through a heat exchanger in a domestic hot water tank.

An AERCO BMS 168 panel, a Combination Control Panel (CCP), and the units are interfaced in this mode of operation. When the space heating units are all at 100% firing rate, the BMS asks the CCP to switch the Combo boilers to space heating mode. If the domestic load is satisfied, the aquastat on the domestic tank is open, the combo units will switch over to space heating. If the domestic load is not satisfied, the combo units remain on the domestic load. If the combo units 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.

In CCP mode, the external interface board is utilized. The interface board, located in the field wiring box, is factory configured, and converts the pulse width modulation signal, sent from the BMS, to an RS-485 signal. The RS-485 signal is then 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	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 in the unit's field wiring box. Wire the units using a twisted pair of 22 gauge minimum wire. No shield is necessary. 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 when in combination (constant setpoint mode).

The setpoint is adjustable from 50 to 220 degrees. To set the setpoint do the following:

1. While in either the primary or secondary menus, scroll through until the display shows "Setp".

2. Use the ⇑ ⇓ keys to set the desired setpoint.

3. Press enter to accept the changes.

While it is possible to change other temperature related functions, when the unit is in combination mode, the unit is factory preset with settings that 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 unit switches to BMS mode, the firing rate is controlled by the AERCO BMS Model 168. There are no setup requirements in this mode. However when the unit is in BMS mode, and it is desired to run the unit in manual mode, it must be taken out of remote mode and set to local mode. Once finished with manual mode it is necessary to set the unit back to remote mode for it to be controlled by the BMS.

To set the unit in local mode do the following:

1. Access the temperature controller's secondary menu.

2. Scroll through the menu until lore is displayed.

3. Use the ⇑ ⇓ 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 temperatures. 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.

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 ⇑ ⇓ 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 ⇑ ⇓ keys to set the desired outside air temperature the units are to begin running.

7. Press ENTER to accept the change

SECTION 6-SAFETY DEVICE TESTING PROCEDURES

6.1 TESTING OF SAFETY DEVICES

Periodic testing of all controls and safety devices is required to insure 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 and cap 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. Shut off the gas supply to the unit.
2. Install a 0-16” W.C. manometer in the gas pipe assembly below the low gas pressure switch. (See Fig. 6.1)
3. Open the gas supply to the unit and reset the low gas switch.
4. Start the unit.
5. Slowly close the manual gas supply valve while monitoring the gas pressure. The unit should fault and shutdown on “LOW GAS PRESSURE” when the manometer indicates approximately 6.5” W.C.
6. Open the gas supply to the unit.
7. The unit should not start until the reset button on gas pressure switch is depressed.

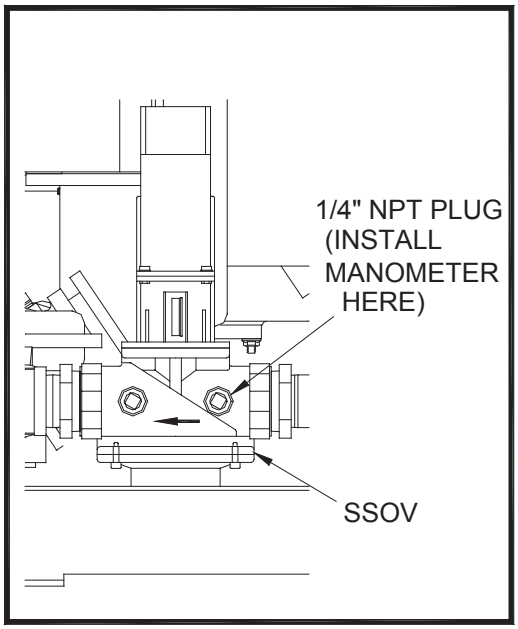

Figure 6.1
1/8” Pipe Plug Position for Manometer installation

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. 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 top of the unit.
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.
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 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 AUTO 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).

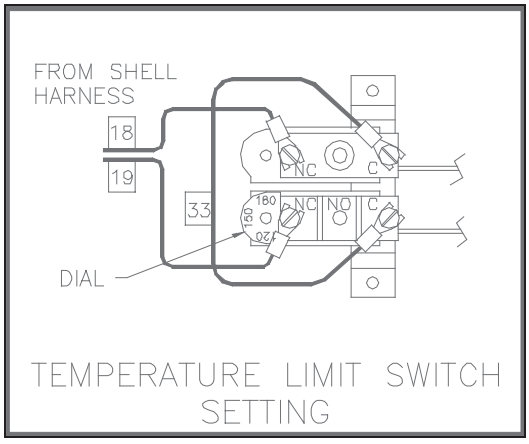

Figure 6.2
Temperature Limit Switch Setting

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 Annunciator.

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 LOCKOUT START FLAME during ignition.

7. Open the leak detection valve.

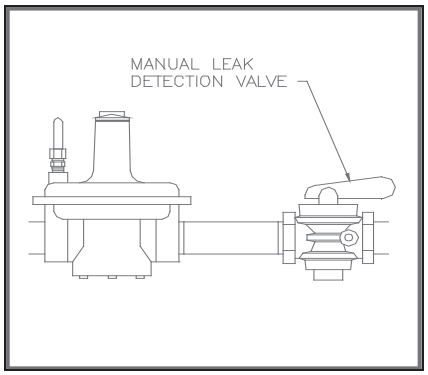

Figure 6.3
Manual Leak Detection Valve

9. Reset the Combustion safeguard and CLEAR the Annunciator.

10. Start the unit.

6.6 AIR PRESSURE FAULT TEST

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.

1. Disconnect AC power from the unit.

2. Disconnect wire #17 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 “SYSTEM FAULT AIR FLOW SWITCH”.

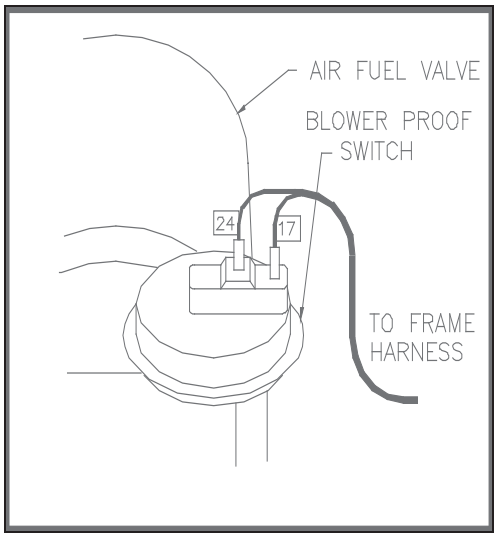

Figure 6.4
Blower Proof Switch Location and Wiring

5. Disconnect AC power from the unit.

6. Replace wire #17.

7. Restore AC power to the unit.

8. Reset the combustion safeguard and clear the annunciator.

6.7 PURGE INTERLOCKS FAULT TEST

1. Turn the ON/OFF switch to the OFF position.

2. Loosen the two setscrews that attach the safety shut off valve actuator to the valve body. (See Fig. 6.5).

3. Lift the SSOV actuator clear of the valve body. This will open the proof of closure switch.

4. Start the unit.

5. The unit should shutdown and display the message “SYSTEM FAULT PURGE INTERLOCKS”.

6. Clear the Annunciator. Turn the ON/OFF switch to the OFF position.

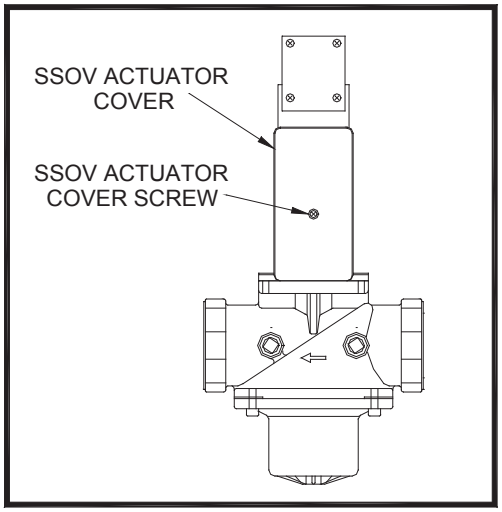

Figure 6.5
SSOV Actuator Set Screw Location

5. Disconnect AC power to the unit.

6. Remove the air/fuel valve cover by loosening the 3 screws securing it in place. (See Fig. 6.6).

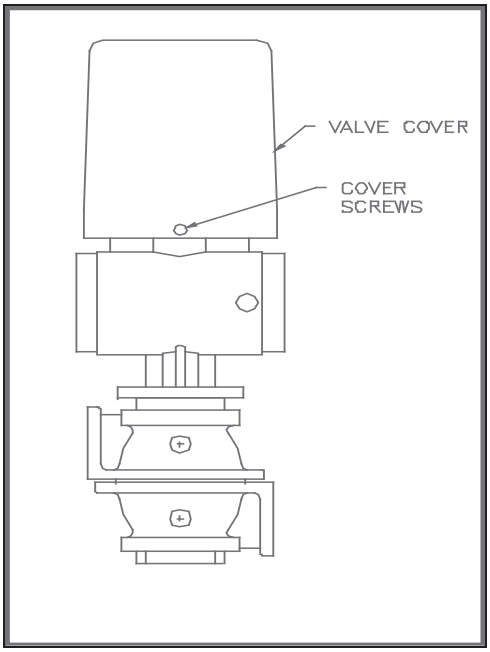

Figure 6.6
Air/Fuel Valve Cover Screw Locations

9. Disconnect wire #60 from the air/fuel valve open position switch. This is the switch closest to the blower (See Fig. 6.7).

10. Restore AC power to the unit.

11. Start the unit.

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.

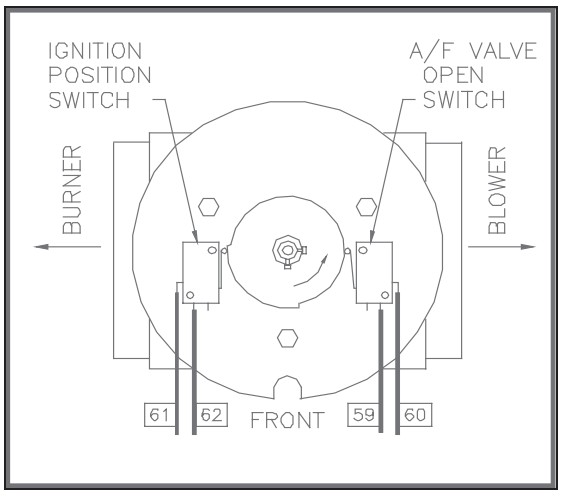

Figure 6.7
Air/Fuel Valve Open Position Switch Location

12. The unit should shutdown and display the message “SYSTEM FAULT PURGE INTERLOCKS”.

13. Disconnect AC power from the unit.

14. Reconnect wire #60 to the air/fuel valve open position switch.

15. Disconnect wire #62 from the ignition position switch. This is the switch closest to the burner of the unit (See Fig. 6.7).

16. Restore AC power to the unit, and reset the combustion safeguard.

17. Start the unit in manual mode.

18. The unit should lockout and display the message “LOCKOUT START FLAME”.

19. Disconnect AC power from the unit.

20. Reconnect wire #62 to the ignition position switch.

21. Replace the air/fuel valve cover.

22. Restore AC power to the unit.

23. 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.

SECTION 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.

Table 1 Maintenance Schedule

Sect	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		Test		20 mins.
7.6	*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.*

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*

7.2 SPARK IGNITOR

The spark ignitor assembly is located in the body of the burner (see Fig. 7.1). 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. Disconnect the plastic tubing from the condensate cup to drain and remove the rear cover panels from the unit. Access to the spark ignitor may also be gained by removing the unit's right side panel
3. Disconnect the ignitor cable from the ignitor contactor and unscrew the ignitor contactor from the burner shell.
4. Insert the ignitor removal tool into the burner shell, where the ignitor contactor was removed. Screw the outer barrel of the tool into the burner shell. Push the inner barrel up and fit the hexagonal end of the tool over the ignitor. Unscrew the ignitor from the burner head and then the tool from the burner shell.
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. Replace the rear cover panels or right side panel. Replace the condensate cup to drain tubing.

7.3 FLAME DETECTOR

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

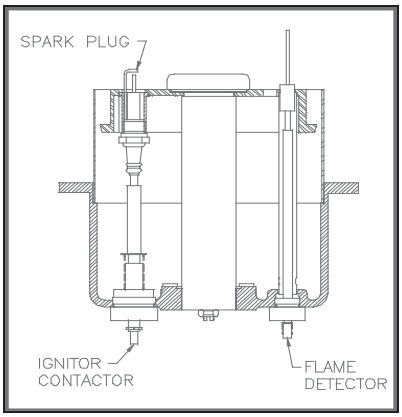

Figure 7.1
Spark Ignitor and Flame Detector Location

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. Disconnect the plastic tubing from the condensate cup to drain and remove the rear covers from the unit. Access to the flame detector may also be gained by removing the unit's left side panel

3. Disconnect the flame detector lead wire. Unscrew the flame detector and remove it from its guide tube. The detector is flexible and may be bent to ease its removal.

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. Replace the rear cover panels or left side panel and reconnect the rear covers to the unit. Replace the condensate cup to drain tubing.

