AERCO
A WATTS Brand

Installation and Startup Manual

Benchmark® Boilers with Edge® [i] Controller

Natural Gas, Propane Gas and Dual Fuel Modulating & Condensing Boilers

Models 750 through 6000

Other documents for this product include:

OMM-0145, GF-218 Operation-Service Manual
OMM-0146, GF-219 Reference Manual
TAG-0019, GF-2070 Boiler Application Guide
TAG-0022, GF-2050 Vent-Combustion Air Guide
TAG-0047, GF-2030 Benchmark Gas Guide
TAG-0048, GF-2060 Benchmark Power Guide

Applies to serial numbers:

G-20-2773 and above – BMK750 – 5000N
N-20-0282 and above – BMK5000 & 6000

GAS-FIRED
LISTED

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FOREWORD

The AERCO Benchmark (BMK) 750 through 6000 natural gas and propane fueled boilers are modulating and condensing units. They represent a true industry advance that meets the needs of today's energy and environmental concerns. Designed for application in any closed loop hydronic system, the Benchmark's modulating capability relates energy input directly to fluctuating system loads. These BMK models provide extremely high efficiency operation and are ideally suited for modern low temperature, as well as, conventional heating systems.

IMPORTANT!

Unless otherwise specified:

- All descriptions in this document apply to the Benchmark Series of boiler.
- All measurements apply to both natural gas and propane models.

The Benchmark models operate within the input and output ranges listed below.

Benchmark Boiler Intake and Output Ranges

MODEL	INPUT RANGE (BTU/HR.)		OUTPUT RANGE (BTU/HR.)	
	MINIMUM	MAXIMUM	MINIMUM	MAXIMUM
BMK750	50,000 (14.6 kW)	750,000 (220 kW)	47,750 (14.0 kW)	716,250 (210 kW)
BMK1000	50,000 (14.6 kW)	1,000,000 (293 kW)	48,300 (14.2 kW)	968,000 (284 kW)
BMK1500	75,000 (22 kW)	1,500,000 (440 kW)	64,500 (18.9 kW)	1,395,000 (409 kW)
BMK2000	100,000 (29.3 kW)	2,000,000 (586 kW)	86,000 (25.2 kW)	1,860,000 (545 kW)
BMK2500	167,000 (48.9 kW)	2,500,000 (732 kW)	144,000 (42.2 kW)	2,395,000 (702 kW)
BMK3000	200,000 (58.6 kW)	3,000,000 (879 kW)	174,000 (51.0 kW)	2,874,000 (842 kW)
BMK4000	267,000 (78.2 kW)	4,000,000 (1172 kW)	232,000 (68.0 kW)	3,800,000 (1113 kW)
BMK5000N	250,000 (73.3 kW)	4,990,000 (1462 kW)	218,000 (63.9 kW)	4,740,000 (1389 kW)
BMK5000	400,000 (117 kW)	5,000,000 (1465 kW)	348,000 (102 kW)	4,750,000 (1392 kW)
BMK6000	400,000 (117 kW)	6,000,000 (1758 kW)	348,000 (102 kW)	5,700,000 (1670 kW)

The output of the boiler is a function of the unit's firing rate (valve position) and return water temperature.

When installed and operated in accordance with this Instruction Manual, the BMK750 – 2000 and 5000 & 6000 comply with the NO_x emission standards outlined in: **South Coast Air Quality Management District (SCAQMD), Rule 1146.2**. In addition, the BMK2500 – 6000 comply with the **Bay Area Air Quality Management District regulation 9, Rule 7**.

Whether used in singular or modular arrangements, the BMK boilers offer the maximum venting flexibility with minimum installation space requirements. These boilers are Category II and IV, positive pressure appliances. Single and/or multiple breeched units are capable of operation in the following vent configurations:

- **Room Combustion Air:**
  - Vertical Discharge
  - Horizontal Discharge
- **Ducted Combustion Air:**
  - Vertical Discharge
  - Horizontal Discharge

Please consult the *Benchmark Venting and Combustion Air Design Guide,* TAG-0022 (GF-2050) for a list of allowable and preferred vent materials.

The Benchmark's advanced electronics are available in several selectable modes of operation offering the most efficient operating methods and energy management system integration.

AERCO Technical Terminology Meanings	
TERMINOLOGY	**MEANING**
A (Amp)	Ampere
ACS	AERCO Control System, AERCO's boiler management systems
ADDR	Address
AGND	Analog Ground
ALRM	Alarm
ANSI	American National Standards Institute,
ASME	American Society of Mechanical Engineers
AUX	Auxiliary
BAS	Building Automation System, often used interchangeably with EMS (see below)
Baud Rate	Symbol rate, or simply the number of distinct symbol changes (signaling events) transmitted per second. It is not equal to bits per second, unless each symbol is 1 bit long.
BMK (Benchmark)	AERCO's Benchmark series boilers
BMS or BMS II	AERCO Boiler Management Systems
BLDG (Bldg)	Building
BST	AERCO on-board Boiler Sequencing Technology
BTU	British Thermal Unit. A unit of energy approximately equal to the heat required to raise 1 pound (0.45 kg) of water 1°F (0.55 °C)
BTU/HR	BTUs per Hour (1 BTU/hr = 0.29 W)
CCS	Combination Control System
CFH	Cubic Feet per Hour (1 CFH = 0.028 m^3/hr)
CO	Carbon Monoxide
COMM (Comm)	Communication
Cal.	Calibration
CNTL	Control
CPU	Central Processing Unit

AERCO Technical Terminology Meanings	
TERMINOLOGY	**MEANING**
DBB	Double Block and Bleed, a gas trains containing 2 Safety Shutoff Valves (SSOVs) and a solenoid operated vent valve.
DIP	Dual In-Line Package, a type of switch
ECU	Electronic Control Unit (O_2 sensor)
EMS	Energy Management System; often used interchangeably with BAS
Edge Controller	A control system developed by AERCO and currently used in the Benchmark and Innovation product lines.
FM	Factory Mutual. Used to define boiler gas trains.
GF-xxxx	Gas Fired (an AERCO document numbering system)
GND	Ground
HDR	Header
Hex	Hexadecimal Number (0 – 9, A – F)
HP	Horse Power
HX	Heat Exchanger
Hz	Hertz (Cycles Per Second)
I.D.	Inside Diameter
IGN	Ignition
IGST Board	Ignition/Stepper Board, contained in Edge Controller
INTLK (INTL'K)	Interlock
I/O	Input/Output
I/O Box	Input/Output (I/O) Box currently used on Benchmark boilers
IP	Internet Protocol
ISO	International Organization for Standardization
Lbs.	Pounds (1 lb = 0.45 kg)
LED	Light Emitting Diode
LN	Low Nitrogen Oxide
MA (mA)	Milliampere (1 thousandth of an ampere)
MAX (Max)	Maximum
MBH	1000 BTUs per Hour
MIN (Min)	Minimum
Modbus®	A serial, half-duplex data transmission protocol developed by AEG Modicon
NC (N.C.)	Normally Closed
NO (N.O.)	Normally Open
NO_x	Nitrogen Oxide
NPT	National Pipe Thread
O_2	Oxygen
O.D.	Outside Diameter

AERCO Technical Terminology Meanings	
TERMINOLOGY	**MEANING**
OMM, O&M	Operation and Maintenance Manual
onAER	AERCO's on-line remote monitoring system
PCB	Printed Circuit Board
PMC Board	Primary Micro-Controller (PMC) board, contained in the Edge Controller
P/N	Part Number
POC	Proof of Closure
PPM	Parts per Million
PSI	Pounds per Square Inch (1 PSI = 6.89 kPa)
PTP	Point-to-Point (usually over RS232 networks)
P&T	Pressure and Temperature
ProtoNode	Hardware interface between BAS and a boiler or water heater
PVC	Poly Vinyl Chloride, a common synthetic plastic
PWM	Pulse Width Modulation
REF (Ref)	Reference
RES.	Resistive
RS232 (or EIA-232)	A standard for serial, full-duplex (FDX) transmission of data based on the RS232 Standard
RS485 (or EIA-485)	A standard for serial, half-duplex (HDX) transmission of data based on the RS485 Standard
RTN (Rtn)	Return
SETPT (Setpt)	Setpoint Temperature
SHLD (Shld)	Shield
SPDT	Single Pole Double Throw, a type of switch
SSOV	Safety Shut Off Valve
TEMP (Temp)	Temperature
Terminating Resistor	A resistor placed at each end of a daisy-chain or multi-drop network in order to prevent reflections that may cause invalid data in the communication
Tip-N-Tell	A device that indicates if a package was tipped during shipping
UL	A business that tests and validates products
VAC	Volts, Alternating Current
VDC	Volts, Direct Current
VFD	Variable Frequency Drive
VPS	Valve Proving System
W	Watt
W.C.	Water Column, a unit of pressure (1 W.C. = 249 Pa)
µA	Micro amp (1 millionth of an ampere)

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, CSA B149.1, 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.

See section 1.4 for important information regarding installation of units within the Commonwealth of Massachusetts.

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.

WARNING!

- Do not use matches, candles, flames, or other sources of ignition to check for gas leaks.
- 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.
- Before attempting to perform any maintenance on the unit, shut off all gas and electrical inputs to the unit.
- The exhaust vent pipe of the unit may operate under a positive pressure and therefore must be completely sealed to prevent leakage of combustion products into living spaces.
- Electrical voltages up to **120 VAC (BMK750 – 2000), 208 or 480 VAC (BMK2500 – BMK3000), 480 VAC (BMK4000 & 5000N), or 208**, **480 or 575 VAC (BMK5000 & 6000) and 24 volts AC** may be used in this equipment. On international units, the voltage can be **220 V to 240 V** single phase. Therefore the cover on the unit's power panel (located behind the unit's front panel) must be installed at all times, except during maintenance and servicing.
- A single-pole (120 VAC units) or three-pole (220 VAC and higher units) switch must be installed on the electrical supply line of the unit. The switch must be installed in an easily accessible position to quickly and safely disconnect electrical service. Do not affix switch to unit sheet metal enclosures.

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.
- 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.

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

Figure 1-1: Manual Gas Shutoff Valve

In addition, to ensure safety an emergency shutdown procedure that addresses the following points should be designed and implement at the site:

- For automatically operated unattended boilers located in a boiler room, provide a manually operated remote shutdown switch or circuit breaker located just inside or outside each boiler room door. Design the system so activation of the emergency shutdown switch or circuit breaker will immediately shut off the fuel supply to the unit(s).
- For automatically operated unattended boilers in a location other than a boiler room, provide a manually operated remote shutdown switch or circuit breaker marked for easy identification at a location readily accessible in the event of boiler mis-operation.
- Design the system so activation of the emergency shutdown switch or circuit breaker will immediately shut off the fuel.
- For boilers monitored and/or operated from a continuously occupied control room, provide an emergency shutdown switch in the control room that is hard-wired to immediately shut off the fuel upon activation.

1.3 PROLONGED SHUTDOWN

If there is an emergency, turn off the electrical power supply to the AERCO boiler and close the manual gas valve located upstream from the unit. The installer must identify the emergency shut-off device.

If the unit is being shut down for an extended period of time, such as a year or more, complete the instructions in Section 8.11: *Shutting Boiler Down For Extended Period* in the *Benchmark 750-6000 with Edge [i] Operation-Maintenance Manual* (OMM-0145, GF-218).

When returning a unit to service after a prolonged shutdown, it is recommended that the instructions in Section 4: *Initial Startup Procedures* and Section 5: *Safety Device Testing* of the *Benchmark 750-6000 with Edge [i] Operation-Maintenance Manual (OMM-0145, GF-218)* be performed to verify that all system-operating parameters are correct.

1.4 IMPORTANT – FOR MASSACHUSETTS INSTALLATIONS

Requirements for Massachusetts Installations

Boiler Installations within the Commonwealth of Massachusetts must conform to the following requirements:

- Boiler must be installed by a plumber or a gas fitter who is licensed within the Commonwealth of Massachusetts.
- Prior to unit operation, the complete gas train and all connections must be leak tested using a non-corrosive soap.
- The vent termination must be located a minimum of 4 feet above grade level. If side-wall venting is used, the installation must conform to the following requirements **extracted from 248 CMR 5.08 (2):**

(a) For all side wall horizontally vented gas fueled equipment installed in every dwelling, building or structure used in whole or in part for residential purposes, including those owned or operated by the Commonwealth and where the side wall exhaust vent termination is less than seven (7) feet above finished grade in the area of the venting, including but not limited to decks and porches, the following requirements shall be satisfied:

1. INSTALLATION OF CARBON MONOXIDE DETECTORS: At the time of installation of the side wall horizontal vented gas fueled equipment, the installing plumber or gasfitter shall observe that a hard wired carbon monoxide detector with an alarm and battery back-up is installed on the floor level where the gas equipment is to be installed. In addition, the installing plumber or gasfitter shall observe that a battery operated or hard wired carbon monoxide detector with an alarm is installed on each additional level of the dwelling, building or structure served by the side wall horizontal vented gas fueled equipment. It shall be the responsibility of the property owner to secure the services of qualified licensed professionals for the installation of hard wired carbon monoxide detectors.

a. In the event that the side wall horizontally vented gas fueled equipment is installed in a crawl space or an attic, the hard wired carbon monoxide detector with alarm and battery back-up may be installed on the next adjacent floor level.

b. In the event that the requirements of this subdivision cannot be met at the time of completion of installation, the owner shall have a period of thirty (30) days to comply with the above requirements; provided, however, that during said thirty (30) day period, a battery operated carbon monoxide detector with an alarm shall be installed.

