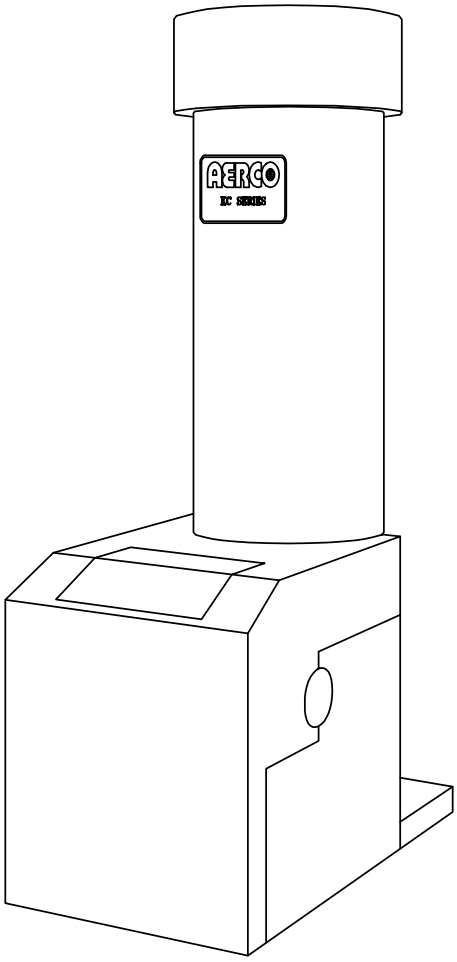
Instruction No. **GF-109LN**

AERCO INTERNATIONAL, Inc., Northvale, New Jersey, 07647 USA

Installation, Operation & Maintenance Instructions

KC Series Gas Fired Low NOx Boiler System



Natural Gas and Propane Fired,
Condensing and Forced Draft Hot Water Boiler
970,000 BTU/HR Input (Natural Gas)
1,000,000 BTU/HR Input (Propane)

Applicable to Serial Numbers G-03-807 and above

Patent No. 4,852,524

REVISED JANUARY, 2009

Telephone Support

Direct to AERCO Technical Support
(8am to 5 pm EST, Monday - Friday):

1-800-526-0288

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CONTENTS

GF-109LN - AERCO KC1000 GAS FIRED LOW NOx BOILER
Operating & Maintenance Instructions

CONTENTS

SECTION 6 – SAFETY DEVICE TESTING PROCEDURES 6-1

SECTION 7 – MAINTENANCE 7-1

SECTION 8 – TROUBLESHOOTING 8-1

APPENDICES

WARRANTIES W-1

Foreword

This system can be operated using natural gas or propane fuel. A simple spring change in the differential regulator and combustion calibration is all that is needed to switch fuels.

The AERCO KC Low NOx 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 11:1 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.

When installed and operated on natural gas in accordance with this Instruction Manual, the KC Boiler complies with the NOx emission standards outlined in:

- South Coast Air Quality Management District (SCAQMD), Rule 1146.2
- Texas Commission on Environmental Quality (TCEQ), Title 30, Chapter 117, Rule117.465.

In addition, when operated using propane fuel, the KC Boiler is certified by AERCO to provide NOx emissions of less than 30 ppm at full rated input.

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 KC Boiler control system offer selectable modes of operation and interface capabilities.

After prolonged shutdown, it is recommended that the startup procedures in Section 4 and the safety device 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 KC 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

1.1 WARNINGS & CAUTIONS

Installers and operating personnel MUST, at all times, observe all safety regulations. The following warnings and cautions are general and must be given the same attention as specific precautions included in these instructions. In addition to all the requirements included in this AERCO Instruction Manual, the installation of units MUST conform with local building codes, or, in the absence of local codes, ANSI Z223.1 (National Fuel Gas Code Publication No. NFPA-54) for gas-fired boilers and ANSI/NFPASB for LP gas-fired boilers. Where applicable, the equipment shall be installed in accordance with the current Installation Code for Gas Burning Appliances and Equipment, CGA B149, and applicable Provincial regulations for the class; which should be carefully followed in all cases. Authorities having jurisdiction should be consulted before installations are made.

IMPORTANT

This Instruction Manual is an integral part of the product and must be maintained in legible condition. It must be given to the user by the installer and kept in a safe place for future reference.

WARNINGS!

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

WARNING!

BEFORE ATTEMPTING TO PERFORM ANY MAINTENANCE ON THE UNIT, SHUT OFF ALL GAS AND ELECTRICAL INPUTS TO THE UNIT.

WARNING!

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

WARNING

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

WARNING!

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

WARNING!

ELECTRICAL VOLTAGES OF 120 VAC ARE USED IN THIS EQUIPMENT. THEREFORE THE COVER ON THE UNIT'S POWER BOX (LOCATED ON THE FRONT RIGHT SIDE OF THE UNIT UNDER THE HOOD AND SHEET METAL SIDE PANEL) MUST BE INSTALLED AT ALL TIMES, EXCEPT DURING MAINTENANCE AND SERVICING.

CAUTIONS!

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

CAUTION!

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

CAUTION!

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

1.2 EMERGENCY SHUTDOWN

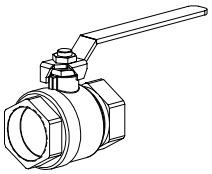
If overheating occurs or the gas supply fails to shut off, close the manual gas shutoff valve (Figure 1-1) located external to the unit.

IMPORTANT

The Installer must identify and indicate the location of the emergency shutdown manual gas valve to operating personnel.

1.3 PROLONGED SHUTDOWN

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



MANUAL GAS SHUTOFF VALVE

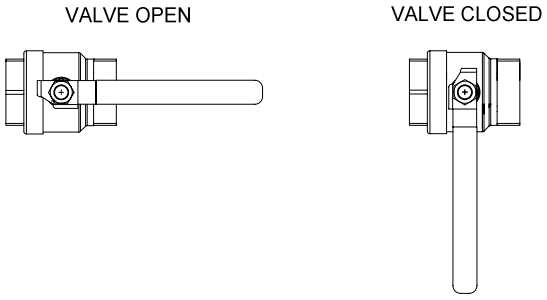


Figure 1-1

Manual Gas Shutoff Valve

SECTION 2 - INSTALLATION PROCEDURES

2.1. RECEIVING THE UNIT

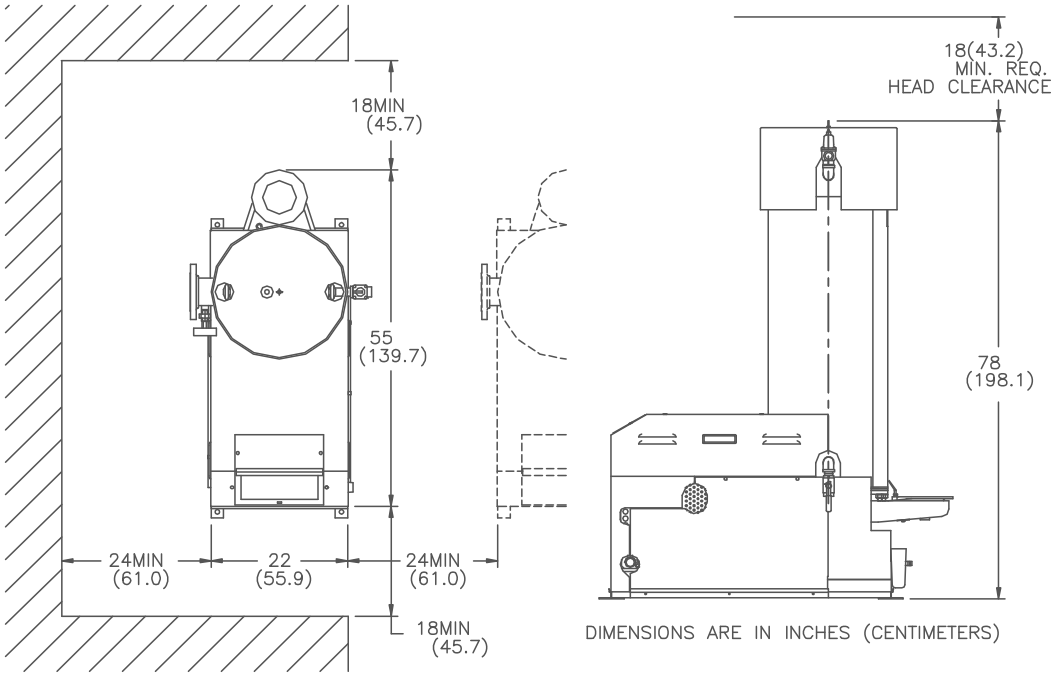
Each KC1000 Boiler is shipped as a single crated unit. The crated shipping weight of the unit is approximately 1500 pounds, and must be moved with the proper rigging equipment for safety and to avoid damages. The unit should be completely inspected for shipping damage and completeness at the time of 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. 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
- Differential Regulator Spring:
  P/N 122548 (Propane) or
  P/N 124803 (Natural Gas)
- Ignitor Removal Tool (One per Site)
- Regulator Adjustment Tool (One per site)
- Temperature/Pressure Gauge and Fittings
- 2 Lifting Lugs
- Stainless Steel Condensate Cup
- Shell Cap
- Wing Nut for Shell Cap

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.



BOILER CLEARANCES

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 additional 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

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 inch high house-keeping 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-816 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.

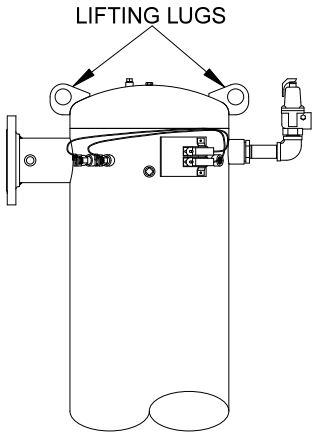


Figure 2.2
Lifting Lug Location

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.

Whether installing single or multiple units, install the piping and accessories as shown in the appropriate piping diagram located in 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 equip-ment must be provided as part of the overall installation. All piping MUST include ample provision for expansion.

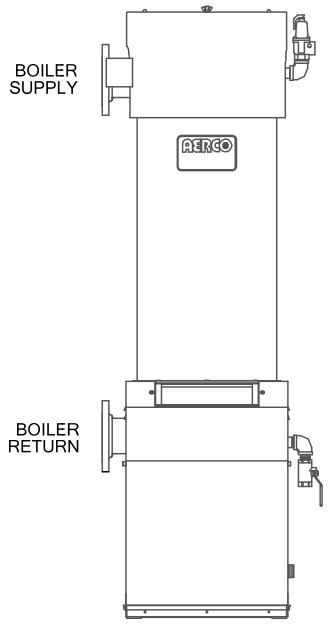


Figure 2.3
Supply and Return Location

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.

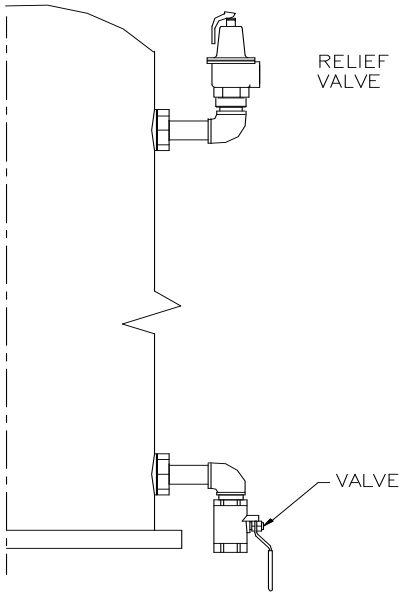


Figure 2.4
Relief and Drain Valve Location

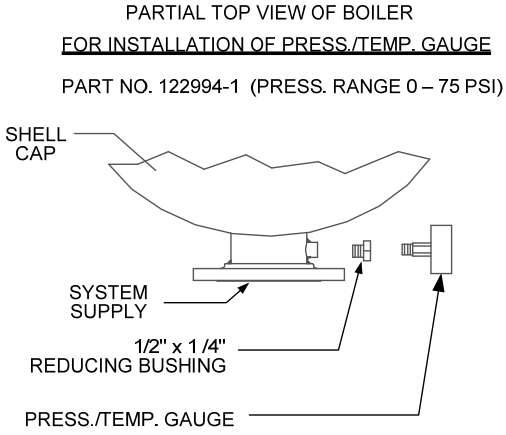


Figure 2.5a
Pressure /Temperature Gauge Installation

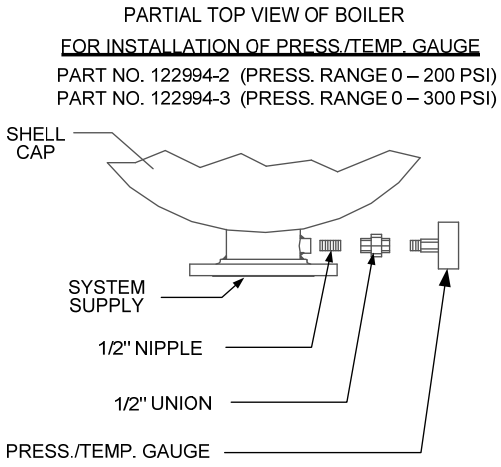


Figure 2.5b
Pressure/Temperature Gauge Installation

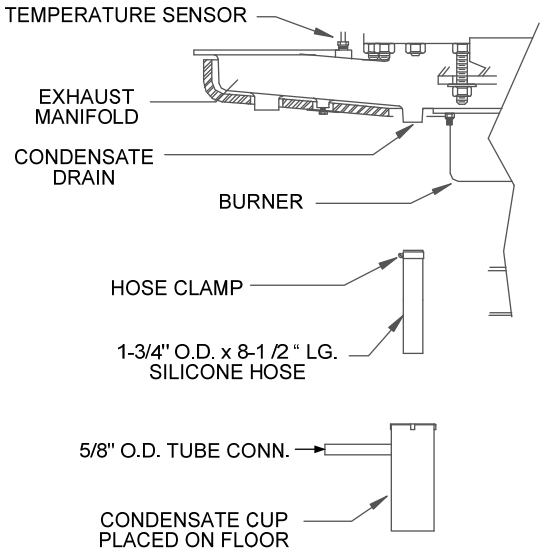


Figure 2.6
Condensate Drain System Location

2.3.5 CONDENSATE PIPING

The KC Boiler is designed to condense. Therefore, the installation site must include suitable provisions for condensate drainage or collection. A stainless steel condensate cup is separately packed within the unit's shipping container. To install the condensate cup, pro-ceed as follows:

1. Remove the left side panel and only the left half of the rear cover to provide access to the exhaust manifold and burner (Figure 2.6).
2. Insert the 1-3/4 inch manifold drain hose into the condensate cup. Allow the cup to rest on the floor directly beneath the manifold drain hole (Figure 2.6).
3. Attach a length of 3/4 inch I.D. polypropylene tubing to the condensate cup drain tube and route it to a floor drain. If a floor drain is not available, a condensate pump can be used to remove the condensate to drain. The condensate drain line must be removable for routine main-tenance. Therefore, DO NOT hard-pipe.
4. Replace the rear cover and side panel on the unit.

2.4. GAS SUPPLY PIPING

The AERCO Gas Fired Equipment Gas Components and Supply Design Guide (GF-1030) must be consulted before any gas piping is designed or started.

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

CAUTION!
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.

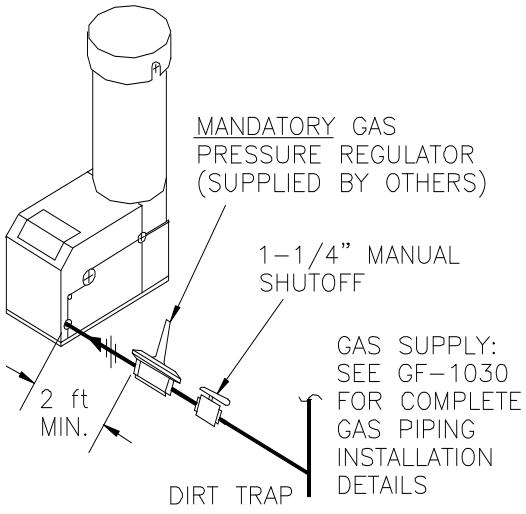


Figure 2.7
Gas Supply Regulator and Manual Shut -Off Valve Location

2.4.1 GAS SUPPLY PRESSURE REGULATOR

A mandatory external, in-line, supply gas regulator (supplied by others) must be installed upstream of each KC1000 and positioned as shown in Figure 2.7. Union connections should be placed in the proper locations to allow maintenance of the regulator if required. The regulator must be capable of providing the required gas pressures for natural gas and propane units as described in the paragraphs which follow.

Natural Gas:
The maximum static inlet pressure to the unit must be no more than 14" W.C. Minimum gas pressure is 8.8" W.C. for FM gas trains and 9.2" W.C. for IRI gas trains when the unit is firing at maximum input. Gas pressure should not exceed 11.5" 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 8.8" W.C. minimum for FM gas trains and 9.2" W.C. for IRI gas trains at maximum BTU input (970,000 BTU/HR) for natural gas 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.

Propane:
The maximum static inlet pressure to the unit must be no more than 14" W.C. Minimum gas pressure is 7.7" W.C. for FM gas trains and 8.1" W.C. for IRI gas trains when the unit is firing at maximum input. Gas pressure should not exceed 11.5" 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 7.7" W.C. minimum for FM gas trains and 8.1" W.C. for IRI gas trains at maximum BTU input (1,000,000 BTU/HR) for propane installations. The supply gas regulator must be of sufficient capacity volume, (400 cfh), for the unit and should have no more than 1" droop from minimum to full fire.

The supply gas regulator must be rated to handle the maximum incoming supply gas pressure. 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.

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 is factory pre-piped and wired. (See Appendix F, Drawing No. SD-A-660).

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. AC power connection to the unit are made at the Power Box.This box is located on the front right side of the unit as shown in Figure 2.8. 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 easily removed.

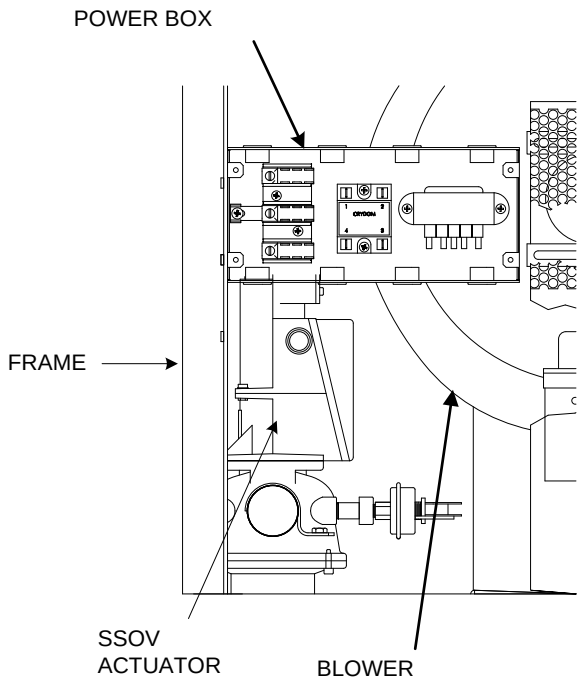


Figure 2.8
AC Power Box Location

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, Single Phase, 60 Hz, 20 Amps from a dedicated electrical circuit. No other devices should be on the same electrical circuit as the KC1000 unit. A means for disconnecting AC power from the unit (such as a service switch) must be installed near the unit for normal operation and maintenance. All electrical connections should be made in accordance with the National Electrical Code and/or with any applicable local codes.

The AC power wiring diagram is shown in Figure 2.9.

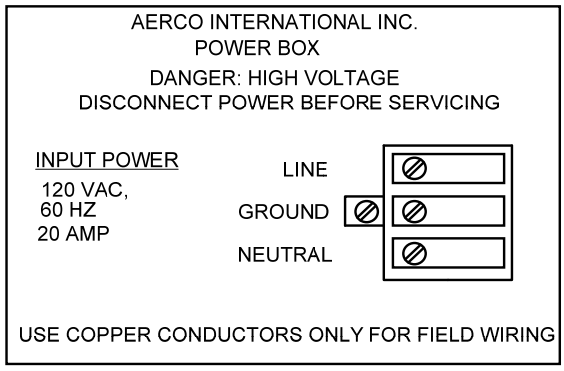


Figure 2.9
AC Power Wiring Diagram

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 the mode specified on the equipment order, some field wiring may be required to complete the installation. This wiring is typically routed to the Input/Output (I/O) 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 paragraphs. For additional information concerning modes of operations, refer to Section 5.

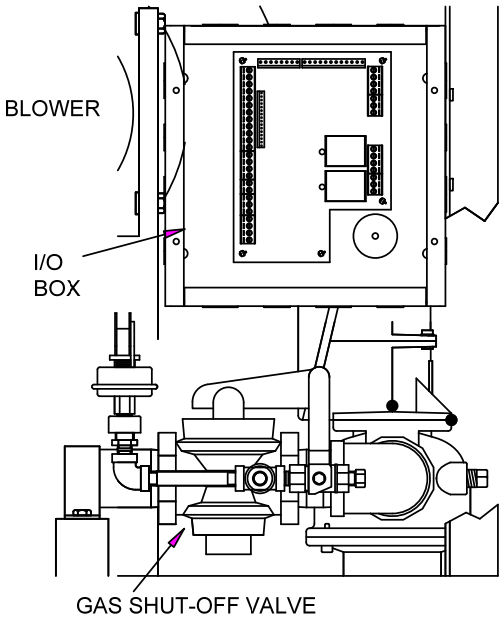


Figure 2.10
Input/Output (I/O) Box Location

2.6.1 CONSTANT SETPOINT MODE

The Constant Setpoint Mode is used when it is desired to have a fixed setpoint that does not deviate. No wiring connections other than electrical supply connections are required for this mode. However, if desired, fault monitoring or enable/disable interlock wiring can be utilized (see paragraphs 2.7.9 and 2.7.10).

2.6.2 INDOOR/OUTDOOR RESET MODE

This mode of operation increases supply water temperature as outdoor temperatures decrease. An outside air temperature sensor (AERCO PN 122790) is required. The sensor MUST BE wired to the I/O Box wiring terminals (see Fig. 2.11). For more information concerning the outside air sensor installation, refer to paragraph 2.7.1. For programming and setup instructions concerning the indoor/outdoor-reset mode of operation, refer to Section 5, paragraph 5.1.

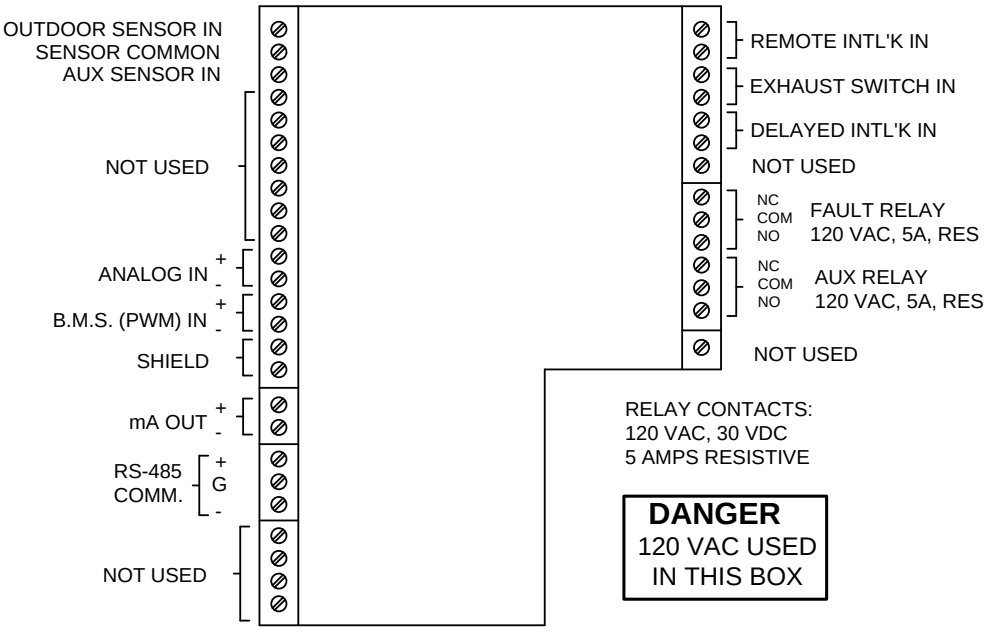


Figure 2.11
I/O Box Terminal Strip

2.6.3 BOILER MANAGEMENT SYSTEM (BMS) MODE

NOTE

BMS Model 168 can utilize either pulse width modulation (PWM) or RS485 Modbus signaling to the Boiler. BMS II Model 5R5-384 can utilize only RS485 signaling to the Boiler.

When using an AERCO Boiler Management System (BMS), the field wiring is connected between the BMS Panel and each Boiler's I/O Box terminal strip (Figure 2-11). Twisted shielded pair wire from 18 to 22 AWG must be utilized for the connections. The BMS Mode can utilize either pulse width modulation (PWM) signaling, or RS485 Modbus signaling. For PWM signaling, connections are made from the AERCO Boiler Management System to the B.M.S. (PWM) IN terminals on the I/O Box terminal strip. For RS485 Modbus signaling, connections are made from the BMS to the RS485 COMM terminals on the I/O Box terminal strip. Polarity must be maintained and the shield must be connected only at the AERCO BMS. The boiler end of the shield must be left floating. For additional instructions, refer to Chapter 5, paragraph 5.6 in this manual. Also, refer to GF-108M (BMS Model 168) and GF-124 (BMS II Model 5R5-184), BMS -Operations Guides.

2.6.4 REMOTE SETPOINT and DIRECT DRIVE MODES

The KC1000 Boiler can accept several types of signal formats from an Energy Management System or other source to control either the setpoint (Remote Setpoint Mode) or firing rate (Direct Drive Mode) of the Boiler. These formats are:

4 to 20 mA/1 to 5 Vdc

0 to 20 mA/0 to 5 Vdc

PWM – (Pulse Width Modulated signal. See paragraph 2.7.4)

Network – (RS485 Modbus. See para. 2.7.7)

While it is possible to control one or more boilers using one of the above modes of operation, it may not be the method best suited for the application. Prior to selecting one of the above modes of operation, it is recommended that you consult with your local AERCO representative or the factory for the mode of operation that will work best with your application. For more information on wiring the 4 to 20 mA / 1to 5VDC or the 0 to 20 mA / 0 to 5 VDC, see paragraph 2.7.3.

2.6.5 COMBINATION MODE

NOTE

Only BMS Model 168 can be utilized for the Combination Mode, not the BMS II (Model 5R5-384).

With a Combination Mode unit, field wiring is between the unit's I/O Box, the CCP (Combination Control Panel), and the BMS Model 168 (Boiler Management System). The wiring must be done using a shielded twisted pair of 22 AWG wire. Polarity must be maintained between the unit, the CCP, and the BMS. For further instructions and wiring diagrams, refer to the GF-108 Boiler Management System Operations Guide and the CCP-1 data sheet.