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.

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 log book. See Section 6-Safety Device Testing Procedures.

7.6 MANIFOLD AND EXHAUST TUBES

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 cup. The degree of deposition is influenced by the extent of the condensing operation and the chloride and sulfur levels that vary significantly from application to application.

The following parts will be necessary for reassembly after inspection:

GP-122537	Exhaust Manifold to Combustion Chamber Gasket
GP-18900	Manifold to Tubesheet Gasket
GP-18899	Burner Gasket
GP-122551	Burner Release Gasket
*GP-161151	Combustion Chamber Liner

**Not necessary to change but should be on hand in case damage occurs during the inspection.*

To remove the manifold for inspection:

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

2. Remove the sheet metal covers from the unit.

3. Disconnect the plastic tubing from the condensate cup to drain and remove the rear covers.
4. Remove the condensate cup from under the unit and the condensate drainage tubing from the manifold.

5. Remove the flame detector and ignition cable wires from the flame detector and ignitor contactor. Remove the flame detector and ignitor as sections 7.2, and 7.3.

6. Remove the grounding terminal from the burner by loosening the upper screw and sliding the connector from the grounding rod. (See Fig. 7.2)

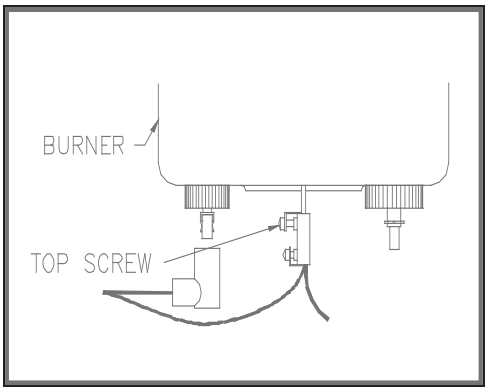

Figure 7.2
Grounding Terminal Location

7. Using a 7/16” socket or open end wrench remove the four 1/4”-20 nuts on the gas inlet pipe flange at the burner (See Fig. 7.3).

8. Using two 9/16” wrenches remove the 3/8"-16 hex nuts and bolts on the gas inlet pipe flange at the air/fuel valve (See Fig. 7.3).

9. Loosen the hose clamp nearest the air/fuel valve outlet on the air/fuel valve to burner adapter (See Fig. 7.3).

10. Using a 1/2” socket wrench remove six 5/16-18 hex nuts supporting the burner (See Fig. 7.3).

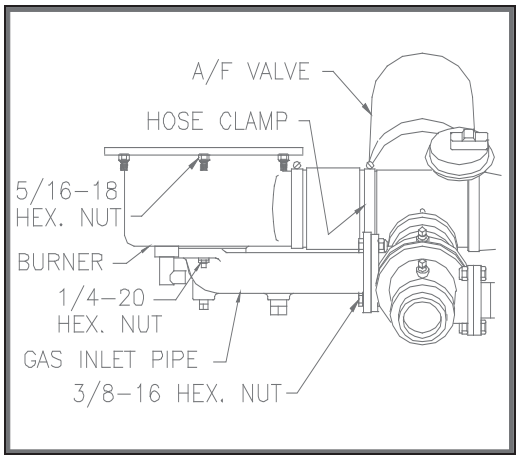

Figure 7.3
Burner Disassembly Diagram

11. Lower the burner while sliding the air hose off the air/fuel valve. Remove the burner through the rear of the unit.

12. Disconnect the exhaust temperature sensor by unscrewing it from the exhaust manifold (See Fig. 7.4).

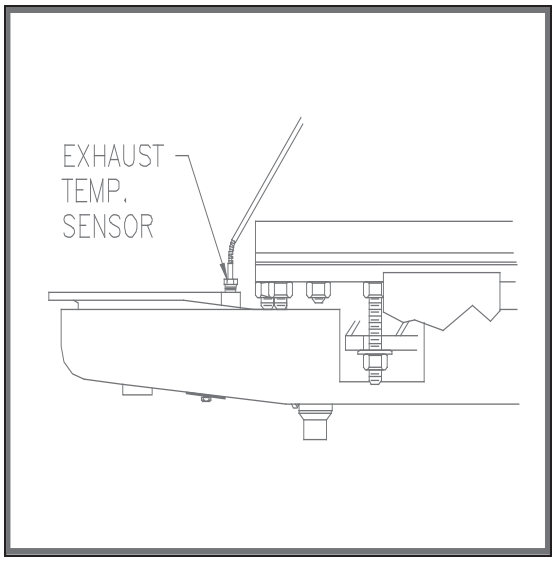

Figure 7.4
Exhaust Sensor Connector Location

13. Disconnect the air/fuel valve wire harness, the 12 pin connector, from the control panel.

14. Disconnect wires #24 and #17 from the blower proof switch (See Fig. 7.5).

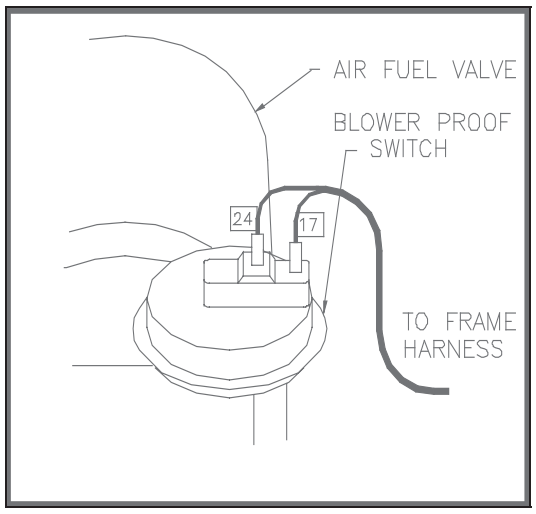

Figure 7.5
Blower Proof Switch Wire Locations

15. Loosen the hose clamp on the air/fuel valve inlet and slide the clamp back towards the blower (See Fig. 7.6).

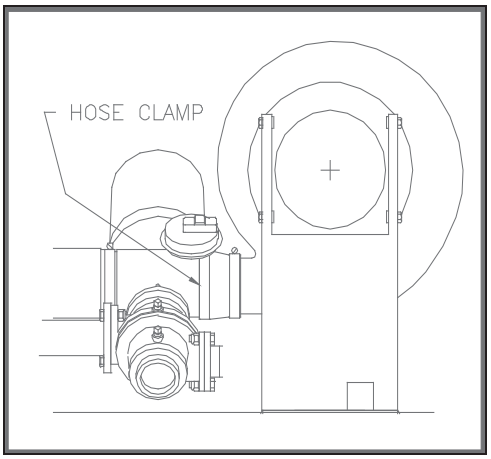

Figure 7.6
Air/Fuel Valve Inlet Hose Clamp

16. Using an 11/16” wrench, loosen the compression fittings on the feedback tube between the air/fuel valve and the differential pressure regulator. Remove the feedback tube (See Fig. 7.7).

17. Using two 9/16” wrenches remove the two 3/8-16 hex nuts and bolts holding the air/fuel valve to the differential pressure regulator (See Fig. 7.7).

18. Remove the air/fuel valve taking care not to damage the flange “O”- ring.

19. Remove the flue venting from the exhaust manifold.

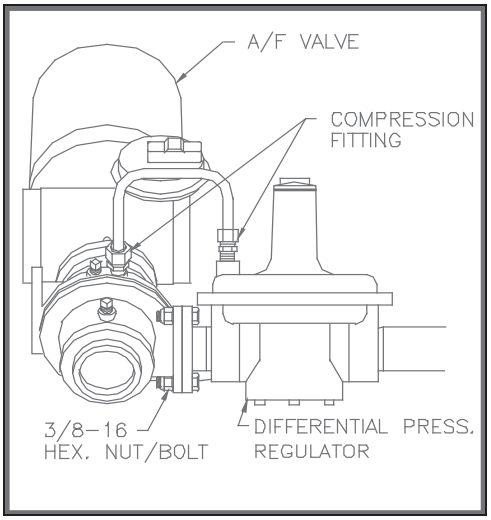

Figure 7.7
Feedback Tube and Air/Fuel Valve to Differential Regulator Bolts

20. To prevent damage to and for easier handling of the exhaust manifold it will be necessary to remove the exhaust manifold insulation. Using a 7/16” wrench or socket, remove the 3 bolts and fender washers securing the insulation to the exhaust manifold.

21. Loosen the three 1-1/16” nuts that hold the manifold. Remove the two side nuts**. DO NOT REMOVE THE FRONT NUT** (See Fig. 7.8).

22. Carefully pull the manifold down and back, removing it through the back of the unit.

23. Inspect the manifold and exhaust tubes for debris. Clean out any debris as necessary.

24. Inspect the combustion chamber and the combustion chamber liner. Replace the liner if any signs of cracking or warpage are evident.

NOTE:
The combustion chamber liner should be installed prior to reinstalling the exhaust manifold

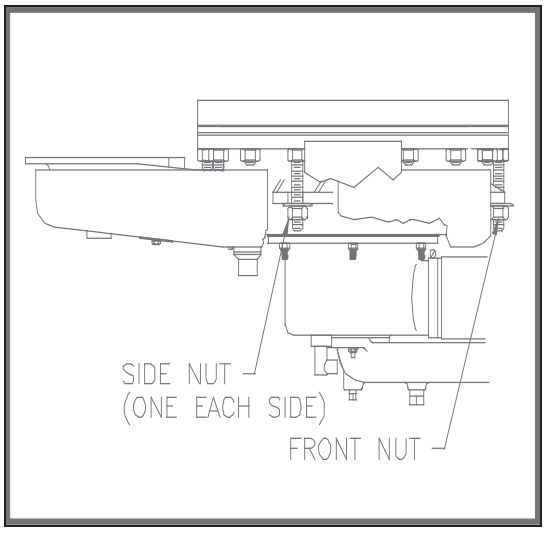

Figure 7.8
Manifold Nut and Bolt Locations

25. Replace the gasket between the manifold and the combustion chamber (P/N GP-122537). The use of Permatex or a similar gasket adhesive is recommended. Replace the gasket between the manifold and tubesheet (P/N GP-18900). Do not use any gasket adhesive; this gasket has an adhesive backing

.

26. Beginning with the manifold, reinstall all the components in the reverse order that they were removed.

7.6.1 PROPANE UNITS

For propane units it will be necessary to remove the air mix assembly in addition to the components outlined in Section 7.6. Proceed as follows:

1. Follow steps 1 through 5 under Section 7.6.

2. Using a wrench, loosen the two compression fittings holding the 1/4" feedback tube between the burner and air regulator and remove the feedback tube (See Fig. 7.9).

3. Using a 1-1/16" wrench or an adjustable wrench loosen and remove the 12" flexible gas hose.

4. Proceed back to Section 7.6 and continue at Step # 6.

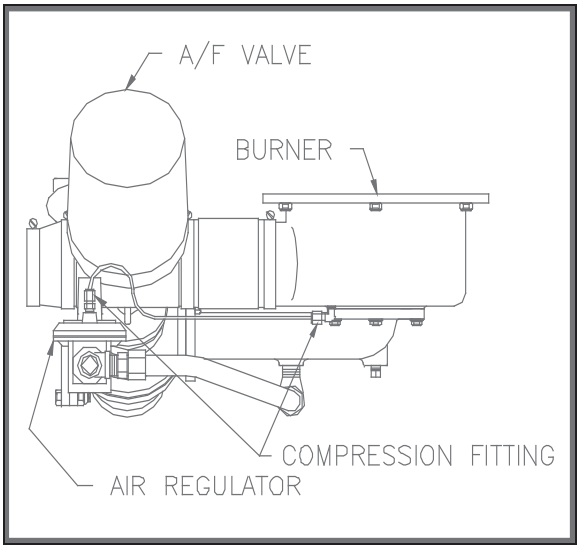

Figure 7.9
Propane Unit Component Location

NOTE:
Older propane units have a 1/8" feedback tube and 1/8" OD tube compression fittings.

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 related to the input BTU's of the unit. For instance a 50% signal equals approximately a 500,000 BTU gas input while a 75 % signal equals approximately a 750,000 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 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 the upper display shows OFF and the controller no longer automatically controls the firing rate of the boiler. 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\disable feature on or off. When ON, an outside 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 alarm. This will put the temperature controller into alarm if the outlet water temperature goes below this setting.
Hlt	This is High Limit Temperature alarm. This will put the temperature controller into alarm if the outlet water temperature exceeds this setting.
Pb1	This is the Proportional Band in ^{0}F for the feedback of the controller. This feature is useful in correcting outlet temperature errors when under steady load conditions.
Int	This is the integral rate, in minutes, for the feedback of the controller. It is adjusted with the⇧ and ⇩. Press ENTER to accept changes.

Drt	This is the derivative rate in % /.1°/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 comands 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 the number of degrees that the header temperature will increase 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	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 alarm. This will put the temperature controller into alarm if the outlet water temperature goes below this setting.
Hlt	This is High Limit Temperature alarm. This will put the temperature controller into alarm if the outlet water temperature exceeds this setting.