2. APPROVED CARBON MONOXIDE DETECTORS: *Each carbon monoxide detector as required in* accordance with the above provisions shall comply with NFPA 720 and be ANSI/UL 2034 listed and IAS certified.

3. SIGNAGE: A metal or plastic identification plate shall be permanently mounted to the exterior of the building at a minimum height of eight (8) feet above grade directly in line with the exhaust vent terminal for the horizontally vented gas fueled heating appliance or equipment. The sign shall read, in print size no less than one-

Requirements for Massachusetts Installations

half (1/2) inch in size, **"GAS VENT DIRECTLY BELOW. KEEP CLEAR OF ALL OBSTRUCTIONS". (Continued)**

4. INSPECTION: The state or local gas inspector of the side wall horizontally vented gas fueled equipment shall not approve the installation unless, upon inspection, the inspector observes carbon monoxide detectors and signage installed in accordance with the provisions of 248 CMR 5.08(2)(a)1 through 4.

(b) EXEMPTIONS: The following equipment is exempt from 248 CMR 5.08(2)(a)1 through 4:

1. The equipment listed in Section 10 entitled "Equipment Not Required To Be Vented" in the most current edition of NFPA 54 as adopted by the Board; and

2. Product Approved side wall horizontally vented gas fueled equipment installed in a room or structure separate from the dwelling, building or structure used in whole or in part for residential purposes.

(c) MANUFACTURER REQUIREMENTS - GAS EQUIPMENT VENTING SYSTEM PROVIDED. When the manufacturer of Product Approved side wall horizontally vented gas equipment provides a venting system design or venting system components with the equipment, the instructions provided by the manufacturer for installation of the equipment and the venting system shall include:

1. Detailed instructions for the installation of the venting system design or the venting system components; and

2. A complete parts list for the venting system design or venting system.

(d) MANUFACTURER REQUIREMENTS - GAS EQUIPMENT VENTING SYSTEM NOT PROVIDED. When the manufacturer of a Product Approved side wall horizontally vented gas fueled equipment does not provide the parts for venting the flue gases, but identifies "special venting systems", the following requirements shall be satisfied by the manufacturer:

1. The referenced "special venting system" instructions shall be included with the appliance or equipment installation instructions; and

2. The "special venting systems" shall be Product Approved by the Board, and the instructions for that system shall include a parts list and detailed installation instructions.

(e) A copy of all installation instructions for all Product Approved side wall horizontally vented gas fueled equipment, all venting instructions, all parts lists for venting instructions, and/or all venting design instructions shall remain with the appliance or equipment at the completion of the installation.

…….[End of Extracted Information From 248 CMR 5.08 (2)]……

SECTION 2: INSTALLATION

2.1 INTRODUCTION

This section provides the descriptions and procedures necessary to unpack, inspect and install AERCO Benchmark Boilers.

2.2 RECEIVING THE UNIT

Each Benchmark Boiler System is shipped as a single crated unit. The shipping weight for these BMK models is approximately as follows:

- **BMK750:** 1,100 lbs. (499 kg)
- **BMK1000:** 1,200 lbs. (544 kg)
- **BMK1500/2000:** 1,800 lbs. (817 kg).
- **BMK2500/3000:** 2,200 lbs. (1000 kg)
- **BMK4000/5000N:** 2,500 lbs. (1136 kg)
- **BMK5000/6000:** 3,530 lbs. (1601 kg)

The unit must be moved with the proper rigging equipment for safety and to avoid equipment damage. The unit should be completely inspected for evidence of shipping damage and shipment completeness at the time of receipt from the carrier and before the bill of lading is signed.

CAUTION!

While in shipping container, unit must be moved by pallet jack or forklift from the ***front only***.

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

2.3 UNPACKING

Carefully unpack the unit taking care not to damage the enclosure.

After unpacking, make a close inspection of the unit to ensure that there is no evidence of damage not indicated by the Tip-N-Tell indicator. The freight carrier should be notified immediately if any damage is detected.

The following accessories come standard with each unit and are either packed separately within the unit's shipping container or are factory installed on the unit:

- **Pressure/Temperature Gauge**
- **ASME Pressure Relief Valve**
- **Condensate Drain Trap (P/N 24441)**
- **A 1", 1-1/2" or 2" Natural Gas Supply Shutoff Valve, and a Propane Shutoff Valve on Propane and Dual Fuel units**

When optional accessories are ordered, they may be packed within the unit's shipping container, factory installed on the unit, or packed and shipped in a separate container. Any standard or optional accessories shipped loose should be identified and stored in a safe place until ready for installation or use.

2.4 SITE PREPARATION

Ensure that the site selected for installation of the Benchmark Boiler includes access to:

- AC Input Power, as specified in the *Benchmark Electrical Power Design Guide,* TAG-0048 (GF-2060).
- Access to a natural gas and/or propane gas supply that conforms to the pressures specified in the *Benchmark Gas Supply Design Guide,* TAG-0047 (GF-2030).
- To ensure proper condensate drainage, the unit must be installed on a level concrete "housekeeping" pad. See Section 2.4.3 for pad requirements.

2.4.1 Installation Clearances

All Benchmark models are the same height but vary in depth by model. The unit must be installed with the minimum prescribed clearances for service as shown in Figure 2-1a through 2-1e and listed below. However, if Local Building Codes require additional clearances, these codes shall supersede AERCO's requirements.

The ***minimum acceptable clearances*** required are as follows:

BMK750 – 5000N

- Front: 24 inches (61 cm)
- Sides: 24 inches (61 cm)
- Rear: 24 inches (61 cm)
- Top: 18 inches (45.7 cm)

BMK5000 – 6000

- Front: 36 inches (91 cm)
- Sides: 24 inches (61 cm)
- Rear: 24 inches (61 cm)
- Top: 18 inches (45.7 cm)

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

In multiple unit installations, it is important to plan the position of each unit in advance. Sufficient space for piping connections and future service/maintenance requirements must also be taken into consideration. All piping must include ample provisions for expansion**.**

NOTE: Benchmark units may be installed with zero side clearances in pairs only (perimeter clearances still apply). See drawings in *Appendix A: Dimensions and Clearance Drawings*.

If installing a Combination Control System (CCS) using an ACS panel (ACS is not needed for combination mode, but can still be used if installing with a legacy BMK unit, or if you already have a panel want to continue to use it), it is important to identify the **Combination Mode** Boilers in advance and place them in the proper physical location. For more information refer to Section 6.6: *Combination Control System* of the *Benchmark 750-6000 with Edge [i] Operation-Service-Maintenance Manual (OMM-0145, GF-218).*