2.7 I/O BOX CONNECTIONS

The types of input and output/signals and devices to be connected to the I/O Box terminals shown in Figure 2.11 are described in the following paragraphs.

CAUTION!

DO NOT make any connections to the I/O Box terminals labeled "NOT USED". Attempting to do so may cause equipment damage.

2.7.1 OUTDOOR SENSOR IN

An outdoor air temperature sensor (AERCO Part No. 122790) will be required mainly for the Indoor/Outdoor Reset mode of operation. It can also be used with another mode if it is desired to use the outdoor sensor enable/disable feature. This feature allows the boiler to be enabled or disabled based on the outdoor air temperature.
The factory default for the outdoor sensor is DISABLED. To enable the sensor and or choose an enable/disable outdoor temperature, see the Configuration menu in Section 3 and Appendix A.

The outdoor sensor may be wired up to 200 feet from the boiler and is connected to the OUTDOOR SENSOR IN and SENSOR COMMON terminals in the I/O box (see Figs. 2.10 and 2.11). Wire the sensor using a twisted shielded pair cable of 18-22 AWG wire. There is no polarity when terminating the wires. The

shield is to be connected only to the terminals labeled SHEILD in the I/O Box. The sensor end of the shield must be left free and ungrounded.

When mounting the sensor, it must be located on the North side of the building where an average outside air temperature is expected. The sensor must be shielded form direct sunlight as well as impingement by the elements. If a shield is used, it must allow for free air circulation.

2.7.2 AUX SENSOR IN

The AUX SENSOR IN terminals can be used to add an additional temperature sensor for monitoring purposes. This input is always enabled and is a view only input that can be seen in the operating menu. The sensor must be wired to the AUX SENSOR IN and SENSOR COMMON and must be similar to AERCO BALCO wire sensor P/N 12449. A resistance chart for this sensor is provided in Appendix C.

2.7.3 ANALOG IN

The ANALOG IN + and – terminals are used when an external signal is used to drive the firing rate (Direct Drive Mode) or change the setpoint (Remote Setpoint Mode) of the Boiler. Either a 4 to 20 mA / 1 to 5 VDC or a 0 to 20 mA / 0 to 5 VDC signal may be used to vary the setpoint or firing rate. The factory default setting is 4 to 20 mA / 1 to 5 VDC, however this may be changed to 0 to 20 mA / 0 to 5 VDC using the Configuration Menu described in Section 3. If voltage rather than current is selected as the drive signal, a DIP switch must be set on the PMC Board located inside the Control Box. Contact the AERCO factory for information on setting DIP switches.

All of the supplied signals must be floating (ungrounded) signals. Connections between the source and the Boiler's I/O Box must be made using twisted shielded pair of 18 –22 AWG wire such as Belden 9841(see Fig. 211). Polarity must be maintained and the shield must be connected only at the source end and must be left floating (not connected) at the Boiler's I/O Box.

Whether using voltage or current for the drive signal, they are linearly mapped to a 40°F to 240°F setpoint or a 0% to 100% firing rate. No scaling for these signals is provided.

2.7.4 B.M.S. (PWM) IN

NOTE

Only BMS Model 168 can utilize Pulse Width Modulation (PWM), not the BMS II (Model 5R5-384).

These terminals are used to connect the AERCO Boiler Management System (BMS) Model 168 to the unit. The BMS Model 168 utilizes a 12 millisecond, ON/OFF duty cycle. This duty cycle is Pulse Width Modulated (PWM) to control firing rate. A 0% firing rate = a 5% ON pulse and a 100% firing rate = a 95% ON pulse.

2.7.5 SHIELD

The SHIELD terminals are used to terminate any shields used on sensor wires connected to the unit. Shields must only be connected to these terminals.

2.7.6 mA OUT

These terminals provide a 4 to 20 mA output that can be used to monitor setpoint (40°F to 220°F), outlet temperature (30°F to 245°F), or fire rate (0% to 100%). This function is enabled in the Configuration Menu (Section 3, Table 3.4).

2.7.7 RS-485 COMM

These terminals are used for RS-485 MODBUS serial communication between the unit and an external "Master", such as a Boiler Management System or other suitable device.

2.7.8 EXHAUST SWITCH IN

These terminals permit an external exhaust switch to be connected to the exhaust manifold of the boiler. The exhaust sensor should be a normally open type switch (such as AERCO Part No. 123463) that closes (trips) at 500^{o}F.

2.7.9 INTERLOCKS

The unit offers two interlock circuits for interfacing with Energy Management Systems and auxiliary equipment such as pumps or louvers. These interlocks are called the Remote Interlock and Delayed Interlock (Fig. 2.11). The wiring terminals for these interlocks are located inside the I/O Box on the left side of the unit. The I/O Box cover contains a wiring diagram which shows the terminal strip locations for these interlocks which are labeled REMOTE INTL'K IN and DELAYED INTL'K IN. Both interlocks, described in the following paragraphs, are factory wired in the closed position.

NOTE:
Both the Delayed Interlock and Remote Interlock must be in the closed position to allow the unit to fire.

2.7.9.1 REMOTE INTERLOCK IN

The remote interlock circuit (REMOTE INTL'K IN) is provided to remotely start (enable) and stop (disable) the Boiler if desired. The circuit is 24 VAC and comes factory pre-wired closed (jumpered).

2.7.9.2 DELAYED INTERLOCK IN

The delayed interlock circuit (DELAYED INTL'K IN) is typically used in conjunction with the auxiliary relay described in paragraph 2.8. This interlock circuit is located in the purge section of the start string. It can be connected to the proving device (end switch, flow switch etc.) of an auxiliary piece of equipment started by the boiler's auxiliary relay. The delayed interlock must be closed for the boiler to fire. If the delayed interlock is connected to a proving device that requires time to close (make), a time delay (Aux Start On Dly) that holds the start sequence of the boiler long enough for for a proving switch to make can be programmed. Should the proving switch not prove within the programmed time frame, the boiler will shut down. The Aux Start On Dly can be programmed from 0 to 120 seconds. This option is locate in the Configuration Menu (Section 3).

2.7.10 FAULT RELAY

The fault relay is a single pole double throw (SPDT) relay having a normally open and normally close set of relay contacts that are rated for 5 amps at 120 VAC and 5 amps at 30 VDC. The relay energizes when any fault condition occurs and remains energized until the fault is cleared and the CLEAR button is depressed. The fault relay connections are shown in Figure 2.11.

2.8 AUXILIARY RELAY CONTACTS

Each KC Boiler is equipped with a single pole double throw (SPDT) relay that is energized when there is a demand for heat and de-energized after the demand for heat is satisfied. The relay is provided for the control of auxiliary equipment, such as pumps and louvers, or can be used as a Boiler status indictor (firing or not firing). Its contacts are rated for 120 VAC @ 5 amps. Refer to Figure 2.11 to locate the AUX RELAY terminals for wiring connections.

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, water-tight 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 there is 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 supplying combustion air are outlined below. For more information on combustion air, 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.

NOTE

KC1000 units equipped with Low NOx Burners require an optional Cold Air Damper for operation with Direct Vent/ Sealed Combustion. The Cold Air Damper is also required when the unit is installed in an area where the combustion air supply temperature can drop below 55°F. Refer to the following paragraph (2.10.3) and GF-1050 for installation details.

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.

In addition, Cold Air Damper # 99026 must be installed. It should be located along the inlet duct run as close as possible to the KC1000 (See Figure 2.12). The Cold Air Damper must be placed on individual sections (one Damper per unit), not in a manifold section. The adjustment screw on the Damper should be moved to the center of the slot position and tightened 1/2 turn past "finger-tight". DO NOT over-tighten.

See AERCO Venting Guide GF-1050 for further details.

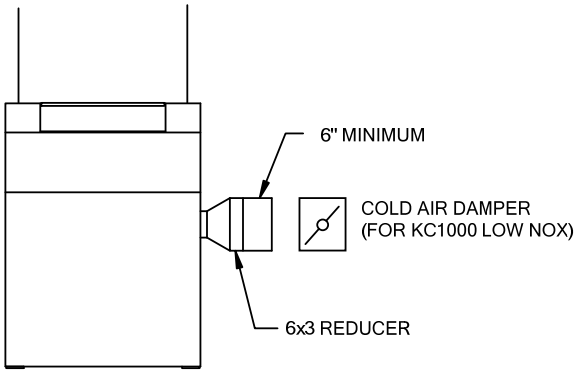


Figure 2.12
Sealed Combustion Air Connection

SECTION 3 - CONTROL PANEL OPERATING PROCEDURES

3.1. INTRODUCTION

The information in this Section provides a guide to the operation of the KC1000 Boiler using the Control Panel mounted on the front of the unit. It is imperative that the initial startup of this unit be performed by factory trained personnel. Operation prior to initial startup by factory trained personnel will void the equipment warranty. In addition, the following WARNINGS and CAUTIONS must be observed at all times.

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

WARNING:
THE ELECTRICAL VOLTAGES IN THIS SYSTEM INCLUDE 120 AND 24 VOLTS AC. IT MUST NOT BE SERVICED OR ACCESSED BY OTHER THAN FACTORY CERTIFIED SERVICE TECHNICIANS.

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

3.2. CONTROL PANEL DESCRIPTION

The KC1000 Control Panel shown in Figure 3-1 contains all of the controls, indicators and displays necessary to operate, adjust and troubleshoot the KC1000 Boiler. These operating controls, indicators and displays are listed and described in Table 3-1. Additional information on these items are provided in the individual operating procedures provided in this Section.

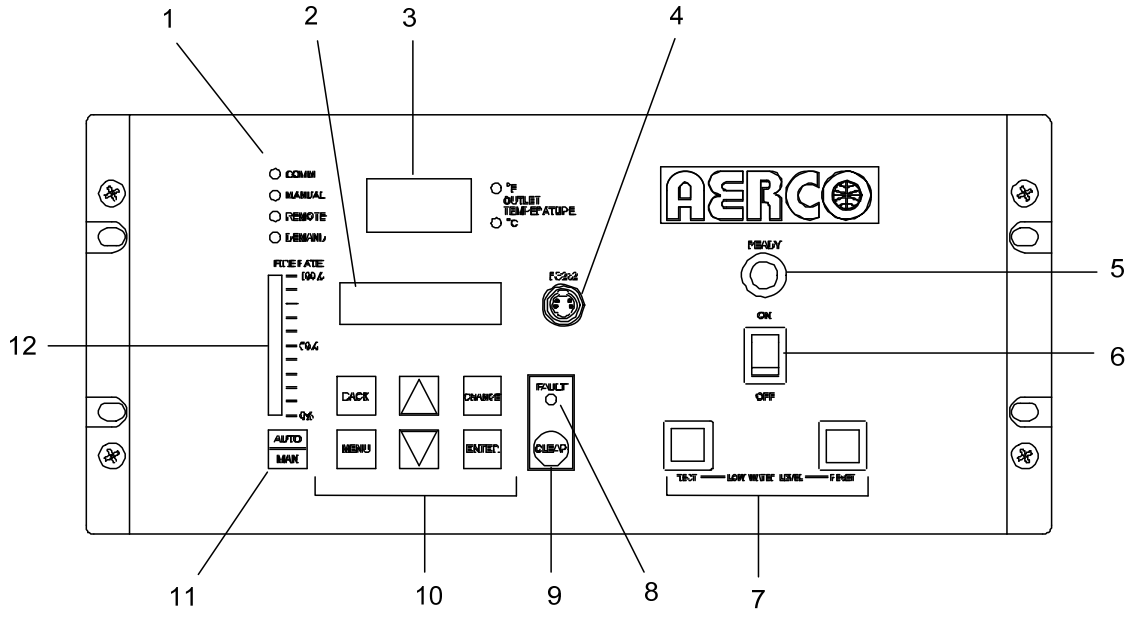


Figure 3-1. Control Panel Front View

Table 3-1. Operating Controls, Indicators and Displays

ITEM NO.	CONTROL, INDICATOR OR DISPLAY	FUNCTION
1	LED Status Indicators	Four Status LEDs indicate the current operating status as follows:
	COMM	Lights when RS-232 communication is occurring
	MANUAL	Lights when the unit is being controlled using the front panel keypad.
	REMOTE	Lights when the unit is being controlled by an external signal from an Energy Management System
	DEMAND	Lights when there is a demand for heat.
2	VFD Display	Vacuum Fluorescent Display (VFD) consists of 2 lines, each capable of displaying up to 16 alphanumeric characters. The information displayed includes: Startup Messages Alarm Messages Operating Status Messages Menu Selection
3	**OUTLET TEMPERATURE** Display	3–Digit, 7–Segment LED display continuously displays the outlet water temperature. The **°F** or **°C** LED next to the display lights to indicate whether the displayed temperature is in degrees Fahrenheit or degrees Celsius.
4	**RS-232** Port	Port permits a Laptop Computer or External Modem to be connected to the boiler Control Panel.
5	**READY** Indicator	Lights when all Pre-Purge conditions have been satisified.
6	**ON/OFF** Switch	Enables and disables boiler operation.
7	**LOW WATER LEVEL TEST/RESET** Switches	Allow the operator to test the operation of the water level monitor. Pressing **TEST** opens the water level probe circuit and simulates a Low Water Level alarm. Pressing **RESET** resets the water level monitor circuit. Pressing **CLEAR** resets the display.
8	**FAULT** Indicator	Red **FAULT** LED indicator lights when a boiler alarm condition occurs. An alarm message will appear in the VFD.
9	**CLEAR** Key	Turns off the FAULT indicator and clears trhe alarm message if the alarm is no longer valid. Lockout type alarms will be latched and cannot be cleared by simply pressing this key. Troubleshooting may be required to clear these types of alarms
10	MENU Keypad	Consists of 6 keys which provide the following functions for the Control Panel Menus:
	MENU	Steps through the main menu categories shown in Figure 3-2. The Menu categories wrap around in the order shown.
	BACK	Allows you to go back to the previous menu level without changing any information. Continuously pressing this key will bring you back to the default status display in the VFD. Also, this key allows you to go back to the top of a main menu category.

Table 3-1. Operating Controls, Indicators and Displays - Continued

ITEM NO.	CONTROL, INDICATOR OR DISPLAY	FUNCTION
10 (Cont.)	▲ (Up) Arrow	When in one of the main menu categories (Figure 3-2), pressing this key will select the displayed menu category. If the **CHANGE** key was pressed and the menu item is flashing, pressing the ▲ arrow key will increment the selected setting.
	▼ (Down) Arrow	When in one of the main menu categories (Figure 3-2), pressing this key will select the displayed menu category. If the **CHANGE** key was pressed and the menu item is flashing, pressing the ▼ (Down) arrow key will increment the selected setting.
	CHANGE	Permits a setting to be changed (edited). When the **CHANGE** key is pressed, the displayed menu item will begin to flash. Pressing the ▲ or ▼ arrow key when the item is flashing will increment or decrement the displayed setting.
	ENTER	Saves the modified menu information in memory. The display will stop flashing.
11	**AUTO/MAN** Switch	This switch toggles the boiler between the Automatic and Manual modes of operation. When in the Manual (**MAN)** mode, the front panel controls are enabled and the **MANUAL** status LED lights. When in the Automatic (**AUTO)** mode, the **MANUAL** status LED will be off and the front panel controls disabled.
12	**FIRE RATE** Bargraph	20 segment red LED bargraph continuously shows the Fire Rate in 5% increments from 0 to 100%

3.3. CONTROL PANEL MENUS

The Control Panel incorporates an extensive menu structure which permits the operator to set up, and configure the unit. The menu structure consists of four major menu categories as shown in Figure 3-2. Each of the menus shown, contain options which permit operating parameters to be viewed or changed. The menus are protected by a password to prevent unauthorized use.

Prior to entering the correct password, the options contained in the Operating, Setup, Configuration and Tuning Menu categories can be viewed. However, with the exception of Internal Setpoint Temperature (Configuration Menu), none of the viewable menu options can be changed.

Once the valid password (159) is entered, the options listed in the Setup, Configuration and Tuning menus can be viewed and changed, if desired.

3.3.1. Menu Processing Procedure

Accessing each menu and option is accomplished using the Menu Keys shown in Figure 3-1. Therefore, it is imperative that you be thoroughly familiar with the following basic steps before attempting to perform specific menu procedures.

1. The Control Panel will normally be in the Operating Menu and the VFD will display the current unit status. Pressing the ▲ or ▼ arrow key will display the other available data items in the Operating Menu.
2. Press the **MENU** key. The display will show the Setup Menu which is the next menu category shown in Figure 3-2. This menu contains the Password option which must be entered if other menu options will be changed.
3. Continue pressing the **MENU** key until the desired menu is displayed.

4. With the desired menu displayed, press the ▲ or ▼ arrow key. The first option in the selected menu will be displayed.
5. Continue to press the ▲ or ▼ arrow key until the desired menu option is displayed. Pressing the ▲arrow key will display the available menu options in the Top-Down sequence. Pressing the ▼ arrow key will display the options in the Bottom-Up sequence. The menu options will wrap-around after the first or last available option is reached.
6. To change the value or setting of a displayed menu option, press the **CHANGE** key. The displayed option will begin to flash. Continue to press the ▲ or ▼ arrow key for the option to be changed. The available menu option choices will be displayed. The menu option choices do not wrap around.
7. To select and store a changed menu option, press the **ENTER** key.

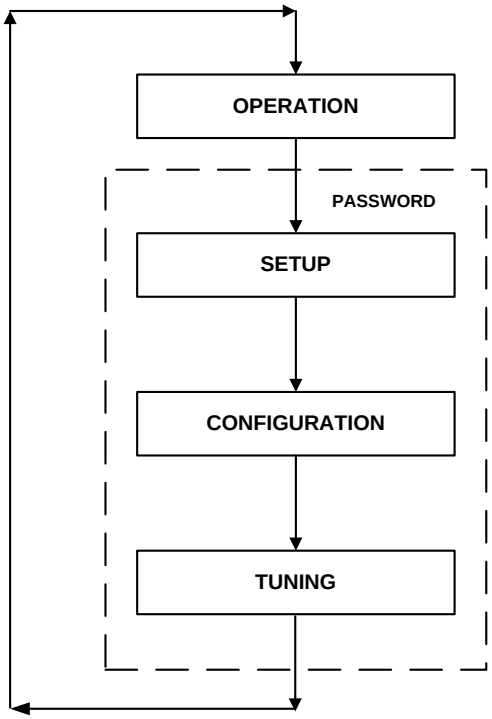


Figure 3-2. Menu Structure

NOTE:
The following paragraphs provide brief descriptions of the options contained in each menu. Refer to Appendix A for detailed descriptions of each menu option. Refer to Appendix B for listings and descriptions of displayed startup, status and error messages.

3.4. OPERATING MENU

The Operating Menu displays a number of key operating parameters for the unit as listed in Table 3-2. This menu is “Read-Only” and does not allow personnel to change or adjust any of the displayed items. Since this menu is “Read-Only”, it can be viewed at any time without entering a password. Press the ▲ arrow key to display the menu items in the order listed (Top-Down). Pressing the ▼ arrow key will display the menu items in reverse order (Bottom-Up).

3.5. SETUP MENU

The Setup Menu (Table 3-3) permits the operator to set the unit password which is required to change any of the menu options. To prevent unauthorized use, a previously entered password entry will time-out after 1 hour. Therefore, the password must be reentered when required. In addition to permitting password entries, the Setup Menu is also used to enter date and time, language to be used for display messages, units of temperature measurements and entries required for external communication and control of the unit via the RS-232 port. A view-only software version display is also provided to indicate the current Control Box software version.

NOTE

The Outdoor Temp display item shown with an asterisk in Table 3-2 will not be displayed unless the Outdoor Sensor function has been enabled in the Configuration Menu (Table 3-4).

Table 3-2. Operating Menu

Menu Item Display	Available Choices or Limits Minimum	Maximum	Default
Status Message			
Active Setpoint	40°F	240°F	
Aux Temp	30°F	245°F	
Outdoor Temp*	-70°F	130°F	
Fire Rate In	0%	Max Fire Rate	
Flame Strength	0%	100%	
Run Cycles	0	999,999	
Run Hours	0	999,999	
Fault Log	0	9	0

Table 3-3. Setup Menu

Menu Item Display	Available Choices or Limits Minimum	Maximum	Default
Passsword	0	9999	0
Language	English		English
Time	12:00 am	11:59 pm	
Date	01/01/00	12/31/99	
Unit of Temp	Fahrenheit Celsius		Fahrenheit
Comm Address	0	127	0
Baud Rate	2400 4800 9600 19.2K		9600
Software	Ver 0.00	Ver 9.99	

3.6. CONFIGURATION MENU

The Configuration Menu shown in Table 3-4 permits adjustment of the Internal Setpoint (Setpt) temperature regardless of whether the valid password has been entered. Setpt is required for operation in the Constant Setpoint mode. The remaining options in this menu require the valid password to be entered, prior to changing existing entries. This menu contains a number of other configuration settings which may or may not be displayed, depending on the current operating mode setting.

NOTE:

The Configuration Menu settings shown in Table 3-4 are Factory-Set in accordance with the requirements specified for each individual order. Therefore, under normal operating conditions, no changes will be required.

Table 3-4. Configuration Menu

Menu Item Display	Available Choices or Limits Minimum	Maximum	Default
Internal Setpt	Lo Temp Limit	Hi Temp Limit	130°F
Unit Type	Boiler Water Heater		Boiler
Unit Size	0.5 MBTU 1.0 MBTU 1.5 MBTU 2.0 MBTU 2.5 MBTU 3.0 MBTU		1.0 MBTU
Boiler Mode	Constant Setpoint Remote Setpoint Direct Drive Combination Outdoor Reset		Constant Setpoint
Remote Signal (If Mode = Remote Setpoint, Direct Drive or Combination)	4 – 20 mA/1 – 5V 0 -20 mA/0 – 5V PWM Input (BMS) Network		4 – 20 mA, 1-5V
Bldg Ref Temp (If Boiler Mode = Outdoor Reset)	40°F	240°F	70°F
Reset Ratio (If Boiler Mode = Outdoor Reset)	0.1	9.9	1.2
Outdoor Sensor	Enabled or Disabled		Disabled
System Start Tmp (If Outdoor Sensor = Enabled)	30°F	100°F	60°F
Setpt Lo Limit	40°F	Setpt Hi Limit	60°F
Setpt Hi Limit	Setpt Lo Limit	240°F	200°F
Temp Hi Limit	40°F	240°F	215°F
Max Fire Rate	40%	100%	100%
Pump Delay Timer	0 min	30 min	0 min
Aux Start On Dly	0 sec	120 sec	0 sec
Failsafe Mode	Shutdown or Constant Setpt		Shutdown
mA Output	Setpoint, Outlet Temp, Fire Rate Out, Off		Off
Lo Fire Timer	2 sec	120 sec	2 sec
Setpt Limiting	Enabled or Disabled		Disabled
Setpt Limit Band	0°F	10°F	5°F

3.7. TUNING MENU

The Tuning Menu items in Table 3-5 are Factory set for each individual unit.

Do not change these menu entries unless specifically requested to do so by Factory-Trained personnel.

Table 3-5. Tuning Menu

Menu Item Display	Available Choices or Limits Minimum	Maximum	Default
Prop Band	1°F	120°F	70°F
Integral Gain	0.00	2.00	1.00
Derivative Time	0.0 min	2.0 min	0.0 min
Reset Defaults?	Yes No Are You Sure?		No

3.8. START SEQUENCE

When the Control Box **ON/OFF** switch is set to the **ON** position, it checks all pre-purge safety switches to ensure they are closed. These switches include:

- Safety Shut-Off Valve Proof of Closure (POC) switch
- Low Water Level switch
- High Water Temperature switch
- High Gas Pressure switch
- Low Gas Pressure switch

If all of the above switches are closed, the **READY** light above the **ON/OFF** switch will light and the unit will be in the Standby mode.

When there is a demand for heat, the following events will occur:

NOTE:

If any of the Pre-Purge safety device switches are open, the appropriate fault message will be displayed. Also, the appropriate fault messages will be displayed throughout the start sequence, if the required conditions are not observed.

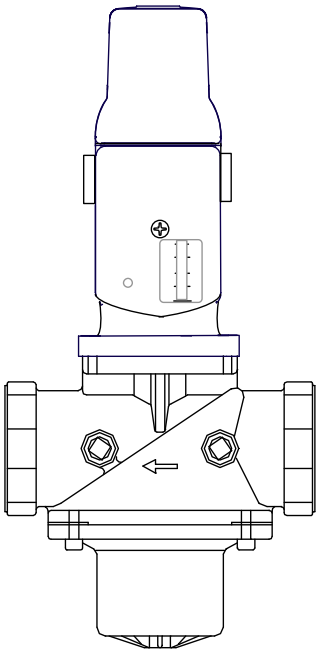


Figure 3-3.

Safety Shut-Off Valve

1. The **DEMAND** LED status indicator will light.
2. The unit checks to ensure that the proof of closure switch in the Safety Shut-Off Valve (SSOV) is closed (Figure 3-3).
3. With all required safety switches closed, a purge cycle will be initiated and the following events will occur:

(a) Blower relay energizes and turns on blower.

(b) Air/Fuel Valve rotates to the full-open purge position and closes purge position switch. The dial on the Air/Fuel Valve (Figure 3-4) will read 100 to indicate that the valve is full-open (100%).

(c) The **FIRE RATE** bargraph will show 100%.

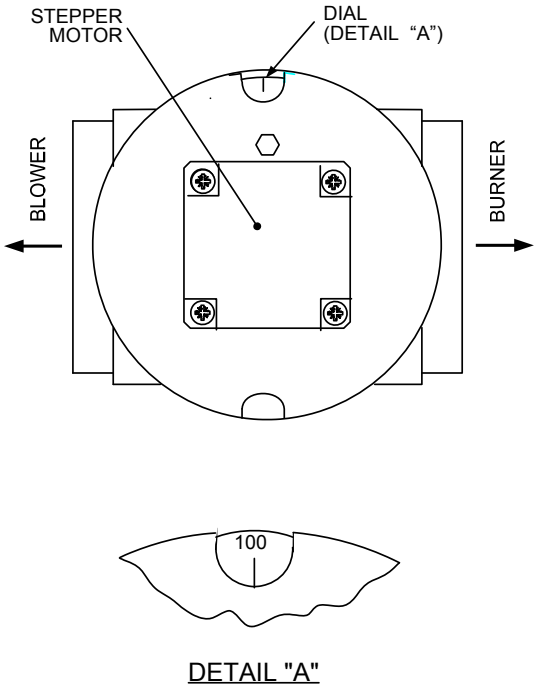


Figure 3-4.

Air/Fuel Valve In Purge Position

4. Next, the blower proof switch (Figure 3-5) closes and the display will show *Purging* and indicate the elapsed time of the purge cycle in seconds. The normal (default) time for the purge cycle is 7 seconds.