Pb1	This is the Proportional Band in ^{0}F for the feedback of the controller. This feature is useful in correcting outlet temperature errors when under steady load conditions.
Int	This is the integral rate, in minutes, for the feedback of the controller. It is adjusted with the⇧ and ⇩. Press ENTER to accept changes.
Drt	This is the derivative rate in % /.1°/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.

SECTION 8- TROUBLESHOOTING GUIDE

This troubleshooting section is intended to serve as a guideline to determining and solving faults on the KC1000. 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 KC1000 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 OHM METER FOR CHECKING CONTINUITY ON SAFETY DEVICES.

WARNING!
TROUBLESHOOTING PROCEDURES, AS OUTLINED IN THIS SECTION MUST BE PERFORMED BY QUALIFIED SERVICE PERSONNEL.

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 6.5" W.C., tripping the low gas pressure switch.

Recommended Troubleshooting Equipment
- 16.5" Manometer
- Analog or Digital Ohmmeter

8.1.1 LOW SUPPLY GAS PRESSURE

1. Install a manometer in the KC1000 Boiler supply gas manifold as per Section 4.2.2.
2. Check the static pressure to the unit. It should be between 10" to 14" W.C.
3. If the static pressure to the unit is lower than 10" W.C., readjust the supply regulator until it's output is between 10" to 14" W.C. If a static supply pressure of 10" to 14" W.C. cannot be obtained, proceed to step #8.
4. If static pressure is already 10" 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 6.5" 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 6.5" 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 6.5" 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 #20 & #140 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 6.5" W.C. and reset the manual rest 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 there is no continuity, check for loose connectors at the switch end of the wires. Check the pins in the connector on the bottom of the control box for proper insertion and/or signs of wear. Make any necessary repairs.

5. If the wires and connectors are not defective, reconnect them. Reconnect electric power.

6. 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
• 16.5" 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 10" 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 6.5" W.C. after reaching 100% input percentage, readjust the gas the gas pressure to 6.5". (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 #32 & #140 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 there is no continuity, check for loose connectors at the switch end of the wires. Check the pins in the connector on the bottom of the control box for proper insertion and/or signs of wear.

8.2 EXHAUST TEMPERATURE FAULT

A HI EXHAUST TEMP. message indicates that the exhaust temperature has exceeded 500^{o}F. This fault is an indication only display. It WILL NOT SHUT DOWN the unit. The fault LED will indicate and the fault relay will trip.

A high exhaust temperature is an indication that the unit has a carbon coating on the fireside of the heat exchanger exhaust tubes. Carbon build-up in the heat exchanger exhaust tubes results in a loss of heat transfer and therefore high exhaust temperatures. Carbon build-up can be due to due to improper combustion calibration, a defective air or fuel component, improper stop/start levels or improper supply gas pressure. The unit should first be combustion calibrated. to determine which one of the above are responsible. Refer to sections 4.2 and 4.3 for combustion calibration, or contact your local AERCO representative further assistance.

8.2.1 Exhaust Temperature Sensor
8.2.2 Wiring & Connections

Recommended Troubleshooting Equipment
Digital Ohmmeter
Digital Temperature Meter

8.2.1 EXHAUST TEMPERATURE SENSOR

Start the unit and wait for the HI EXHAUST TEMP. message to display.

1. Using an accurate temperature measurement device, measure the actual flue gas temperature. If the measurement, taken from the exhaust sensor, is less than 500°F, and the fault message still does not clear, shut the unit off and remove AC power.

2. Disconnect the exhaust sensor wires from the field wiring box.

3. Check continuity between the sensor wires. (ensure that the sensor has cooled below 400°) If there is continuity replace the exhaust sensor.

4. If there is no continuity and the exhaust temperature fault still will not clear, replace the Annunciator board.

5. If the measured flue gas temperature is greater than 500^0 F, check combustion calibration as per Sections 4.2 and 4.3.

8.3. WATER LEVEL FAULT

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.

8.3.1 Water Level Probe
8.3.2 Wiring & Connections
8.3.3 Water level Circuit

Recommended Troubleshooting Equipment
- Digital Volt/Ohmmeter

8.31 WATER LEVEL PROBE

1. Disconnect the electric power to the unit.
2. Remove the unit cap and remove wire #25 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 #25 and the unit frame.
4. Reapply AC power to the unit. The AC voltmeter should read approximately 12 VAC. If approximately 12 VAC is not read on the AC voltmeter, proceed to section 8.3.2.
5. If 12 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 8.3.3. If the fault clears, replace the probe.

8.3.2 WIRING AND CONNECTIONS

1. Disconnect AC power to the unit.
2. Remove the unit cap and disconnect wire #25 from the water level probe and unplug the 9 pin connector from the control box.
3. Referring to system schematic 161413 in Appendix H, locate wire #25.
4. Using an ohmmeter check wire #25 for continuity
5. If wire #25 does not have continuity, repair as necessary.
6. If wire #25 has continuity, check the probe end of the wire for a loose connector.
7. Check the pin in the 9 pin connector for proper insertion or signs of wear.
8. If the connector and pin are okay, reconnect wire #25 to the water level probe.
9. Reconnect the 9 pin connector to the control panel.
10. Reconnect electric power to the unit. If the water level fault still does not clear, see Section 8.3.3.

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 #96 and #99 from terminals LLCO and G.

4. Using an ohm meter, check continuity between wire #96 in the control box, and wire # 25 on the unit. Also check continuity between wire #99 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 WATER TEMPERATURE FAULT

A HIGH WATER TEMPERATURE fault indicates that the temperature of the discharge water has exceeded the setpoint of the over temperature switches. If the unit fires but displays the HIGH WATER TEMP. message replace the Annunciator. Try to reset the unit by pressing the clear button to clear the fault message. If the fault message cannot be cleared, and the unit does not fire, check the following.

8.4.1 Determining the Cause
8.4.2 Over Temperature Limit Switches
8.4.3 Other Causes

Recommended Troubleshooting Equipment
- Digital Voltmeter
- Digital Ohmmeter

8.4.1 DETERMINING THE CAUSE

Remove the unit cap to expose the over temperature limit switches.

Check the setpoint of the unit and the setpoint of the lower over temperature switch. The lower over temperature switch must be set a minimum of 20^{o}F higher than the setpoint of the unit. Make adjustments if necessary.

Often in a boiler system, supply water temperatures can vary and may be higher than the system design temperature. Check the actual outlet water temperature of the unit and ensure that the lower temperature switch is 20^{o}F or more above the actual discharge water temperature. In a situation like this it may be necessary to raise the lower limit setting to 40^{0} F above the system design temperature. If after raising the lower limit switch setting the water temperature the fault still persists, see Section 8.4.2.

It is sometimes common for a unit to over-temp when it is being controlled by an external energy management system that also controls the system pump(s). The external energy management system may not be interlocked to the unit(s) to disable the unit(s) in the event that the system pump or other system component should fail. Typically in an over-temperature situation of this nature the upper, manual reset, temperature limit switch is tripped.
Reset the unit and, if necessary, the upper over temperature limit switch. If the unit will not reset, proceed to section 8.4.2.

8.4.2 OVER TEMPERATURE LIMIT SWITCHES

1. Disconnect AC power to the unit.

2. Raise the temperature limit switch setpoint a minimum of 10^{0} F above the actual discharge water temperature.

3. Referring to system schematic 161413 in Appendix H, remove wires #18 and #33 from the lower switch and wires #19 and #33 from the upper switch.

4. Using an ohmmeter, check for continuity across the C, common, and NC, normally closed, terminals of both switches.

5. Replace the switches if either or both show no continuity.

6. If the switches show continuity, disconnect the 15 pin connector from the control panel.

7. Using an ohmmeter, check wires #18, #19 and #33 back to the 15 pin connector for continuity.

8. Check for loose connectors on the switch end of wire's #18, #19 and #33.

9. Check the pins of the 15 pin connector for proper insertion or wear.

10. If the connectors, pins, and continuity are okay, reconnect wires #19 and #33 to the lower switch and wires #18 and #33 to the upper temperature switch.

11. Reconnect the 15 pin connector to the control panel.

12. Reapply AC power to the unit.

13. If the over temperature fault still does not clear consult your local AERCO representative or contact a qualified service technician

8.4.3 OTHER CAUSES

Other over temperature related causes include:

1. Improper settings of PID control settings.

2. Improper flow rates through the unit.

3. PID settings require tuning to the loop

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

8.5 FLAME FAULT

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.

8.5.1 Flame Fault While Firing
8.5.2 Flame Fault During Ignition Cycle
8.5.3 Safety Shut-Off Valve
8.5.4 Spark Ignitor
8.5.5 Flame Detector
8.5.6 Ignition Circuit
8.5.7 Air Fuel Valve Ignition Position Switch
8.5.8 Flame Detector Voltage
8.5.9 Residual Flame

Recommended Troubleshooting Equipment

- Digital or Analog Voltmeter
- Combustion Analyzer
- 8” and 16.5” Manometers

8.5.1 FLAME FAULT WHILE FIRING

1. Install a DC voltmeter in the flame test jacks located on the front of the combustion safeguard and start the unit.

2. Once flame is established, a steady reading of approximately 5VDC should be observed.

3. Fire the unit at various firing rates (i.e, 16%, 30%, 50%, 100% etc,).

4. If flame signal is erratic at any time during the test, combustion calibrate the unit as per Section 4.of this manual.

5. If combustion calibration is okay remove the burner and inspect it for debris that may have fallen on it.

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 8.5.4 and the flame detector, as per Section 8.5.5.

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 8.5.6.

7. If the flame fault still persists after checking the above, measure the flame detector lead voltage as per Section 8.5.7.

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 161413 in Appendix H, connect an AC voltmeter across wires #14 and #28.

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 9 pin connector from the control panel, and remove the cover from the AC wiring box.

15. Referring to system schematic 161413 in Appendix H, locate wires #14, #28 and #27 and check each for continuity.

16. Check each wire for loose connectors at the safety shut-off valve end. Check wires #28 and #27 for loose connectors in the KC1000 AC wiring box

17. Check the pin on wire #9 at the 9 pin 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 #14, #28 and #29 to the safety shut-off valve and wires #28 and #29 to their proper locations in the AC wiring box.

20. Replace the cover plates on the safety shut-off valve actuator and the AC wiring box.

21. Reconnect the 9 pin connector to the control panel ensuring that it locks into place.

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 8.7.8

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
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6. If there is carbon carbon build-up, on the ignitor, the combustion calibration settings must be checked as per Section 4. 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 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 15 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 161413 in Appendix H, locate wires #12 and #29.
13. Connect an AC voltmeter across wires #12 and #29.
14. Reconnect AC power to the unit and start the unit.
15. At the ignition cycle check for 120VAC across wires #12 and #29.
16. If 120VAC is observed across wires #12 and #29, 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 9 pin connector from the control panel, and wires #12 and #29 from the ignition transformer.
19. Remove the cover plate from the AC wiring box.
20. Referring to system schematic 161413 in Appendix H, check wires #12 and #29 for continuity.
21. If wires #12 and #29 have continuity, inspect the pin on wire #12 in the 9 pin connector for proper insertion or signs of wear.
22. Inspect the connector on wire #29 at the AC wiring box end for a loose connection.
23. Make any necessary repairs.
24. After all wiring and connections have been inspected or repaired, reconnect wires #12 and #29 to the ignition transformer. Reconnect wire #29 to its proper position in the AC wiring box.
25. Reconnect the 9 pin connector to the control panel ensuring it is locked into place.
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 345 VAC.

4. Reconnect AC power to the unit.

5. An AC voltage reading of approximately 345 VAC should be observed.
6. If 345 VAC is observed, proceed to Section 8.5.2, Step 8.

7. If 345 VAC is not observed, disconnect AC power to the unit.

8. Disconnect the 9 pin connector from the control panel.

9. Referring to system schematic 161413 in Appendix H, locate wire #9.

10. Check wire #9 for continuity.

11. Check the flame detector end of wire #9 for loose connections. Inspect the pins in the 9 pin connector for proper insertion and signs of wear.

12. Repair if necessary.

13. If wire #9 has continuity and all connections are okay or a repair was performed, reconnect the flame detector lead to the flame detector. Reconnect the 9 pin connector to the control panel.

14. Reconnect AC power to the unit and start the unit.

15. If the flame fault still persists, contact you're your local AERCO representative 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 set screw from its 1/8" leak detection port.

4. Install an 8" or 16.5" 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.

8.6 AIR PRESSURE FAULT

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.

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 8.6.2.

3. If the blower does not start, proceed to Section 8.6.3.

4. If the blower starts but the Annunciator displays LOW AIR FLOW, proceed to Section 8.6.4.

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 firing rates above 75%, combustion calibrate the unit as per sections 4.3 and 4.4.

8.6.3 BLOWER

1. Disconnect AC power to the unit.

2. Remove the cover plate from the AC wiring box.

3. Locate wire #13 and the blower hot lead wire inside the AC wiring box. They will be the only two wires connected by a wire nut.