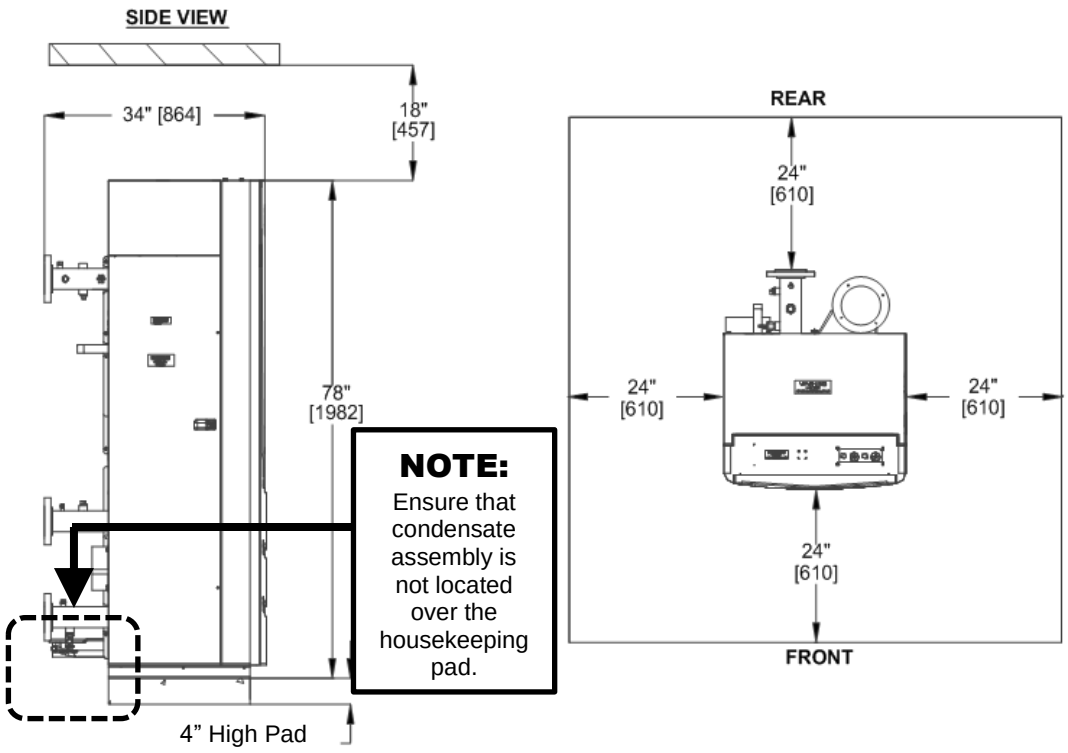


Figure 2-1a: BMK750-1000 Clearances

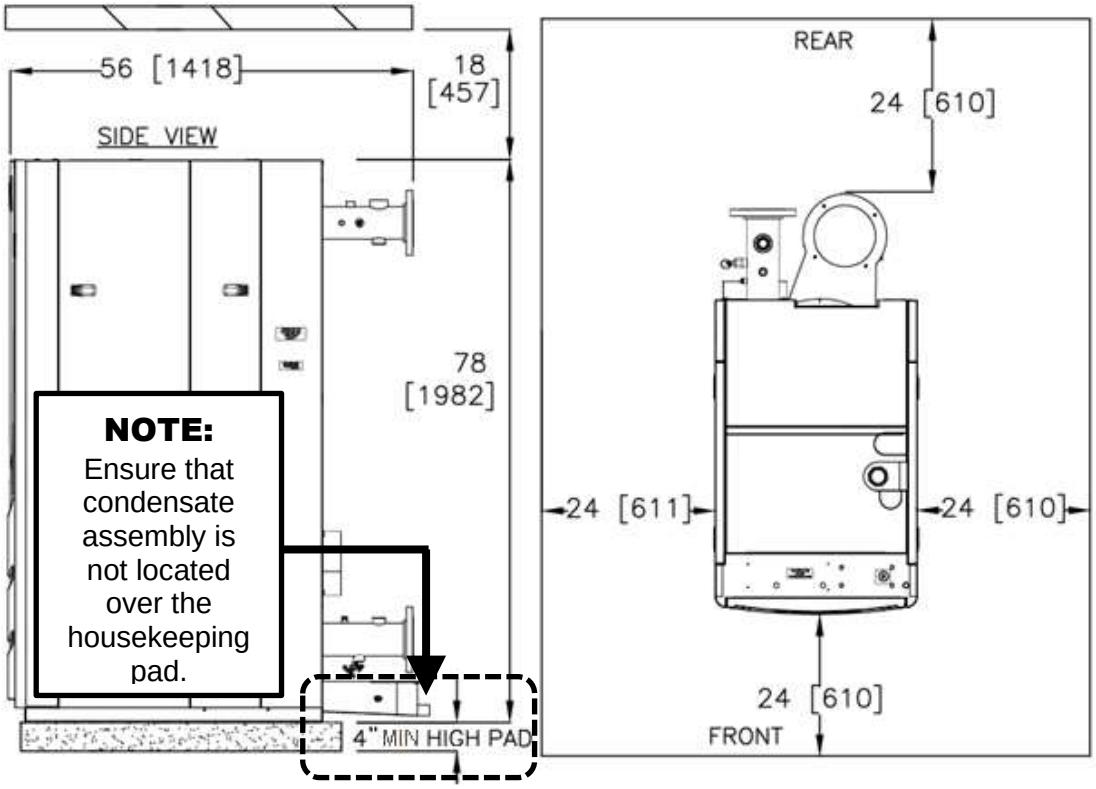


Figure 2-1b: BMK1500-2000 Clearances

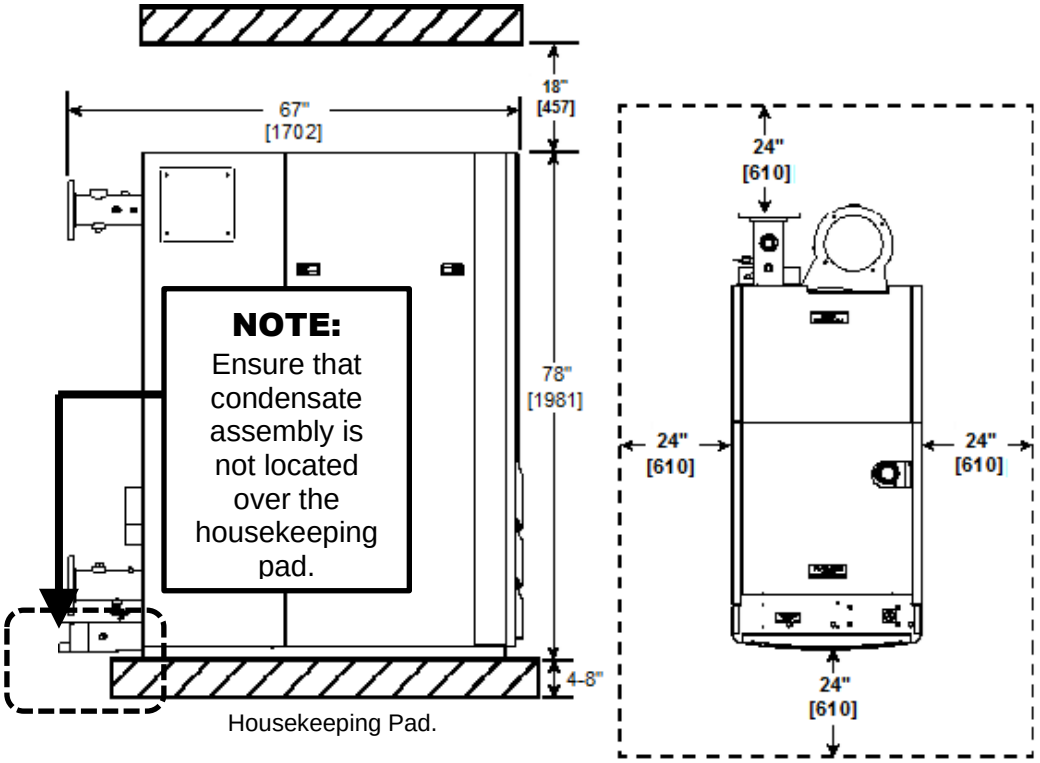


Figure 2-1c: BMK2500-3000 Clearances

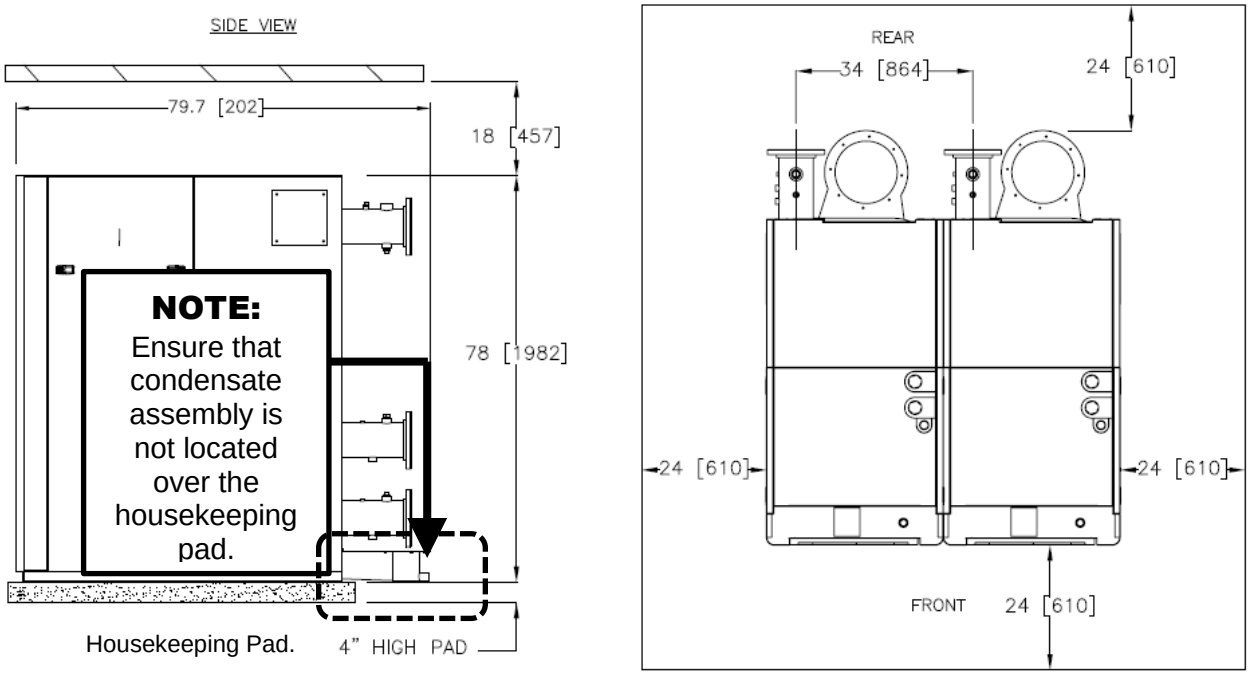


Figure 2-1d: BMK4000-5000N Clearances

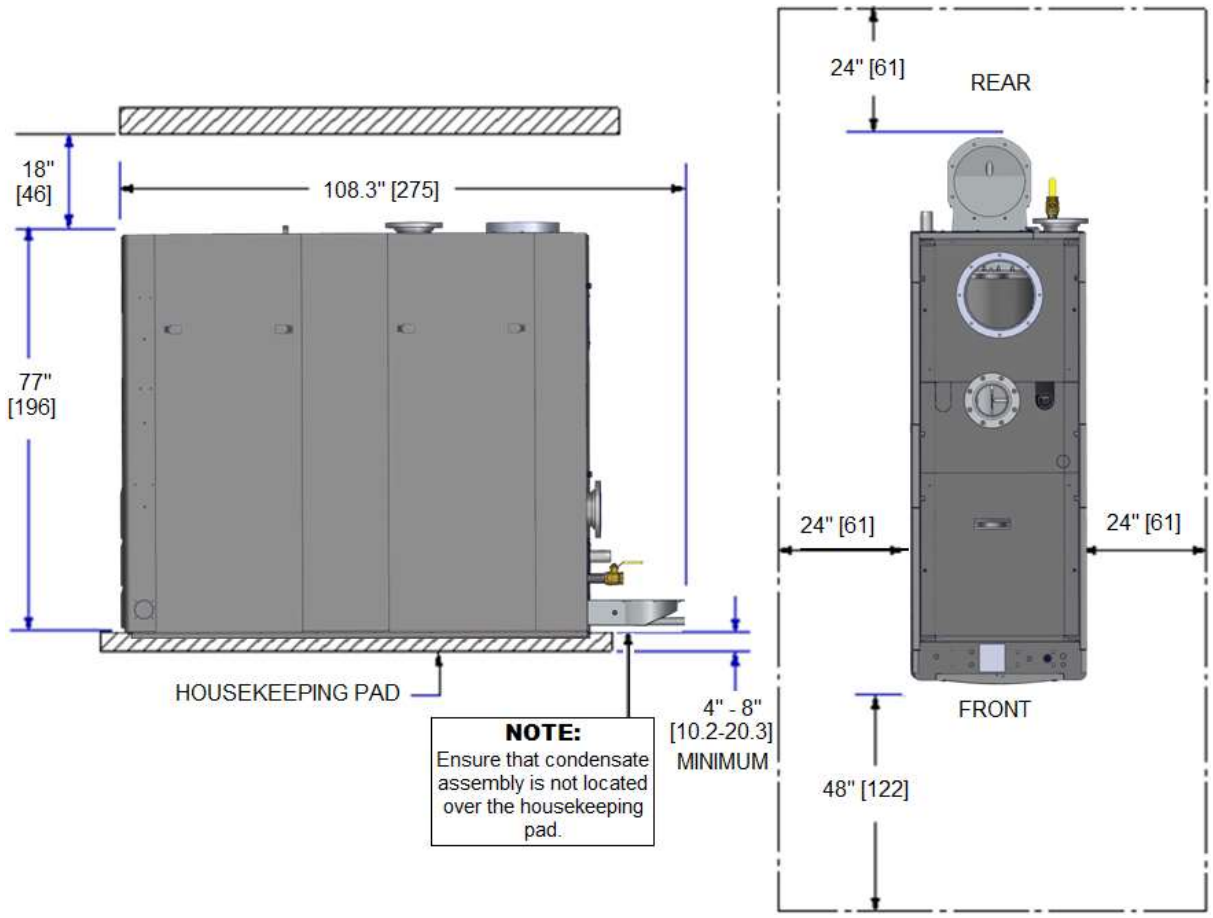


Figure 2-1e: Benchmark Model 5000-6000 Clearances

WARNING!

Keep area clear and free from all combustible materials and flammable vapors or liquids.

FOR MASSACHUSETTS ONLY:

For Massachusetts installations, the unit must be installed by a plumber or gas-fitter licensed within the Commonwealth of Massachusetts. In addition, the installation must comply with all requirements specified in Section 1.4, above.

2.4.2 Setting the Unit

If anchoring the unit, refer to Figure 2-2a through 2-2e for anchor locations.

- All holes are flush with the bottom surface of the frame.
- All dimensions shown are in inches [millimeters]