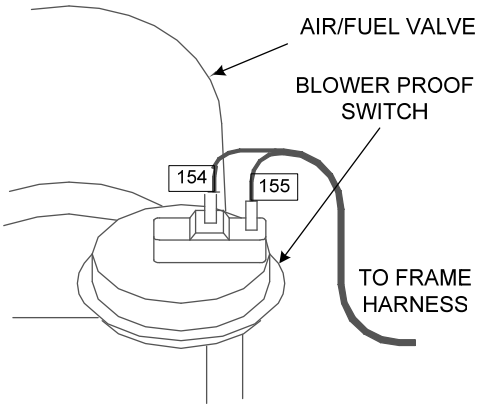


Figure 3-5.

Blower Proof Switch

5. Upon completion of the purge cycle, the Control Box initiates an ignition cycle and the following events occur:

   (a) The Air/Fuel Valve rotates to the low-fire ignition position and closes the ignition switch. The dial on the Air/Fuel Valve (Figure 3-6) will read between 25 and 35 to indicate that the valve is in the low-fire position.

   (b) The igniter relay is activated and provides ignition spark.

   (c) The gas Safety Shut Off Valve (SSOV) is energized (opened) allowing gas to flow into the Air/Fuel Valve.

6. Up to 7 seconds will be allowed for ignition to be detected. The igniter relay will be turned off one second after flame is detected.

7. After 2 seconds of continuous flame, *Flame Proven* will be displayed and the flame strength will be indicated. After 5 seconds, the current date and time will be displayed in place of the flame strength.

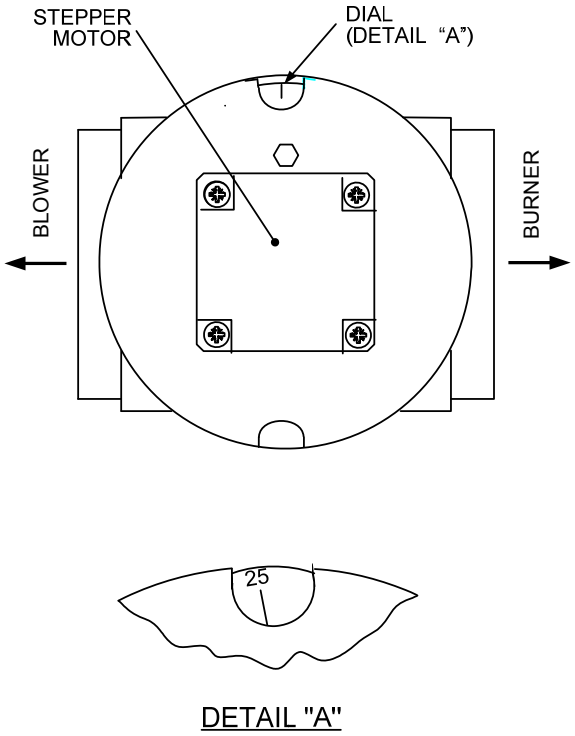


Figure 3-6.

Air/Fuel Valve In Ignition Position

8. With the unit firing properly, it will be controlled by the temperature controller circuitry. The **FIRE RATE** will be continuously displayed on the front panel bargraph.
9. Once the demand for heat has been satisfied, the Control Box will turn off the gas valve. The blower relay will be deactivated and the Air/Fuel Valve will be closed. *Standby* will be displayed.

3.9. START/STOP LEVELS

The start and stop levels are the fire rate percentages that start and stop the unit, based on load. These levels are Factory preset as follows:

- Start Level: 20%
- Stop Level: 16%

Normally, these settings should not require adjustment.

SECTION 4 - INITIAL START- UP

4.1 INITIAL START- UP REQUIREMENTS

The initial start-up of the KC-1000 Low NOx 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. Also, the initial 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 must 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 device 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 on a KC Boiler equipped with a low NOx burner, the proper instruments and tools must be used and correctly installed on the unit. The following paragraphs 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 a low NOx unit:

1. Digital Combustion Analyzer - Oxygen accuracy to ± 0.4%; Carbon Monoxide and NOx resolution to 1 PPM.
2. A 16" W.C. manometer and plastic tubing.
3. One 1/4" and two 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 site)
5. Small and large flat blade screwdrivers.
6. 7/16" open end wrench and small adjustable wrenches.
7. Tube of silicone adhesive

4.2.2 INSTALLING THE SUPPLY GAS MANOMETER

1. Close the main manual gas supply valve up stream of the unit.
2. Remove the 1/4" NPT pipe plug from the port on the inlet side of the safety shut off valve (see Figure 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.

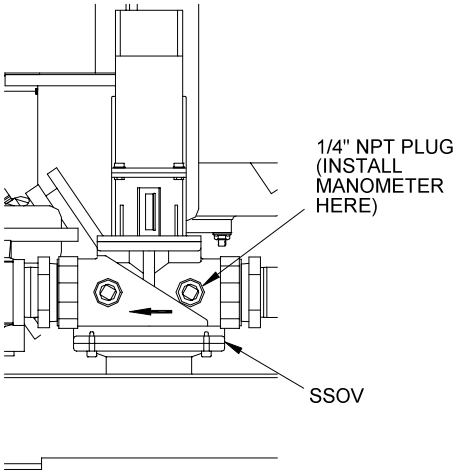


Figure 4.1
1/8" Gas Plug Location

4.2.3 PREPARING THE FLUE VENT PROBE HOLE

1. If the unit has been installed using the recommended AL29-4C vent, there will be a 3/8" hole, 18" to 24" above the exhaust manifold. The outer vent section, that covers vent connections must be loosened and moved to uncover the hole (see Figure 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.

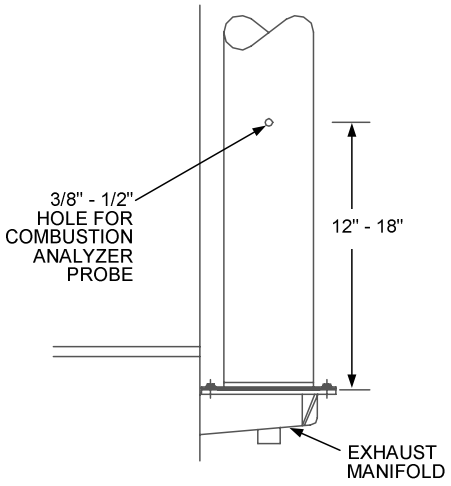


Figure 4.2
Analyzer Probe Hole Location

4.2.4 INSTALLING THE DIFFERENTIAL REGULATOR ADJUSTMENT TOOL

1. First, remove the cap from the differential pressure regulator (see Figure 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.

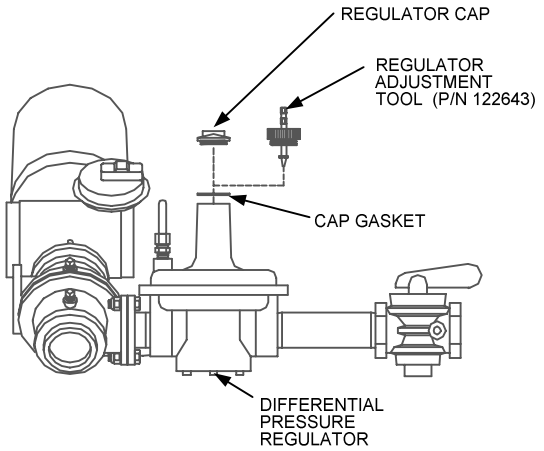


Figure 4.3
Differential Regulator Adjustment Tool Installation

IMPORTANT

The unit is shipped from the factory set up for either natural gas or propane, as specified by the Style No. on the Sales Order. If desired, the unit can be easily switched from natural gas to propane (or vice versa) using the regulator spring change procedure in Appendix J.

For propane units, disregard paragraph 4.3 and proceed to paragraph 4.4.

4.3 NATURAL GAS COMBUSTION CALIBRATION

The KC-1000 is shipped combustion calibrated from the factory. Recalibration as part of a start-up is necessary due to differences in 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.

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. If a lockup style regulator is installed as a gas supply regulator, adjust the gas supply until a reading of 12" W.C. static pressure is obtained.

4. Set the **ON/OFF** switch to the **OFF** position. Turn on AC power to the unit. The display will show *LOSS OF POWER* and the time and date.

5. Set the unit to the Manual Mode by pressing the **AUTO/MAN** switch. A flashing *Manual Fire Rate* message will be displayed with the present rate in %. Also, the **MANUAL** LED will light.

NOTE:
For a review of the control panel operating procedures, refer to Section 3.

6. Adjust the rate to 0% by pressing the ▼ arrow key.

7. Set the **ON/OFF** switch to the **ON** position.

8. Change the firing rate to 25% using the ▲ arrow key. This will put the unit into the starting sequence.

NOTE:
On initial start-up, or return to service from a fault condition, the unit will remain at a 29% firing rate for two-minutes, although the control signal may indicate a greater input.

9. Following the warm-up period, increase the firing rate in 20% increments while monitoring the gas pressure after every increase. If gas pressure dips below 8.8" W.C. for FM gas trains and 9.2" for IRI gas trains at any input firing rate percentage, stop and raise the pressure. Once 100% is reached, adjust the gas pressure for 8.8" W.C. (FM) or 9.2" W.C. (IRI).

NOTE:
If 8.8" W.C. for FM gas trains or 9.2" 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 8.8" W.C. or 9.2" W.C. is set at the 100% level change the firing rate to 30%. Insert the combustion analyzer probe into the stack.

NOTE:
Always approach a firing rate percentage from the same direction, (i.e., 100% to 30%, 30% to 20%, etc.). Whenever going to an increased firing rate from below (i.e., 20% to 30%), first go above and 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 (page 4-5). Also, ensure that the carbon monoxide (CO) and nitrogen oxide (NOx) readings do not exceed the values shown.

12. If the measured oxygen level, CO and NOx emissions are within the ranges shown 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 counterclockwise 1/4 to 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 to 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 as shown in Table 2 (page 4-5). Also, ensure that the CO and NOx readings do not exceed the values shown. No adjustment should be necessary. Contact the Factory if the oxygen, CO or NOx levels are not within the specified ranges.

NOTE:
At a 100% firing rate, the KC1000 will not operate reliably at inlet air temperatures below 55°F if the Cold Air Damper (P/N 99026) is not installed. See paragraphs 2.10.2 and 2.10.3.

19. Change the firing rate to 100% and allow the combustion analyzer to settle. If the optional Cold Air Damper (P/N 99026) is installed, compare the measured oxygen level with the levels in Table 3. If the Cold Air Damper is not installed, compare the oxygen levels with the readings in Table 3A.

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

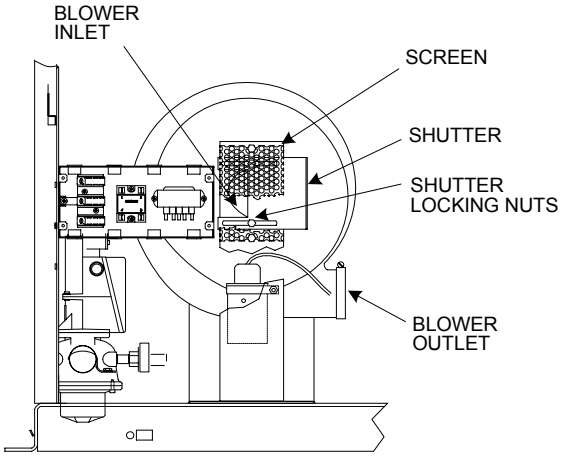


Figure 4.4
Air Shutter Locking Nut Location

21. Wait for the analyzer to settle then compare the new oxygen reading to Table 3 (or 3A). Repeat the inlet air shutter adjustment until the oxygen is within the specified range. Also, ensure that the CO and NOx emissions do not exceed the values shown. Firmly tighten the inlet air shutter locking nuts when finished.

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

22. 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.

23. Allow the analyzer to settle then compare the new oxygen reading to Table 3 (or 3A).

24. Repeat the adjustment until the oxygen is within the specified range. Also, ensure that the CO and NOx readings do not exceed the values shown. 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.

25. Change the firing rate to 30%. Allow time for the combustion analyzer to settle. Check the measured oxygen level, CO and NOx emissions to ensure that they are still within the ranges shown in Table 1.

26. Continue these procedures until all oxygen levels are within the ranges specified in Tables 1, 2 and 3 (or 3A) on page 4-5.

27. Record all readings on the AERCO start-up sheet provided with each unit. Proceed to **paragraph 4.5** when all natural gas combustion calibration procedures are completed.

Table 1
Combustion Oxygen Levels for a 30% Firing Rate

Inlet Air Temp	Oxygen (±0.2%)	Carbon Monoxide	*NOx
-25°F	7.8%	<100 ppm	<30 ppm
-10°F	7.5%	<100 ppm	<30 ppm
0°F	7.4%	<100 ppm	<30 ppm
10°F	7.2%	<100 ppm	<30 ppm
25°F	6.9%	<100 ppm	<30 ppm
40°F	6.5%	<100 ppm	<30 ppm
55°F	6.4%	<100 ppm	<30 ppm
70°F	6.2%	<100 ppm	<30 ppm
85°F	5.9%	<100 ppm	<30 ppm
100°F	5.7%	<100 ppm	N/A

* NOx readings corrected to 3% oxygen.

Table 2
Combustion Oxygen Levels for a 16% Firing Rate

Inlet Air Temp	Oxygen (±0.2%)	Carbon Monoxide	*NOx
-25°F	<10%	<100 ppm	<30 ppm
-10°F	<10%	<100 ppm	<30 ppm
0°F	<10%	<100 ppm	<30 ppm
10°F	<10%	<100 ppm	<30 ppm
25°F	<10%	<100 ppm	<30 ppm
40°F	<10%	<100 ppm	<30 ppm
55°F	<10%	<100 ppm	<30 ppm
70°F	<10%	<100 ppm	<30 ppm
85°F	<10%	<100 ppm	<30 ppm
100°F	<10%	<100 ppm	N/A

* NOx readings corrected to 3% oxygen.

Table 3
Combustion Oxygen Levels for a 100% Firing Rate <u>With</u> Cold Air Damper

Inlet Air Temp	Oxygen (±0.2%)	Carbon Monoxide	*NOx
-25°F	6.7	<100 ppm	<30 ppm
-10°F	6.5	<100 ppm	<30 ppm
0°F	6.4	<100 ppm	<30 ppm
10°F	6.3	<100 ppm	<30 ppm
25°F	6.2	<100 ppm	<30 ppm
40°F	6.1	<100 ppm	<30 ppm
55°F	5.9	<100 ppm	<30 ppm
70°F	5.8	<100 ppm	<30 ppm
85°F	5.6	<100 ppm	<30 ppm
100°F	4.7	<100 ppm	N/A

* NOx readings corrected to 3% oxygen.

Table 3A
Combustion Oxygen Levels for a 100% Firing Rate <u>Without</u> Cold Air Damper

Inlet Air Temp	Oxygen (±0.2%)	Carbon Monoxide	*NOx
55°F	7.5%	<100 ppm	<30 ppm
70°F	6.5%	<100 ppm	<30 ppm
85°F	5.5%	<100 ppm	<30 ppm
100°F	4.5%	<100 ppm	N/A

* NOx readings corrected to 3% oxygen.

IMPORTANT

The unit is shipped from the factory set up for either natural gas or propane, as specified by the Style No. on the Sales Order. If desired, the unit can be easily switched from natural gas to propane (or vice versa) using the regulator spring change procedure in Appendix J.

Since the required gas supply pressures for propane differ from those required for natural gas, the Propane Combustion Calibration procedures are repeated in their entirety in paragraph 4.4. It should be noted that the Combustion Calibration data in Tables 1, 2, 3 (and 3A) apply to both natural gas and propane units.

4.4 PROPANE COMBUSTION CALIBRATION

The KC-1000 is shipped combustion calibrated from the factory. Recalibration as part of a start-up is necessary due to differences in altitude, gas BTU content, gas supply piping and supply regulators. Factory test data sheets are shipped with each unit as a reference.

Prior to starting these procedures, ensure that the KC1000 has been set up as specified in paragraphs 4.2 through 4.2.4.

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

INITIAL START-UP

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. If a lockup style regulator is installed as a gas supply regulator, adjust the gas supply until a reading of 11" W.C. static pressure is obtained.

4. Set the **ON/OFF** switch to the **OFF** position. Turn on AC power to the unit. The display will show *LOSS OF POWER* and the time and date.

5. Set the unit to the Manual Mode by pressing the **AUTO/MAN** switch. A flashing *Manual Fire Rate* message will be displayed with the present rate in %. Also, the **MANUAL** LED will light.

NOTE:
For a review of the control panel operating procedures, refer to Section 3.

6. Adjust the rate to 0% by pressing the ▼ arrow key.

7. Set the **ON/OFF** switch to the **ON** position.

8. Change the firing rate to 25% using the ▲ arrow key. This will put the unit into the starting sequence.

NOTE:
On initial start-up, or return to service from a fault condition, the unit will remain at a 29% firing rate for two-minutes, although the control signal may indicate a greater input.

9. Following the warm-up period, increase the firing rate in 20% increments while monitoring the gas pressure after every increase. If gas pressure dips below 7.7" W.C. for FM gas trains and 8.1" for IRI gas trains at any input firing rate percentage, stop and raise the pressure. Once 100% is reached, adjust the gas pressure for 7.7" (FM) W.C. or 8.1" W.C. (IRI).

NOTE:
If 7.7" W.C. for FM gas trains or 8.1" 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 7.7" W.C. or 8.1" W.C. is set at the 100% level change the firing rate to 30%. Insert the combustion analyzer probe into the stack.

NOTE:
Always approach a firing rate percentage from the same direction, (i.e., 100% to 30%, 30% to 20%, etc.). Whenever going to an increased firing rate from below (i.e., 20% to 30%), first go above and 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. Also, ensure that the carbon monoxide (CO) and nitrogen oxide (NOx) readings do not exceed the values shown.

12. If the measured oxygen level, CO and NOx emissions are within the ranges shown 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 counterclockwise 1/4 to 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 to 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 as shown in Table 2. Also, ensure that the CO and NOx readings do not exceed the values shown. No adjustment should be necessary. Contact the Factory if the oxygen, CO or NOx levels are not within the specified ranges.

NOTE:
At a 100% firing rate, the KC1000 will not operate reliably at inlet air temperatures below 55°F if the Cold Air Damper (P/N 99026) is not installed. See paragraphs 2.10.2 and 2.10.3.

19. Change the firing rate to 100% and allow the combustion analyzer to settle. If the optional Cold Air Damper (P/N 99026) is installed, compare the measured oxygen level with the levels in Table 3. If the Cold Air Damper is not installed, compare the oxygen levels with the readings in Table 3A.

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

21. Wait for the analyzer to settle then compare the new oxygen reading to Table 3 (or 3A). Repeat the inlet air shutter adjustment until the oxygen is within the specified range. Also, ensure that the CO and NOx emissions do not exceed the values shown. Firmly tighten the inlet air shutter locking nuts when finished.

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

22. 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.

23. Allow the analyzer to settle then compare the new oxygen reading to Table 3 (or 3A).

24. Repeat the adjustment until the oxygen is within the specified range. Also, ensure that the CO and NOx readings do not exceed the values shown. 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.

25. Change the firing rate to 30%. Allow time for the combustion analyzer to settle. Check the measured oxygen level, CO and NOx emissions to ensure that they are still within the ranges shown in Table 1.

26. Continue these procedures until all oxygen levels are within the ranges specified in Tables 1, 2 and 3.

27. Record all readings on the AERCO start-up sheet provided with each unit. Proceed to paragraph 4.5 when all propane combustion calibration procedures are completed.

4.5 UNIT REASSEMBLY

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

1. Set the **ON/OFF** switch to the **OFF** position. Disconnect the AC power supply from 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. Apply a drop of silicone adhesive to the regulator adjusting screw to lock its setting.

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

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

9. Replace the unit's panels and hood.

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° to 40°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°F. **DO NOT** attempt to adjust its setpoint.

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° to 40°F higher than the maximum header temperature the unit may see.
3. Replace the shell cap and wing nut.

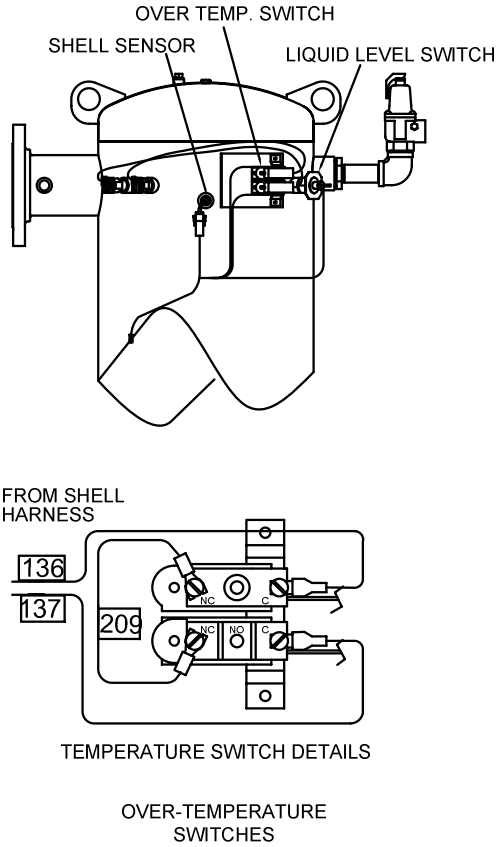


Figure 4.6
Over Temperature Limit Switch Location

SECTION 5 - MODE OF OPERATION

5.1 INTRODUCTION

The following paragraphs provide detailed descriptions of the six different modes of operation for the KC1000 Boiler. Each unit is shipped from the factory tested and configured for the ordered mode of operation. 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 descriptions of the temperature related parameters are included in Appendix A. Factory defaults are listed in Appendix E. After reading this section, parameters can be customized to suit the needs of the specific application.

5.2 INDOOR/OUTDOOR RESET MODE

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

5.2.1 RESET RATIO

Reset ratio is an adjustable number from 0.1 to 9.9. Once it is 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.

5.2.2. BUILDING REFERENCE TEMPERATURE

This is a temperature from 40°F to 240°F. Once selected, it 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 select a building reference temperature of 70°F, then at an outside temperature of 69°F, the supply header temperature will increase by 1.6° to 71.6°F.

5.2.3 OUTDOOR AIR TEMPERATURE SENSOR INSTALLATION

The outdoor air temperature sensor must be mounted on the North side of the building in an area where the average outside air temperature is expected. The sensor must be shielded from the sun's direct rays, as well as from 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 200 feet from the unit. Sensor connections are made inside the Input/Output (I/O) Box on the left side of the KC1000 Boiler. Connections are made at the terminals labeled OUTDOOR SENSOR IN and SENSOR COMMON inside the I/O Box using shielded 18 to 22 AWG wire. A wiring diagram is provided on the cover of the I/O Box. Refer to Section 2, paragraph 2.6.2 for additional wiring information.

5.2.4 INDOOR/OUTDOOR STARTUP

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

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

4. Once the design outdoor air temperature is chosen, go across the chart to the desired supply header temperature for the design temperature chosen in step 3.
5. Next, go up that column to the Reset Ratio row to find the corresponding reset ratio.
6. Access the Configuration Menu and scroll through it until the display shows *Bldg Ref Temp (Building Reference Temperature)*.
7. Press the **CHANGE** key. The display will begin to flash.
8. Use the ▲ and ▼ arrow keys to select the desired building reference temperature.
9. Press **ENTER** to save any changes.
10. Next, scroll through the Configuration Menu until the display shows *Reset Ratio*.

11. Press the **CHANGE** key. The display will begin to flash.

12. Use the ▲ and ▼ arrow keys to select the reset ratio determined in step 5.

13. Press **ENTER** to save the change.

Refer to paragraph 3.3 for detailed instructions on menu changing.

5.3 CONSTANT SETPOINT MODE

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

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

5.3.1 SETTING THE SETPOINT

The setpoint temperature of the unit is adjustable from 40°F to 240°F. To set the unit for operation in the Constant Setpoint Mode, the following menu settings must be made in the Configuration Menu:

MENU OPTION	SETTING
Boiler Mode	*Constant Setpoint*
Internal Setpt	Select desired setpoint using ▲ and ▼ arrow keys (40°F to 240°F)

Refer to paragraph 3.3 for detailed instructions on changing menu options.

5.4 REMOTE SETPOINT MODES

The unit's setpoint can be remotely controlled by an Energy Management System (EMS) or Building Automation System (BAS). The Remote Setpoint can be driven by a current or voltage signal within the following ranges:

4-20 mA/1-5 Vdc

0-20 mA/0-5 Vdc

The factory default setting for the Remote Setpoint mode is 4 - 20 mA/1 - 5 Vdc. With this setting, a 4 to 20 mA/1 to 5 Vdc signal, sent by an EMS or BAS, is used to change the unit's setpoint. The 4 mA/1V signal is equal to a 40°F setpoint while a 20 mA /5V signal is equal to a 240°F setpoint. When a 0 to 20 mA/0 to 5 Vdc signal is used, 0 mA is equal to a 40°F setpoint.

In addition to the current and voltage signals described above, the Remote Setpoint mode can also driven by a RS485 Modbus Network signal from an EMS or BAS.

The Remote Setpoint modes of operation can be used to drive single as well as multiple units.

NOTE:
If a voltage, rather than current signal is used to control the remote setpoint, a DIP switch adjustment must be made on the PMC Board in the Control Box. Contact your local AERCO representative for details.

In order to enable the Remote Setpoint Mode, the following menu setting must be made in the Configuration Menu:

MENU OPTION	SETTING
Boiler Mode	Remote Setpoint
Remote Signal	4-20mA/1-5V, 0-20mA/0-5V, or Network

Refer to paragraph 3.3 for detailed instructions on changing menu options.

If the Network setting is selected for RS485 Modbus operation, a valid Comm Address must be entered in the Setup Menu. Refer to Modbus Communication Manual GF-114 for additional information.

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

5.4.1 REMOTE SETPOINT FIELD WIRING

The only wiring connections necessary for the Remote Setpoint mode are connection of the remote signal leads from the source to the unit's I/O Box. The I/O Box is located on the front panel of the Benchmark Boiler. For either a 4-20mA/0-5V or a 0-20mA/0-5V setting, the connections are made at the ANALOG IN terminals in the I/O Box. For a Network setting, the connections are made at the RS-485 COMM terminals in the I/O Box. The signal must be floating, (ungrounded) at the I/O Box and the wire used must be a two wire shielded pair from 18 to 22 AWG. Polarity must be observed. The source end of the shield must be connected at the source. When driving multiple units, each unit's wiring must conform to the above.

5.4.2 REMOTE SETPOINT STARTUP

Since this mode of operation is factory preset and the setpoint is being externally controlled, no startup instructions are necessary. In this mode, the **REMOTE** LED will light when the external signal is present.

To operate the unit in the Manual mode, press the **AUTO/MAN** switch. The **REMOTE** LED will go off and the **MANUAL** LED will light.

To change back to the Remote Setpoint mode, simply press the **AUTO/MAN** switch. The **REMOTE** LED will again light and the **MANUAL** LED will go off.