4. Remove the wire nut and separate wire #13 from the blower hot lead wire.

5. Connect an AC voltmeter between wire #13 and the unit frame.

6. Reconnect AC power to the unit.

7. Start the unit.

8. The AC voltmeter should measure 120VAC.

9. If 120VAC is not measured, proceed to section 8.6.5

10. If 120VAC is measured, check the blower capacitor using an analog ohmmeter or substitute the capacitor.

11. If the capacitor checks okay or is substituted and the blower still does not start, replace the blower.

8.6.4 BLOWER PROOF SWITCH

1. Remove wires #17 and #24 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 15 pin connector from the control panel.

7. Referring to system schematic 161413 in Appendix H, locate wire #17 and #24 and check both for continuity.

8. Check the switch end of wires #17 and #24 for loose connections.

9. Check the pins on the 15 pin connector for proper pin insertion or wear.

10. If continuity, connector and pins are okay, reconnect wires #17 and #24 to the blower proof switch.

11. Reconnect the 15 pin 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 SOLID STATE RELAY

1. Referring to Appendix I,Item #17, open the control box and locate the solid state relay.
2. Locate wire 81 on terminal 3 of the relay. Measure the AC voltage on terminal 3 when the unit is attempting to start.
3. If 120VAC is measured on terminal 3 and the blower still does not start, replace the solid state relay.
4. If not 120VAC is not measured, replace the combustion safeguard relay module.

8.7 SYSTEM FAULT

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.

Recommended Troubleshooting Equipment
AC Voltmeter
Ohmmeter

8.7.1 DETERMINING THE CAUSE

1. Clear the Annunciator and start the unit.
2. If the blower starts and the message SYSTEM FAULT PURGE INTERLOCKS is displayed proceed to section 8.7.4
3. If the blower does not start, and the message SYSTEM FAULT LOW AIR PRESSURE is displayed, proceed to section 8.7.2.
4. If the blower starts, and the message SYSTEM FAULT LOW AIR PRESSURE is displayed, proceed to section 8.7.3
5. If the unit does not fire, and the message SYS FLT is displayed on the temperature controller and the Annunciator, proceed to section 8.7.8.

8.7.2. BLOWER

1. Disconnect power to the unit
2. Remove the cover plate from the AC wiring box.
3. Locate wire #13 and the blower hot lead wire inside the AC wiring box. These will be the only two wires connected by a wire nut.
4. Remove the wire nut and separate wire #13 from the blower hot lead wire.
5. Connect an AC voltmeter between wire #18 and the unit frame.
6. Reconnect AC power to the unit.
7. Start the unit.
8. The AC voltmeter should display 120VAC.
9. If 120VAC is not displayed, replace the control panel.
10. If 120VAC is displayed, check the capacitor using an analog ohm meter or substitute the capacitor.
11. If the capacitor checks okay or is substituted and blower still does not start, replace the blower.

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 #17 and #24 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 15 pin connector from the control panel.

9. Referring to system schematic 161413 in Appendix H, locate wires #17 and #24 and check both for continuity.

10. Check the switch end of wires #17 and #24 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 #17 and #24 to the blower proof switch.

13. Reconnect the 15 pin 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 8.7.7.

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 8.7.6.

8.7.5 SSOV PROOF OF CLOSURE SWITCH

1. Disconnect AC power to the unit.

2. Loosen the two set screws 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 set screws.

4. Remove the electrical cover plate exposing the control wiring

5. Referring to the system schematic 161413 in Appendix H, remove wires #21 and #22 from the proof of closure switch.

6. Connect an ohm meter 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 ohm meter while pushing on the lever. Pushing downward on the lever should make continuity. Releasing the lever should break continuity.

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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 ohm meter.

13. If continuity is now okay, reconnect wires #21 and #22, 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 #21 and #22 from the proof of closure switch. Disconnect the 15 pin connector from the control panel.

17. Referring to system schematic 161413 in Appendix H, locate wires #21 and #22, check each for continuity using an ohm meter.

18. Check for loose connections.

19. Check wires #21 and #22 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 #21 and #22 to the proof of closure switch and reconnect the 15 pin 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 set screws.

23. Reconnect AC power to the unit.

24. Start the unit. If the condition still persists proceed to section 8.7.6.

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 8.8.7.

5. Disconnect AC power to the unit.

6. Referring to system schematic 161413, in Appendix H, locate wires #59 and #60. Remove wires #59 and #60 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 #59 and #60 were located

8. Manually depress the switch and check the ohm meter for continuity.

9. If the switch does not show continuity, replace the switch.

10. If the switch shows continuity disconnect the 12 pin connector from the control panel.

11. Referring to system schematic 161413 in Appendix H, locate wires #59 and #60. Check wires #59 and #60 for continuity.

12. Check for loose connectors at the switch end of wires #59 and #60.

13. Check the 12 pin connector end for worn and/or properly inserted pins.

14. If connections and continuity are okay, reconnect wire #59 and #60 to the air/fuel valve open switch. Reconnect the 12 pin connector to the control panel and start the unit.

15. If the fault persists, restart the unit and check for AC voltage at wires #59 and #60.

16. If 120 VAC is present, go to section 7.7.3.

17. If 120VAC is not present proceed to section 7.7.5.

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 12 pin connector from the control panel. Referring to schematic 161413 in Appendix H, check all wires for continuity.

7. Check all the pins in the 12 pin 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. Referring to Appendix I, Item #4, 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 ± 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 stepper motor driver board.

18. If the voltage remains at 15 volts ± 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.

8.8.8 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 161413 in Appendix H, locate wires #60 and #61. Remove wires #60 and #61 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.)

4. Place an ohm meter across the terminals of the switch, where wires #60 and #61 were located.

5. Manually depress the switch and check the ohm meter 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 the 12 pin connector from the control panel.

9. Referring to system schematic 161413 in Appendix H, locate wires #60 and #61. Check wires #60 and #61 for continuity.

10. Check for loose connectors at the switch end of wires #60 and #61.

11. Check the 12 pin connector end for worn and/or properly inserted pins.

12. If continuity, pins and connections are okay, reattach wire #60 and #61 to the air/fuel valve ignition position. Reconnect the 12 pin connector to the control panel and start the unit.

13. If the system fault still persists, contact your local AERCO representative.

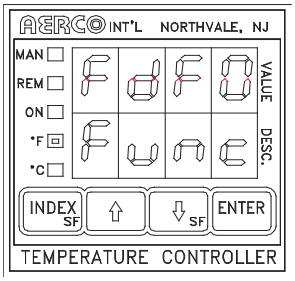
TEMPERATURE CONTROLLER QUICK REFERENCE PROGRAMMING GUIDE

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 ⇑ arrow key.

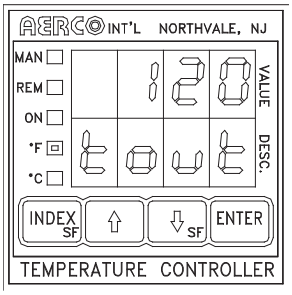
The display will indicate:



- **SECONDARY MENU to PRIMARY MENU**

Press INDEX and the ⇓ 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.

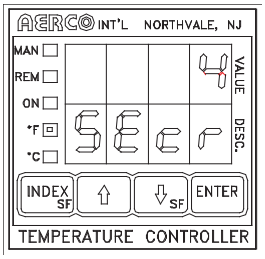
NOTE:
The number 120, shown above, is arbitrary. This number is dependent on the actual outlet water temperature of the unit being serviced.

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 ⇓ arrow key.
OR while in secondary menu press and hold ENTER and ⇑ for 5 seconds.

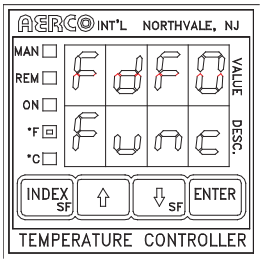
The display will indicate:



- **SECURE MENU to the SECONDARY MENU**

Pressing either, INDEX and ⇓ arrow key or ENTER and the ⇑ arrow key will return you to the SECONDARY menu.

The display will indicate:

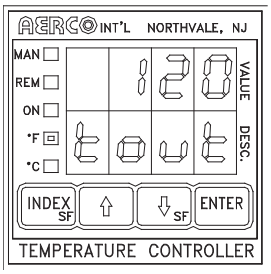


NOTE:
Anytime the SECURE menu is entered the unit will shut down. It will resume normal operation upon going back to the PRIMARY or SECONDARY menu.

- **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:



- **SCROLLING THROUGH MENU ITEMS**

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

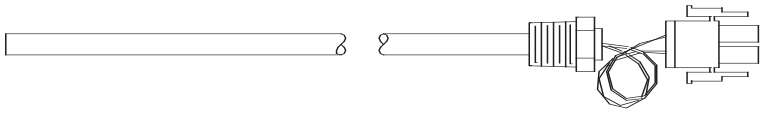
To scroll thru the PRIMARY, SECURE, or SECONDARY menus in reverse, simultaneously press INDEX and the ⇓ arrow key.

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.

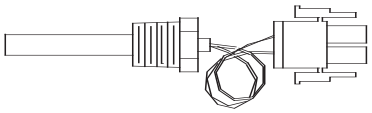
- **CHANGING MENU ITEM VALUES**

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.



SHELL SENSOR
AERCO PN 123448



BTU TRANSMITTER SENSOR (WATER HEATER ONLY)
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(Ohms)=.00161T^2+1.961T+854.841
T=°F

AERCO INTERNATIONAL, INC.
NORTHVALE, NJ 07647

KC1000 TEMPERATURE SENSORS
RESISTANCE CHART
RESISTANCE IN 10°F STEPS

DWN.BY JES DATE 022799
SCALE _____ SIZE _____
CHKD. _____ APPD. _____

AP−A−613

REV. C

INDOOR\OUTDOOR RESET RATIO CHARTS

Header Temperature for a Building Reference Temperature of 50F

	RESET RATIO									
Air Temp	**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

	RESET RATIO									
Air Temp	**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

	RESET RATIO									
Air Temp	**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

	RESET RATIO									
Air Temp	**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				

Header Temperature for a Building Reference Temperature of 75F

	RESET RATIO									
Air Temp	**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	17
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

	RESET RATIO									
Air Temp	**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					

Header Temperature for a Building Reference Temperature of 90F

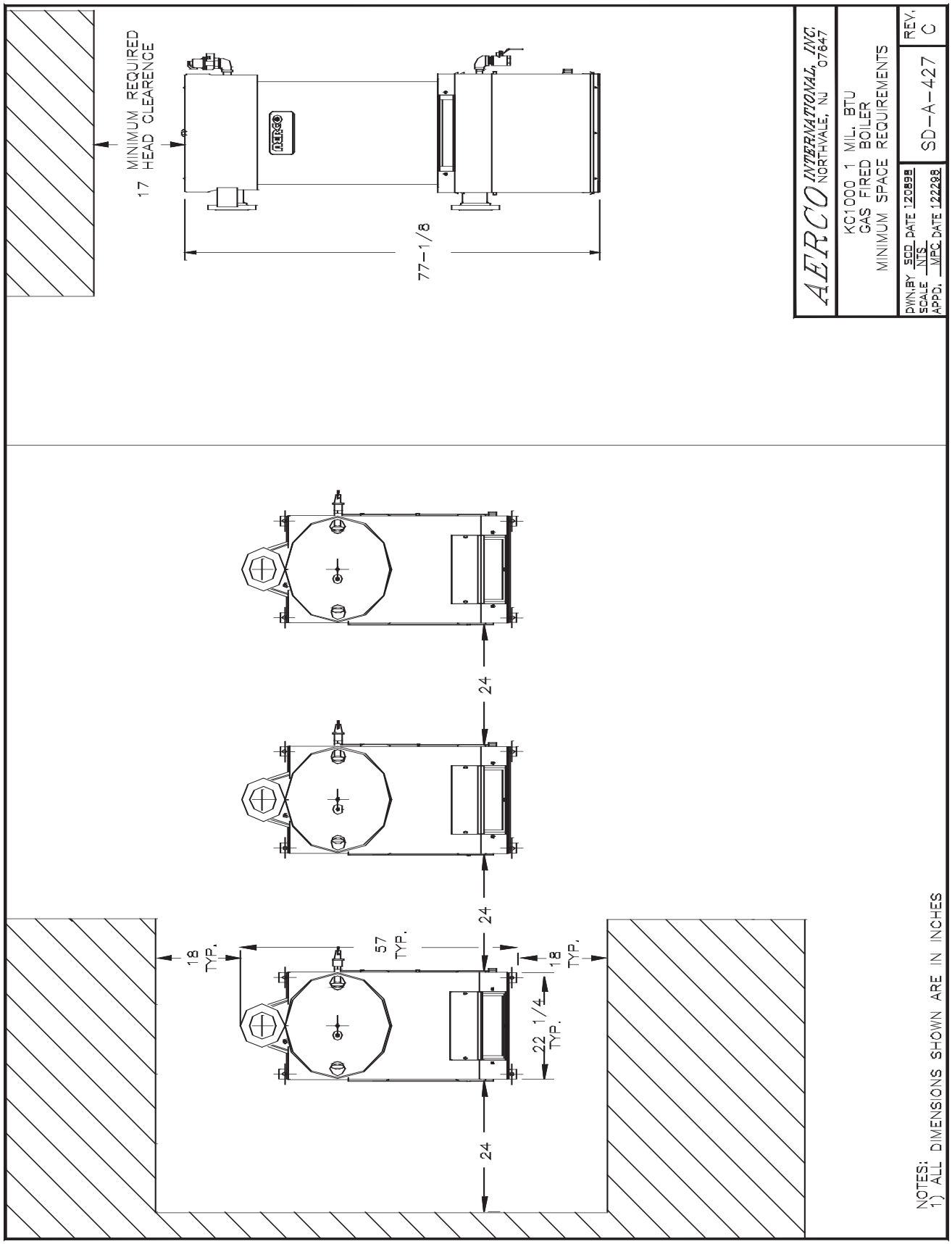
	RESET RATIO									
Air Temp	**0.6**	**0.8**	**1.0**	**1.2**	**1.4**	**1.6**	**1.8**	**2.0**	**2.2**	**2.4**
90F	90	90	90	90	90	90	90	90	90	90
85F	93	94	95	96	97	98	99	100	101	102
80F	96	98	100	102	104	106	108	110	112	114
75F	99	102	105	108	111	114	117	120	123	126
70F	102	106	110	114	118	122	126	130	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					