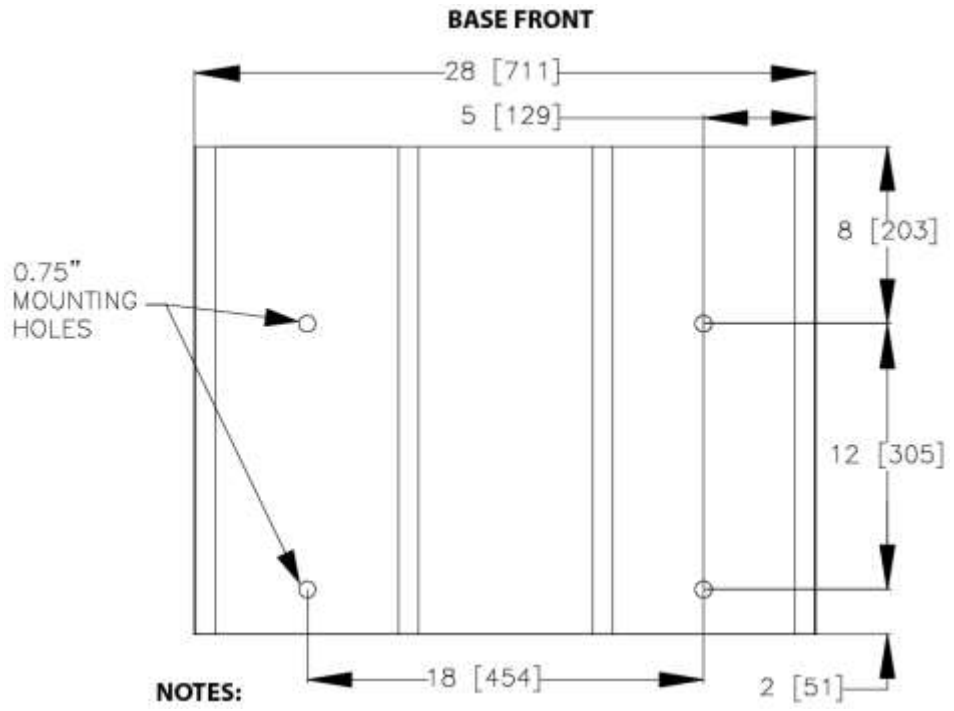


Figure 2-2a: BMK750-1000 Anchor Bolt Locations

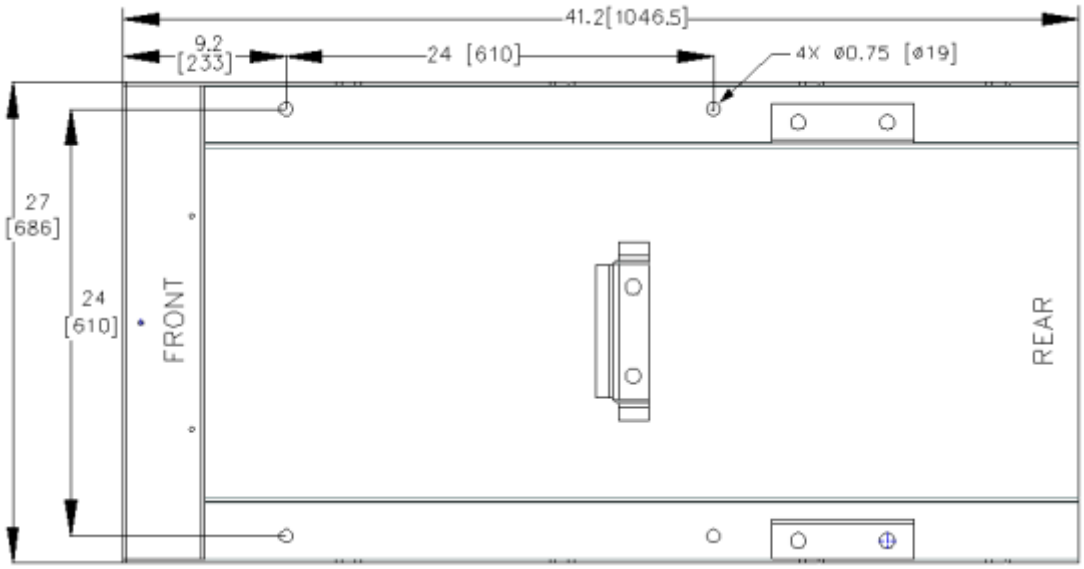


Figure 2-2b: BMK1500-2000 Anchor Bolt Locations

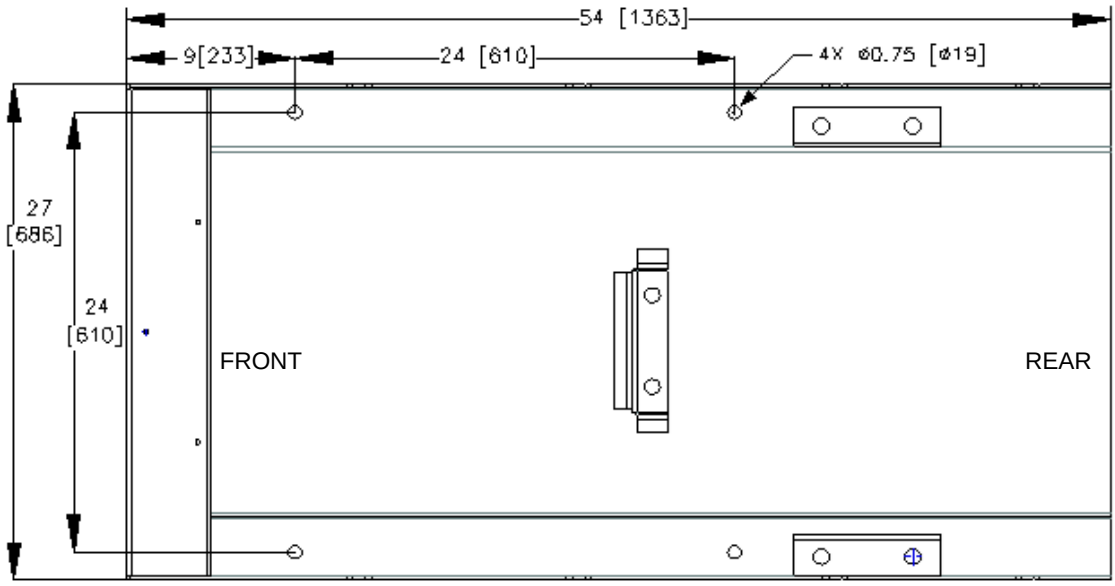


Figure 2-2c: BMK2500-3000 Anchor Bolt Locations

Figure 2-2d: BMK4000-5000N Anchor Bolt Locations

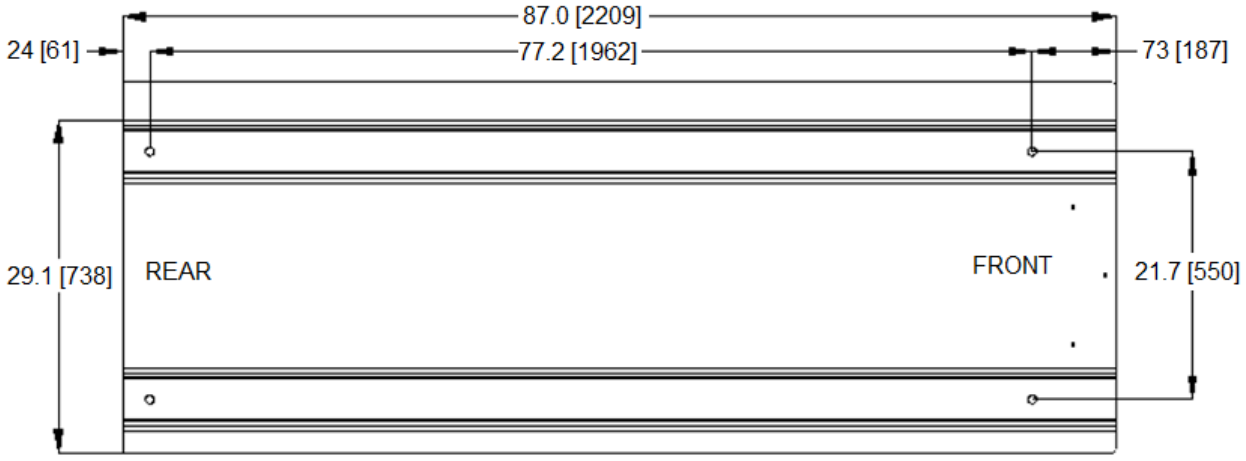


Figure 2-2e. Benchmark 5000-6000 Anchor Bolt Locations

2.4.3 Housekeeping Pad Requirements

To ensure proper condensate drainage, the unit must be installed on a level concrete "housekeeping" pad. The unit must be positioned on the pad such that the condensate assembly is *not* located over the pad, as shown below.

The minimum thickness of the concrete "housekeeping" pad depends on two factors:

- Which Benchmark model you're installing
- Whether the unit will connect to a Condensate Neutralizer tank.

The minimum pad thickness for installations *without* a Condensate Neutralizer tank are:

- Benchmark 750 & 1000: **4 to 6 inches** (10.2 to 15.2 cm)
- Benchmark 1500 to 6000: **4 to 8 inches** (10.2 to 20.3 cm)

If you are using the AERCO Condensate Neutralizer Tank (P/N **89030**), you must ensure enough height for the condensate to drain into the condensate trap, then into the neutralizer tank, and then to the drain. This may require that a pit be dug for the Neutralizer Tank. For more information on the Condensate Neutralizer Tank, see Technical Instructions TID-0074.

The following table specifies the minimum pit depth for the AERCO Condensate Neutralizer Tank (P/N **89030**) if the boiler is installed on a **4" pad**, and the pad height if the Neutralizer Tank must be installed on the floor; note, in all cases a **6" pad** eliminates the need to a pit.

BMK Model	Minimum Pit Depth	Pad Height Without Pit
750/1000	Pit not required	4"
1500/2000	1-1/4"	5-1/4"
2500/3000	1"	5"
4000/5000N	1-3/4"	5-3/4"
5000/6000	Pit not required	4"

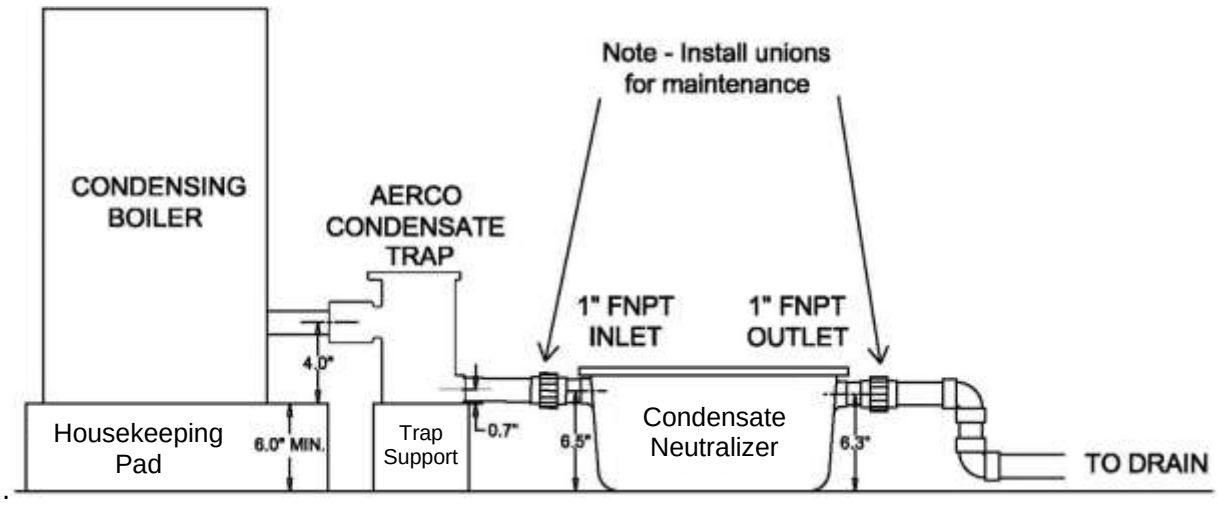


Figure 2-3: Condensate Neutralizer Tank Installation

2.5 LIFTING PROVISIONS

WARNING!

When lifting or moving the boiler, ***DO NOT*** manipulate boiler using the gas train or blower.

2.5.1 BMK750 – 1000 Lifting Provisions

Unpack and inspect the unit, then remove the four (4) lag screws securing the boiler to the shipping pallet. The boiler can be lifted and moved by inserting forklift tines in the front slots provided in the base of the unit, or it can be lifted by attaching a lifting bar to the unit's heat exchanger. A lifting bar (P/N **59174**), with attaching hardware, is supplied with each unit. When shipped, this bar is attached to the rear of the unit as shown in Figure 2-4a (View A). One (1) lifting tab is provided at the top of the unit's heat exchanger as shown. This tab is used to attach the lifting bar to the unit, as described below.

WARNING!

When using the lifting tab and bar, ensure there is no load placed on the gas train or blower.

Attaching the Lifting Bar: BMK750-1000 Instructions

1. Remove the lifting bar from its shipping location at the rear of the unit (Figure 2-4a, View A). Retain the two (2) hex head cap screws, hex nuts and flat washers.
2. Remove the top shroud from the boiler and locate the lifting tab at the top-rear of the heat exchanger.
3. Attach the lifting bar to the heat exchanger lifting tab using the hardware removed in step 1 (Figure 2-4a, View B). The upper end of the lifting bar containing the oval cutout should be positioned over the top of the heat exchanger as shown.
4. Using proper rigging equipment capable of lifting **1200 lbs. (544 kg)**, lift the boiler and position it on the housekeeping pad.
5. After the boiler is properly set on the pad, detach the lifting bar and replace the shroud on the top of the unit, but retain the lifting bar for possible reuse at the installation site.

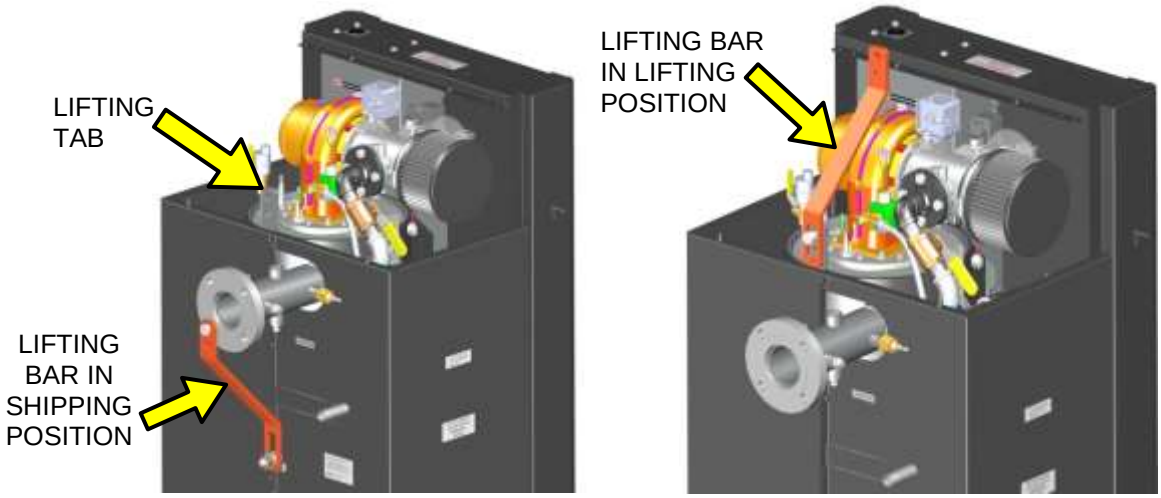


Figure 2-4a: BMK750-1000 Boiler Lifting Provisions

2.5.2 BMK1500 – 5000N Lifting Provisions

Three lifting lugs are provided at the top of the primary heat exchanger as shown in Figure 2-4b. Remove the front top panel from the unit to provide access to the lifting lugs. Remove the four (4) lag screws securing the unit to the shipping skid. Lift the unit off the shipping skid and position it on the **4 inch to 8 inch (10.2 cm to 20.3 cm)** housekeeping concrete pad (required) in the desired location.

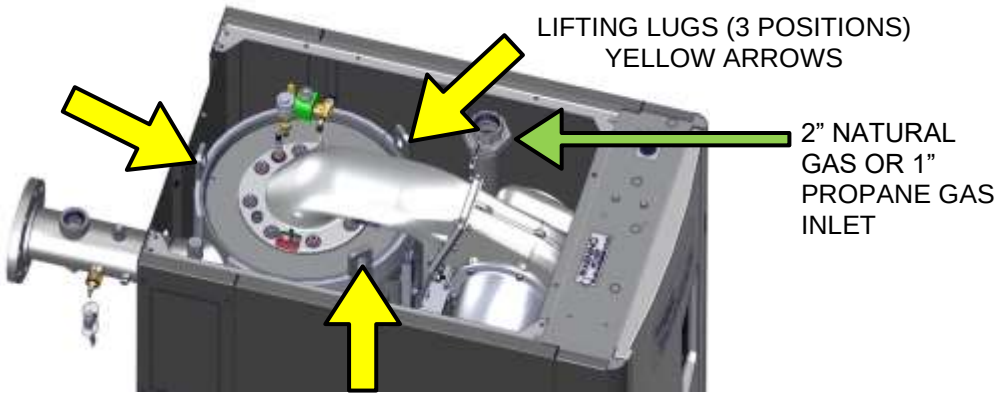


Figure 2-4b: Boiler Lifting Provisions – BMK1500-2000 Shown

2.5.3 BMK5000-6000 Lifting Provisions

Two (2) lifting lugs are provided at the top of the primary heat exchanger (see Figure 2-4c). The location of the lifting tabs is marked on the shrink-wrap coving the unit for shipping.

Remove the four (4) lag screws securing the unit to the shipping skid, and, if still in place, remove the front Top Panel. Lift the unit off the shipping skid using a spreader bar and position it on the (required) concrete Housekeeping Pad in the desired location.

WARNING!

When lifting or moving the boiler, do not attempt to manipulate the unit using the gas train or blower. A spreader bar is required for all vertical lifts. Failure to use a spreader bar can put excessive force on the unit and can cause boiler failure.

LIFTING LUGS

NOTE:

The front top panel must be removed to access the front lifting lug.