5.5 DIRECT DRIVE MODES

The unit's fire rate can be changed by a remote signal which is typically sent from an Energy Management System (EMS) or from a Building Automation System (BAS). The Direct Drive mode can be driven by a current or voltage signal within the following ranges:

4-20 mA/1-5 Vdc

0-20 mA/0-5 Vdc

The factory default setting for the Direct Drive mode is 4-20 mA/1-5 Vdc. With this setting, a 4 to 20 mA signal, sent by an EMS or BAS is used to change the unit's fire rate from 0% to 100%. A 4 mA/1V signal is equal to a 0% fire rate, while a 20 mA /5V signal is equal to a 100% fire rate. When a 0-20 mA/0-5 Vdc signal is used, zero is equal to a 0% fire rate.

In addition to the current and voltage signals described above, the Direct Drive mode can also driven by a RS485 Modbus Network signal from an EMS or BAS.

When in a Direct Drive mode, the unit is a slave to the EMS or BAS and does not have a role in temperature control. Direct Drive can be used to drive single, or multiple units.

NOTE:
If a voltage, rather than current signal is used to control the fire rate, a DIP switch adjustment must be made on the PMC Board in the Control Box. Contact your local AERCO representative for details.

To enable the Direct Drive Mode, the following menu setting must be made in the Configuration Menu:

MENU OPTION	SETTING
Boiler Mode	Direct Drive
Remote Signal	4-20mA/1-5V, 0-20mA/0-5V, or Network

Refer to paragraph 3.3 for instructions on changing menu options.

If the Network setting is selected for RS485 Modbus operation, a valid Comm Address must be entered in the Setup Menu. Refer to Modbus Communication Manual GF-114 for additional information.

5.5.1 DIRECT DRIVE FIELD WIRING

The only wiring connections necessary for Direct Drive mode are connection of the remote signal leads from the source to the unit's I/O Box. For either a 4-20mA/0-5V or a 0-20mA/0-5V setting, the connections are made at the ANALOG IN terminals in the I/O Box. For a Network setting, the connections are made at the RS-485 COMM terminals in the I/O Box. The signal must be floating, (ungrounded) at the I/O Box and the wire used must be a two wire shielded pair from 18 to 22 AWG. Polarity must be observed. The source end of the shield must be connected at the source. When driving multiple units, each unit's wiring must conform to the above.

5.5.2 DIRECT DRIVE STARTUP

Since this mode of operation is factory preset and the fire rate is being externally controlled, no startup instructions are necessary. In this mode, the **REMOTE** LED will light when the signal is present.

To operate the unit in manual mode, press the **AUTO/MAN** switch. The **REMOTE** LED will go off and the **MANUAL** LED will light.

To change back to the Direct Drive mode, simply press the **AUTO/MAN** switch. The **REMOTE** LED will again light and the **MANUAL** LED will go off.

5.6 BOILER MANAGEMENT SYSTEM (BMS) MODE

NOTE

BMS Model 168 can utilize either pulse width modulation (PWM) or RS485 Modbus signaling to the Boiler. BMS II Model 5R5-384 can utilize only RS485 signaling to the Boiler.

The BMS mode of operation is used in conjunction with an AERCO Boiler Management System. The BMS mode is used when it is desired to operate multiple units in the most efficient manner possible. The BMS can control up to 40 boilers; 8 via pulse width modulation (PWM) and up to 32 via Modbus (RS485) network communication. For BMS programming and operation, see GF-108M (BMS Model 168) and GF-124 (BMS II Model 5R5-384), BMS Operations Guides. For operation via an RS485 Modbus network, refer to Modbus Communication Manual GF-114.

To enable the BMS Mode, the following menu settings must be made in the Configuration Menu:

MENU OPTION	SETTING
Boiler Mode	Direct Drive
Remote Signal	BMS (PWM Input) or Network (RS485)

Refer to paragraph 3.3 for instructions on changing menu options.

5.6.1 BMS EXTERNAL FIELD WIRING

Wiring connections for BMS control using PWM signaling are made between connector JP2 on the BMS panel (boilers 1 through 8), and the B.M.S. (PWM) IN terminals in the I/O Box on the front of the Benchmark Boilers. Refer to the wiring diagram provided on the cover of the I/O Box.

Wiring connections for RS485 Modbus control are made between connector JP11 on the BMS (boilers 9 through 40) and the RS485 COMM terminals in the I/O Box on the front of the unit.

Wire the units using shielded twisted pair wire between 18 and 22 AWG. Observe the proper polarity for the B.M.S. (PWM) IN and/or RS485 COMM wiring connections. Shields should be terminated only at the BMS and the boiler end must be left floating. Each unit's wiring must conform to the above.

5.6.2 BMS SETUP AND STARTUP

This mode of operation is factory preset and the AERCO BMS controls the firing rate. There are no setup instructions for each individual unit.

To operate the unit in manual mode, press the **AUTO/MAN** switch. The **REMOTE** LED will go off and the **MANUAL** LED will light

To change back to the BMS mode, simply press the **AUTO/MAN** switch. The **REMOTE** LED will again light and the **MANUAL** LED will go off.

5.7 COMBINATION CONTROL SYSTEM (CCS)

NOTE

Only BMS Model 168 can be utilized for the Combination Mode, not the BMS II (Model 5R5-384).

A Combination Control System (CCS) is one that uses multiple boilers to cover both space-heating and domestic hot water needs. An AERCO Boiler Management System (BMS) Model 168 and a Combination Control Panel (CCP) are necessary to configure this system. Typically, an adequate number of boilers are installed to cover the space-heating load on the design day, however one or more units are used for the domestic hot water load.

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

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

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

5.7.1 COMBINATION CONTROL SYSTEM FIELD WIRING

Wiring for this system is between the BMS Model 168 panel, the CCP and the B.M.S. (PWM) IN terminals in the I/O Box. Wire the units using a shielded twisted pair of 18 to 22 AWG wire. When wiring multiple units, each unit's wiring must conform to the above. For a complete CCP system-wiring diagram see the AERCO CCP-1 literature.

5.7.2 COMBINATION CONTROL SYSTEM SETUP AND STARTUP

Setup for the Combination Mode requires entries to be made in the Configuration Menu for boiler mode, remote signal type and setpoint. The setpoint is adjustable from 40°F to 240°F.

Enter the following settings in the Configuration Menu:

MENU OPTION	SETTING
Boiler Mode	Combination
Remote Signal	BMS (PWM Input)
Internal Setpt	40°F to 240°F

Refer to paragraph 3.3 for instructions on changing menu options.

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

To set the unit to the manual mode, press the **AUTO/MAN** switch. The **MANUAL** LED will light.

To set the unit back to the auto mode, press the **AUTO/MAN** switch. The **MANUAL** LED will go off and the **REMOTE** LED will light.

When the boiler is switched to BMS mode, the AERCO BMS controls the firing rate. There are no setup requirements to the boiler(s) in this mode.

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!
ELECTRICAL VOLTAGES USED IN THIS SYSTEM INCLUDE 120 AND 24 VOLTS AC. POWER MUST BE REMOVED PRIOR TO PERFORMING WIRE REMOVAL OR OTHER TESTING PROCEDURES THAT CAN RESULT IN ELECTRICAL SHOCK.

6.2 LOW 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 depress the **CLEAR** button to clear any displayed fault messages..
4. Place the unit in Manual Mode and fire the unit at a firing rate between 25% and 30%.
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 and press the **CLEAR** button on the Control Box.
7. The unit should restart.

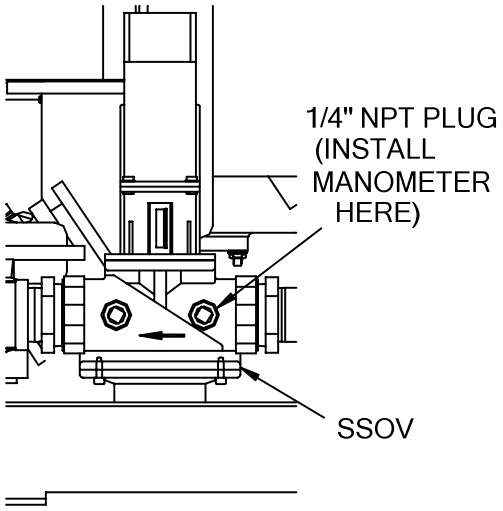


Figure 6.1
1/8” Pipe Plug Position for Manometer Installation

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 HIGH GAS PRESSURE TEST

1. Start the unit in manual mode and fire between 25% and 30%.
2. Remove either wire # 150 or wire #151 from the high gas pressure switch. See Fig. 6.2.
3. The unit should shut down on a *HIGH GAS PRESSURE FAULT*.
4. Reconnect the wire previously removed from the high gas pressure switch and depress the **CLEAR** button.
5. The unit should restart.

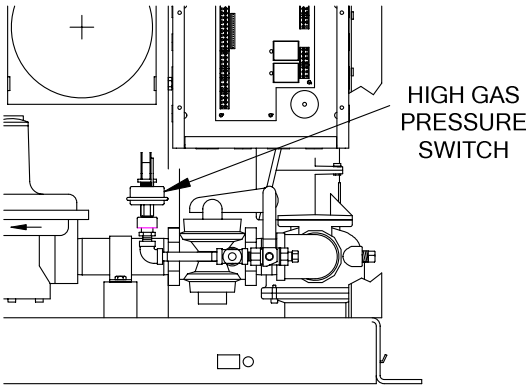


Figure 6.2
High Gas Pressure Switch

6.4 LOW WATER LEVEL FAULT TEST

1. Set 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. Set the **ON/OFF** switch to **ON**. The **READY** light should remain off and the unit should not start. If the unit does start, shut the unit off immediately and refer fault to qualified service personnel.

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. After the shell is full, press the **LOW WATER LEVEL RESET** button to reset the low water cutoff. Press the **CLEAR** button to reset the **FAULT** LED and clear the error message.

11. Set the **ON/OFF** switch to the **ON** position. The unit is now ready for operation.

6.5 WATER TEMPERATURE FAULT TEST

1. In the normal operating mode, allow the unit to stabilize at its setpoint.

2. Lower the adjustable temperature limit switch setting to match the outlet water temperature. (See Fig. 6.3).

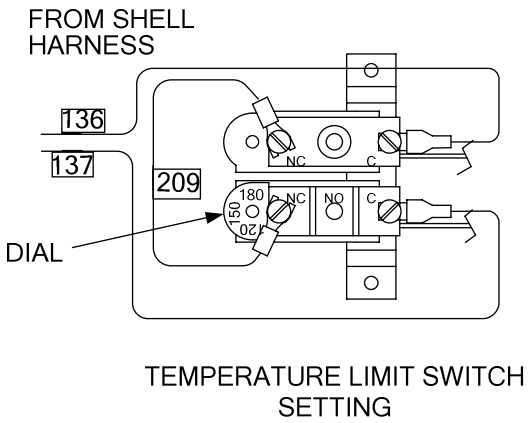


Figure 6.3
Temperature Limit Switch Setting

3. Once the switch setting is approximately at the actual water temperature, the unit should shutdown. The red **FAULT** LED should be flashing and the message *HIGH WATER TEMP SWITCH OPEN* should be displayed. The unit should not start.

4. Reset the temperature limit switch setting to its prior setting.

5. The unit should start once the adjustable temperature limit switch setting is above the actual outlet water temperature.

6.6 INTERLOCK TESTS

The unit is equipped with two interlock circuits called the Remote Interlock and the Delayed Interlock. Terminal connections for these circuits are located in the I/O Box and are labeled REMOTE INTL'K IN and DELAYED INTL'K IN. These circuits can shut down the unit in the event that an interlock is opened. These interlocks are shipped from the factory jumped (closed). However, each of these interlocks may be utilized in the field as a remote stop and start, an emergency cut-off, or to prove that a device such as a pump gas booster, or louver is operational.

6.6.1 REMOTE INTERLOCK

1. Remove the cover from the I/O Box and locate the REMOTE INTL'K IN terminals.

2. Start the unit in manual mode and fire at 25% to 30% firing rate.

3. If there is a jumper across the REMOTE INTL'K IN terminals, remove one side of the jumper. If the interlock is being controlled by an external device, either open the interlock via the external device or disconnect one of the wires leading to the external device.

4. The unit should shut down and display *INTERLOCK OPEN.*

5. Once the interlock connection is reconnected, the *INTERLOCK OPEN* message should automatically clear and the unit should resume running.

6.6.2 DELAYED INTERLOCK

1. Remove the cover from the I/O Box and locate the DELAYED INTL'K IN terminals.

2. Start the unit in manual mode and fire at a 25% to 30% firing rate.

3. If there is a jumper across the DELAYED INTL'K IN terminals, remove one side of the jumper. If the interlock is connected to a proving switch of an external device, disconnect one of the wires leading to the proving switch.

4. The unit should shut down and display *DELAYED INTERLOCK OPEN.* The **FAULT** LED should be flashing.
5. Once the interlock connection is reconnected, depress the **CLEAR** button. The unit should start.

6.7 FLAME FAULT TEST

1. Place the **ON/OFF** switch in the **OFF** position.

2. Place the unit in the Manual Mode and set the firing rate between 25% and 30%.

3. Close the manual leak detection valve located between the safety shut-off valve and the differential regulator (see Fig. 6.4).

4. Start the unit.

5. The unit should shut down after reaching the Ignition cycle and display *FLAME LOSS DURING IGN.*

6. Open the valve previously closed in step 3 and depress the **CLEAR** button.

7. Restart the unit and allow it to prove flame.

8. Once flame is proven, close the manual leak detection valve located between the safety shut-off valve and the differential regulator.

9. The unit should shut down and display *FLAME LOSS DURING RUN*.

10. Open the valve previously closed in step 8 and depress the **CLEAR** button. The unit should restart and fire.

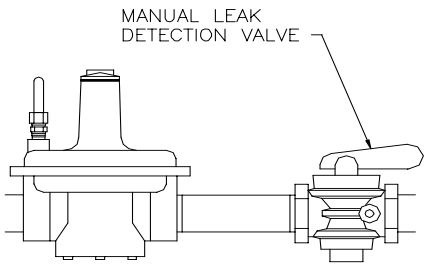


Figure 6.4
Manual Leak Detection Valve

6.8 AIR FLOW FAULT TEST

1. Start the unit in manual mode and set the fire rate between 25% and 30%.

2. Once the unit has proved flame, remove either wire #154 or #155 from the blower proof switch (see Fig. 6.5) located on the air/fuel valve.

3. The unit should shut down and display *AIRFLOW FAULT DURING RUN*.

4. Replace the wire previously removed from the blower-proof switch and depress the **CLEAR** button. The unit should restart.

WARNING!
ELECTRICAL VOLTAGES USED IN THIS SYSTEM INCLUDE 120 AND 24 VOLTS AC. POWER MUST BE REMOVED PRIOR TO PERFORMING WIRE REMOVAL OR OTHER TESTING PROCEDURES THAT CAN RESULT IN ELECTRICAL SHOCK.

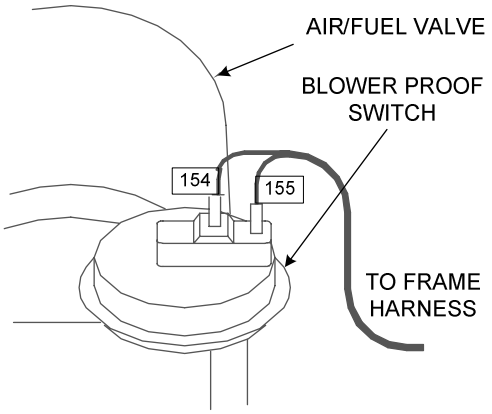


Figure 6.5
Blower Proof Switch Location and Wiring

6.9 SSOV PROOF OF CLOSURE SWITCH

1. Set the unit's **ON/OFF** switch to the **OFF** position. Place the unit in manual mode and set the fire rate between 25% and 30%.

2. Remove the Safety Shut-Off Valve (SSOV) cover to access the terminal connections. See Fig. 6.6. For units with IRI gas trains, access the terminals of the downstream SSOV (see drawing SD-A-660 in Appendix F.

3. Remove either wire #149 or #148 from the SSOV.

4. The unit should fault and display *SSOV SWITCH OPEN.*

5. Replace the wire previously removed and depress the **CLEAR** button.

6. Start the unit.

7. Remove the wire again when the unit reaches the purge cycle.

8. The unit should shut down and display *SSOV FAULT DURING PURGE.*

9. Replace the wire on the SSOV and depress the **CLEAR** button. The unit should restart.

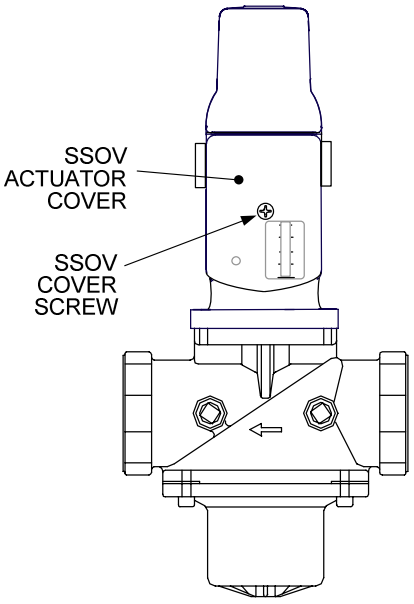


Figure 6.6
SSOV Actuator Cover Screw Location

6.10 PURGE SWITCH OPEN DURING PURGE

1. Set the unit's **ON/OFF** switch to the **OFF** position. Place the unit in manual mode and set the fire rate between 25% and 30%

2. Remove the air/fuel valve cover by rotating the cover counterclockwise to unlock it and then pulling it towards you. See Fig. 6.7.

3. Remove one of the two wires from the purge switch (Fig. 6.8) and start the unit.

4. The unit should begin to start, then shut down and display *PRG SWITCH OPEN DURING PURGE.*

5. Replace the wire on the purge switch and depress the **CLEAR** button. The unit should restart.

6.11 IGNITION SWITCH OPEN DURING IGNITION

1. Set the unit's **ON/OFF** switch to the **OFF** position. Place the unit in manual mode and set the fire rate between 25% and 30%.

2. Remove the air/fuel valve cover (Fig. 6.7) by rotating the cover counterclockwise to unlock it then pulling it towards you.

3. Remove one of the two wires from the ignition switch (Fig. 6.8) and start the unit.

4. The unit should begin to start then shut down and display *IGN SWITCH OPEN DURING IGNITION.*

5. Replace the wire on the ignition switch and depress the **CLEAR** button. The unit should restart.

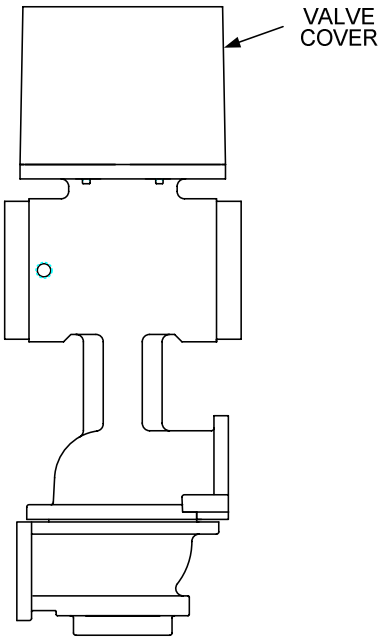


Figure 6.7
Air/Fuel Valve Cover Location

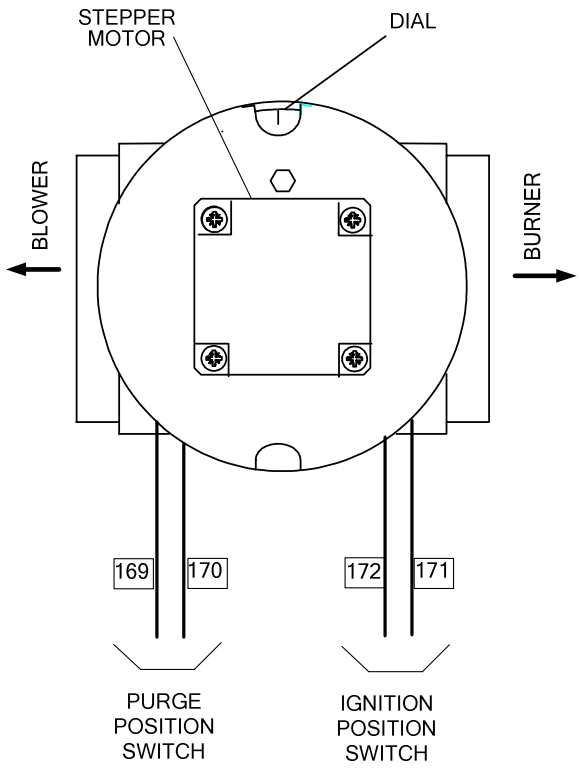


Figure 6.8
Air/Fuel Valve Purge and Ignition Switch Locations

6.12 SAFETY PRESSURE RELIEF VALVE TEST

Test the unit's 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 routine maintenance procedures listed in Table 1 should be performed within the specified time periods.

Table 1 Maintenance Schedule

Para	Item	6 Mos.	12 Mos.	24 Mos.	Labor Time
7.2	Spark Igniter	Inspect	Replace		20 mins.
7.3	Flame Detector	Inspect	Replace		20 mins.
7.4	Combustion Cal.	Check	Check		1 hr.
7.5	Testing of Safety Devices		Test		20 mins.
7.6	*Manifold & Tubes			Inspect & clean if needed	4 hrs.
7.7	Water Side Inspection			Inspect	2 hr.
7.8	Condensate Drain		Inspect & clean		30 mins.

** 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 AC POWER FROM THE UNIT.*

***(B)** SHUT OFF THE GAS SUPPLY TO THE UNIT.*

***(C)** ALLOW THE UNIT TO COOL TO A SAFE TEMPERATURE.*

7.2 SPARK IGNITER

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

To inspect or replace the Igniter :

1. Set the **ON/OFF** switch on the control panel to the **OFF** position and disconnect AC power from the unit.
2. To access the spark igniter, remove the unit's left side paneland left rear cover.
3. Disconnect the igniter cable from the igniter contact.
4. Using a 15/16" open-end wrench, remove the igniter from the burner shell.
5. Inspect the igniter for erosion or carbon build-up. If there is substantial erosion of the spark gap or ground electrode, the igniter should be replaced. If carbon build-up is present, clean the igniter using fine emery cloth. Repeated carbon build-up on the igniter is an indication that a check of the combustion settings is required. See Section 4 for Combustion Calibration procedures.
6. Prior to reinstalling the igniter, a conductive anti-seize compound must be applied to the igniter threads.
7. Reinstall the igniter in the burner shell. Do Not over-tighten. A slight snugging up is sufficient.
8. Reconnect the igniter cable.
9. Replace the left side panel and left rear cover on the unit.

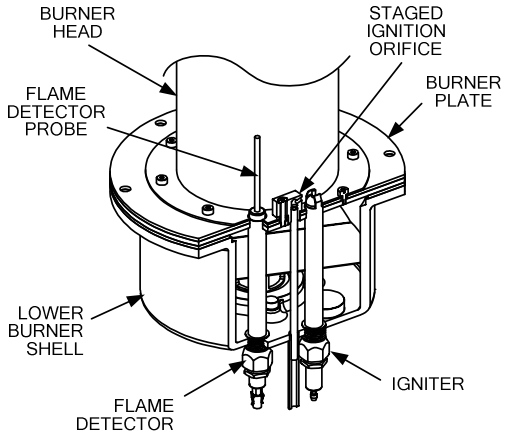


Figure 7.1
Spark Igniter and Flame Detector Location

7.3 FLAME DETECTOR

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

To inspect or replace the flame detector:

1. Set the ON/OFF switch on the control panel to the OFF position and disconnect AC power from the unit.
2. To access the flame detector, remove the unit's left side panel and left rear cover.
3. Disconnect the flame detector wire lead.
4. Using a 15/16" open-end wrench, loosen and remove the flame detector from the burner shell.
5. Inspect the detector thoroughly. If eroded, the detector should be replaced. Otherwise, clean the detector with a fine emery cloth.
6. Reinstall the flame detector in the burner shell. Do Not over-tighten. A slight snugging up is sufficient.
7. Reconnect the flame detector wire lead.
8. Replace the left side panel and left rear cover on the unit.

7.4 COMBUSTION CALIBRATION

Combustion settings must be checked at the intervals shown in Table 1 as part of the scheduled maintenance requirements. Refer to the combustion calibration instructions in Section 4..

7.5 SAFETY DEVICE TESTING

Systematic and thorough testing of the operating and safety devices should be performed to ensure that they are operating properly. 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, 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 replacement parts will be required for reassembly after inspection:

GP-122537	Combustion Chamber Gasket
GP-18900	Manifold to Tubesheet Gasket
124749	Burner Head/Plate Gasket
124834	Burner Plate/Shell Gasket
*124839	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. Remove the sheet metal covers from the unit.
2. Disconnect the plastic tubing from the condensate cup to drain and remove the rear covers.
3. Remove the condensate cup from under the unit Disconnect AC power and turn off the gas supply to the unit.
4. and disconnect the condensate drain tubing from the exhaust manifold.
5. Remove the flame detector and ignition cable wires from the flame detector and igniter contactor. Remove the igniter and flame detector per paragraphs 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)

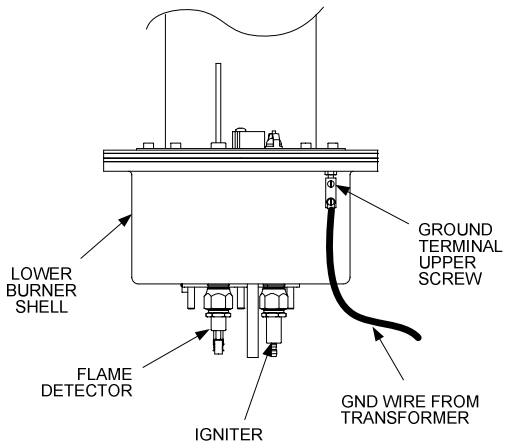


Figure 7.2
Grounding Terminal Location

7. Loosen the 1/4” NPT union on the low NOx staged ignition assembly (Figure 7.3).

8. Disconnect the staged ignition assembly 1/8” elbow from the 3” long NPT nipple at the bottom of the burner shell.

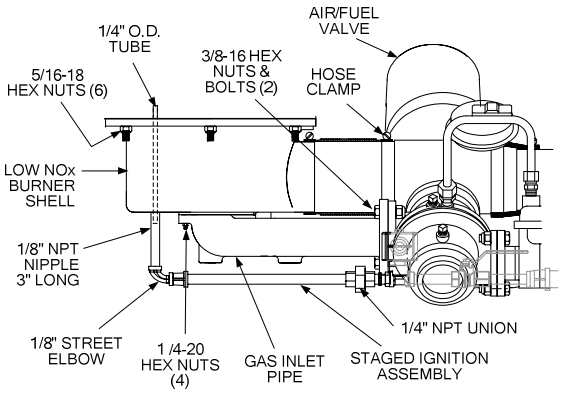


Figure 7.3
Burner Disassembly Diagram

9. Remove the 3” long NPT nipple and 1/4” O.D. tube (Figure 7.3) from the burner shell.

10. 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.