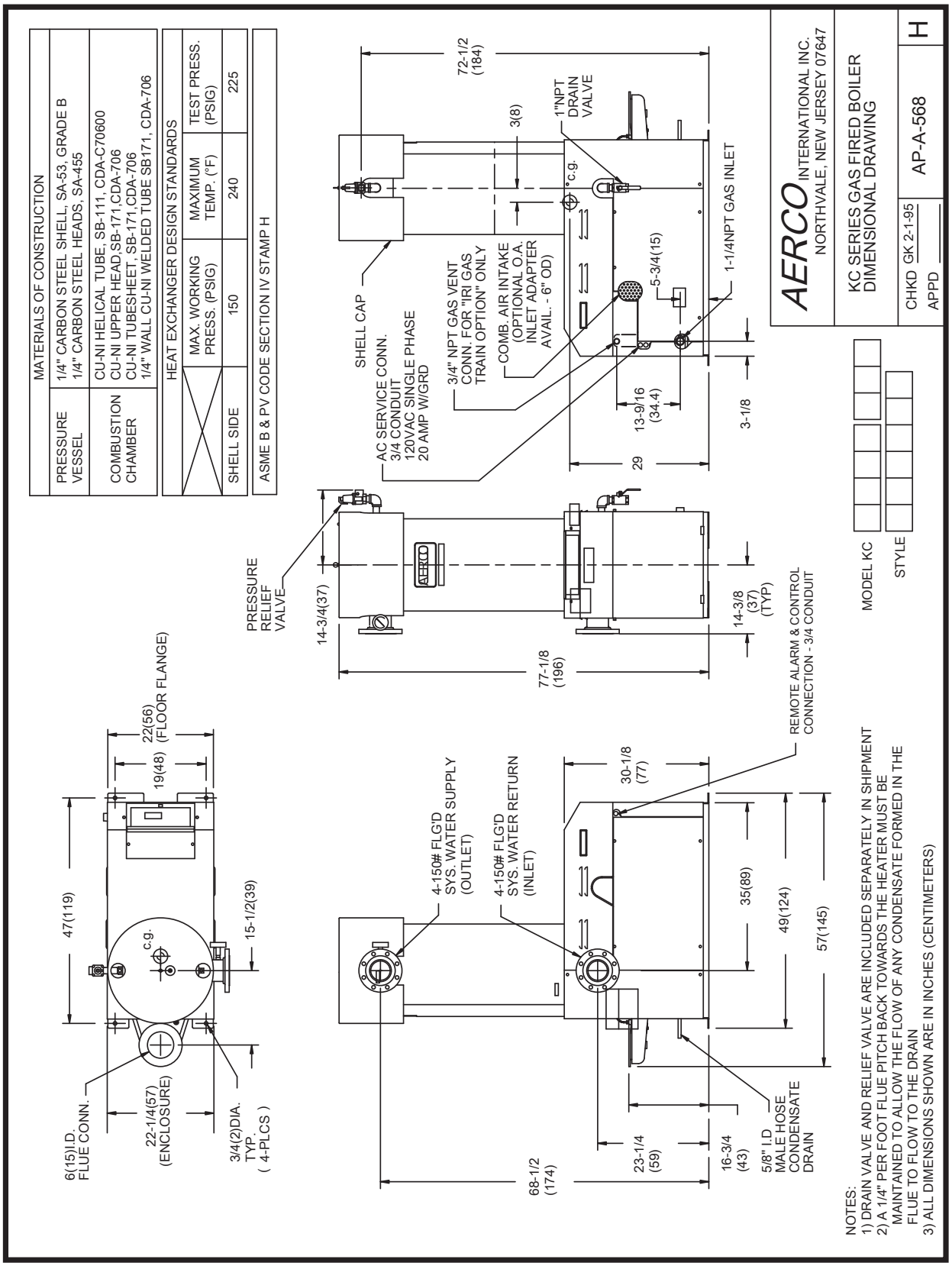
BOILER DEFAULT SETTINGS
CONSTANT SET POINT MODE

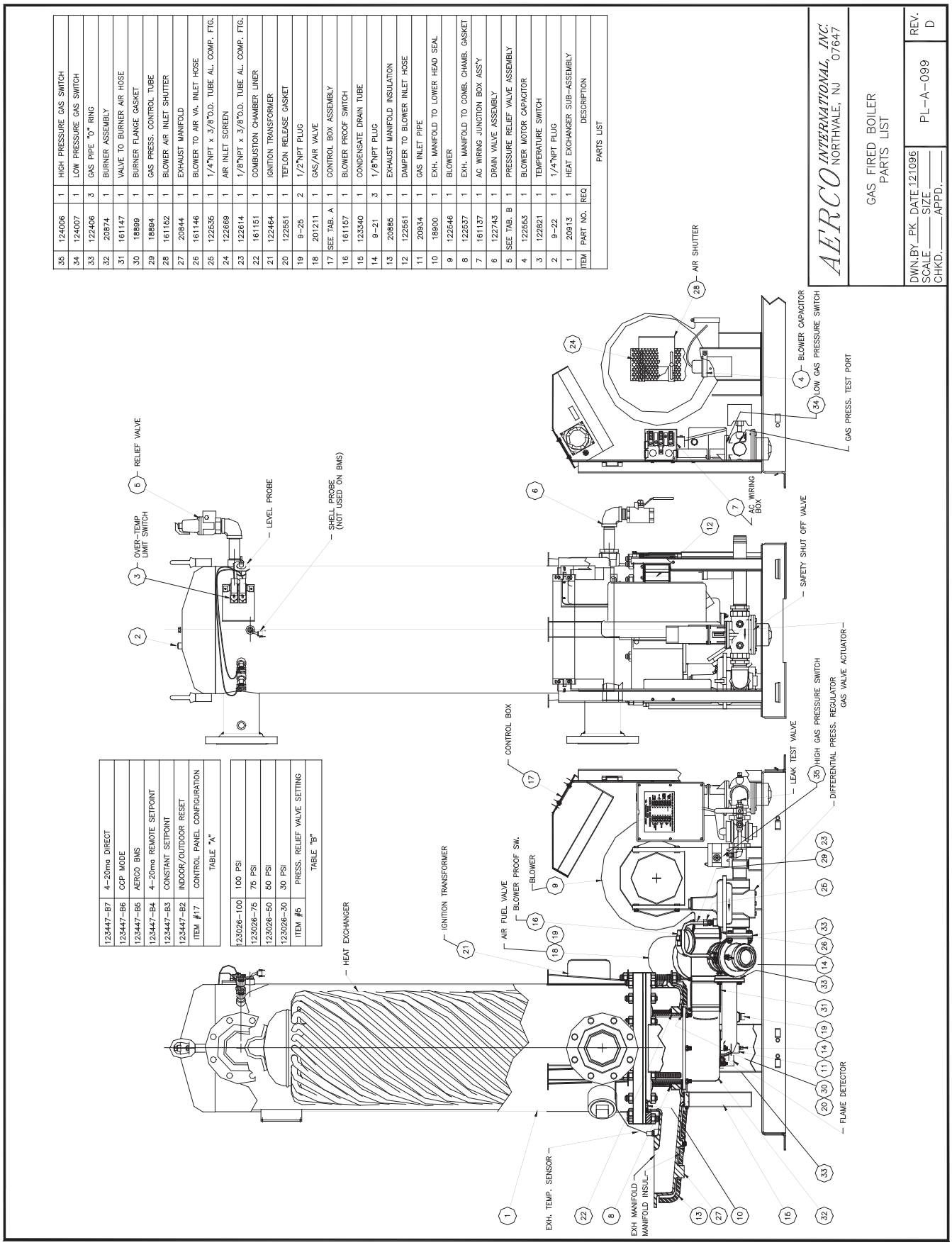
MENU LEVEL & CODE	DESCRIPTION OF CODE	FACTORY DEFAULT
PRIMARY MENU		
tout	OUTLET TEMPERATURE	ACTUAL
pct	PERCENTAGE OF FIRING RATE	ACTUAL
setp	UNIT'S SETPOINT TEMPERATURE	120
airt	OUTSIDE AIR TEMPERATURE	ACTUAL
auto	AUTOMATIC\MANUAL MODE	AUTO ON
SECONDARY MENU		
func	MODE OF OPERATION	CONT
OAST	OUTSIDE 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	16%
O2-C	START LEVEL	20%
FLTI	FAULT TIMER	0 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