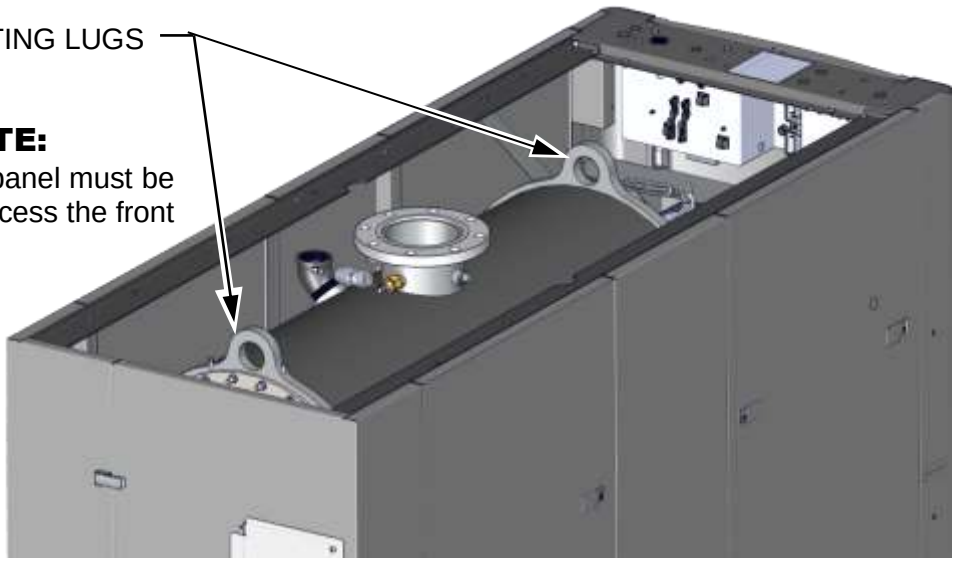


Figure 2-4c: Lifting Lug Locations – BMK5000-/6000

2.6 SUPPLY AND RETURN PIPING

When connecting the hot water outlet and cold-water inlet to building piping, first make sure the mating surfaces are thoroughly clean. Gaskets of appropriate size for the pipe flange must be provided in the field.

2.6.1 BMK750 – 1000 Supply and Return Piping

Benchmark 750 and 1000 Boiler utilizes 3" (7.62cm) 150# flanges for the water system supply and return piping connections. The physical location of the supply and return piping connections are on the rear of the unit as shown in Figure 2-5a.

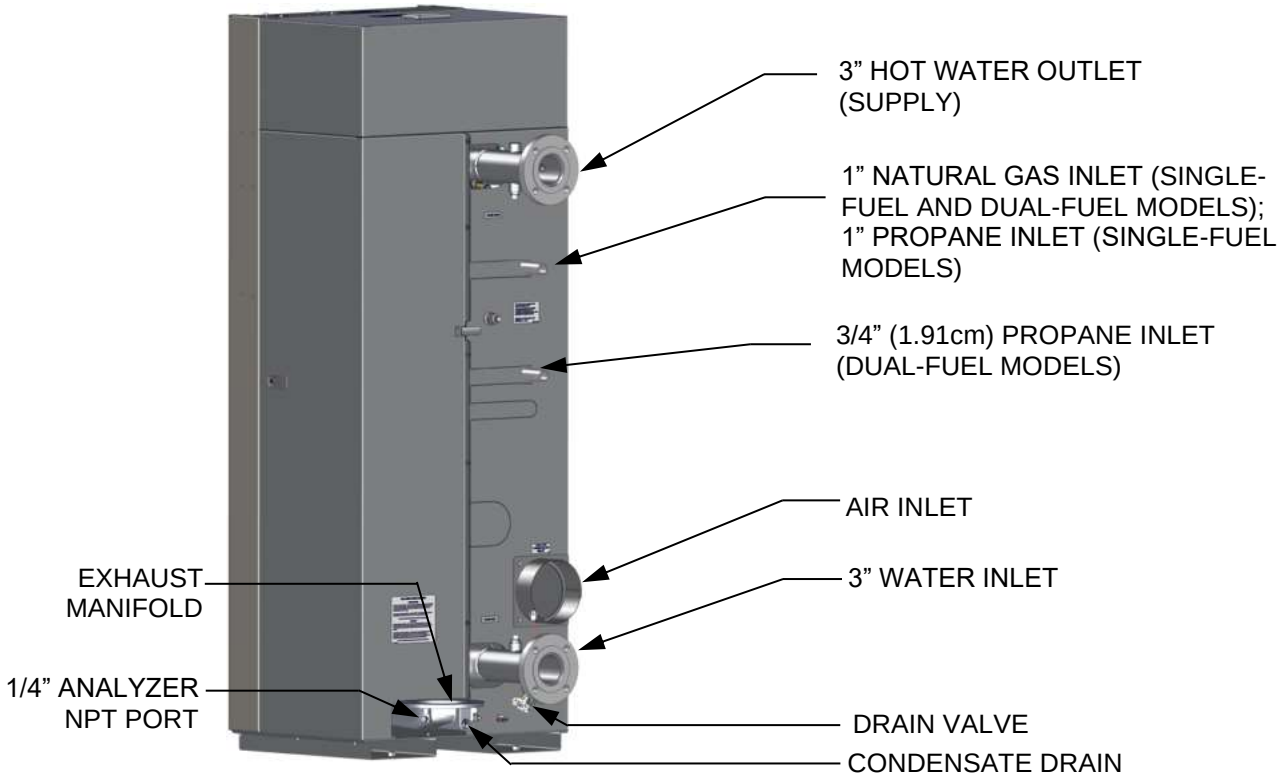


Figure 2-5a: BMK750-1000 Supply and Return Locations

2.6.2 BMK1500 – 5000N Supply and Return Piping

Benchmark 1500 – 3000 units have the following inlets and outlets:

- 4" (10.2 cm) 150# flange water INLET (supply) and hot water OUTLET (return) piping.
- One of the following gas inlet pipes:
  - 2" (5.08 cm) Natural Gas inlet pipe.
  - 1" (2.54 cm) Propane inlet pipe (BMK 1500-2000).
  - 2" (5.08 cm) Propane inlet pipe (BMK 2500-3000).
- 8" (20.3 cm) Air Inlet adapter.

Benchmark 4000 and 5000N units have:

- 6" (15.2 CM) 150# flange water INLET (supply) and hot water OUTLET (return) piping.
- One of the following gas inlet pipes:

- 3” (7.62 cm) Natural Gas inlet pipe.
- 1-1/2” (3.81 cm) Propane inlet pipe

- 10” (25.4 cm) Air Inlet adapter.

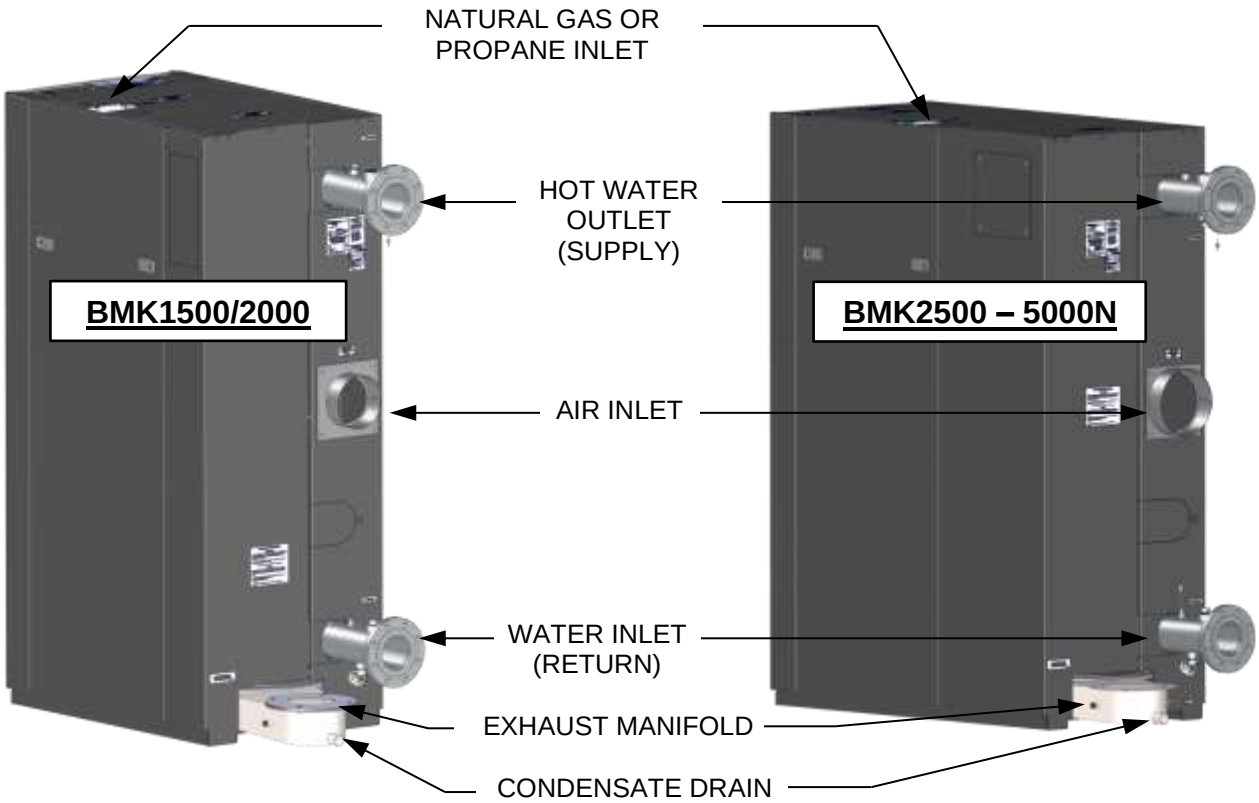


Figure 2-5b: BMK1500 – 5000N Supply and Return Locations

2.6.3 BMK5000 – 6000 Supply and Return Piping

Benchmark 5000 and 6000 boilers utilizes 6” (15.24 cm) flanged fittings for the water system supply and return piping connections. The physical location of the supply and return piping connections are shown in Figure 2-5c.

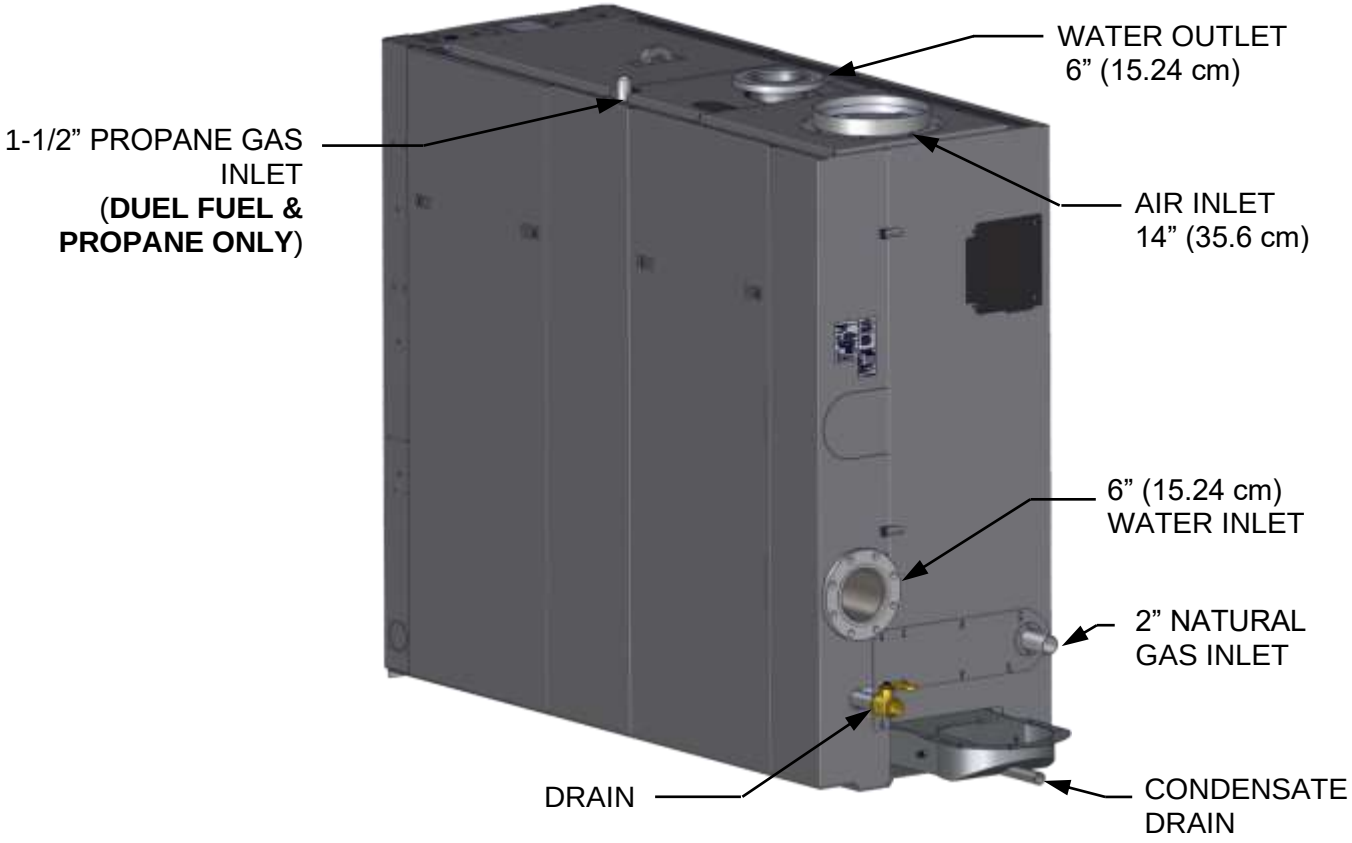


Figure 2-5c: BMK5000-6000 Supply and Return Locations (DF Model Shown)

2.7 PRESSURE RELIEF VALVE INSTALLATION

An ASME rated Pressure Relief Valve is supplied with each Benchmark Boiler (BMK5000 and 6000 boilers are supplied with one or more valves, depending on the pressure required). The pressure rating for the relief valve must be specified on the sales order. Available pressure ratings range from **30 to 160 psi (207 to 1103 kPa)**. The relief valve is installed on the hot water outlet of the boiler as shown in Figure 2-6a – 2-6c. A suitable pipe joint compound should be used on the threaded connections. Any excess should be wiped off to avoid getting any joint compound into the valve body. The relief valve must be piped to **within 12 inches (30.5 cm)** of the floor to prevent injury in the event of a discharge. No valves, restrictions, or other blockages are allowed in the full port discharge line. In multiple unit installations the discharge lines must ***NOT*** be manifolded together. Each must be individually run to a suitable discharge location.