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

12. Loosen the hose clamp on the air/fuel valve outlet (Figure 7.3).

13. Using a 1/2” socket wrench, remove the six 5/16-18 hex nuts supporting the burner (Figure 7.3).

14. Lower the burner while sliding the air hose off the air/fuel valve. Remove the burner through the rear of the unit. Due to space limitations, it will be necessary to separate the burner head and shell during the removal process.

15. Disconnect the exhaust temperature sensor by unscrewing it from the exhaust manifold (Figure 7.4).

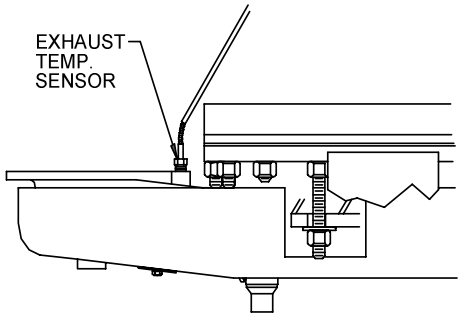


Figure 7.4
Exhaust Sensor Connector Location

16. Disconnect the air/fuel valve 12-pin connector from the KC wiring harness.

17. Disconnect wires #24 and #17 from the blower proof switch (Figure 7.5).

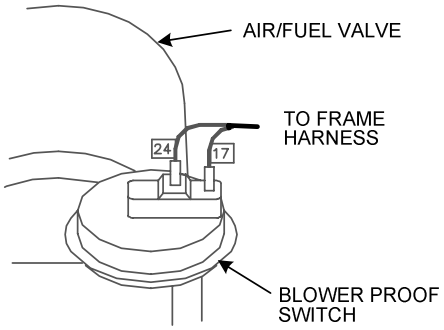


Figure 7.5
Blower Proof Switch Wire Locations

18. Loosen the hose clamp on the air/fuel valve inlet and slide the clamp back towards the blower (Figure 7.6).

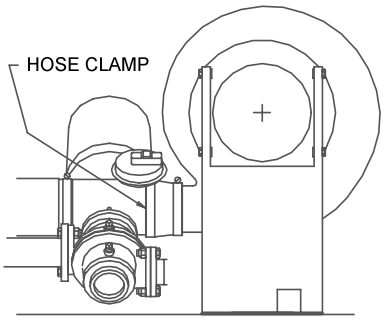


Figure 7.6
Air/Fuel Valve Inlet Hose Clamp

19. 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 (Figure 7.7).

20. Using two 9/16” wrenches, remove the two 3/8-16 hex nuts and bolts securing the air/fuel valve to the differential pressure regulator (Figure 7.7).

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

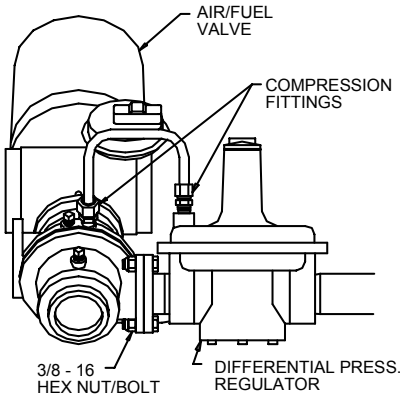


Figure 7.7
Feedback Tube and Air/Fuel Valve to Differential Regulator Bolts

22. Remove the flue venting from the exhaust manifold.

23. To prevent damage and simplify 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 (Figure 7.8).

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

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

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

27. Inspect the combustion chamber and liner. Replace the liner if any signs of cracking or warping are observed.

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

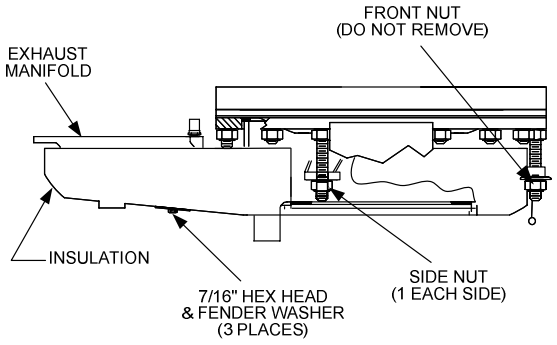


Figure 7.8
Manifold Nut and Bolt Locations

28. Replace the gasket between the manifold and the combustion chamber (Part Number GP-122537). The use of Permatex or a similar gasket adhesive is recommended. Replace the gasket between the manifold and tubesheet (Part No. GP-18900). Do not use any gasket adhesive; this gasket has an adhesive backing.

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

7.7 HEAT EXCHANGER WATER SIDE INSPECTION

Per CSD-1, the water side of the heat exchanger requires an inspection. To inspect the heat exchanger, proceed as follows:

1. Shut off AC power to the unit.

2. Close the supply and return valves to the unit (Figure 7.9).

3. Open the drain valve and allow the unit to fully drain. The 1/4 inch plug in the top of the shell may be removed to aid in drainage or the relief valve may be opened (Figure 7.9).

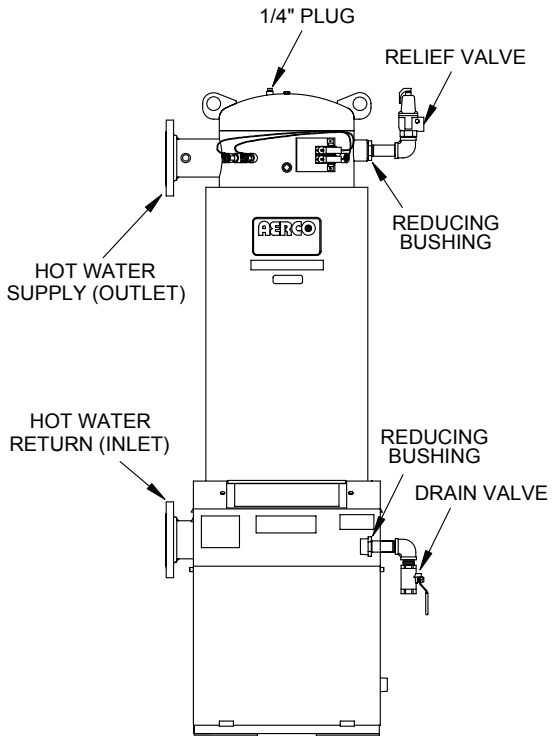


Figure 7.9
Heat Exchanger Supply and Return Locations

4. Remove the 2 ½ inch plug located in the shell at the rear of the unit (Figure 7.10).

5. Remove the relief valve, drain valve (Figure 7.9) and any reducing bushings.

6. Perform the inspection. Reassemble the unit once the inspection is completed.

7. Open the supply and return valves and reconnect AC power to the unit.

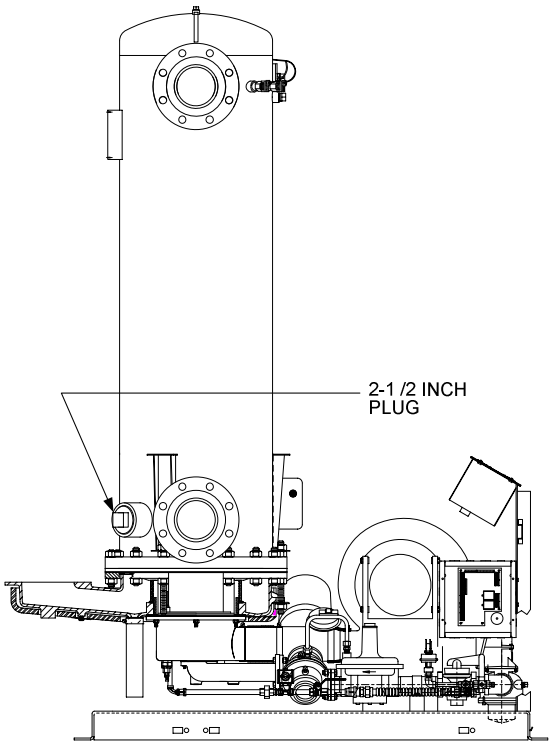


Figure 7.10
Heat Exchanger 2 ½ Inch Inspection Plug Location

7.8 Condensate Drain Assembly

KC Boilers contain a condensate drain cup (Figure 2.6) which should be inspected and cleaned annually to ensure proper operation.
To inspect and clean the assembly, proceed as follows:

1. Remove the left side panel and left rear cover to provide access to the condensate drain components (see Figure 2.6).

2. Disconnect the plastic tubing from the condensate cup drain tube to the drain.

3. Remove the condensate cup from the unit. Thoroughly clean the cup and inspect the cup drain tube for blockage.

4. After the above items have been cleaned and inspected, reassemble the drain components by reversing the previous steps.

Chapter 8- TROUBLESHOOTING GUIDE

8.1 INTRODUCTION

This troubleshooting guide is intended to aid service/maintenance personnel in isolating the cause of a fault in a KC1000 Boiler. The trouble-shooting procedures contained herein are presented in tabular form on the following pages. These tables are comprised of three columns labeled: Fault Indication, Probable Cause and Corrective Action. The numbered items in the Probable Cause and Corrective Action columns correspond to each other. For example, Probable Cause No. 1 corresponds to Corrective Action No. 1, etc.

When a fault occurs in the KC1000 Boiler, proceed as follows to isolate and correct the fault:

1. Observe the fault messages displayed in the Control Box display.
2. Refer to the Fault Indication column in the following troubleshooting tables and locate the Fault that best describes the existing conditions.
3. Proceed to the Probable Cause column and start with the first item (1) listed for the Fault Indication.
4. Perform the checks and procedures listed in the Corrective Action column for the first Probable Cause candidate.
5. Continue checking each additional Probable Cause for the existing fault until the fault is corrected.
6. If the fault cannot be corrected using the information provided in the Troubleshooting Tables, please contact your local AERCO Representative.

TABLE 8-1. BOILER TROUBLESHOOTING

FAULT INDICATION	PROBABLE CAUSES	CORRECTIVE ACTION
AIRFLOW FAULT DURING IGNITION	1. Blower stopped running due to thermal or current overload	1. Check combustion blower for signs of excessive heat or high current drain that may trip thermal or current overload devices.
	2. Blocked Blower inlet or inlet ductwork	2. Inspect the inlet to the combustion blower including any ductwork leading up to the combustion blower for signs of blockage.
	3. Blocked airflow switch	3. Remove the airflow switch and inspect for signs of blockage, clean or replace as necessary.
	4. Defective airflow switch	4. Measure the airflow switch for continuity with the combustion blower running. If there is an erratic resistance reading or the resistance reading is greater than zero ohms, replace the switch.
AIRFLOW FAULT DURING PURGE	1. Blower not running or running too slow	1. Start the unit. If the blower does not run check the blower solid state relay for input and output voltage. If the relay is okay, check the blower.
	2. Defective Air Flow Switch	2. Start the unit. If the blower runs, check the airflow switch for continuity. Replace the switch if there is no continuity.
	3. Blocked Air flow Switch	3. Remove the air flow switch and inspect for signs of blockage, clean or replace as necessary.
	4. Blocked Blower inlet or inlet ductwork.	4. Inspect the inlet to the combustion blower including any ductwork leading up to the combustion blower for signs of blockage.
	5. No voltage to switch from control box.	5. Measure for 24 VAC during start sequence from each side of the switch to ground. If 24VAC is not present refer to qualified service personnel.
AIRFLOW FAULT DURING RUN	1. Blower stopped running due to thermal or current overload	1. Check combustion blower for signs of excessive heat or high current draw that may trip thermal or current overload devices.
	2. Blocked Blower inlet or inlet ductwork	2. Inspect the inlet to the combustion blower including any ductwork leading up to the combustion blower for signs of blockage.
	3. Blocked airflow switch	3. Remove the airflow switch and inspect for signs of blockage, clean or replace as necessary.
	4. Defective airflow switch	4. Measure the airflow switch for continuity with the combustion blower running. If there is an erratic resistance reading or the resistance reading is greater than zero ohms, replace the switch.
	5. Combustion oscillations	5. Run unit to full fire. If the unit rumbles or runs rough, perform combustion calibration.

TABLE 8-1. BOILER TROUBLESHOOTING – Continued

FAULT INDICATION	PROBABLE CAUSES	CORRECTIVE ACTION
DELAYED INTERLOCK OPEN	1. Delayed Interlock Jumper not installed or removed. 2. Device proving switch hooked to interlocks is not closed	1. Check for a jumper properly installed across the delayed interlock terminals in the I/O box. 2. If there are 2 external wires on these terminals, check to see if an end switch for a device (i.e. a pump, louver, etc.) is tied to these interlocks. Ensure that the device and its end switch are functional. (jumper may be temporarily installed to test interlock
DIRECT DRIVE SIGNAL FAULT	1. Direct drive signal is not present: Not yet installed. Wrong polarity. Signal defective at source. Broken or loose wiring. 2. Signal is not isolated (floating). 3. Control Box signal type selection switches not set for correct signal type (voltage or current).	1. Check I/O Box to ensure signal is hooked up. Hook up if not installed. If installed, check polarity. Measure signal level. Check continuity of wiring between source and boiler. 2. Check signal at source to ensure it is isolated. 3. Check DIP switch on PMC board to ensure it is set correctly for the type of signal being sent. Check control signal type set in Configuration Menu.
FLAME LOSS DURING IGN	1. Burner Ground Screw not installed or loose. 2. Worn flame detector 3. No spark from Spark Plug 4. Defective Ignition Transformer 5. Defective Ignition/Stepper (IGST) Board 6. Defective SSOV 7. Defective Differential Pressure Regulator. 8. Carbon or other debris on Burner.	1. Inspect and install/retighten Burner Ground Screw. 2. Remove and inspect the flame detector for signs of wear. Replace if necessary. 3. Close the internal gas valve in the boiler. Install and arc a spark ignitor outside the unit. 4. If there is no spark, check for 120VAC at the primary side to the ignition transformer during the ignition cycle. 5. If 120VAC is not present, the IGST Board in the Control Box may be defective. Refer fault to qualified service personnel. 6. While externally arcing the spark ignitor, observe the open/close indicator in the Safety Shut-Off Valve to ensure it is opening. If the valve does not open, check for 120VAC at the valves input terminals. If 120VAC is not present, the IGST board in the Control Box may be defective. Refer fault to qualified service personnel. 7. Check gas pressure using gauge or manometer into and out of the Air/Fuel Valve to ensure gas is getting to burner. 8. Remove burner and inspect for any carbon or debris. Clean and reinstall

TABLE 8-1. BOILER TROUBLESHOOTING – Continued

FAULT INDICATION	PROBABLE CAUSES	CORRECTIVE ACTION
FLAME LOSS DURING RUN	1. Worn Flame Detector or cracked ceramic.	1. Remove and inspect the Flame Detector for signs of wear or cracked ceramic. Replace if necessary.
	2. Defective Differential Regulator.	2. Check gas pressure readings using a gauge or manometer into and out of the Air/Fuel Valve to ensure that the gas pressure into and out of the valve is correct.
	3. Poor combustion calibration.	3. Check combustion calibration. Adjust as necessary.
	4. Debris on burner.	4. Remove the burner and inspect for any carbon or debris. Clean and reinstall.
	5. Blocked condensate drain.	5. Remove blockage in condensate drain.
HEAT DEMAND FAILURE	1. The Heat Demand Relays on the Ignition/Stepper board failed to activate when commanded	1. Press CLEAR button and restart the unit. If the fault persists, replace Ignition/Stepper (IGST) Board.
	2. Relay is activated when not in Demand	2. Defective relay. Replace IGST Board.
HIGH EXHAUST TEMPERATURE	1. Defective exhaust sensor.	1. Measure the actual exhaust temperature and continuity of the exhaust sensor. If the exhaust temperature is less than 475 ^{o}F and the exhaust sensor shows continuity replace the sensor.
	2. Carboned heat exchanger due to incorrect combustion calibration	2. If exhaust temperature is greater than 500 ^{o}F, check combustion calibration. Calibrate or repair as necessary.
HIGH GAS PRESSURE	1. Incorrect supply gas pressure.	1. If using a non-lock up style regulator for the gas supply, measure static gas pressure downstream, it should be 14”WC or less. Adjust as necessary.
	2. Defective Supply Regulator or Wrong Style Regulator	2. If gas supply pressure cannot be lowered, a lock-up style regulator may be required or the supply regulator may be defective.
	3. Defective High Gas Pressure Switch	3. Remove the leads from the high gas pressure switch. Measure continuity across the common and normally closed terminals with the unit not firing. Replace the switch if it does not show continuity.

TABLE 8-1. BOILER TROUBLESHOOTING – Continued

FAULT INDICATION	PROBABLE CAUSES	CORRECTIVE ACTION
HIGH WATER TEMP SWITCH OPEN	1. Faulty Water temperature switch.	1. Test the temperature switch to insure it trips at its actual water temperature setting.
	2. Incorrect PID settings.	2. Check PID settings against Menu Default settings in the Appendix. If the settings have been changed, record the current readings then reset them to the default values.
	3. Faulty shell temperature sensor.	3. Using the resistance charts in the Appendix C, Measure the resistance of Shell sensor and BTU sensor at a known water temperature.
	4. Unit in Manual mode	4. If unit is in Manual Mode switch to Auto Mode.
	5. Unit setpoint is greater than Over Temperature Switch setpoint.	5. Check setpoint of unit and setpoint of Temperature Switch; Ensure that the temperature switch is set higher than the unit's setpoint.
	6. Boiler Management System PID or other settings not correctly setup.	6. Check the BMS for changes to PID default values, correct as necessary.
	7. No interlock to boiler or BMS to disable boiler(s) in event that system pumps have failed.	7. If system pump is controlled by Energy Management System other than BMS or pumps are individually controlled by boiler, check to see if there are flow switches interlocked to the BMS or boiler.
	8. System flow rate changes are occurring faster than boilers can respond.	8. If the system is a variable flow system, monitor system flow changes to ensure that the rate of flow change is not faster than what the boilers can respond to.
HIGH WATER TEMPERATURE	1. See HIGH WATER TEMPERATURE SWITCH OPEN.	1. See HIGH WATER TEMPERATURE SWITCH OPEN.
	2. Temp HI Limit setting is too low.	2. Check Temp HI Limit setting.
IGN BOARD COMM FAULT	1. Communication fault has occurred between the PMC board and Ignition/Stepper (IGST) board	1. Press CLEAR button and restart unit. If fault persists, contact qualified Service Personnel.

TABLE 8-1. BOILER TROUBLESHOOTING – Continued

FAULT INDICATION	PROBABLE CAUSES	CORRECTIVE ACTION
IGN SWTCH CLOSED DURING PURGE	1. Air/Fuel Valve not rotating	1. Start the unit. The Air/Fuel Valve should rotate to the purge (open) position. If the valve does not rotate at all or does not rotate fully open, check the Air/Fuel Valve calibration. If calibration is okay, the problem may be in the Air-Fuel Valve or the Control Box. Refer to qualified service personnel
	2. Defective or shorted switch	2. . If the Air/Fuel Valve does rotate to purge, check the ignition switch for continuity between the N.O. and COM terminals. If the switch shows continuity when not in contact with the cam replace the switch.
	3. Switch wired incorrectly	3. Check to ensure that the switch is wired correctly (correct wire numbers on the normally open terminals). If the switch is wired correctly, replace the switch
	4. Defective Power Supply Board or fuse	4. Check DS1 & DS2 LEDs on Power Supply Board. If they are not steady ON, replace Power Supply Board.
	5. Defective IGST Board	5. Check “Heartbeat” LED DS1 and verify it is blinking ON & OFF every second. If not, replace IGST Board
IGN SWTCH OPEN DURING IGNITION	1. Air/Fuel Valve not rotating to ignition position.	1. Start the unit. The Air/Fuel Valve should rotate to the purge (open) position, then back to ignition position (towards closed) during the ignition cycle. If the valve does not rotate back to the ignition position, check the Air/Fuel Valve calibration. If calibration is okay, the problem may be in the Air/Fuel Valve or the Control Box. Refer fault to qualified service personnel.
	2. Defective ignition switch	2. If the Air/Fuel Valve does rotate to the ignition position, check the ignition position switch for continuity between the N.O. and COM terminals when in contact with the cam.
	3. Defective Power Supply Board or fuse	3. Check DS1 & DS2 LEDs on Power Supply Board. If they are not steady ON, replace Power Supply Board.
	4. Defective IGST Board	4. Check “Heartbeat” LED DS1 and verify it is blinking ON & OFF every second. If not, replace IGST Board.
INTERLOCK OPEN	1. Interlock jumper not installed or removed	1. Check for a jumper properly installed across the interlock terminals in the I/O box
	2. Energy Management System does not have boiler enabled.	2. If there are two external wires on these terminals check any Energy Management system to see if they have the units disabled (a jumper may be temporarily installed to see if the interlock circuit is functioning).
	3. Device proving switch hooked to interlocks is not closed.	3. Check that proving switch for any device hooked to the interlock circuit is closing and that the device is operational.

TABLE 8-1. BOILER TROUBLESHOOTING – Continued

FAULT INDICATION	PROBABLE CAUSES	CORRECTIVE ACTION
LINE VOLTAGE OUT OF PHASE	1. Line and Neutral switched in AC Power Box. 2. Incorrect power supply transformer wiring.	1. Check hot and neutral in AC Power Box to ensure they are not reversed 2. Check transformer wiring, in AC Power Box, against the power box transformer wiring diagram to ensure it is wired correctly
LOW GAS PRESSURE	1. Incorrect supply gas pressure. 2. Defective or incorrectly sized Gas Supply Regulator. 3. Defective Low Pressure Gas Switch	1. Measure gas pressure upstream of the supply gas regulator with the unit firing ensure it is 14” WC or greater. 2. Measure gas pressure downstream of the supply regulator with unit firing and adjust the gas supply regulator to increase the outlet gas pressure; if outlet gas pressure cannot be increased, check the sizing of the Supply regulator. 3. Measure gas pressure at the low gas pressure switch, if it is greater than 5” WC, measure continuity across the switch and replace if necessary.
LOW WATER LEVEL	1. Insufficient water level in system 2. Defective water level circuitry. 3. Defective water level probe.	1. Check system for sufficient water level. 2. Test water level circuitry using the Control Box front panel LOW WATER TEST and RESET buttons. Replace water level circuitry if it does not respond. 3. Check continuity of probe end to the shell, change probe if there is no continuity.
MODBUS COMM FAULT	1. Boiler not seeing information from Modbus network	1. Check network connections. If fault persists, contact qualified Service Personnel.
PRG SWTCH CLOSED DURING IGNITION	1. A/F Valve rotated open to purge and did not rotate to ignition position 2. Defective or shorted switch. 3. Switch wired incorrectly. 4. Defective Power Supply Board or fuse	1. Start the unit. The Air/Fuel Valve should rotate to the purge (open) position, then back to ignition position (towards closed) during the ignition cycle. If the valve does not rotate back to the ignition position, check the Air/Fuel Valve calibration. If calibration is okay, the problem may be in the Air/Fuel Valve or the Control Box. Refer fault to qualified service personnel. 2. If the Air/Fuel Valve does rotate to the ignition position, check the purge switch for continuity between the N.O. and COM terminals. If the switch shows continuity when not in contact with the cam, check to ensure that the switch is wired correctly (correct wire numbers on the normally open terminals). 3. If the switch is wired correctly, replace the switch. 4. Check DS1 & DS2 LEDs on Power Supply Board. If they are not steady ON, replace Power Supply Board.

TABLE 8-1. BOILER TROUBLESHOOTING – Continued

FAULT INDICATION	PROBABLE CAUSES	CORRECTIVE ACTION
continued	5. Defective IGST Board	5. Check “Heartbeat” LED DS1 and verify it is blinking ON & OFF every second. If not, replace IGST Board.
PRG SWTCH OPEN DURING PURGE	1. Defective purge switch. 2. No voltage present at switch. 3. Switch wired incorrectly. 4. Defective Power Supply Board or fuse 5. Defective IGST Board	1. If the air-fuel valve does rotate, check the purge switch for continuity when closing. Replace switch if continuity does not exist. 2. Measure for 24 VAC from each side of the switch to ground. If 24VAC is not present, refer fault to qualified service personnel. 3. Check to ensure that the switch is wired correctly (correct wire numbers on the normally open terminals). 4. Check DS1 & DS2 LEDs on Power Supply Board. If they are not steady ON, replace Power Supply Board. 5. Check “Heartbeat” LED DS1 and verify it is blinking ON & OFF every second. If not, replace IGST Board.
OUTDOOR TEMP SENSOR FAULT	1. Loose or broken wiring. 2. Defective Sensor. 3. Incorrect Sensor.	1. Inspect Outdoor Temperature sensor for loose or broken wiring. 2. Check resistance of sensor to determine if it is within specification. 3. Ensure that the correct sensor is installed.
REMOTE SETPT SIGNAL FAULT	1. Remote setpoint signal not present: Not yet installed. Wrong polarity. Signal defective at source. Broken or loose wiring. 2. Signal is not isolated (floating) if 4 to 20 mA. 3. Control Box signal type selection switches not set for correct signal type (voltage or current).	1. Check I/O Box to ensure signal is hooked up. Hook up if not installed. If installed, check polarity. Measure signal level. Check continuity of wiring between source and boiler. 2. Check signal at source to ensure it is isolated. 3. Check DIP switch on PMC board to ensure it is set correctly for the type of signal being sent. Check control signal type set in Configuration Menu.
RESIDUAL FLAME	1. SSOV not fully closed.	1. Check open/close indicator window of Safety Shut-Off Valve (SSOV) and ensure that the SSOV is fully closed. If not fully closed, replace the valve and or actuator. Close gas shut-off valve downstream of SSOV. Install a manometer or gauge in a gas test port between the SSOV and the gas shut off valve. If a gas pressure reading is observed replace the SSOV valve and or actuator.