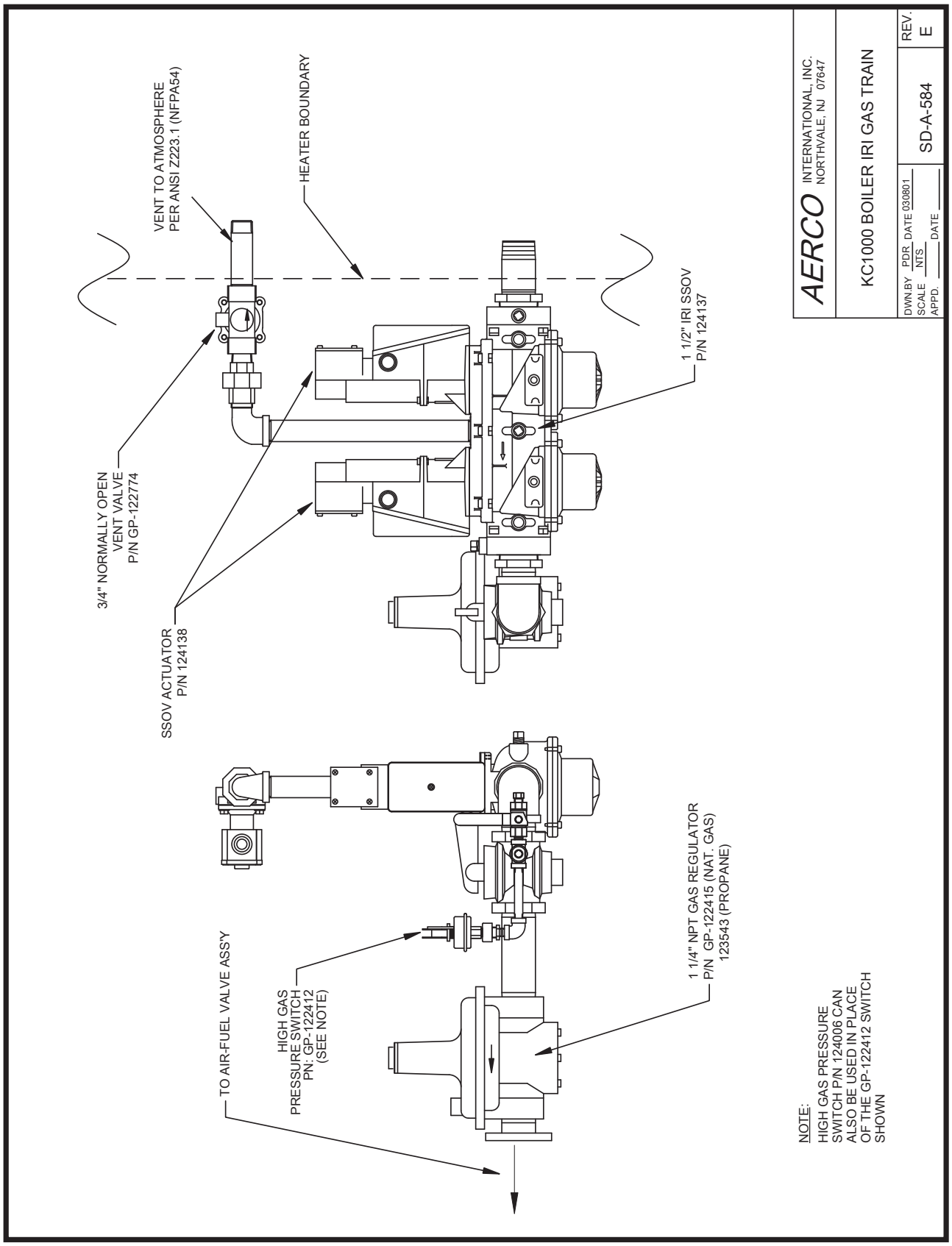
BOILER DEFAULT SETTINGS
INDOOR /OUTDOOR RESET MODE

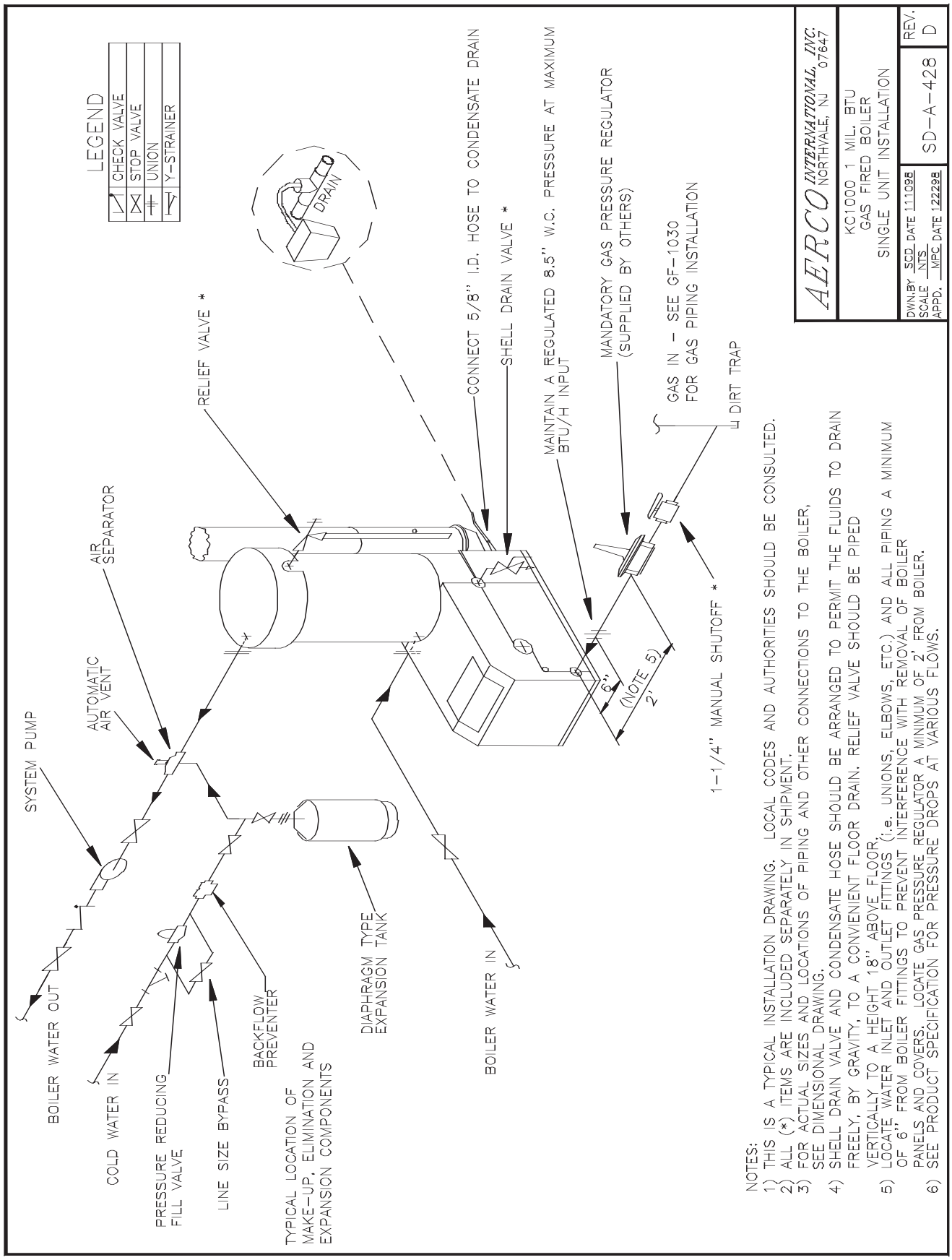
MENU LEVEL & CODE	DESCRIPTION OF CODE	DEFAULT VALUE
PRIMARY MENU		
tout	OUTLET TEMPERATURE	ACTUAL
Pct	PERCENTAGE OF FIRE RATE	ACTUAL
SEtP	UNIT'S SETPOINT TEMPERATURE	120
Airt	OUTSIDE AIR TEMPERATURE	ACTUAL
Auto	AUTO\MANUAL MODE	AUTO ON
SECONDARY MENU		
Func	MODE OF OPERATION	OART
rEFt	BUILDING REFERENCE 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	16%
O2-C	START LEVEL	20%
FLti	FAULT TIMER	0 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

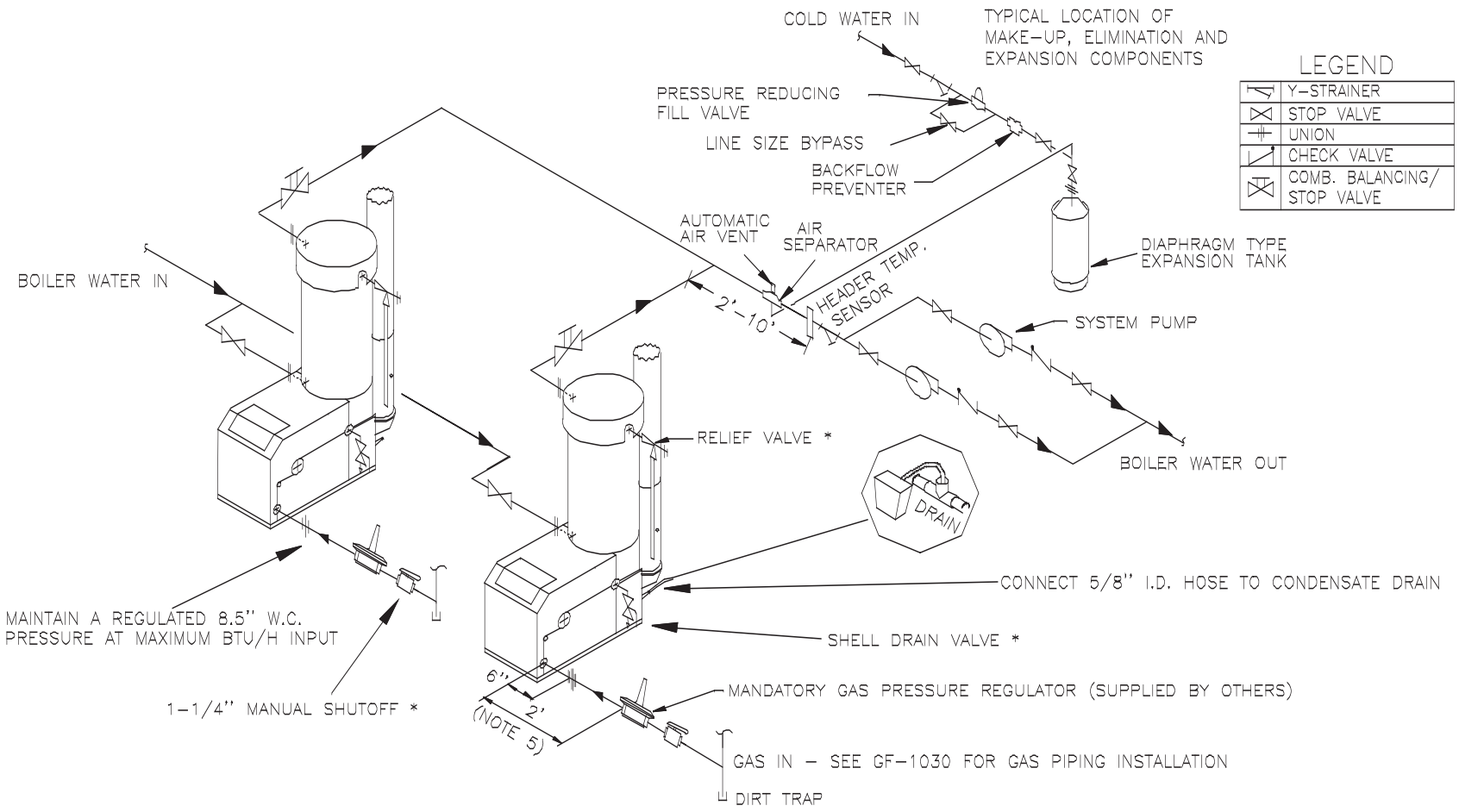

MINIMUM REQUIRED
17 HEAD CLEARENCE
77-1/8
AERCO INTERNATIONAL, INC.
NORTHVALE, NJ 07647
KC1000 1 MIL. BTU
GAS FIRED BOILER
MINIMUM SPACE REQUIREMENTS
DWN. BY SCD DATE 120898
SCALE NTS
APPD. MPC DATE 122298
SD-A-427
REV. C
24
24
24
18 TYP.
57 TYP.
18 TYP.
22 1/4 TYP.
NOTES:
1) ALL DIMENSIONS SHOWN ARE IN INCHES


MATERIALS OF CONSTRUCTION
PRESSURE VESSEL
1/4" CARBON STEEL SHELL, SA-53, GRADE B
1/4" CARBON STEEL HEADS, SA-455
COMBUSTION CHAMBER
CU-NI HELICAL TUBE, SB-111, CDA-C70600
CU-NI UPPER HEAD,SB-171,CDA-706
CU-NI TUBESHEET, SB-171,CDA-706
1/4" WALL CU-NI WELDED TUBE SB171, CDA-706
HEAT EXCHANGER DESIGN STANDARDS
MAX. WORKING PRESS. (PSIG)
MAXIMUM TEMP. (°F)
TEST PRESS. (PSIG)
SHELL SIDE
150
240
225
ASME B & PV CODE SECTION IV STAMP H
AERCO INTERNATIONAL INC.
NORTHVALE, NEW JERSEY 07647
KC SERIES GAS FIRED BOILER
DIMENSIONAL DRAWING
CHKD GK 2-1-95
APPD
AP-A-568
H
MODEL KC
STYLE
SHELL CAP
AC SERVICE CONN.
3/4 CONDUIT
120VAC SINGLE PHASE
20 AMP W/GRD
3/4" NPT GAS VENT
CONN. FOR "IRI GAS
TRAIN OPTION" ONLY
COMB. AIR INTAKE
(OPTIONAL O.A.
INLET ADAPTER
AVAIL. - 6" OD)
72-1/2
(184)
3(8)
1"NPT
DRAIN
VALVE
c.g.
5-3/4(15)
1-1/4NPT GAS INLET
13-9/16
(34.4)
29
3-1/8
PRESSURE
RELIEF
VALVE
14-3/4(37)
14-3/8
(37)
(TYP)
77-1/8
(196)
REMOTE ALARM & CONTROL
CONNECTION - 3/4 CONDUIT
4-150# FLG'D
SYS. WATER SUPPLY
(OUTLET)
4-150# FLG'D
SYS. WATER RETURN
(INLET)
30-1/8
(77)
35(89)
49(124)
57(145)
68-1/2
(174)
23-1/4
(59)
16-3/4
(43)
5/8" I.D
MALE HOSE
CONDENSATE
DRAIN
6(15)I.D.
FLUE CONN.
47(119)
22(56)
(FLOOR FLANGE)
19(48)
c.g.
15-1/2(39)
22-1/4(57)
(ENCLOSURE)
3/4(2)DIA.
TYP.
(4-PLCS)
NOTES:
1) DRAIN VALVE AND RELIEF VALVE ARE INCLUDED SEPARATELY IN SHIPMENT
2) A 1/4" PER FOOT FLUE PITCH BACK TOWARDS THE HEATER MUST BE
MAINTAINED TO ALLOW THE FLOW OF ANY CONDENSATE FORMED IN THE
FLUE TO FLOW TO THE DRAIN
3) ALL DIMENSIONS SHOWN ARE IN INCHES (CENTIMETERS)