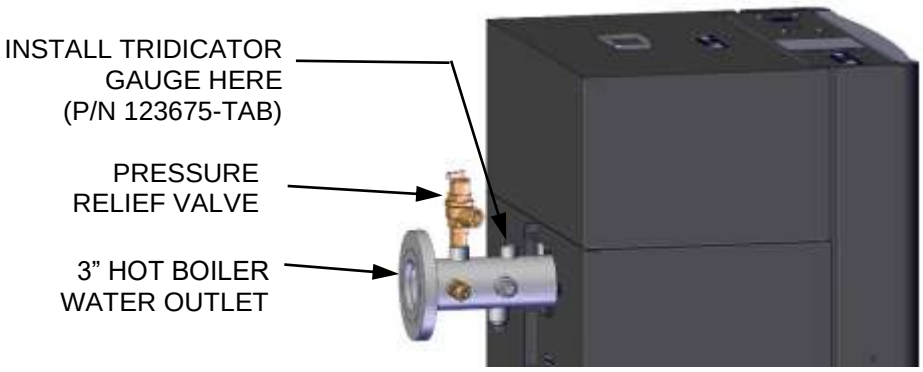


Figure 2-6a: BMK750-1000 P&T Relief Valve Location

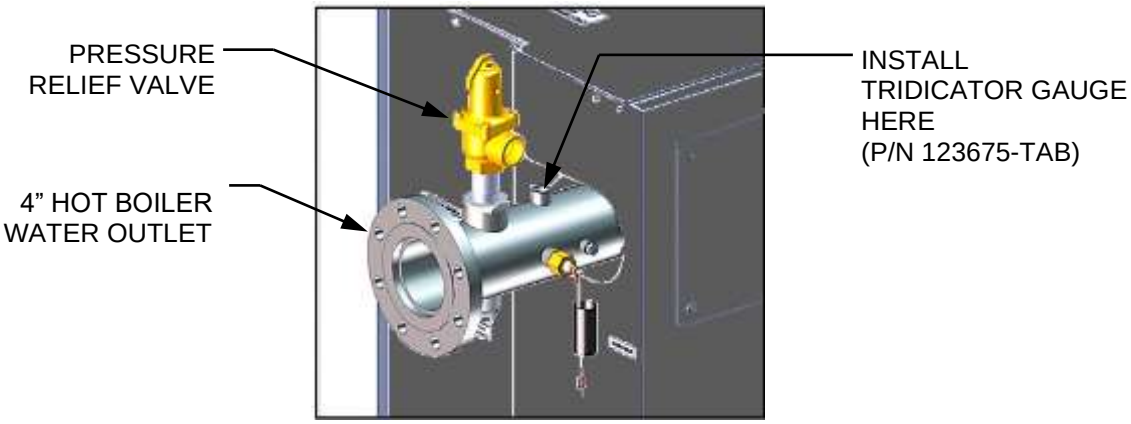


Figure 2-6b: BMK1500 – 5000N P&T Relief Valve Location

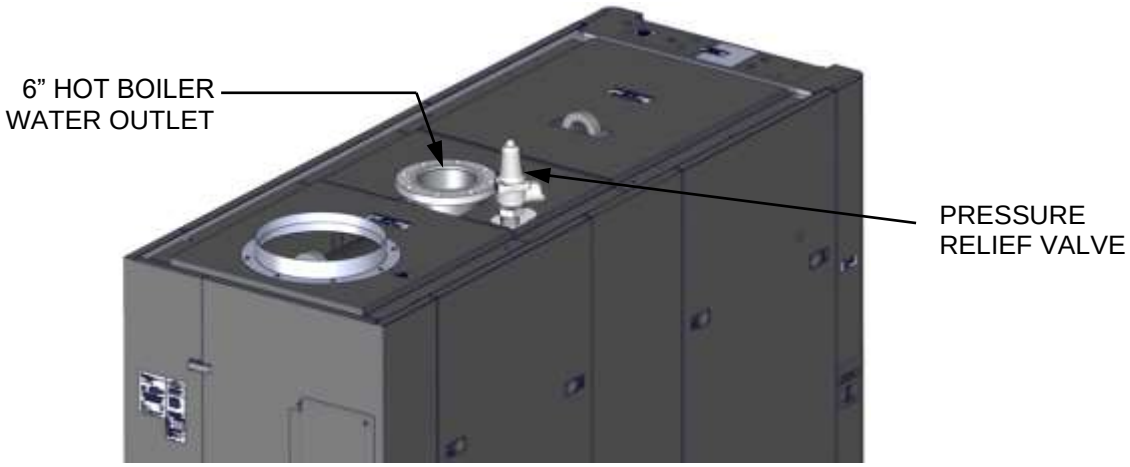


Figure 2-6c. BMK5000-6000 P&T Relief Valve Location

2.8 CONDENSATE DRAIN and PIPING

The Benchmark Boiler is designed to condense water vapor from the flue products. Therefore, the installation must have provisions for suitable condensate drainage or collection. See below for information on the condensate drain and piping for the various models.

The condensate drain port located on the exhaust manifold (see Figure 2-7a and 2-7b, below) must be connected to the condensate trap (P/N **24441**), which is packed separately within the unit's shipping container. Its inlet and outlet connections contain tapped 3/4" NPT ports.

A sample condensate trap installation is shown in Figure 2-7a and 2-7b. However, the actual installation details for the trap will vary depending on the available clearances, housekeeping pad height/dimensions and other prevailing conditions at the site.

NOTE: The following guidelines ***must*** be observed to ensure proper condensate drainage:

- The condensate trap inlet must be level with, or lower than exhaust manifold drain port.
- The base of the condensate trap must be supported to ensure that it is level (horizontal).
- The trap must be removable for routine maintenance. AERCO recommends that a union be utilized between the exhaust manifold condensate drain port and the trap inlet port.
- If the condensate trap does not connect directly to the exhaust manifold condensate drain port, the pipe between the drain and the trap ***must*** be **stainless steel** or **aluminum**.
- The concrete housekeeping pad must not extend under the condensate assembly.

While observing the above guidelines, install the condensate trap as follows:

Condensate Drain Installation Instructions

1. Connect the condensate trap inlet to the exhaust manifold drain connection using the appropriate piping components (nipples, reducers, elbows, etc.).
2. At the condensate trap outlet, install a 3/4" NPT nipple.
3. Connect a length of 1" (2.54 cm) I.D. polypropylene hose to the trap outlet and secure with a hose clamp.
4. Route the hose on the trap outlet to a condensate neutralizer tank or nearby floor drain.

WARNING!

Use PVC, stainless steel, aluminum or polypropylene for condensate drain piping. Do ***NOT*** use carbon or copper components.

If a floor drain is not available, a condensate pump can be used to remove the condensate to an appropriate drain. The maximum condensate flow rate is:

Model	Maximum Condensate Flow Per Boiler		
BMK750	6 gallons (23 L) per hour	BMK3000	20 gallons (76 L) per hour
BMK1000	8 gallons (30 L) per hour	BMK4000	30 gallons (113 L) per hour
BMK1500	9 gallons (34 L) per hour	BMK5000N	33 gallons (125 L) per hour
BMK2000	10 gallons (38 L) per hour	BMK5000	34 gallons (128 L) per hour
BMK2500	17 gallons (64 L) per hour	BMK6000	40 gallons (151 L) per hour