TABLE 8-1. BOILER TROUBLESHOOTING – Continued

FAULT INDICATION	PROBABLE CAUSES	CORRECTIVE ACTION
(continued)	2. Defective Flame Detecto	2. Replace Flame Detector.
SSOV FAULT DURING PURGE	See SSOV SWITCH OPEN	
SSOV FAULT DURING RUN	1. SSOV switch closed for 15 seconds during run.	1. Replace or adjust microswitch in SSOV actuator. If fault persists, replace actuator.
SSOV RELAY FAILURE	1. SSOV relay failed on board.	1. Press CLEAR button and restart unit. If fault persists, replace Ignition/Stepper (IGST) Board.
SSOV SWITCH OPEN	1. Actuator not allowing for full closure of gas valve	1. Observe operation of the Safety Shut-Off Valve (SSOV) through indicator on the Valve actuator and ensure that the valve is fully and not partially closing.
	2. SSOV powered when it should not be	2. If the SSOV never closes, it may be powered continuously. Close the gas supply and remove power from the unit. Refer fault to qualified service personnel.
	3. Defective Switch or Actuator	3. Remove the electrical cover from the SSOV and check switch continuity. If the switch does not show continuity with the gas valve closed, either adjust or replace the switch or actuator.
	4. Incorrectly wired switch.	4. Ensure that the SSOV Proof of Closure switch is correctly wired.
STEPPER MOTOR FAILURE	1. Air/Fuel Valve out of calibration.	1. Refer to GF-112 and perform Stepper Test (para. 6.3.5) to ensure stepper motor rotates properly between the 0% (fully closed) and 100% (fully open) positions. Verify that the FIRE RATE bargraph and the dial on the Air/Fuel Valve track each other to indicate proper operation. If operation is not correct, perform the Stepper Feedback Calibration (GF-112, para. 6.2.1).
	2. Air/Fuel Valve unplugged.	2. Check that the Air/Fuel Valve is connected to the Control Box.
	3. Loose wiring connection to the stepper motor.	3. .Inspect for loose connections between the Air/Fuel Valve motor and the wiring harness.
	4. Defective Air/Fuel Valve stepper motor.	4. Replace stepper motor.
	5. Defective Power Supply Board or fuse	5. Check DS1 & DS2 LEDs on Power Supply Board. If they are not steady ON, replace Power Supply Board.
	6. Defective IGST Board	6. Check “Heartbeat” LED DS1 and verify it is blinking ON & OFF every second. If not, replace IGST Board.

BOILER MENU ITEM DESCRIPTIONS

MENU LEVEL & OPTION	DESCRIPTION
OPERATING MENU	
Active Setpoint	This is the setpoint temperature to which the control is operating when operating in the Constant Setpoint, Remote Setpoint or Outdoor Reset Mode. When in the Constant Setpoint Mode, this value is equal to the Internal Setpoint setting in the Configuration Menu. When in the Remote Setpoint Mode, this value is the setpoint equivalent to the remote analog signal supplied to the unit. When in the Outdoor Reset Mode, this is the derived value from the charts in Appendix D.
Aux Temp	For monitoring purposes only
Outdoor Temp	Displayed only if an outdoor sensor is installed and enabled in the Configuration Menu.
Fire Rate In	Indicates desired input fire rate. This will normally be the same as the fire rate shown on the bar-graph (fire rate out) when the boiler is operating.
Flame Strength	Displays flame strength from 0 to 100%.
Run Cycles	Displays the total number of run cycles from 0 to 999,999.
Run Hours	Displays total run time of unit in hours from 0 to 999,999.
Fault Log	Displays information on the last 9 faults.

BOILER MENU ITEM DESCRIPTIONS - Continued

MENU LEVEL & OPTION	DESCRIPTION
SETUP MENU	
Password	Allows password to be entered. Once the valid password (159) is entered, options in the Setup, Configuration and Tuning Menus can be modified.
Language	English Only
Time	Displays time from 12:00am to 11:59pm.
Date	Displays dates from 01/01/00 to 12/31/99
Unit of Temp	Permits selection of temperature displays in degrees Fahrenheit (°F) or degrees Celsius (°C). Default is °F.
Comm Address	For RS-485 (MODBUS) communications (0 to 255). Default address is 0. RS-232 should have its own (programmable) password.
Baud Rate	Allows communications Baud Rate to be set (2400 to 19.2K). Default is 9600.
Software Version	Identifies the current software version of the control box.
CONFIGURATION MENU	
Internal Setpoint	Allows internal setpoint to be set . Default is 130°F.
Unit Type	Allows selection of Boiler or Water Heater. Default is Boiler.
Unit Size	Sets unit size from 0.5 to 3.0 MBTUs. Default is 1.0 MBTU.
Boiler Mode	It allows selection of: Constant Setpoint, Remote Setpoint, Direct Drive, Combination, or Outdoor Reset Mode. Default is Constant Setpoint Mode.
Remote Signal	Used to set the type of external signal which will be used when operating in the Remote Setpoint, Direct Drive or Combination Mode. The factory default is 4-20 mA/1-5V.
Bldg Ref Temp	Allows the building reference temperature to be set when operating a boiler in the Outdoor Reset Mode. Default is 70°F.

BOILER MENU ITEM DESCRIPTIONS - Continued

MENU LEVEL & OPTION	DESCRIPTION
Reset Ratio	Permits setting of Reset Ratio when operating boiler in the Outdoor Reset Mode. Reset Ratio is adjustable from 0.1 to 9.9. Default is 1.2.
Outdoor Sensor	Allows outdoor sensor function to be enabled or disabled. Default is Disabled.
System Start Tmp	If outdoor sensor is enabled in the Configuration Menu, this menu item allows the system start temperature to be set from 30°F to 100°F. Default is 60°F.
Setpoint Lo Limit	Used to set the minimum allowable setpoint (40°F to Setpoint Hi Limit). Default is 60°F
Setpoint Hi Limit	Used to set the maximum allowable setpoint (Setpoint Lo Limit to 240°F). Default is 200°F.
Temp Hi Limit	Used to set the maximum allowable outlet temperature (40°F to 240°F). Any temperature above this setting will turn off the unit. The temperature must then drop 5°F below this setting to allow the unit to run. Default Temp Hi Limit is 215°F.
Max Fire Rate	Sets the maximum allowable fire rate for the unit (40% to 100%). Default is 100%.
Pump Delay Timer	Specifies the amount of time (0 to 30 min.) to keep the pump running after the unit turns off. Default is zero.
Aux Start On Dly	Specifies the amount of time to wait (0 to 120 sec.) between activating the Aux Relay (due to a demand) and checking the pre-purge string to start the boiler. Default is 0 sec.
Failsafe Mode	Allows the Failsafe mode to be set to either Constant Setpoint or Shutdown. Default is Shutdown.
mA Output	Can be set to allow this output to monitor Setpoint, Outlet Temperature, Fire Rate Out or be set to OFF. Default is OFF.
Lo Fire Timer	Specifies how long (2 to 120 sec.) to remain in the low fire position after ignition, before going to the desired output. Default is 2 sec.

BOILER MENU ITEM DESCRIPTIONS - Continued

MENU LEVEL & OPTION	DESCRIPTION
Setpt Limiting	Allows Setpoint Limiting to be enabled or disabled. Default is disabled.
Setpt Limit Band	If Setpoint Limiting is enabled, this menu item allows the Setpt Limit Band to be set from 0°F to 10°F. Default is 5°F.
TUNING MENU	
Prop Band	Generates a fire rate based on the error that exists between the setpoint temperature and the actual outlet temperature. If the actual error is less than the proportional band setting (1 to 120°F), the fire rate will be less than 100%. If the error is equal to or greater than the proportional band setting, the fire rate will be 100%. Default is 70°F.
Integral Gain	This sets the fraction of the output, due to setpoint error, to add or subtract from the output each minute to move towards the setpoint. Gain is adjustable from 0.00 to 2.00. Default is 1.00.
Derivative Time	This value (0.0 to 2.00 min.) responds to the rate of change of the setpoint error. This is the time that this action advances the output. Default is 0.0 min.
Reset Defaults?	Allows Tuning Menu options to be reset to their Factory Default values.

STARTUP, STATUS AND FAULT MESSAGES

STARTUP AND STATUS MESSAGES

MESSAGE	DESCRIPTION
DISABLED HH:MM pm MM/DD/YY	Displayed if ON/OFF switch is set to OFF. The display also shows the time and date that the unit was disabled.
STANDBY	Displayed when ON/OFF switch is in the ON position, but there is no demand for heat. The time and date are also displayed.
DEMAND DELAY XX sec	Displayed if Demand Delay is active.
PURGING XX sec	Displayed during the purge cycle during startup. The duration of the purge cycle counts up in seconds.
IGNITION TRIAL XX sec	Displayed during ignition trial of startup sequence. The duration of cycle counts up in seconds.
FLAME PROVEN	Displayed after flame has been detected for a period of 2 seconds. Initially, the flame strength is shown in %. After 5 seconds has elapsed, the time and date are shown in place of flame strength.
WARMUP XX sec	Displayed for 2 minutes during the initial warmup only.
WAIT	Prompts the operator to wait.

APPENDIX B

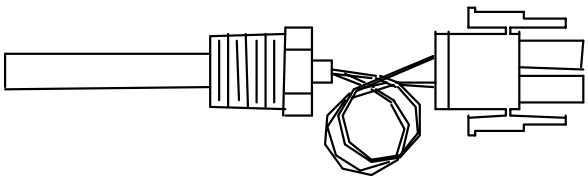
FAULT MESSAGES

FAULT MESSAGE	FAULT DESCRIPTION
HIGH WATER TEMP SWITCH OPEN	The High Water Temperature Limit Switch is open.
LOW WATER LEVEL	The Water Level Control board is indicating low water level.
LOW GAS PRESSURE	The Low Gas Pressure Limit Switch is open.
HIGH GAS PRESSURE	The High Gas Pressure Limit Switch is open.
INTERLOCK OPEN	The Remote Interlock is open.
DELAYED INTERLOCK OPEN	The Delayed Interlock is open.
AIRFLOW FAULT DURING PURGE	The Blower Proof Switch opened during purge.
PRG SWTCH OPEN DURING PURGE	The Purge Position Limit switch on the air/fuel valve opened during purge.
IGN SWTCH OPEN DURING IGNITION	The Ignition Position Limit switch on the air/fuel valve opened during ignition.
IGN SWTCH CLOSED DURING PURGE	The Ignition Position Limit switch on the air/fuel valve closed during purge.
PRG SWTCH CLOSED DURING IGNITION	The Purge Position Limit switch on the air/fuel valve closed during ignition.
AIRFLOW FAULT DURING IGN	The Blower Proof Switch opened during ignition.
AIRFLOW FAULT DURING RUN	The Blower Proof Switch opened during run.
SSOV SWITCH OPEN	The SSOV switch opened during standby.
SSOV FAULT DURING PURGE	The SSOV switch opened during purge.
SSOV FAULT DURING IGN	The SSOV switch closed or failed to open during ignition.
SSOV FAULT DURING RUN	The SSOV switch closed for more than 15 seconds during run.
SSOV RELAY FAILURE	A failure has been detected in one of the relays that control the SSOV.
FLAME LOSS DURING IGN	The Flame signal was not seen during ignition or lost within 5 seconds after ignition.
FLAME LOSS DURING RUN	The Flame signal was lost during run.
HIGH EXHAUST TEMPERATURE	The High Exhaust Temperature Limit Switch is closed.
LOSS OF POWER	A power loss had occurred. The time and date when power was restored is displayed.

FAULT MESSAGES - Continued

FAULT MESSAGE	FAULT DESCRIPTION
RESIDUAL FLAME	The Flame signal was seen for more than 60 seconds during standby.
HEAT DEMAND FAILURE	The Heat Demand Relays on the Ignition board failed to activate when commanded.
IGN BOARD COMM FAULT	A communication fault has occurred between the PMC board and Ignition board.
DIRECT DRIVE SIGNAL FAULT	The direct drive signal is not present or is out of range.
REMOTE SETPT SIGNAL FAULT	The remote setpoint signal is not present or is out of range.
OUTDOOR TEMP SENSOR FAULT	The temperature measured by the Outdoor Air Sensor is out of range.
OUTLET TEMP SENSOR FAULT	The temperature measured by the Outlet Sensor is out of range.
FFWD TEMP SENSOR FAULT	The temperature measured by the FFWD Sensor is out of range.
HIGH WATER TEMPERATURE	The temperature measured by the Outlet Sensor exceeded the Temp Hi Limit setting.
LINE VOLTAGE OUT OF PHASE	The High AC voltage is out of phase from the low AC voltage.
STEPPER MOTOR FAILURE	The stepper motor failed to move the valve to the desired position.
NETWORK COMM FAULT	The RS-485 network information is not present or is corrupted.

Temperature Sensor Resistance Chart (Balco)



TEMPERATURE SENSOR
AERCO PN 123449

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

R(Ohms)=.00161T^2+1.961T+854.841
T='F

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 Temperatrure 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			

APPENDIX D

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					

APPENDIX D

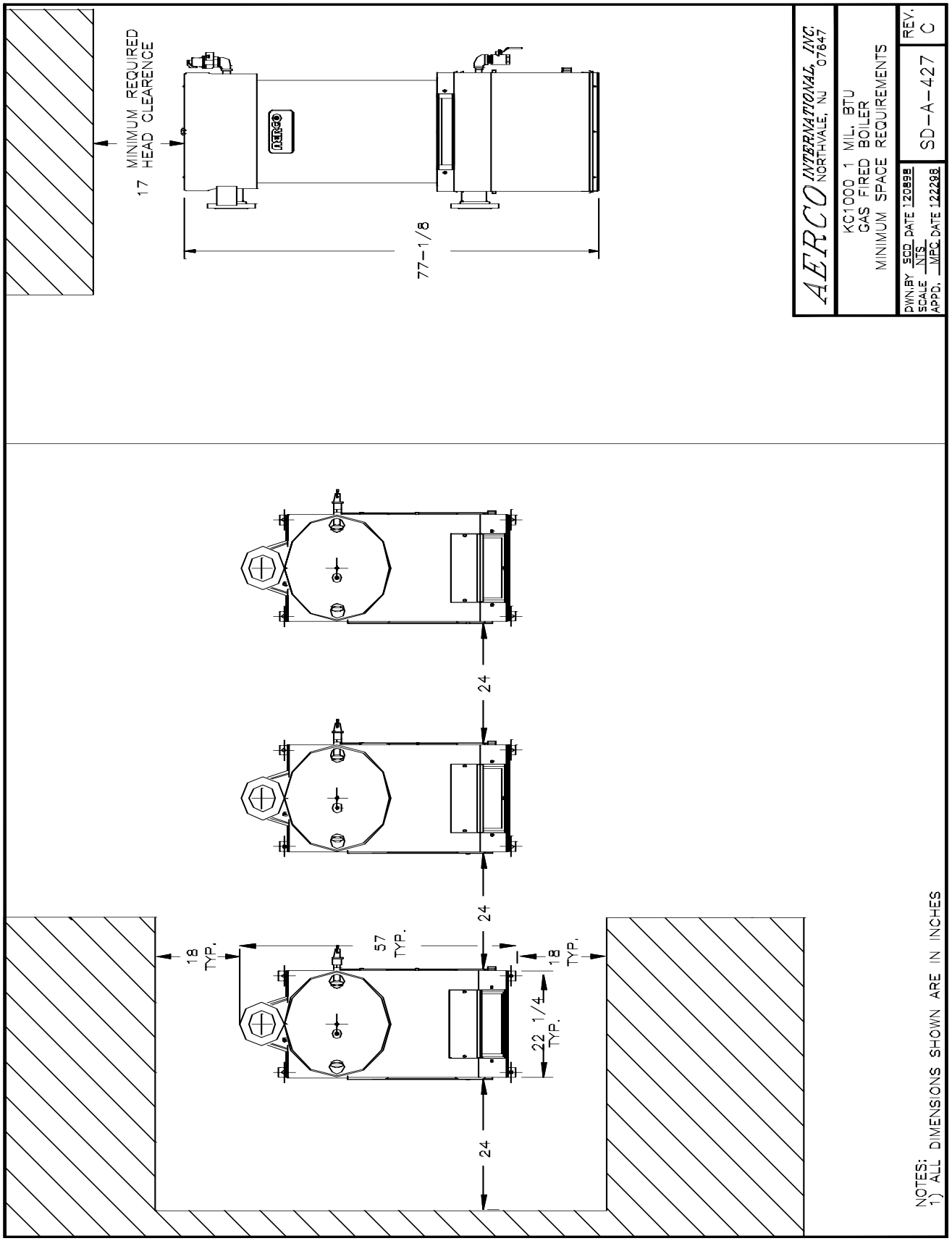
Header Temperature for a Building Reference Temperature of 90F

	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					

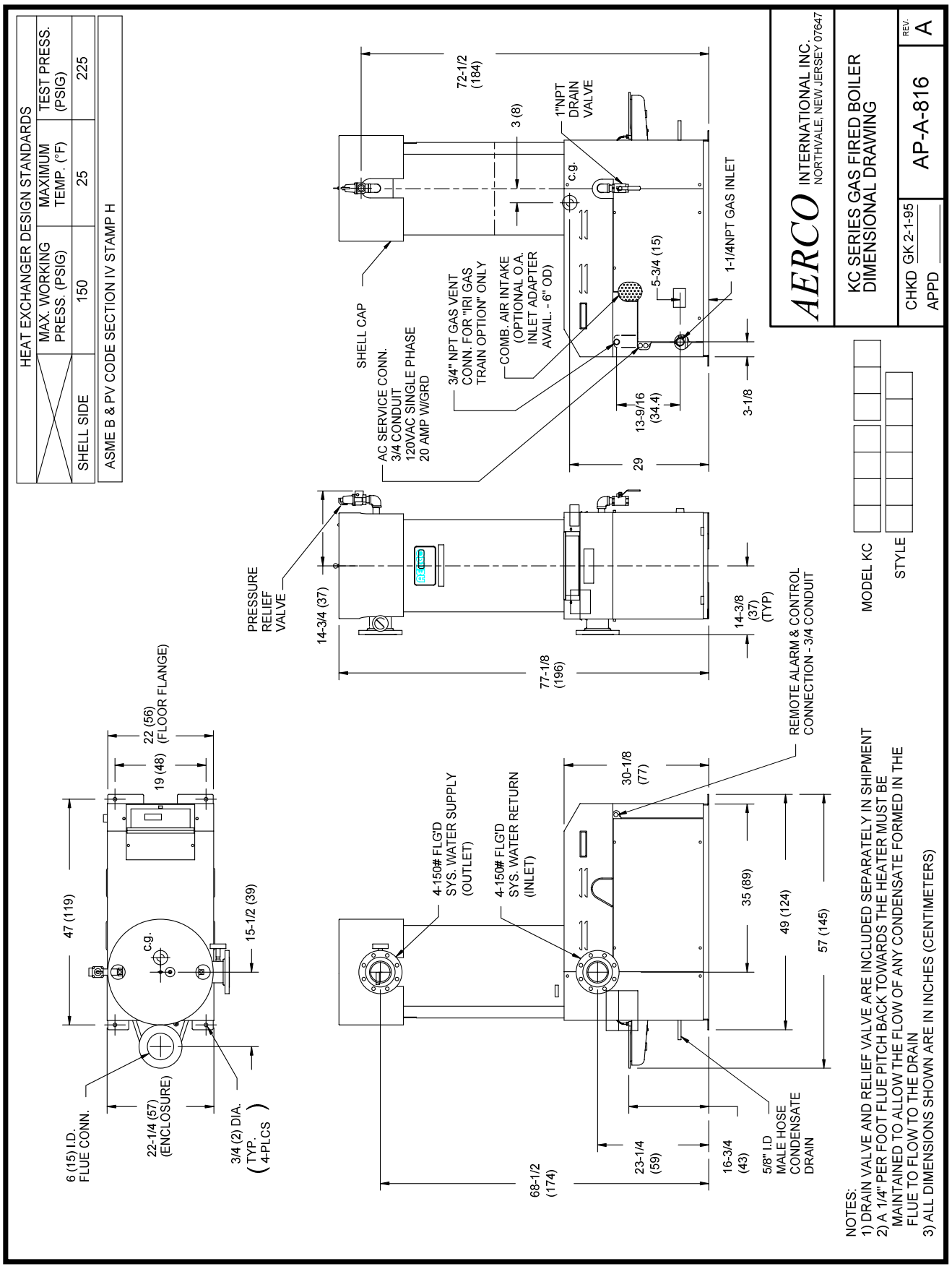
APPENDIX E

BOILER DEFAULT SETTINGS

MENU & OPTION	FACTORY DEFAULT
Setup Menu	
Password	0
Language	English
Unit of Temp	Fahrenheit
Comm Address	0
Baud Rate	9600
Configuration Menu	
Internal Setpt	130°F
Unit Type	Boiler
Unit Size	1.0 MBTU
Boiler Mode	Constant Setpoint
Remote Signal (If Mode = Remote Setpoint, Direct Drive or Combination)	4 – 20 mA /1-5V
Bldg Ref Temp (If Boiler Mode = Outdoor Reset)	70°F
Reset Ratio (If Boiler Mode = Outdoor Reset)	1.2
Outdoor Sensor	Disabled
System Start Tmp (If Outdoor Sensor = Enabled)	60°F
Setpt Lo Limit	60°F
Setpt Hi Limit	200°F
Temp Hi Limit	215°F
Max Fire Rate	100%
Pump Delay Timer	0 min
Aux Start On Dly	0 sec
Failsafe Mode	Shutdown
mA Output	Off
Lo Fire Timer	2 sec
Setpt Limit Band (If Setpt Limiting = Enabled)	5°F
Tuning Menu	
Prop Band	70°F
Integral Gain	1.00
Derivative Time	0.0 min


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

APPENDIX F


HEAT EXCHANGER DESIGN STANDARDS
SHELL SIDE
MAX. WORKING PRESS. (PSIG) 150
MAXIMUM TEMP. (°F) 25
TEST PRESS. (PSIG) 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-816
REV. A
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)
77-1/8
(196)
14-3/8
(37)
(TYP)
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
22 (56)
(FLOOR FLANGE)
19 (48)
47 (119)
c.g.
15-1/2 (39)
6 (15) I.D.
FLUE CONN.
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)

HEAT EXCHANGER			
ITEM	PART NO.	QTY	DESCRIPTION
1	GM–20881	1	HEAT EXCHANGER ASS'Y

EXHAUST MANIFOLD			
ITEM	PART NO.	QTY	DESCRIPTION
2	GM–20844–2	1	EXHAUST MANIFOLD
3	GP–20885	1	EXHAUST MANIFOLD INSULATION
4	GM–123352	1	EXHAUST MANIFOLD DRAIN HOSE
5	GP–122540	1	HOSE CLAMP 13/16" – 1–3/4"ø RANGE
6	GP–123337	1	CONDENSATE CUP ASSEMBLY
7	GP–122849	2	VENT MOUNTING FLANGE

GASKETS			
ITEM	PART NO.	QTY	DESCRIPTION
13	GP–18532	1	SHELL GASKET
15	GP–18900	1	EXH. MANIFOLD TO LOWER HEAD SEAL
17	124839	1	COMBUSTION CHAMBER LINER (LOW NOX)
18	GP–122537	1	EXH. MANIFOLD TO COMB. CHAMB. GASKET

OTHER ACCESSORIES			
ITEM	PART NO.	QTY	DESCRIPTION
8	8–22	1	1–1/2" X 1" REDUCING BUSHING
9	GP–9–428	1	1" NPT X 4" LG. NIPPLE – RED BRASS
10	GP–122789	1	1" NPT 90° ELBOW – BRONZE
11	GM–122743	1	DRAIN VALVE ASSEMBLY
* 12	GP–5130–☐	1	1" NPT PRESSURE RELIEF VALVE
19	9–308	1	1" NPT CLOSE NIPPLE – RED BRASS
** 20	69087–☐	1	TEMP./PRESS. GAUGE
XX	GP–123050	1	EXTERNAL GAS SHUT–OFF VALVE

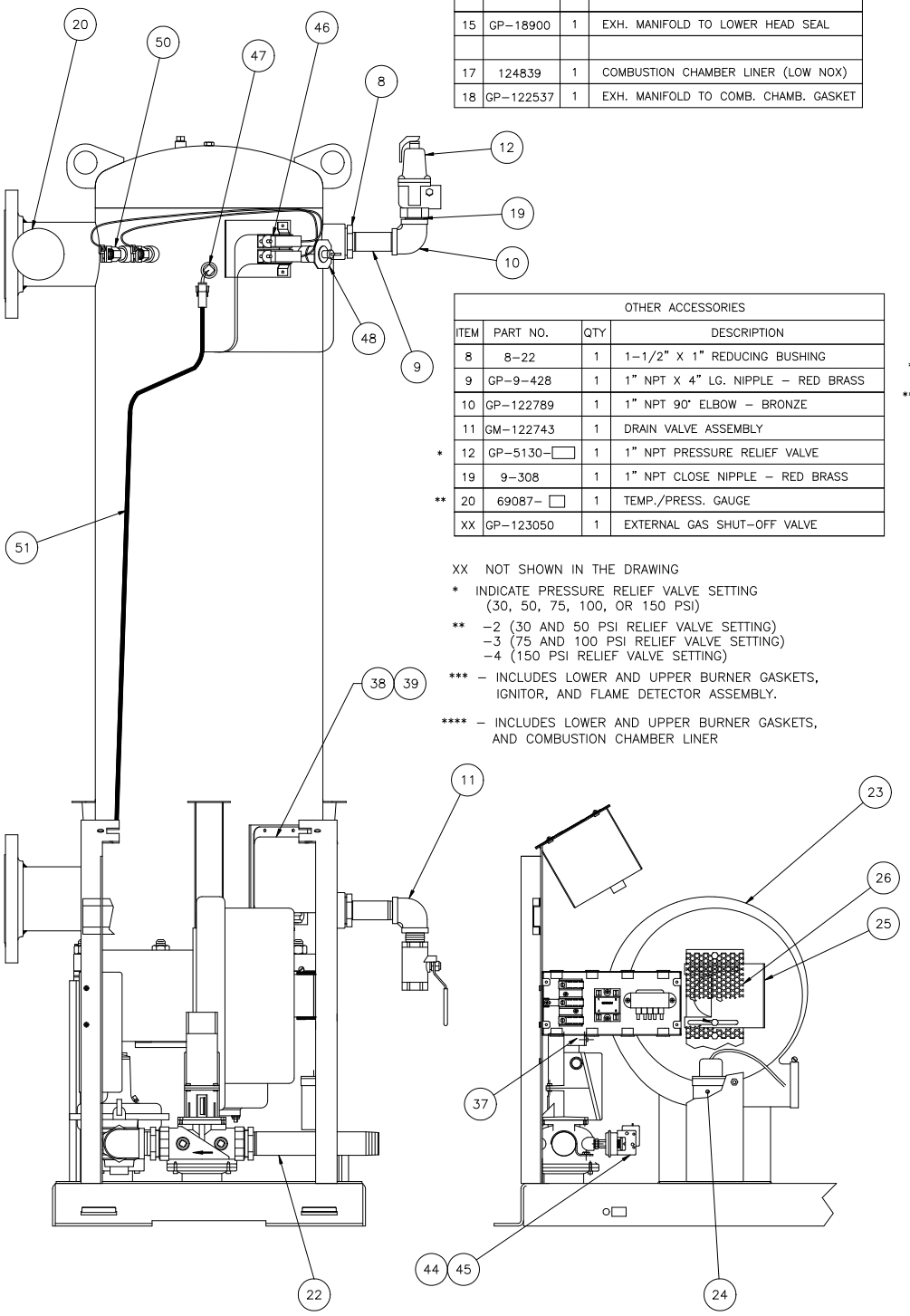
XX NOT SHOWN IN THE DRAWING

* INDICATE PRESSURE RELIEF VALVE SETTING (30, 50, 75, 100, OR 150 PSI)