AERCO INTERNATIONAL, INC.
NORTHVALE, NJ 07647
GAS FIRED BOILER
PARTS LIST
DWN.BY PK DATE 121096
SCALE ____ SIZE ____
CHKD. ____ APPD. ____
PL-A-099
REV. D
PARTS LIST
ITEM | PART NO. | REQ | DESCRIPTION
1 | 20913 | 1 | HEAT EXCHANGER SUB-ASSEMBLY
2 | 9-22 | 1 | 1/4"NPT PLUG
3 | 122821 | 1 | TEMPERATURE SWITCH
4 | 122653 | 1 | BLOWER MOTOR CAPACITOR
5 | SEE TAB. B | 1 | PRESSURE RELIEF VALVE ASSEMBLY
6 | 122743 | 1 | DRAIN VALVE ASSEMBLY
7 | 161137 | 1 | AC WIRING JUNCTION BOX ASS'Y
8 | 122637 | 1 | EXH. MANIFOLD TO COMB. CHAMB. GASKET
9 | 122546 | 1 | BLOWER
10 | 18900 | 1 | EXH. MANIFOLD TO LOWER HEAD SEAL
11 | 20934 | 1 | GAS INLET PIPE
12 | 122561 | 1 | DAMPER TO BLOWER INLET HOSE
13 | 20985 | 1 | EXHAUST MANIFOLD INSULATION
14 | 9-21 | 3 | 1/8"NPT PLUG
15 | 123340 | 1 | CONDENSATE DRAIN TUBE
16 | 161167 | 1 | BLOWER PROOF SWITCH
17 | SEE TAB. A | 1 | CONTROL BOX ASSEMBLY
18 | 201211 | 1 | GAS/AIR VALVE
19 | 9-25 | 2 | 1/2"NPT PLUG
20 | 122561 | 1 | TEFLON RELEASE GASKET
21 | 122464 | 1 | IGNITION TRANSFORMER
22 | 161146 | 1 | BLOWER TO AIR VAL INLET HOSE
23 | 122614 | 1 | 1/8"NPT x 3/8"O.D. TUBE AL. COMP. FTG.
24 | 122669 | 1 | AIR INLET SCREEN
25 | 122535 | 1 | 1/4"NPT x 3/8"O.D. TUBE AL. COMP. FTG.
26 | 161146 | 1 | EXHAUST MANIFOLD
27 | 20844 | 1 | BLOWER AIR INLET SHUTTER
28 | 161162 | 1 | BLOWER AIR INLET SHUTTER
29 | 18894 | 1 | GAS PRESS. CONTROL TUBE
30 | 18899 | 1 | BURNER FLANGE GASKET
31 | 161147 | 1 | VALVE TO BURNER AIR HOSE
32 | 20874 | 1 | BURNER ASSEMBLY
33 | 122406 | 3 | GAS PIPE "O" RING
34 | 124007 | 1 | LOW PRESSURE GAS SWITCH
35 | 124006 | 1 | HIGH PRESSURE GAS SWITCH
TABLE "A"
ITEM #17 | CONTROL PANEL CONFIGURATION
123447-B2 | INDOOR/OUTDOOR RESET
123447-B3 | CONSTANT SETPOINT
123447-B4 | 4-20ma REMOTE SETPOINT
123447-B5 | AEROC BMS
123447-B6 | CCP MODE
123447-B7 | 4-20ma DIREGT
TABLE "B"
ITEM #5 | PRESS. RELIEF VALVE SETTING
123026-30 | 30 PSI
123026-50 | 50 PSI
123026-75 | 75 PSI
123026-100 | 100 PSI
1 EXH. TEMP. SENSOR
2 LEVEL PROBE
3 OVER-TEMP LIMIT SWITCH
4 BLOWER CAPACITOR
6 RELIEF VALVE
7 AC WIRING BOX
8 EXH MANIFOLD MANIFOLD INSUL.
9 BLOWER
10 FLAME DETECTOR
11 SHELL PROBE (NOT USED ON BMS)
12 SAFETY SHUT OFF VALVE
13 HEAT EXCHANGER
15 GAS VALVE ACTUATOR
16 AIR FUEL VALVE
17 CONTROL BOX
18 BLOWER PROOF SW.
19 DIFFERENTIAL PRESS. REGULATOR
20 IGNITION TRANSFORMER
21 HIGH GAS PRESSURE SWITCH
22 LEAK TEST VALVE
23 LOW GAS PRESSURE SWITCH
24 GAS PRESS. TEST PORT
25 AIR SHUTTER

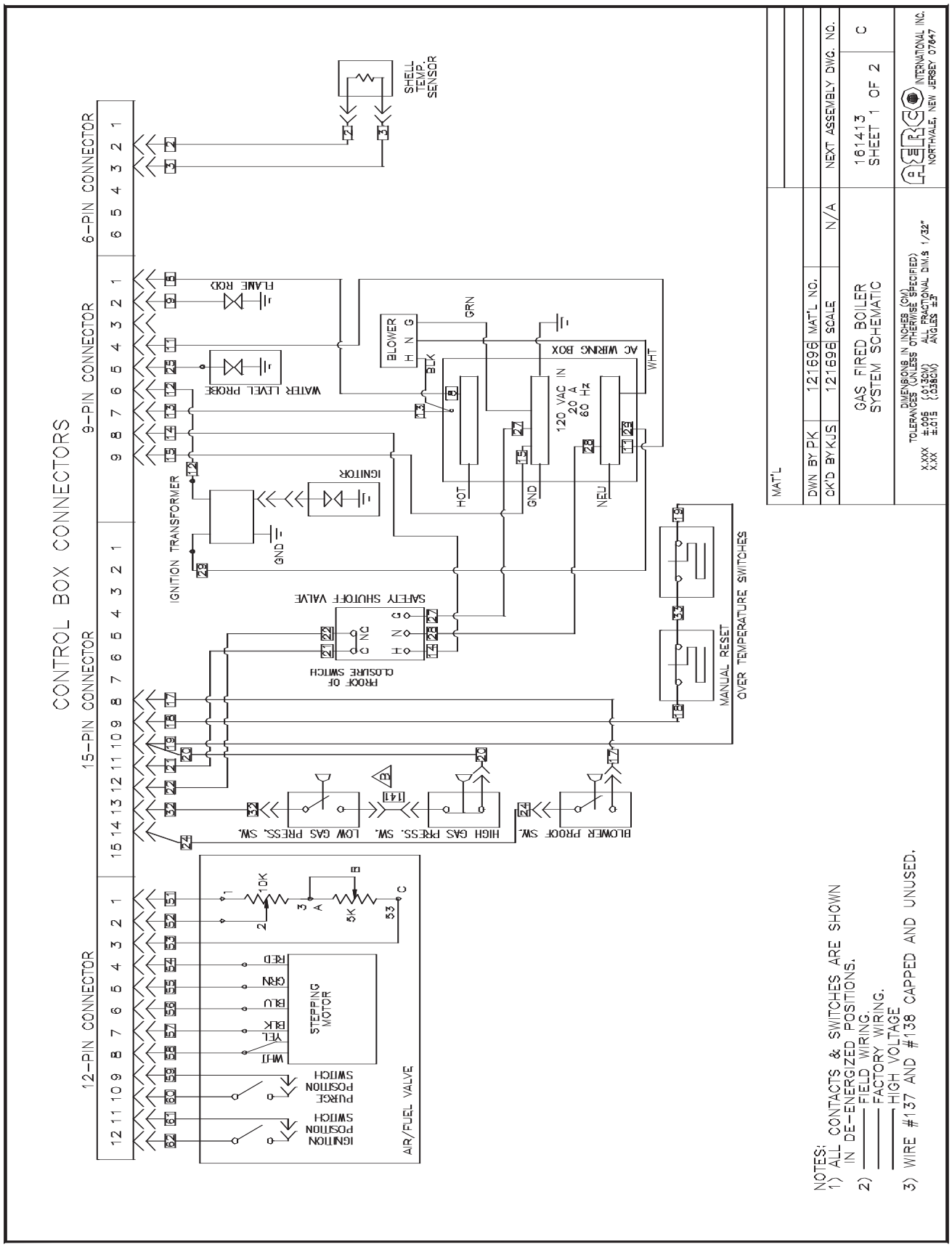

VENT TO ATMOSPHERE
PER ANSI Z223.1 (NFPA54)
HEATER BOUNDARY
3/4" NORMALLY OPEN
VENT VALVE
P/N GP-122774
SSOV ACTUATOR
P/N 124138
1 1/2" IRI SSOV
P/N 124137
TO AIR-FUEL VALVE ASS'Y
HIGH GAS
PRESSURE SWITCH
PN: GP-122412
(SEE NOTE)
1 1/4" NPT GAS REGULATOR
P/N GP-122415 (NAT. GAS)
123543 (PROPANE)
NOTE:
HIGH GAS PRESSURE
SWITCH P/N 124006 CAN
ALSO BE USED IN PLACE
OF THE GP-122412 SWITCH
SHOWN
AERCO INTERNATIONAL, INC.
NORTHVALE, NJ 07647
KC1000 BOILER IRI GAS TRAIN
DWN.BY PDR DATE 030801
SCALE NTS
APPD. DATE
SD-A-584
REV. E


LEGEND
CHECK VALVE
STOP VALVE
UNION
Y-STRAINER
DRAIN
RELIEF VALVE *
CONNECT 5/8" I.D. HOSE TO CONDENSATE DRAIN
SHELL DRAIN VALVE *
MAINTAIN A REGULATED 8.5" W.C. PRESSURE AT MAXIMUM BTU/H INPUT
MANDATORY GAS PRESSURE REGULATOR (SUPPLIED BY OTHERS)
GAS IN - SEE GF-1030 FOR GAS PIPING INSTALLATION
DIRT TRAP
1-1/4" MANUAL SHUTOFF *
6"
2' (NOTE 5)
AIR SEPARATOR
AUTOMATIC AIR VENT
SYSTEM PUMP
BOILER WATER OUT
COLD WATER IN
PRESSURE REDUCING FILL VALVE
LINE SIZE BYPASS
BACKFLOW PREVENTER
TYPICAL LOCATION OF MAKE-UP, ELIMINATION AND EXPANSION COMPONENTS
DIAPHRAGM TYPE EXPANSION TANK
BOILER WATER IN
NOTES:
1) THIS IS A TYPICAL INSTALLATION DRAWING. LOCAL CODES AND AUTHORITIES SHOULD BE CONSULTED.
2) ALL (*) ITEMS ARE INCLUDED SEPARATELY IN SHIPMENT.
3) FOR ACTUAL SIZES AND LOCATIONS OF PIPING AND OTHER CONNECTIONS TO THE BOILER, SEE DIMENSIONAL DRAWING.
4) SHELL DRAIN VALVE AND CONDENSATE HOSE SHOULD BE ARRANGED TO PERMIT THE FLUIDS TO DRAIN FREELY, BY GRAVITY, TO A CONVIENIENT FLOOR DRAIN. RELIEF VALVE SHOULD BE PIPED VERTICALLY TO A HEIGHT 18" ABOVE FLOOR.
5) LOCATE WATER INLET AND OUTLET FITTINGS (i.e. UNIONS, ELBOWS, ETC.) AND ALL PIPING A MINIMUM OF 6" FROM BOILER FITTINGS TO PREVENT INTERFERENCE WITH REMOVAL OF BOILER PANELS AND COVERS. LOCATE GAS PRESSURE REGULATOR A MINIMUM OF 2' FROM BOILER.
6) SEE PRODUCT SPECIFICATION FOR PRESSURE DROPS AT VARIOUS FLOWS.
AERCO INTERNATIONAL, INC. NORTHVALE, NJ 07647
KC1000 1 MIL. BTU
GAS FIRED BOILER
SINGLE UNIT INSTALLATION
DWN. BY SCD DATE 111098
SCALE NTS
APPD. MPC DATE 122298
SD-A-428
REV. D