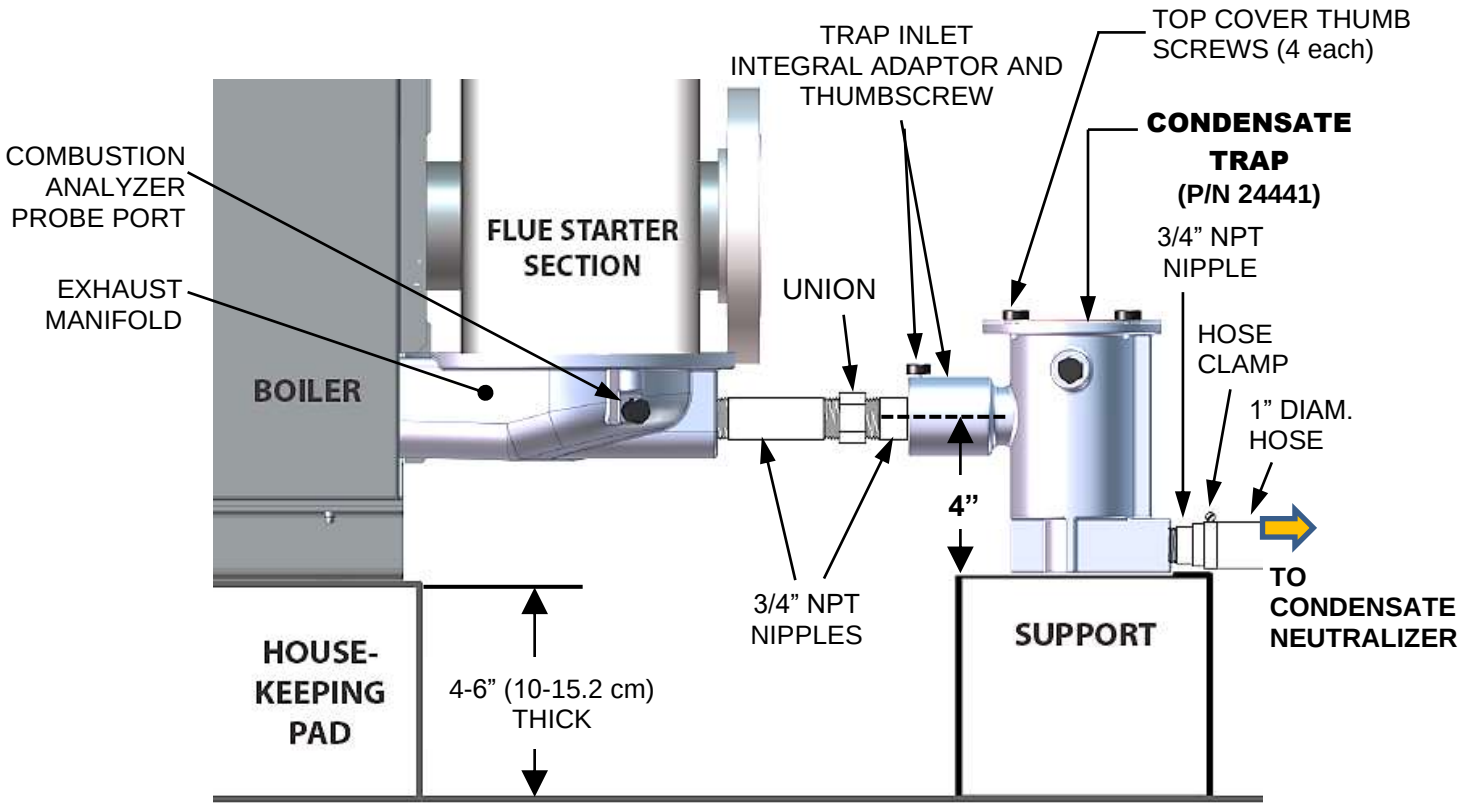


Figure 2-7a: BMK750-1000 Sample Condensate Trap Installation

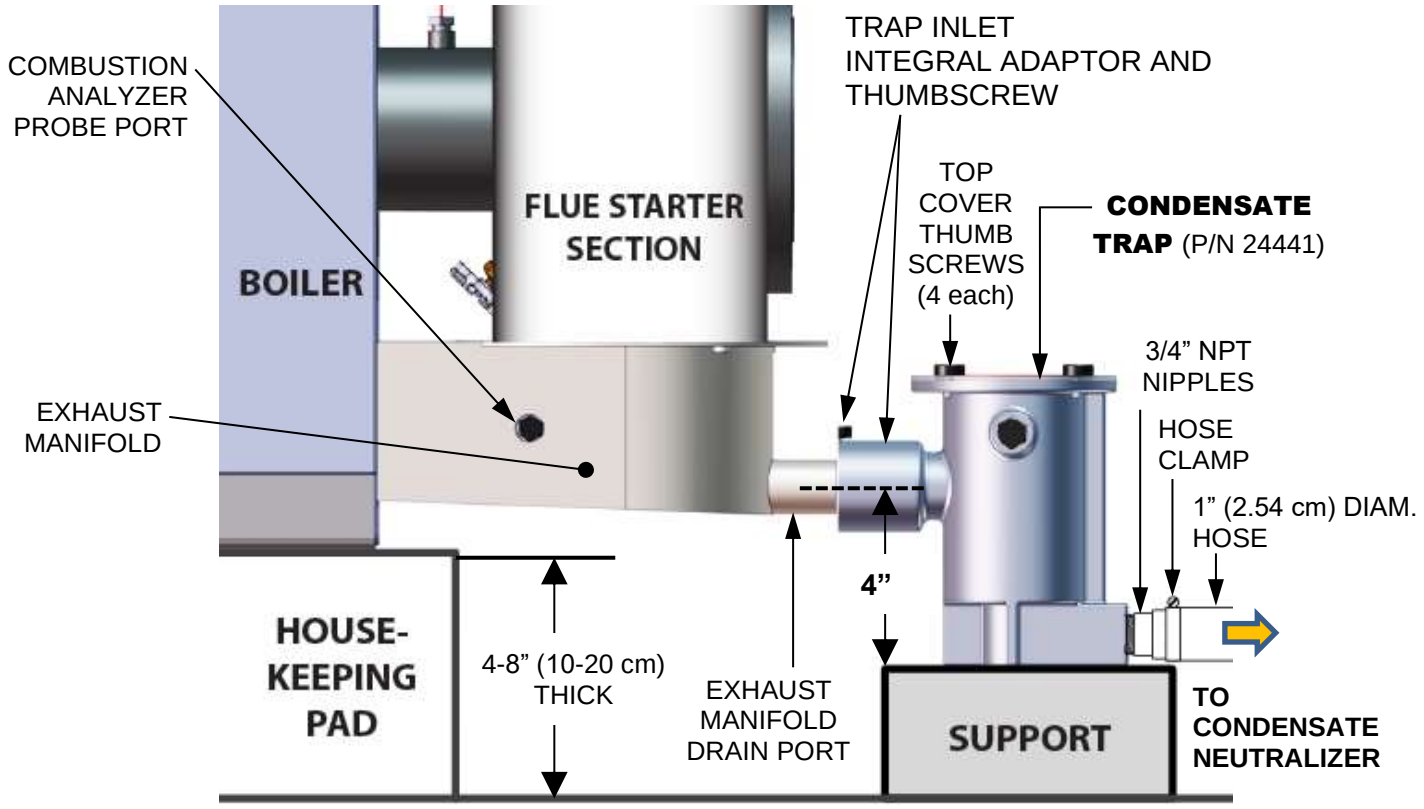


Figure 2-7b: BMK1500 – 6000 Sample Condensate Trap Installation

2.9 GAS SUPPLY PIPING

AERCO's *Benchmark Gas Supply Design Guide*, TAG-0047 (GF-2030) must be consulted prior to designing or installing any gas supply piping.

WARNING!

Never use matches, candles, flames or other sources of ignition to check for gas leaks.

CAUTION!

Many of the soaps used for gas pipe leak testing are corrosive to metals. Therefore, 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 covers, inhibit service/maintenance, or restrict access to the unit.

BMK Model	Natural Gas Piping	Propane Piping
750 and 1000	1 inch (2.54 cm) in back of unit	**Single Fuel**: 1 inch (2.54 cm) in back of unit **Dual Fuel**: 3/4 inch (1.91 cm) in back of unit
1500 – 3000	2 inch (5.08 cm) on top of unit	1 inch (2.54 cm) on top of unit
4000-5000N	3 inch (7.62 cm) on top of unit	1-1/2 inch (3.81 cm) on top of unit
5000-6000	2" (5.08 cm) in back of unit 3" (7.62 cm) LGP in back of unit	1-1/2 inch (3.81 cm) on top of unit

Prior to installation, all pipes should be de-burred and internally cleared of any scale, metal chips or other foreign particles. Do *NOT* install any flexible connectors or unapproved gas fittings. Piping must be supported from the floor, ceiling or walls only and must not be supported by the unit.

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

To avoid unit damage when pressure testing gas piping, the unit must be isolated from the gas supply piping. A thorough leak test of all external piping must be performed using a soap and water solution or suitable equivalent. The gas piping used must meet all applicable codes.

2.9.1 Gas Supply Specifications

AERCO Benchmark Low NOx series boilers require a stable natural gas and propane input pressure. It must comply with the allowable gas inlet pressure range specified in the *Benchmark Gas Supply Design Guide,* TAG-0047 (GF-2030).

2.9.2 External Gas Supply Regulator

An external gas pressure regulator is required on the gas inlet piping under most conditions (see, below). Regulators must conform to the specifications in the *Benchmark Gas Supply Design Guide,* TAG-0047 (GF-2030).

NOTE: It is the responsibility of the customer to source and purchase the appropriate gas regulator as described above. However, AERCO offers for sale an appropriate regulator, which may be ordered at the time of unit purchase or separately. Contact your AERCO sales representative for more information.

On all Benchmark models it is strongly recommended that the pressure regulator be installed a minimum distance of **10 pipe diameters** between the pressure regulator and the nearest *downstream* fittings (an elbow or the unit itself), and a minimum of **5 pipe diameters** between the pressure regulator and any *upstream* fitting, such as elbow or shutoff valve, as shown in Figure 2-8a, below.

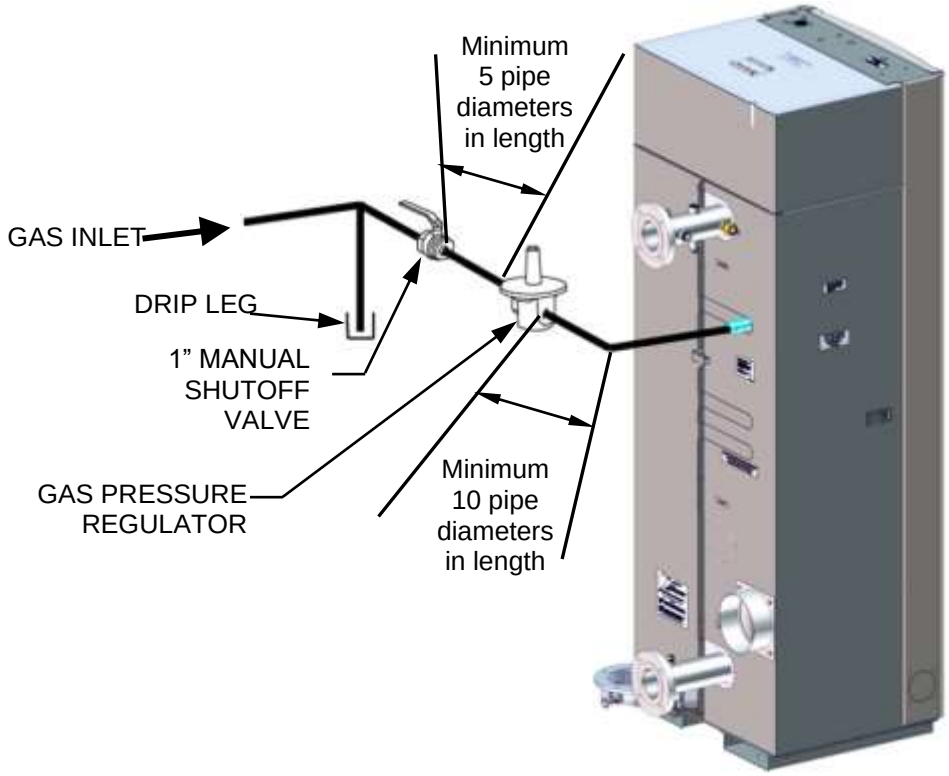


Figure 2-8a: BMK750-1000 Gas Regulator and Manual Shut-Off Valve

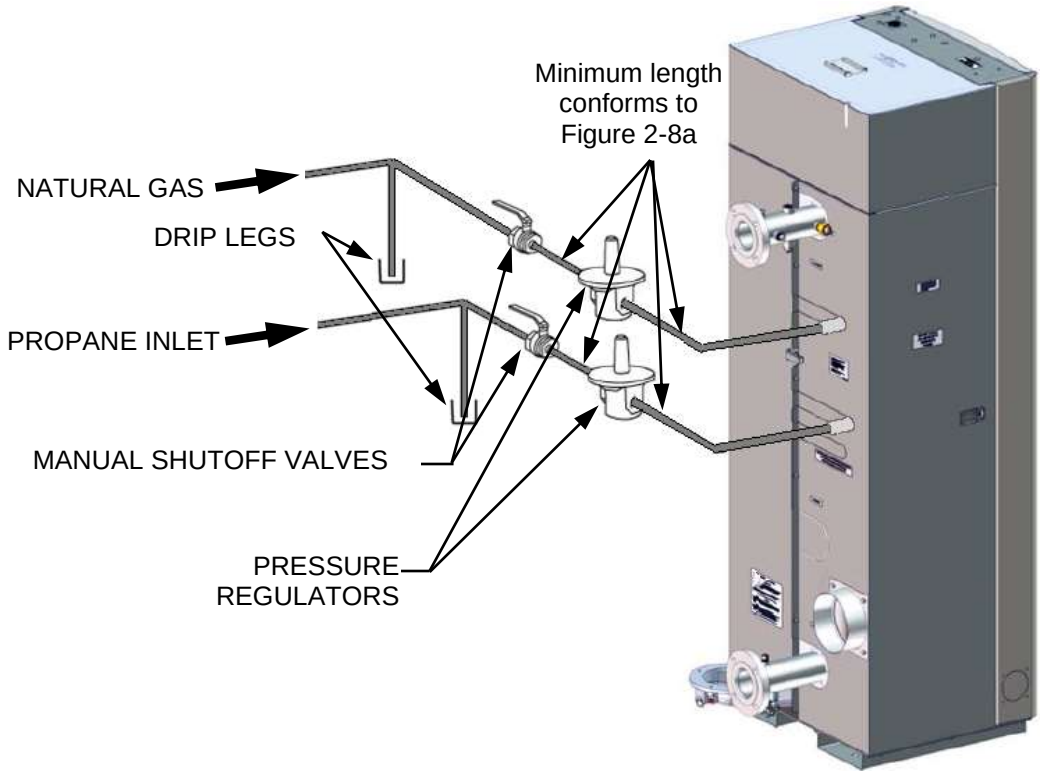


Figure 2-7b: BMK750-1000 Dual Fuel Gas Regulator and Manual Shut-Off Valve

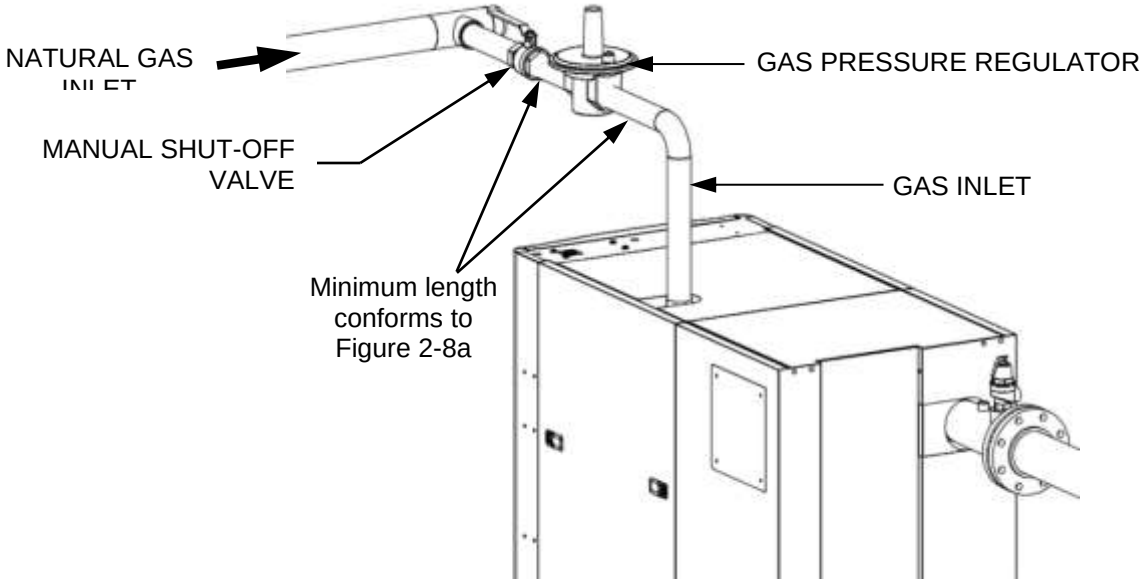
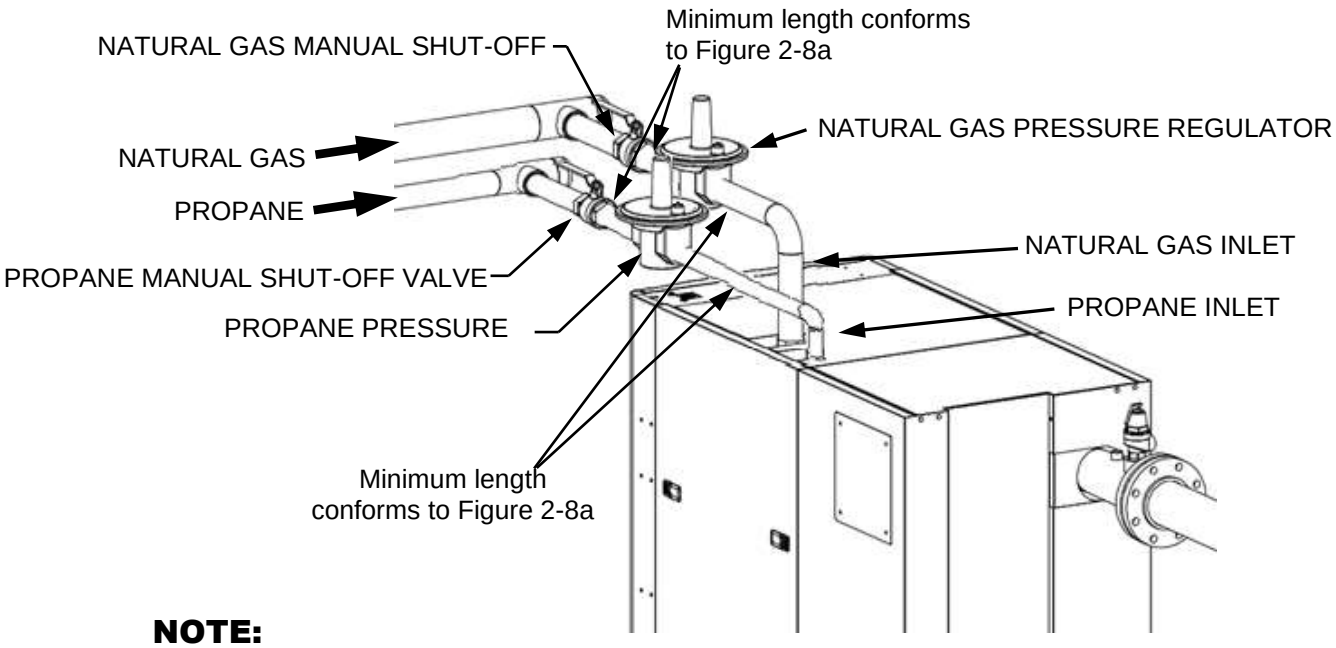


Figure 2-8c: BMK1500 – 5000N Gas Regulator and Manual Shut-Off Valve



NOTE:
In propane-only units, natural gas piping and components in Figure 2-8d and 8e are not present.