** –2 (30 AND 50 PSI RELIEF VALVE SETTING)
–3 (75 AND 100 PSI RELIEF VALVE SETTING)
–4 (150 PSI RELIEF VALVE SETTING)

*** – INCLUDES LOWER AND UPPER BURNER GASKETS, IGNITOR, AND FLAME DETECTOR ASSEMBLY.

**** – INCLUDES LOWER AND UPPER BURNER GASKETS, AND COMBUSTION CHAMBER LINER



GAS TRAIN			
ITEM	PART NO.	QTY	DESCRIPTION
22	124800–1	1	GAS TRAIN ASSEMBLY (LOW NOX; FM; NATURAL GAS)
	124800–2		GAS TRAIN ASSEMBLY (LOW NOX; FM; PROPANE)
	124801–1		GAS TRAIN ASSEMBLY (LOW NOX; IRI; NATURAL GAS)
	124801–2		GAS TRAIN ASSEMBLY (LOW NOX; IRI; PROPANE)

BLOWER			
ITEM	PART NO.	QTY	DESCRIPTION
23	124935	1	BLOWER (INCLUDES CAPACITOR 65029)
24	65029	1	BLOWER MOTOR CAPACITOR (FOR ACI BLOWERS)
	124936		BLOWER MOTOR CAPACITOR (FOR BLOWERS WITH BALDOR MOTOR)
	GP–122553		BLOWER MOTOR CAPACITOR (FOR BLOWERS WITH AMETEK/A.O. SMITH MOTOR)
25	GP–161152	1	BLOWER AIR INLET SHUTTER
26	GP–122669	1	AIR INLET SCREEN
27	GP–122835	2	SPACER
28	85003	1	DAMPER TO BLOWER INLET HOSE

BURNER AND AIR/FUEL VALVE			
ITEM	PART NO.	QTY	DESCRIPTION
29	GP–161146	1	BLOWER TO AIR VA. INLET HOSE
30	GP–18894	1	GAS PRESS. CONTROL TUBE
31	123581	1	3/8" NPT x 3/8" O.D. TUBE AL. COMP. FTG.
32	GP–122614	1	1/8" NPT x 3/8" O.D. TUBE AL. COMP. FTG.
33	201271	1	AIR/FUEL VALVE (LOW NOX)
34	GP–161147	1	VALVE TO BURNER AIR HOSE
35	GM–20934	1	GAS INLET PIPE
*** 36	201258	1	BURNER ASSEMBLY (LOW NOX)
****	24043	1	KC1000 LOW NOx BURNER HEAD ONLY ASS'Y (REPLACEMENT KIT)

CONTROLS			
ITEM	PART NO.	QTY	DESCRIPTION
37	161559	1	POWER BOX ASSEMBLY
38	GP–122464	1	IGNITION TRANSFORMER
39	GP–122569	1	IGNITION CABLE ASSEMBLY
40	161560	1	INPUT/OUTPUT (I/O) BOX ASSEMBLY
41	181198	1	CONTROL BOX ASSEMBLY
42	161450	1	GAS TRAIN WIRING HARNESS
43	61002–14	1	BLOWER PROOF SWITCH
44	GP–122403	1	LOW PRESSURE GAS SWITCH
45	123536	1	1/4" MNPT x 1/8" FNPT RED. BUSHING
46	GP–122821	1	TEMPERATURE SWITCH
47	123448	1	SHELL SENSOR
48	122843	1	LOW WATER CUT–OFF
49	123463	1	EXHAUST TEMPERATURE SWITCH
50	123711	2	TEMPERATURE SWITCH THERMOWELL
51	161569	1	SHELL WIRING HARNESS
52	124334	1	EXHAUST TEMP. SWITCH HARNESS
53	GP–122412	1	HIGH PRESS. GAS SWITCH
54	123863	1	1/8" NPT BALL VALVE
55	124867	1	STAGED IGNITION ASSEMBLY
56	124870	1	SOLENOID VALVE HARNESS

OTHER PARTS			
ITEM	PART NO.	QTY	DESCRIPTION
57	GP–122406	3	BURNER & AIR/FUEL VALVE O–RING

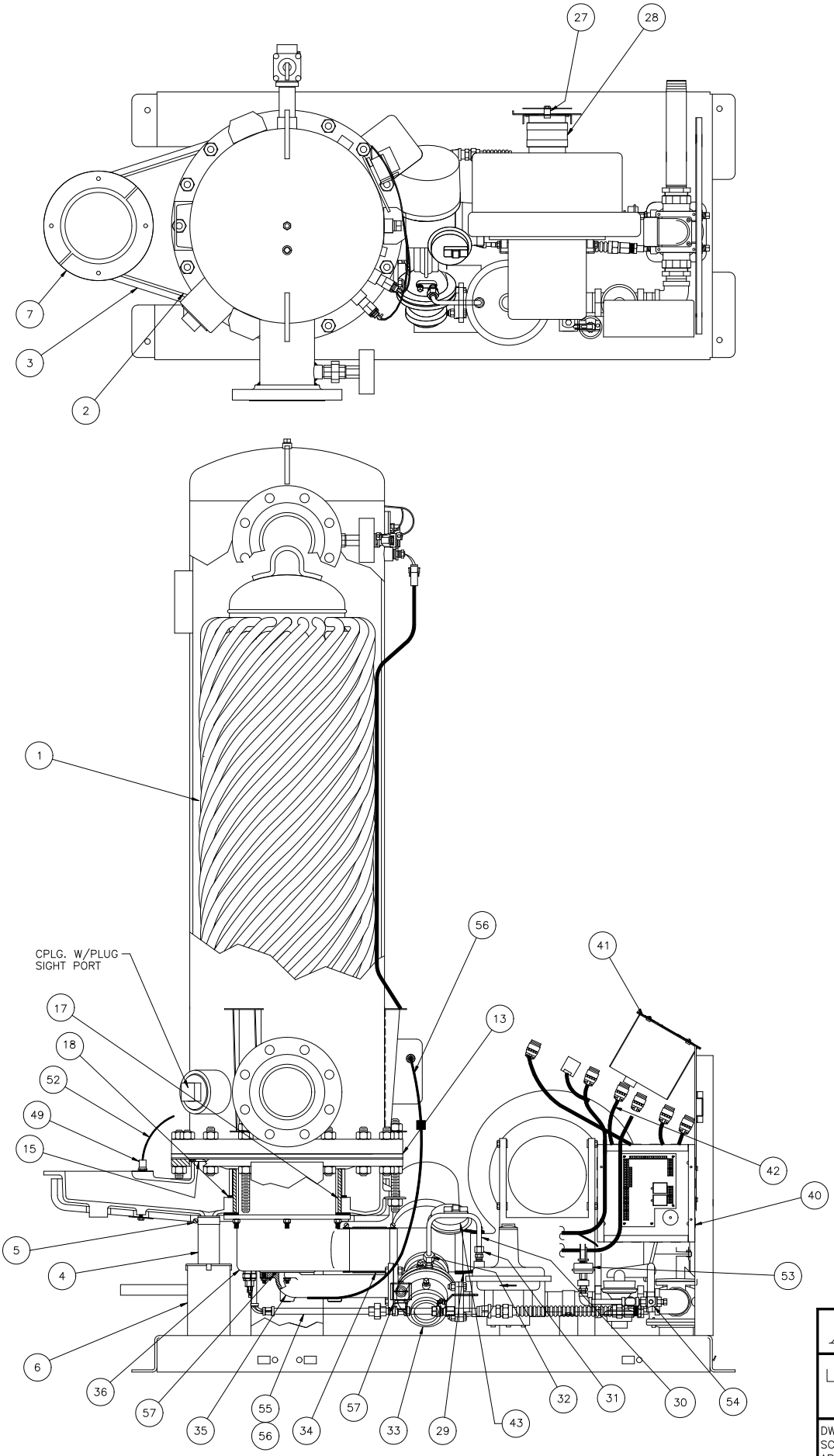
AERCO INTERNATIONAL, INC.
NORTHVALE, NJ 07647

LOW NOX KC1000 WATER BOILER
PARTS LIST

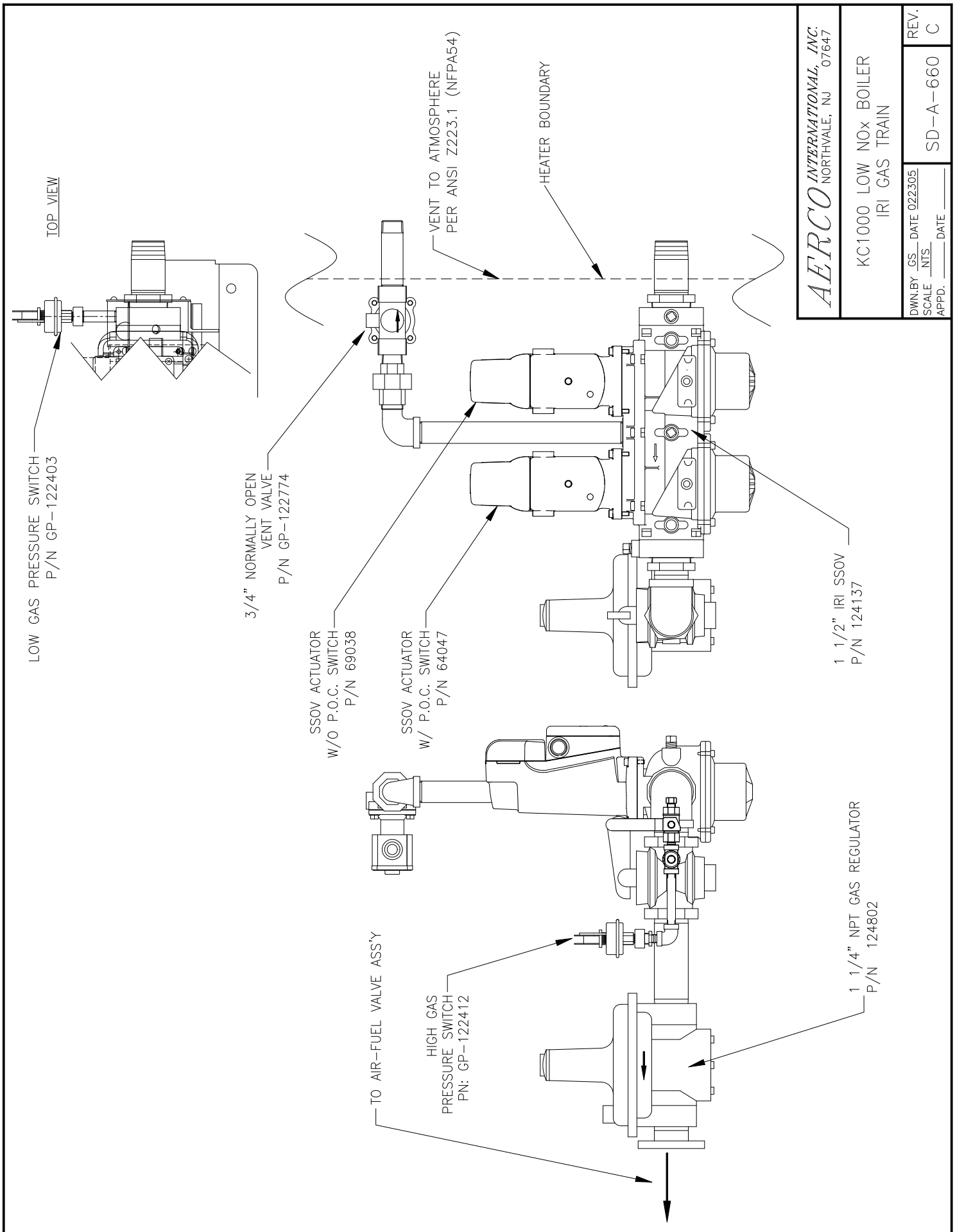
DWN.BY CZ DATE 022505
SCALE _____
APPD. _____ DATE _____

PL–A–145
(SH. 1 OF 2)

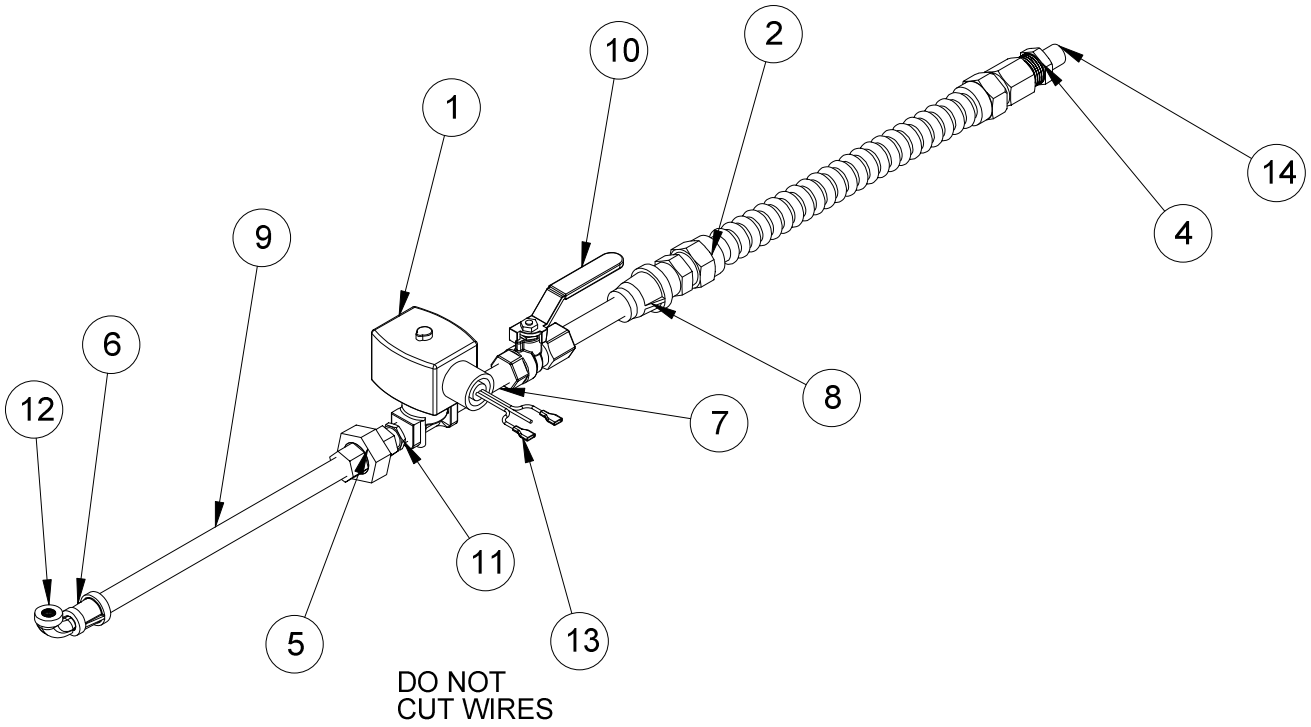
H



AERCO INTERNATIONAL, INC. NORTHVALE, NJ 07647		
LOW NOX KC1000 WATER BOILER PARTS LIST		
DWN.BY CZ DATE 022505 SCALE _____ APPD. _____ DATE _____	PL-A-145 (SH. 2 OF 2)	H

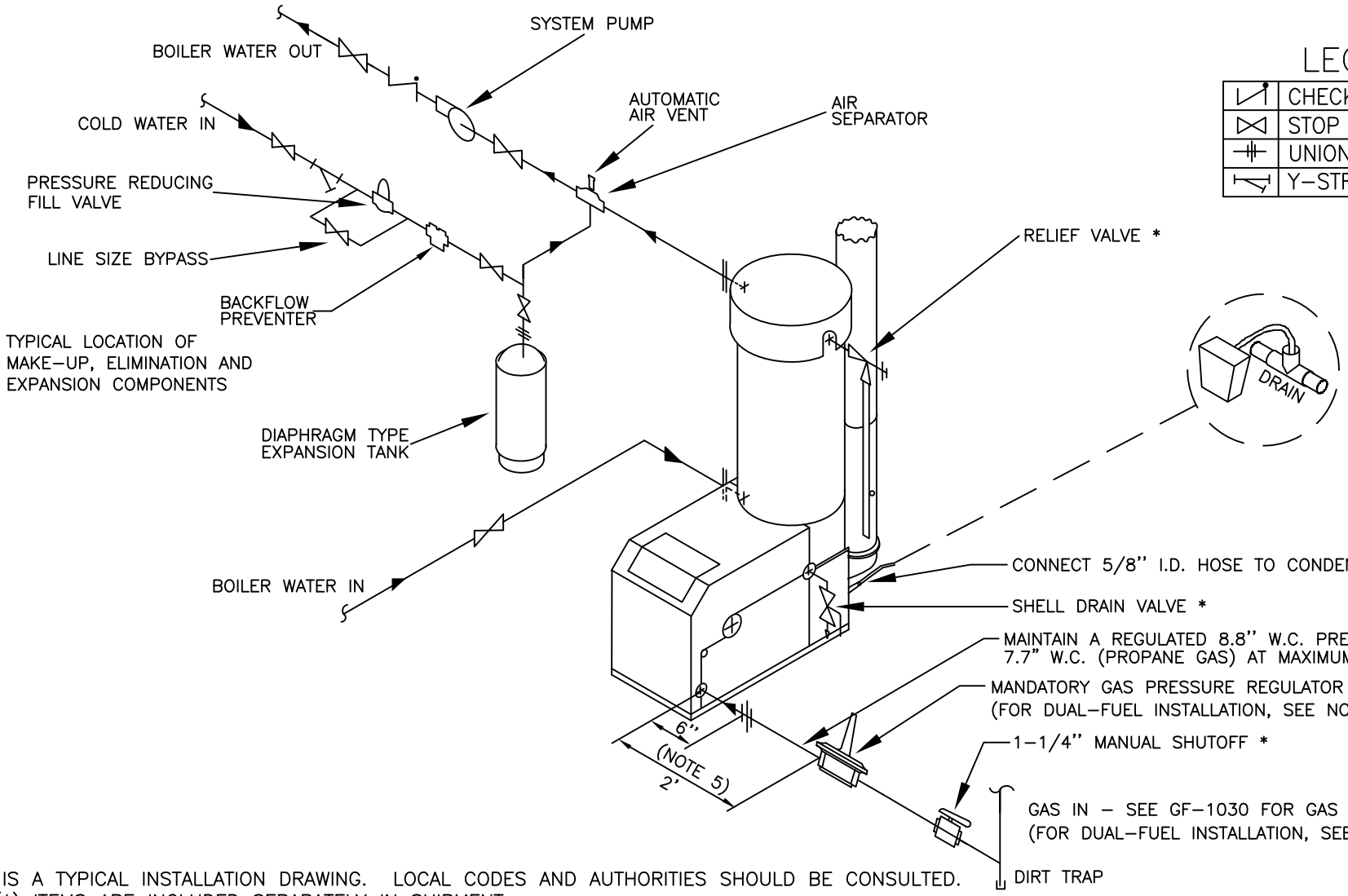

AERCO INTERNATIONAL, INC.
NORTHVALE, NJ 07647
KC1000 LOW NOx BOILER
IRI GAS TRAIN
SD-A-660
REV. C
DWN.BY GS DATE 022305
SCALE NTS
APPD. ____ DATE ____
TOP VIEW
LOW GAS PRESSURE SWITCH
P/N GP-122403
3/4" NORMALLY OPEN
VENT VALVE
P/N GP-122774
VENT TO ATMOSPHERE
PER ANSI Z223.1 (NFPA54)
HEATER BOUNDARY
SSOV ACTUATOR
W/O P.O.C. SWITCH
P/N 69038
SSOV ACTUATOR
W/ P.O.C. SWITCH
P/N 64047
1 1/2" IRI SSOV
P/N 124137
TO AIR-FUEL VALVE ASS'Y
HIGH GAS
PRESSURE SWITCH
PN: GP-122412
1 1/4" NPT GAS REGULATOR
P/N 124802

APPENDIX F



ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	1	124866	SOLENOID VALVE, 1/4" NPT
2	1	122712	1/2" NPT, FLEX, GAS HOSE, 12" LONG
3	1	123314	ELBOW, 1/4" NPT
4	1	9-43	REDUCER BUSHING, 1/2" TO 1/4" NPT
5	1	124933	UNION, 1/4" NPT
6	1	124934	1/4" X 1/8" REDUCING COUPLING
7	2	124088	NIPPLE, 1/4" NPT, C.S. 2 1/2" LONG
8	1	124932	REDUCING COUPLING, 1/2" TO 1/4" NPT
9	1	124910	NIPPLE, 1/4" NPT, CS. 9" LG
10	1	12820-1	1/4" NPT BALL VALVE
11	1	124939	1/4" NPT ORIFICE PIPE NIPPLE
12	1	124979	1/8" C.S. STREET ELBOW
13	2	124891	FEMALE FAST-ON CONNECTOR
14	1	12607-2	CLOSE NIPPLE, 1/4" NPT SCH.40, C.S.

LOW NOx STAGED IGNITION ASSEMBLY – 124867



LEGEND

	CHECK VALVE
	STOP VALVE
	UNION
	Y-STRAINER

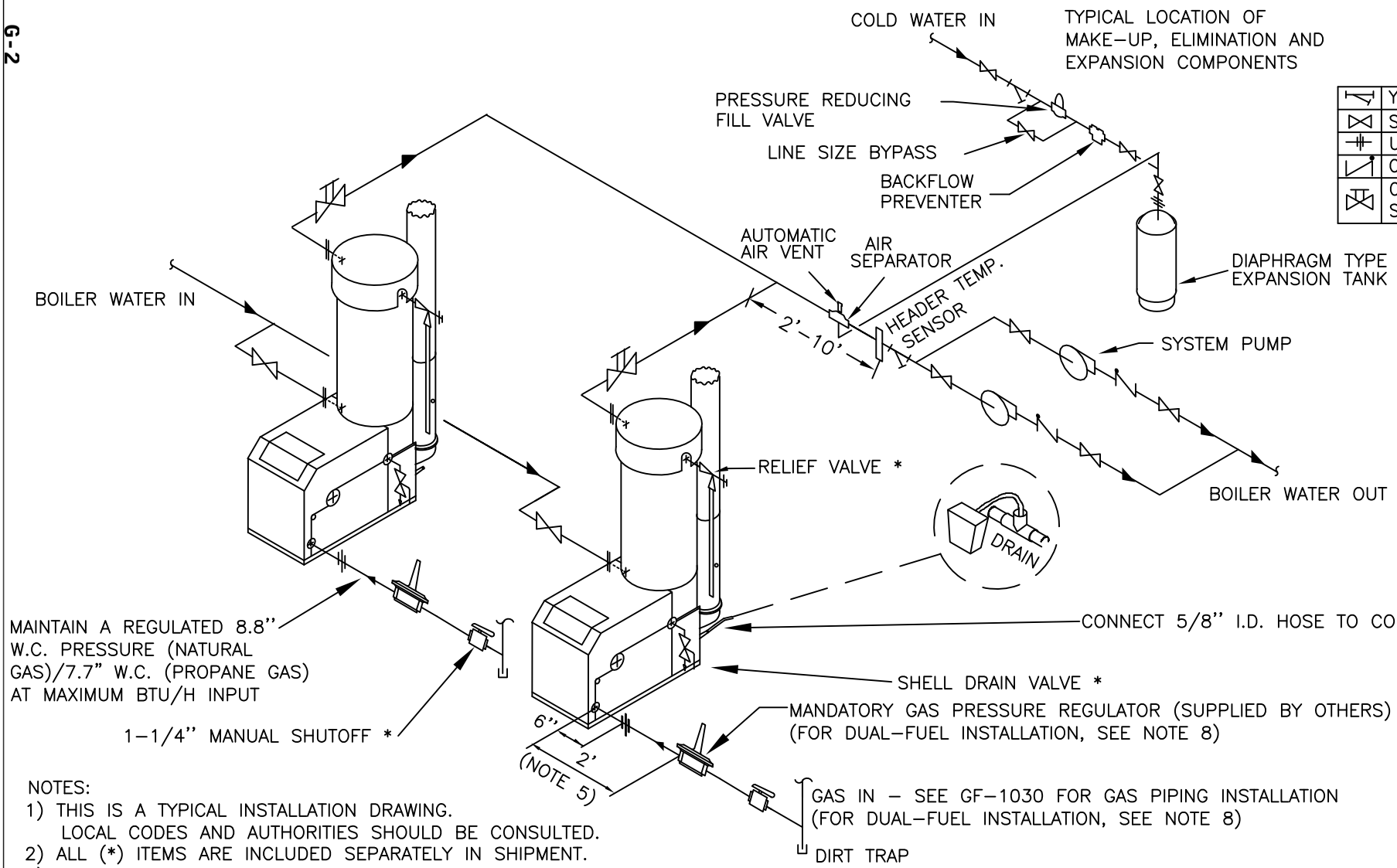
NOTES:

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) FOR DUAL-FUEL INSTALLATION:
   - INSTALL APPROPRIATE REGULATOR FOR CURRENT FUEL IN USE.
   - INSTALLER MUST CHECK WITH LOCAL CODES REGARDING ACCEPTABLE METHOD OF DESIGNING DUAL GAS PIPING SYSTEM TO PREVENT DIRECT FLOW OF FUEL FROM ONE SYSTEM OF GAS PIPING INTO ANOTHER (FOR EXAMPLE, FROM NATURAL GAS TO PROPANE, AND VICE VERSA).