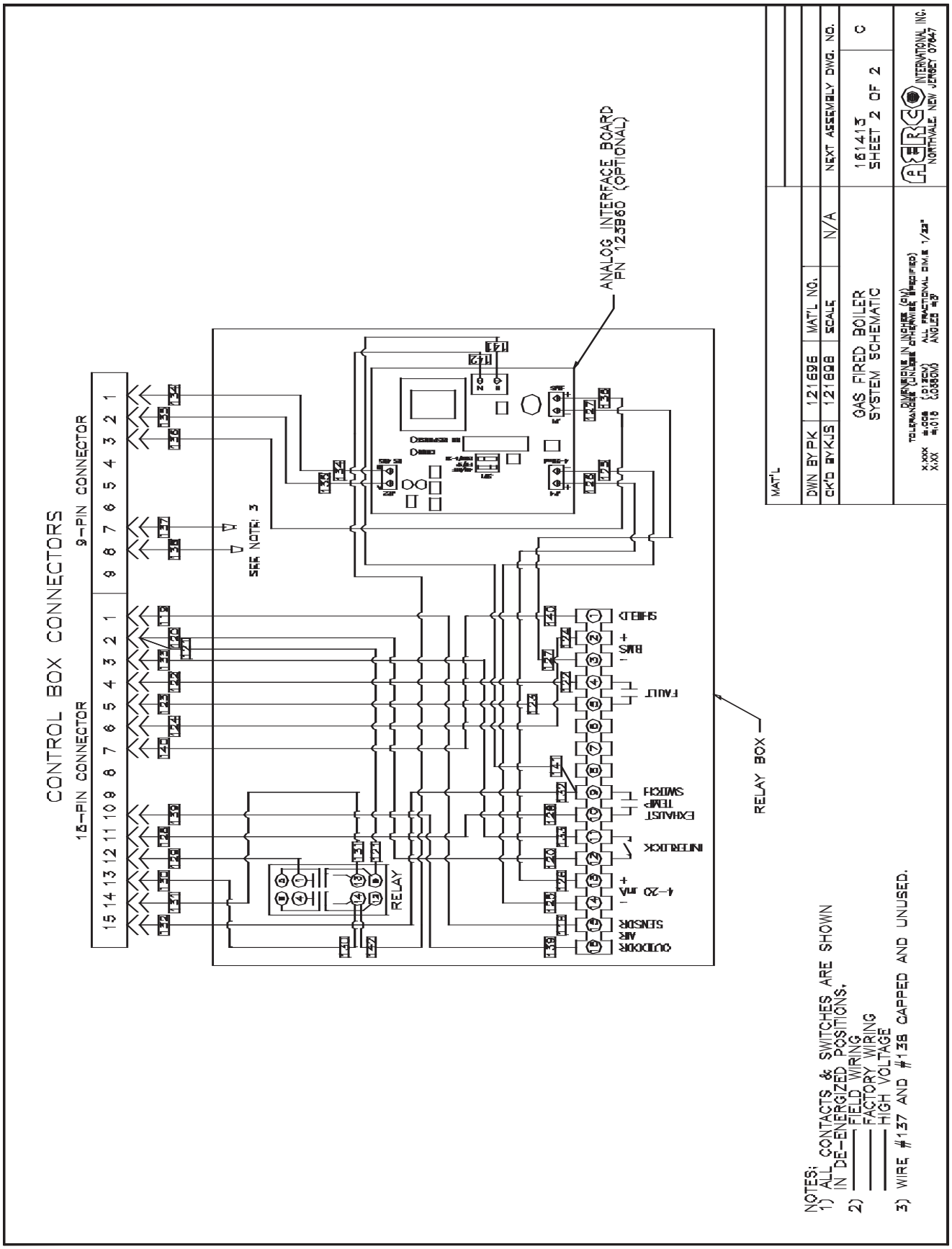


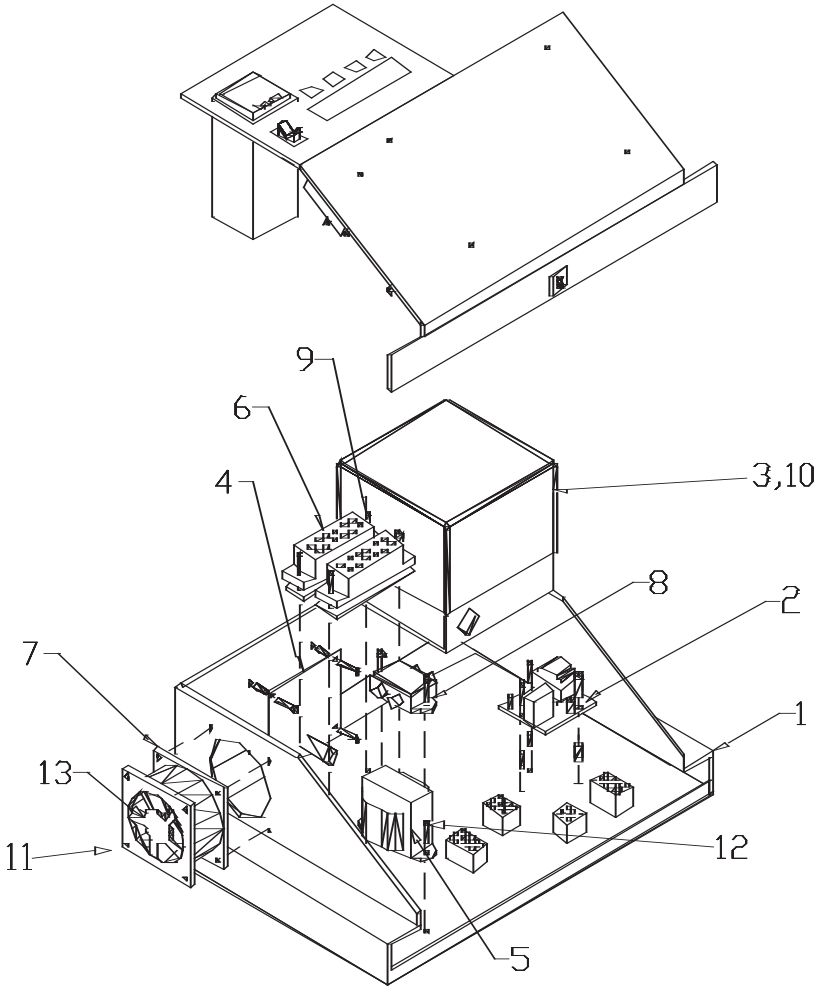
NOTES:
1) THIS IS A TYPICAL INSTALLATION DRAWING. LOCAL CODES AND AUTHORITIES SHOULD BE CONSULTED.
2) ALL (*) ITEMS ARE INCLUDED SEPARATELY IN SHIPMENT.
3) FOR ACTUAL SIZES AND LOCATIONS OF PIPING AND OTHER CONNECTIONS TO THE BOILER, SEE DIMENSIONAL DRAWING.
4) SHELL DRAIN VALVE AND CONDENSATE HOSE SHOULD BE ARRANGED TO PERMIT THE FLUIDS TO DRAIN FREELY, BY GRAVITY, TO A CONVIENIENT FLOOR DRAIN. RELIEF VALVE SHOULD BE PIPED VERTICALLY TO A HEIGHT 18" ABOVE FLOOR.
5) LOCATE WATER INLET AND OUTLET FITTINGS (i.e. UNIONS, ELBOWS, ETC.) AND ALL PIPING A MINIMUM OF 6" FROM BOILER FITTINGS TO PREVENT INTERFERENCE WITH REMOVAL OF BOILER PANELS AND COVERS. LOCATE GAS PRESSURE REGULATOR A MINIMUM OF 2' FROM BOILER.
6) SEE PRODUCT SPECIFICATION FOR PRESSURE DROPS AT VARIOUS FLOWS.
7) BOILERS SHOULD BE PIPED REVERSE RETURN AS SHOWN OR BALANCING DEVICES ON THE OUTLETS OF THE HEATERS SHOULD BE EMPLOYED.

AERCO INTERNATIONAL, INC. NORTHVALE, NJ 07647		
KC1000 1 MIL. BTU GAS FIRED BOILER MULTIPLE UNIT INSTALLATION		
DWN.BY SCD DATE 110598 SCALE NTS APPD. MPC DATE 122298	SD-A-439	REV. B


CONTROL BOX CONNECTORS
12-PIN CONNECTOR
15-PIN CONNECTOR
9-PIN CONNECTOR
6-PIN CONNECTOR
SHELL TEMP. SENSOR
FLAME ROD
WATER LEVEL PROBE
IGNITOR
IGNITION TRANSFORMER
GND
BLOWER
H N G
BLK
GRN
AC WIRING BOX
120 VAC IN
20 A
60 Hz
HOT
GND
NEU
WHT
SAFETY SHUTOFF VALVE
PROOF OF CLOSURE SWITCH
MANUAL RESET OVER TEMPERATURE SWITCHES
LOW GAS PRESS. SW.
HIGH GAS PRESS. SW.
BLOWER PROOF SW.
AIR/FUEL VALVE
STEPPING MOTOR
RED
GRN
BLU
BLK
YEL
WHT
PURGE POSITION SWITCH
IGNITION POSITION SWITCH
10K
5K
NOTES:
1) ALL CONTACTS & SWITCHES ARE SHOWN IN DE-ENERGIZED POSITIONS.
2) ——— FIELD WIRING.
——— FACTORY WIRING.
——— HIGH VOLTAGE
3) WIRE #137 AND #138 CAPPED AND UNUSED.
MAT'L
DWN BY PK | 121696 | MAT'L NO.
CK'D BY KJS | 121696 | SCALE | N/A
GAS FIRED BOILER
SYSTEM SCHEMATIC
NEXT ASSEMBLY DWG. NO.
181413
SHEET 1 OF 2
C
DIMENSIONS IN INCHES (CM)
TOLERANCES UNLESS OTHERWISE SPECIFIED)
X.XXX ±.005 (±.13CM)
X.XX ±.015 (±.38CM)
ANG. FRACTIONAL DIM.'S 1/32"
ANGLES ±2°
AERCO INTERNATIONAL INC.
NORTHVALE, NEW JERSEY 07647

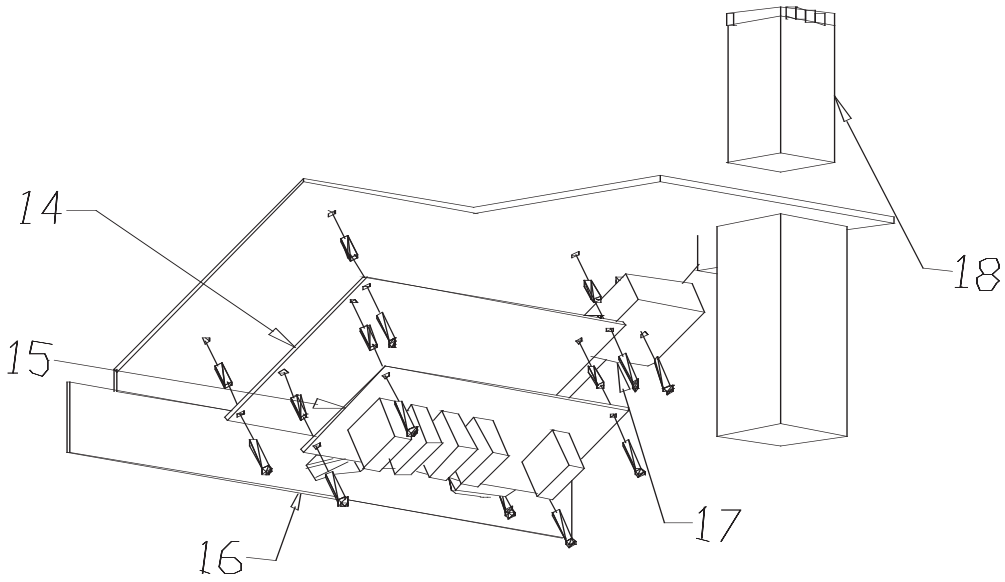
APPENDIX H

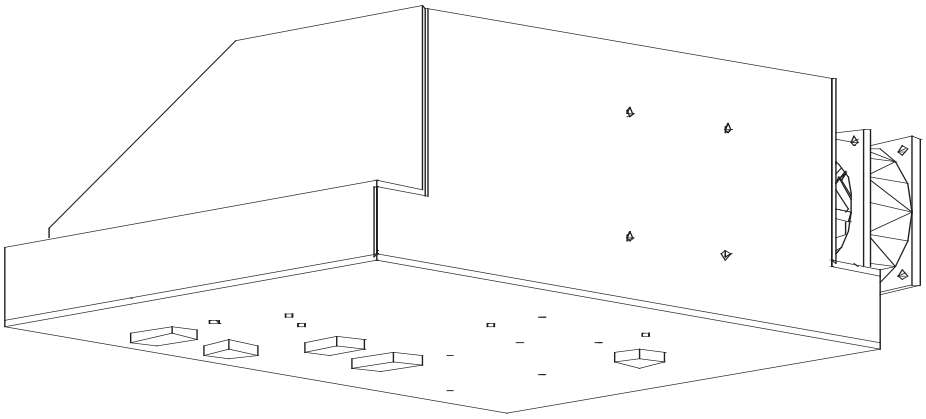

CONTROL BOX CONNECTORS
15-PIN CONNECTOR
9-PIN CONNECTOR
ANALOG INTERFACE BOARD
PN 123960 (OPTIONAL)
SEE NOTE: 3
RELAY BOX
RELAY
SHIELD
BMS
FAULT
EXHAUST TEMP SWITCH
INTERLOCK
4-20 mA
OUTDOOR AIR SENSOR
NOTES:
1) ALL CONTACTS & SWITCHES ARE SHOWN IN DE-ENERGIZED POSITIONS.
2) ——— FIELD WIRING
——— FACTORY WIRING
——— HIGH VOLTAGE
3) WIRE #137 AND #138 CAPPED AND UNUSED.
MAT'L
DWN BY PK
121696
MAT'L NO.
CK'D BY KJS
121698
SCALE
N/A
NEXT ASSEMBLY DWG. NO.
GAS FIRED BOILER
SYSTEM SCHEMATIC
161413
SHEET 2 OF 2
C
AERCO INTERNATIONAL, INC.
NORTHVALE, NEW JERSEY 07647



13	123446	FAN GUARD
12	123402	#6-32 X 3/8 LG PAN HEAD MACH. SCREW
11	123459	#6-32 X 2 LG PAN HEAD MACH. SCREW
10	123452	#8-32 X 5/16 LG PAN HEAD MACH. SCREW
9	123437	#6-32 X 5/8 LG PAN HEAD MACH. SCREW
8	123389	LINE FILTER
7	123436	FAN
6	123393	TERMINAL BLOCK
5	123388	TRANSFORMER
4	123399	VALVE INTERFACE BOARD
3	123747	HONEYWELL FLAME RECIFICATION AMPLIFIER
	123746	HONEYWELL PURGE TIMER
	123745	HONEYWELL MODULE BASE
	123744	HONEYWELL RELAY MODULE
2	123435	LOW WATER CUT OFF
1	201076	CONTROL BOX BASE
ITEM	PART NUMBER	DESCRIPTION

PARTS LIST





18	123280-B_	TEMPERATURE CONTROLLER (NEED STYLE NUMBER)
17	123803	SOLID STATE TIMER-ARTISAN CORP(123469 FOR SSAC INC.)
16	123438	CIRCUIT BREAKER
15	123391	RELAY BOARD
14	123390	STATUS ANNUNCIATOR
ITEM	PART NUMBER	DESCRIPTION

PARTS LIST