AERCO INTERNATIONAL, INC. NORTHVALE, NJ 07647

KC1000 1 MIL. BTU LOW NOx
GAS FIRED BOILER
SINGLE UNIT INSTALLATION

DWN.BY JK DATE 012207 SCALE NTS APPD. CZ DATE 012207	SD-A-711	REV. C



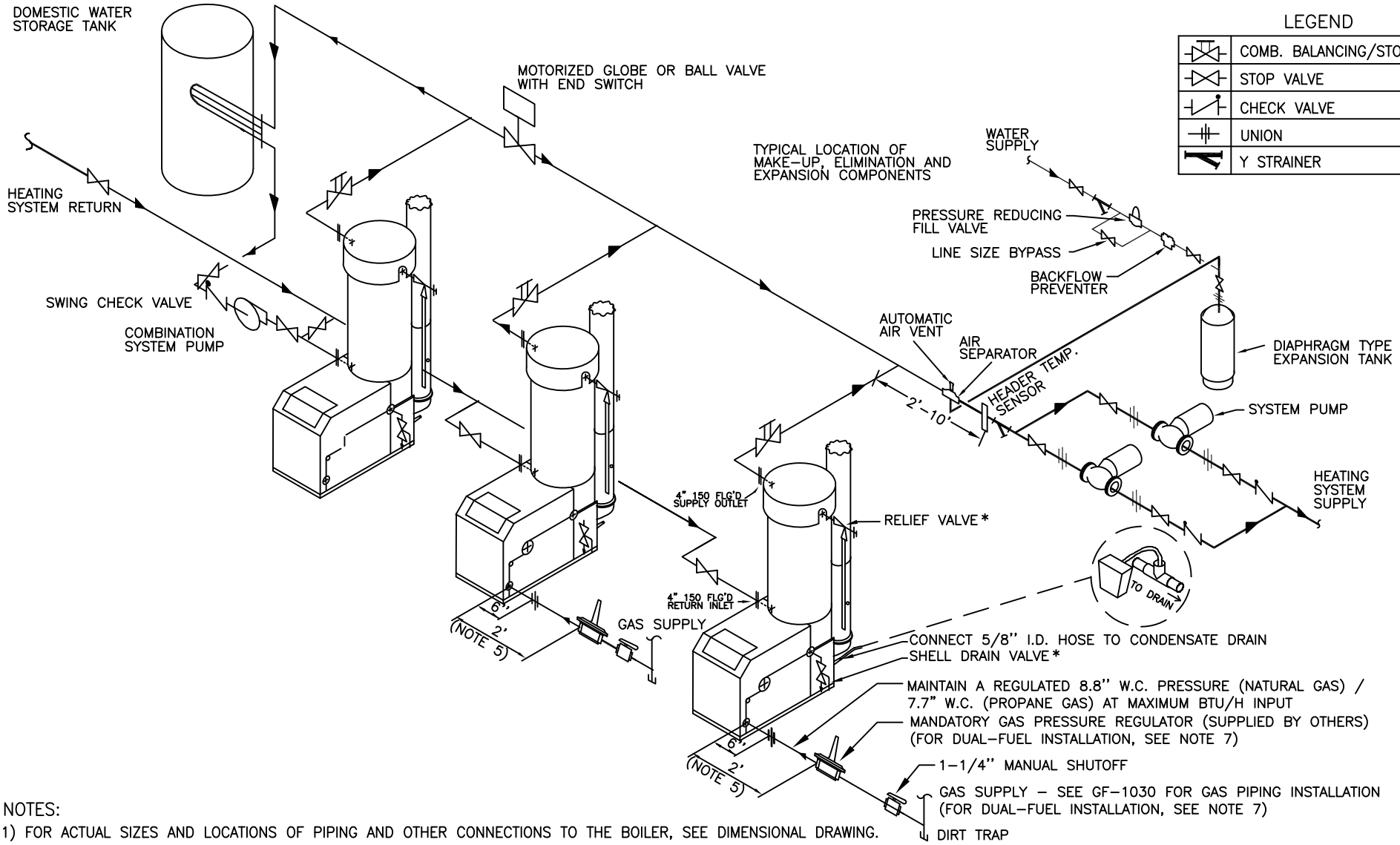
NOTES:

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.
8) FOR DUAL-FUEL INSTALLATION:
   - INSTALL APPROPRIATE REGULATOR FOR CURRENT FUEL IN USE.
   - INSTALLER MUST CHECK WITH LOCAL CODES REGARDING ACCEPTABLE METHOD OF DESIGNING DUAL GAS PIPING SYSTEM TO PREVENT DIRECT FLOW OF FUEL FROM ONE SYSTEM OF GAS PIPING INTO ANOTHER (FOR EXAMPLE, FROM NATURAL GAS TO PROPANE, AND VICE VERSA).

AERCO INTERNATIONAL, INC. NORTHVALE, NJ 07647

KC1000 1 MIL. BTU LOW NOx GAS FIRED BOILER MULTIPLE UNIT INSTALLATION

DWN.BY JK DATE 012207	SD-A-712	REV.
SCALE NTS		C
APPD. CZ DATE 012207		



LEGEND

	COMB. BALANCING/STOP VALVE
	STOP VALVE
	CHECK VALVE
	UNION
	Y STRAINER

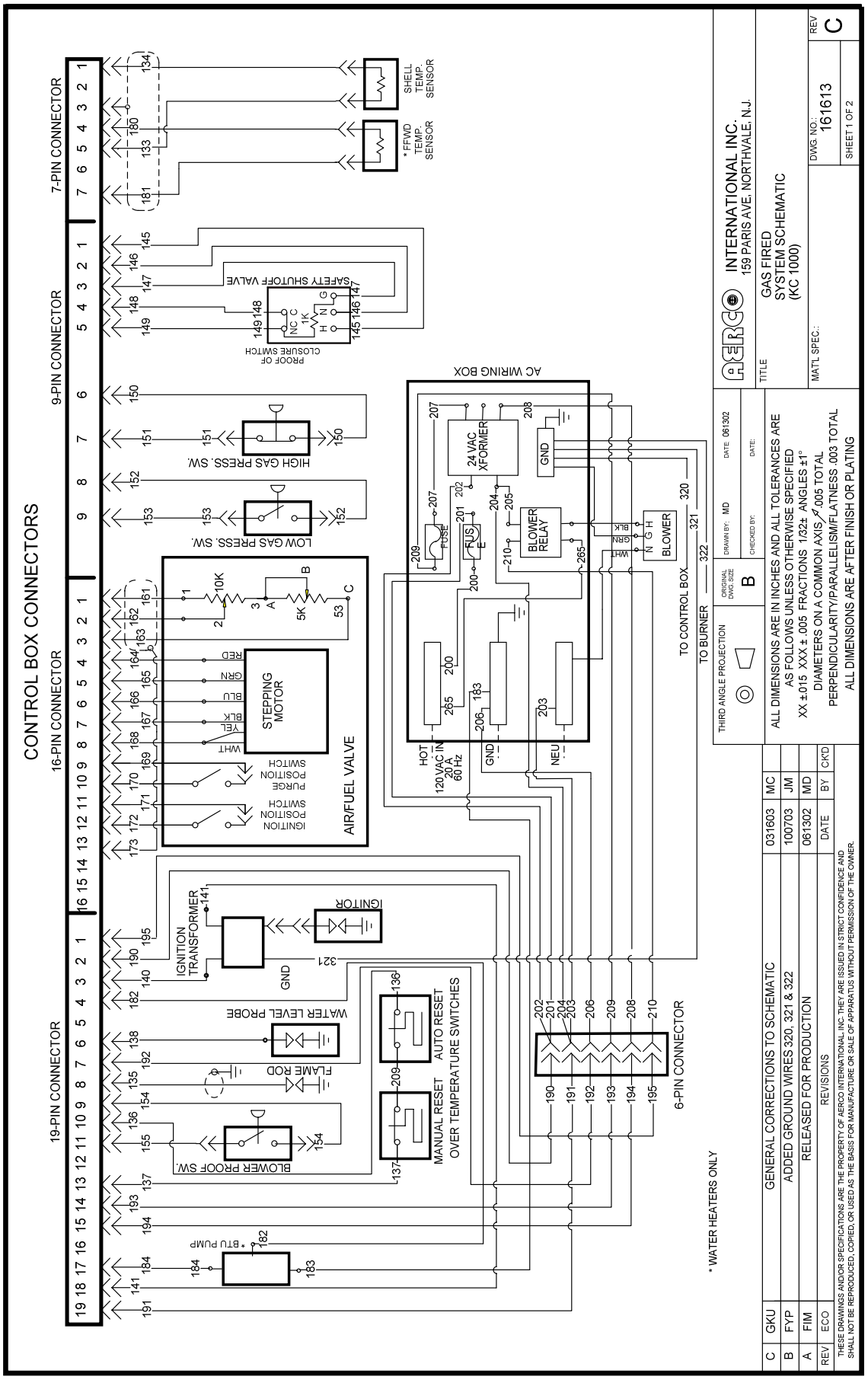
NOTES:

1) FOR ACTUAL SIZES AND LOCATIONS OF PIPING AND OTHER CONNECTIONS TO THE BOILER, SEE DIMENSIONAL DRAWING.
2) SHELL DRAIN VALVE AND CONDENSATE HOSE SHOULD BE ARRANGED TO PERMIT THE FLUIDS TO DRAIN FREELY, BY GRAVITY, TO A CONVENIENT FLOOR DRAIN. RELIEF VALVE SHOULD BE PIPED VERTICALLY TO A HEIGHT 18" ABOVE FLOOR.
3) ALL (*) ITEMS ARE INCLUDED SEPARATELY IN SHIPMENT.
4) THIS IS A TYPICAL INSTALLATION DRAWING. LOCAL CODES AND AUTHORITIES SHOULD BE CONSULTED.
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) FOR DUAL-FUEL INSTALLATION:
   - INSTALL APPROPRIATE REGULATOR FOR CURRENT FUEL IN USE.
   - INSTALLER MUST CHECK WITH LOCAL CODES REGARDING ACCEPTABLE METHOD OF DESIGNING DUAL GAS PIPING SYSTEM TO PREVENT DIRECT FLOW OF FUEL FROM ONE SYSTEM OF GAS PIPING INTO ANOTHER (FOR EXAMPLE, FROM NATURAL GAS TO PROPANE, AND VICE VERSA).

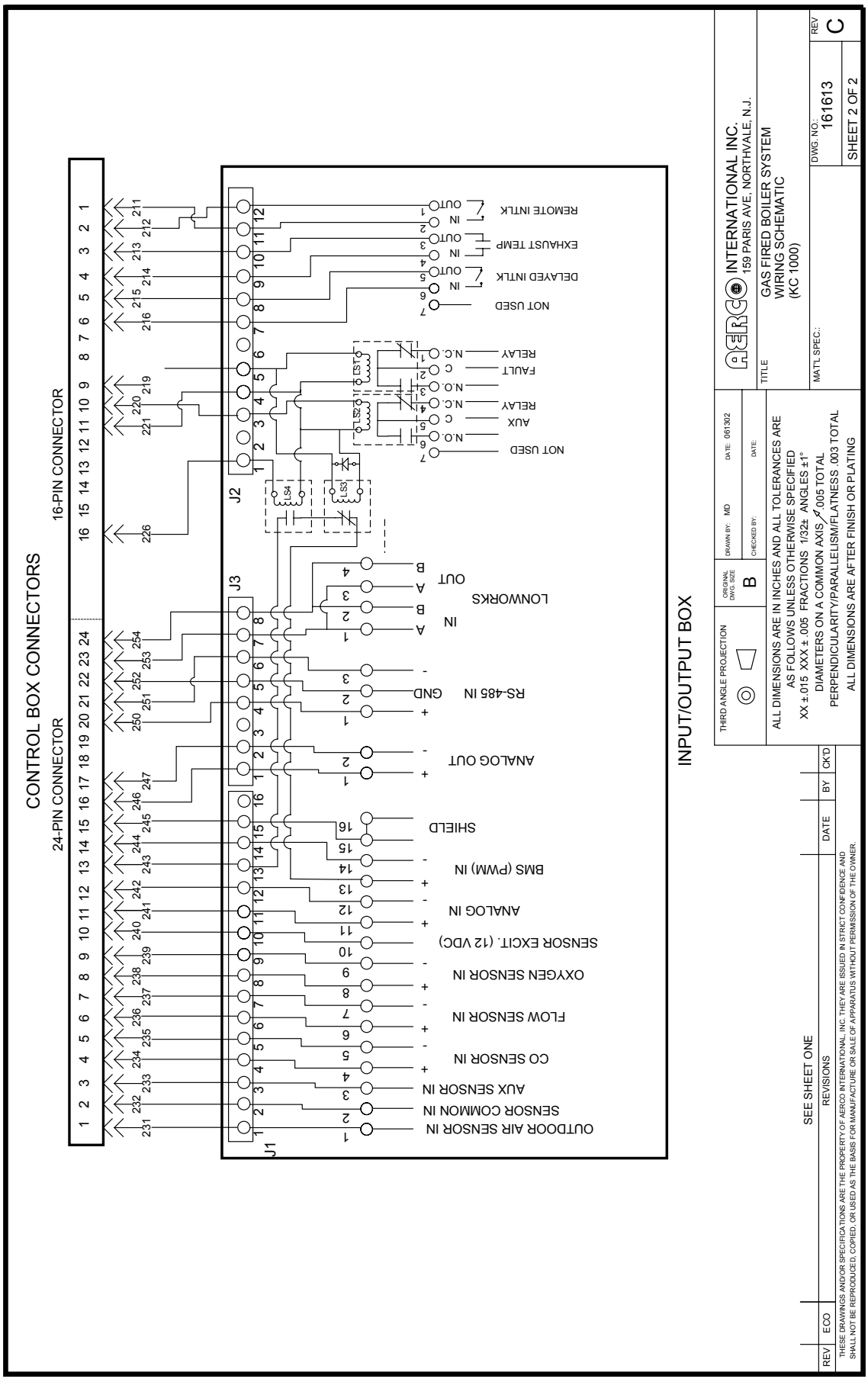
AERCO INTERNATIONAL, INC. NORTHVALE, NJ 07647

KC LOW NOx SERIES GAS FIRED BOILERS COMBINATION HEATING & DOMESTIC WATER BOILER PLANT

DWN.BY JK DATE 1-22-07 SCALE NTS SIZE B CHKD. CZ APPD. 1-22-07	SD-A-713	REV. C


CONTROL BOX CONNECTORS
19-PIN CONNECTOR
16-PIN CONNECTOR
9-PIN CONNECTOR
7-PIN CONNECTOR
6-PIN CONNECTOR
AIR/FUEL VALVE
STEPPING MOTOR
IGNITION POSITION SWITCH
PURGE POSITION SWITCH
LOW GAS PRESS. SW.
HIGH GAS PRESS. SW.
SAFETY SHUTOFF VALVE
PROOF OF CLOSURE SWITCH
* FFWD TEMP. SENSOR
SHELL TEMP. SENSOR
AC WIRING BOX
24 VAC XFORMER
BLOWER RELAY
BLOWER
FUSE
GND
HOT 120 VAC IN 20 A 60 Hz
NEU
TO CONTROL BOX
TO BURNER
IGNITION TRANSFORMER
IGNITOR
WATER LEVEL PROBE
FLAME ROD
BLOWER PROOF SW.
MANUAL RESET
AUTO RESET
OVER TEMPERATURE SWITCHES
* BTU PUMP
* WATER HEATERS ONLY
AERCO INTERNATIONAL INC.
159 PARIS AVE. NORTHVALE, N.J.
GAS FIRED
SYSTEM SCHEMATIC
(KC 1000)
DWG. NO.: 161613
REV C
SHEET 1 OF 2
ALL DIMENSIONS ARE IN INCHES AND ALL TOLERANCES ARE AS FOLLOWS UNLESS OTHERWISE SPECIFIED
XX ±.015 XXX ± .005 FRACTIONS 1/32± ANGLES ±1°
DIAMETERS ON A COMMON AXIS .005 TOTAL
PERPENDICULARITY/PARALLELISM/FLATNESS .003 TOTAL
ALL DIMENSIONS ARE AFTER FINISH OR PLATING
THIRD ANGLE PROJECTION
ORIGINAL DWG SIZE B
DRAWN BY: MD DATE 061302
CHECKED BY: DATE:
C GKU GENERAL CORRECTIONS TO SCHEMATIC 031603 MC
B FYP ADDED GROUND WIRES 320, 321 & 322 100703 JM
A FIM RELEASED FOR PRODUCTION 061302 MD
REV ECO REVISIONS DATE BY CKD
THESE DRAWINGS AND/OR SPECIFICATIONS ARE THE PROPERTY OF AERCO INTERNATIONAL INC. THEY ARE ISSUED IN STRICT CONFIDENCE AND SHALL NOT BE REPRODUCED, COPIED, OR USED AS THE BASIS FOR MANUFACTURE OR SALE OF APPARATUS WITHOUT PERMISSION OF THE OWNER.

APPENDIX H


CONTROL BOX CONNECTORS
24-PIN CONNECTOR
16-PIN CONNECTOR
INPUT/OUTPUT BOX
J1
J2
J3
OUTDOOR AIR SENSOR IN
SENSOR COMMON IN
AUX SENSOR IN
CO SENSOR IN
FLOW SENSOR IN
OXYGEN SENSOR IN
SENSOR EXCIT. (12 VDC)
ANALOG IN
BMS (PWM) IN
SHIELD
ANALOG OUT
RS-485 IN
GND
LONWORKS
IN
OUT
NOT USED
AUX
FAULT
RELAY
DELAYED INTLK
EXHAUST TEMP
REMOTE INTLK
LS1
LS2
LS3
LS4
THIRD ANGLE PROJECTION
ORIGINAL DWG SIZE
B
DRAWN BY: MD
DATE: 061302
CHECKED BY:
DATE:
AERCO INTERNATIONAL INC.
159 PARIS AVE, NORTHVALE, N.J.
TITLE
GAS FIRED BOILER SYSTEM
WIRING SCHEMATIC
(KC 1000)
MAT'L SPEC.:
DWG. NO.:
161613
REV
C
SHEET 2 OF 2
ALL DIMENSIONS ARE IN INCHES AND ALL TOLERANCES ARE
AS FOLLOWS UNLESS OTHERWISE SPECIFIED
XX ±.015 XXX ± .005 FRACTIONS 1/32± ANGLES ±1°
DIAMETERS ON A COMMON AXIS .005 TOTAL
PERPENDICULARITY/PARALLELISM/FLATNESS .003 TOTAL
ALL DIMENSIONS ARE AFTER FINISH OR PLATING
SEE SHEET ONE
REV
ECO
REVISIONS
DATE
BY
CK'D
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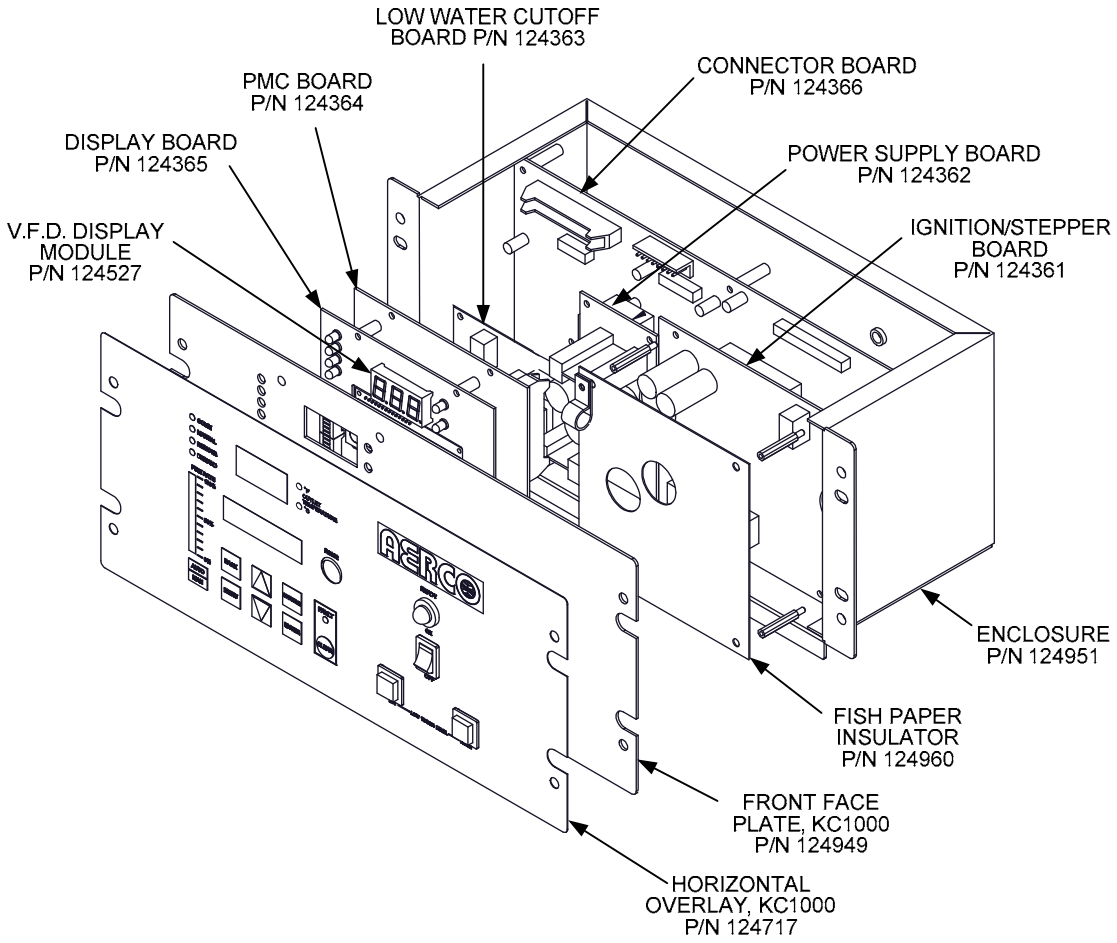
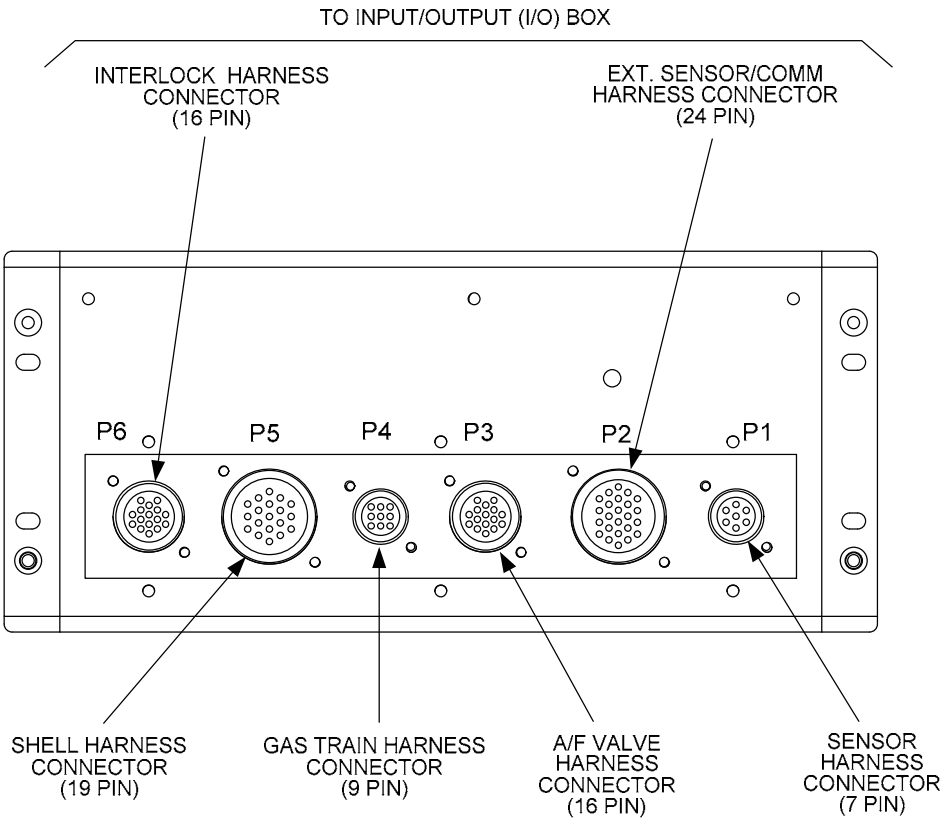


KC1000 CONTROL PANEL EXPLODED VIEW

APPENDIX I



KC1000 CONTROL PANEL REAR VIEW

KC1000 LOW NOx DUAL-FUEL SWITCH-OVER INSTRUCTIONS

The KC1000 Low NOx Boiler is shipped from the factory configured for either natural gas or propane operation, as specified on the Sales Order. However, if required, the unit's operating configuration can be easily switched from natural gas to propane (or vice-versa) by performing a simple change to the spring contained in the unit's differential regulator.

The extra spring required to switch from natural gas to propane, or from propane to natural gas is included with the unit accessories (see Chapter 2, para. 2.2). Units configured for natural gas operation include a zinc-plated regulator spring, part no. 124803. Units configured for propane operation include a brown painted spring, part no. 122548.

The following instructions provide the steps necessary to convert the unit from Natural Gas to Propane operation. Proceed as follows:

1. Shut down the unit and close the external gas supply valve.
2. Remove the sheet metal covers and locate the differential regulator on the left side of the unit.
3. Refer to Figure 1 and remove the cap on the differential regulator.
4. Using a flat-blade screwdriver, remove the adjustment screw by turning it counter-clockwise. Remove the installed zinc-plated regulator spring (124803) used for Natural Gas operation. **DO NOT DISCARD THE REMOVED SPRING.**
5. Install the brown painted spring (122548) required for Propane operation.
6. Replace the regulator adjustment screw. Rotate the screw clockwise to a depth of 1-1/2 inches from the top of the regulator housing.
7. Upon completion of the spring change, perform the combustion calibration procedures in Section 4 of this Instruction Manual.

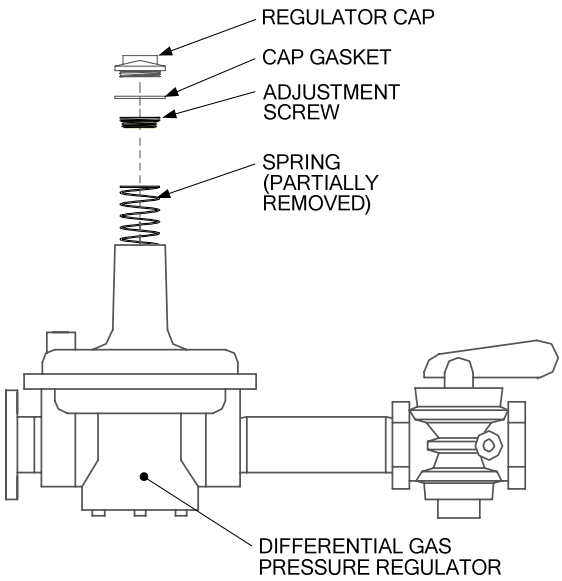


FIGURE 1. REGULATOR SPRING REPLACEMENT

PRESSURE VESSEL: 10 YEARS NON-PRORATED

The shell shall carry a non-prorated 10 year guarantee from shipment against leakage due to thermal shock, mechanical defects or workmanship. The shell **will not** be covered for waterside corrosion.

HEAT EXCHANGER TUBES/COMBUSTION CHAMBER: 5 YEARS

The heat exchanger/combustion chamber shall carry a 5 year, non-prorated, warranty from shipment against any condensate corrosion, thermal stress failure, mechanical defects or workmanship. Operation of the boiler using contaminated air will void the warranty. The heat exchangers combustion chamber shall not be warranted from failure due to scaling, liming, corrosion, or erosion due to water or installation conditions. **AERCO** will repair, rebuild or exchange, at its option the heat exchanger/combustion chamber for the warranted time period.

"C-MORE" CONTROL PANEL: 2 YEARS FROM SHIPMENT

AERCO labeled control panels are conditionally warranted against failure for (2) two years from shipment.

OTHER COMPONENTS: 18 MONTHS FROM SHIPMENT

All other components, with the exception of the ignitor and flame detector, are conditionally guaranteed against any failure for 18 months from shipment.

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

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

CONDITIONS OF WARRANTY

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

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

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

Warranty coverage for all components and equipment mentioned in said warranty are not valid unless the water heater or hydronic boiler is started up by a factory certified SST (Service, Start-Up and Troubleshooting) Technician and an AERCO start-up sheet is completed.

This warranty coverage is only applicable within the United States and Canada. All other geographical areas carry a standard warranty of 18 months from date of shipment or 12 months from startup, whichever comes first.