Figure 2-8d: BMK1500 – 5000N Dual Fuel Gas Regulator and Manual Shut-Off Valve

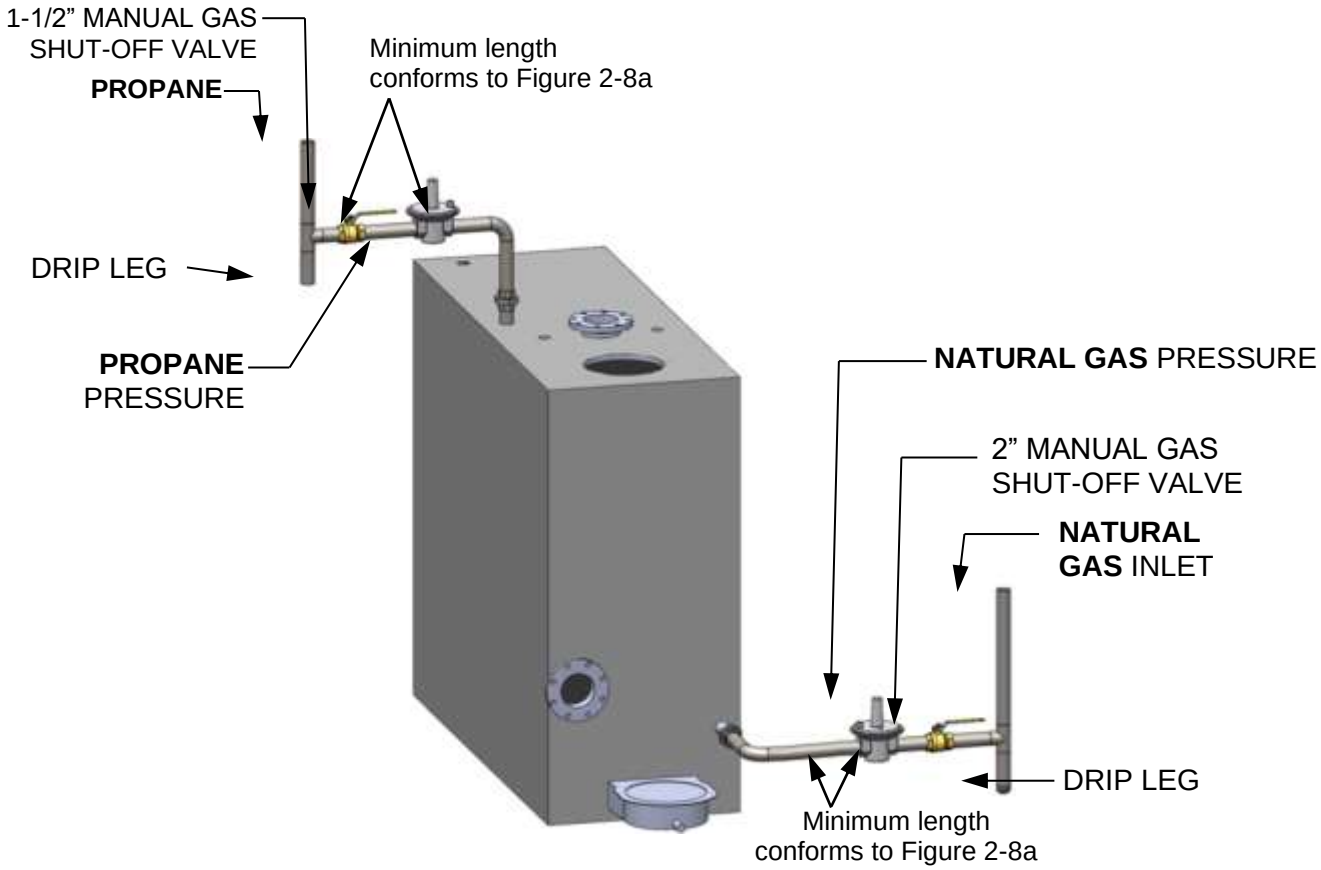


Figure 2-8e: BMK5000-6000 Manual Gas Shut-Off Valve Location – Dual Fuel

2.9.2.1 Massachusetts Installations Only

For Massachusetts installations, a mandatory external gas supply regulator must be positioned as shown in Figure 2-8a – 2-8e, above. The gas supply regulator must be properly vented to outdoors. Consult the local gas utility for detailed requirements concerning venting of the supply gas regulator.

2.9.3 Manual Gas Shutoff Valve

A manual shut-off valve must be installed in the gas supply line upstream of the boiler as shown in Figure 2-8a – 2-8e, above.

2.10 AC ELECTRICAL POWER WIRING

AERCO's *Benchmark Electrical Power Design Guide*, TAG-0048 (GF-2060), must be consulted prior to connecting any AC power wiring to the unit.

2.10.1 Electrical Power Requirements

Benchmark boilers are available with the following power options:

BMK Model	Voltage	Phase	Amperage
BMK750 – 1000 Domestic	120 V	1Ø / 60 Hz	15
BMK750 – 1000 International	220 V	1Ø / 50-60 Hz	20
BMK1500 – 2000 Domestic	120 V	1Ø / 60 Hz	20
BMK1500 – 2000 International	220 V	1Ø / 50-60 Hz	20
BMK2500 - 3000 Domestic	208 V	3Ø / 60 Hz	20
	460 V	3Ø / 60 Hz	15
BMK2500 - 3000 International	380-415 V	3Ø / 50-60 Hz	15
BMK4000 – 5000N Domestic	208V	3Ø / 60 Hz	40
	480V	3Ø / 60 Hz	20
BMK5000 - 6000 Domestic	208 V	3Ø / 60 Hz	30
	460 V	3Ø / 60 Hz	20
BMK5000 - 6000 Canada	575 V	3Ø / 60 Hz	20
BMK5000 - 6000 International	380-415 V	3Ø / 50-60 Hz	20

All electrical power requirements are in the *Benchmark Electrical Power Design Guide,* TAG-0048 (GF-2060).

2.10.2 Power Panel Locations

External AC power connections are made to the unit inside the Power Box on the front of the unit. Remove the front panel to access the Power Box, which is mounted in the upper part of the unit as shown in Figure 2-9a and 2-9b. The internal connections inside the power box is shown in Section 2.10.3, below.

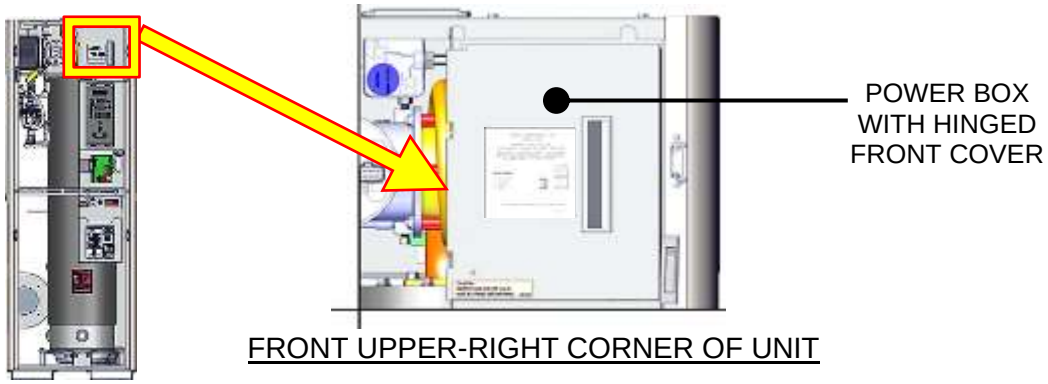


Figure 2-9a: BMK750-1000 Power Box with Closed Cover

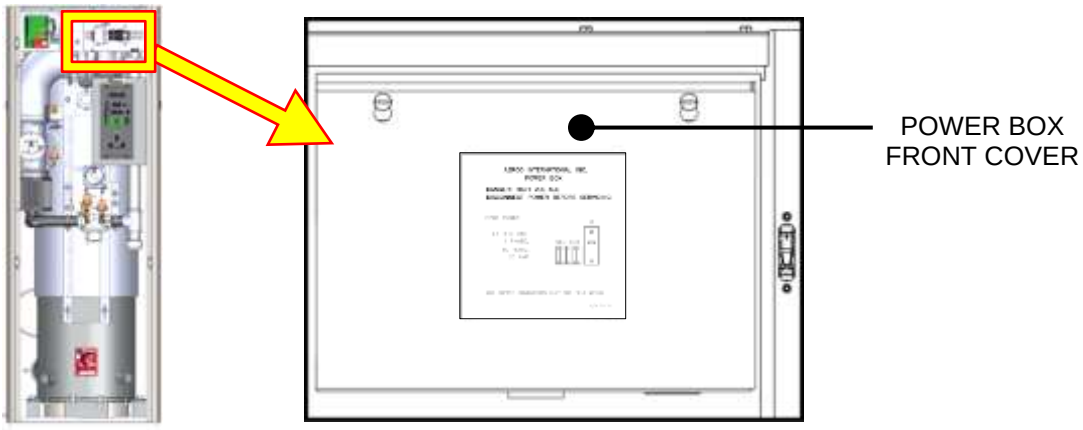


Figure 2-9b: BMK1500 – 6000 Power Box with Closed Cover

Each unit must be connected to a dedicated electrical circuit. **NO OTHER DEVICES SHOULD BE ON THE SAME ELECTRICAL CIRCUIT AS THE BOILER.**

A switch must be installed on the electrical supply line, external to the unit, in an easily accessible location to quickly and safely disconnect electrical service. DO NOT attach the switch to sheet metal enclosures of the unit.

After placing the unit in service, the ignition safety shutoff device must be tested. If an external electrical power source is used, the installed boiler must be electrically bonded to ground in accordance with the requirements of the authority having jurisdiction. In the absence of such requirements, the installation shall conform to National Electrical Code (NEC), ANSI/NFPA 70 and/or the Canadian Electrical Code (CEC) Part I, CSA C22.1 Electrical Code.

For electrical power wiring diagrams, see the *Benchmark Electrical Power Design Guide*, TAG-0048 (GF-2060).

2.10.3 Electrical Power Panel Internal Components

Remove the front panel to access the Power Panel. Run the electrical service through the opening above the Power Panel and make the connections to the Power Breaker in accordance to the Power Panel cover label (see Figure 2-9, above).

WARNING!

The power breaker, shown in Figure 2-10a, 2-10b and 2-10c, does **NOT** remove power from the terminal blocks.

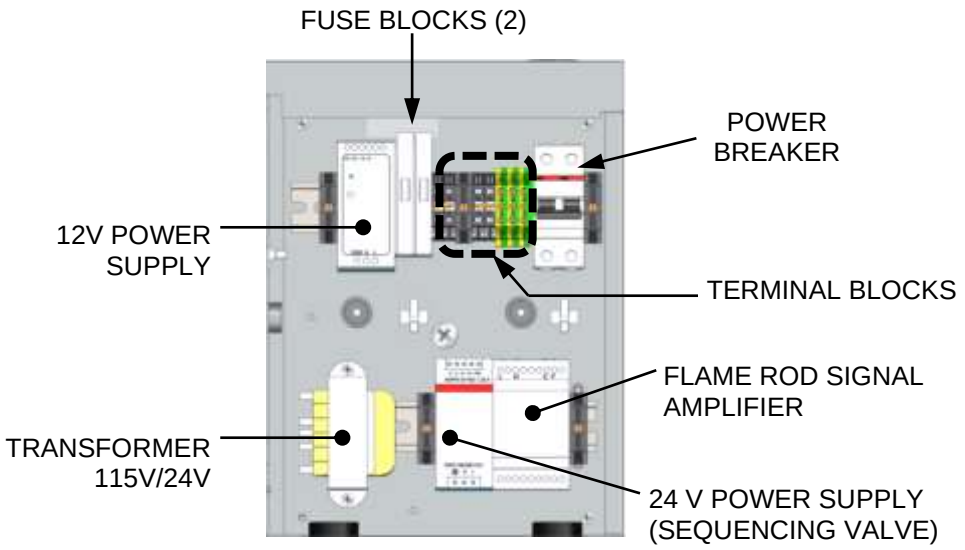


Figure 2-10a: BMK750-1000 Power Box Internal Components

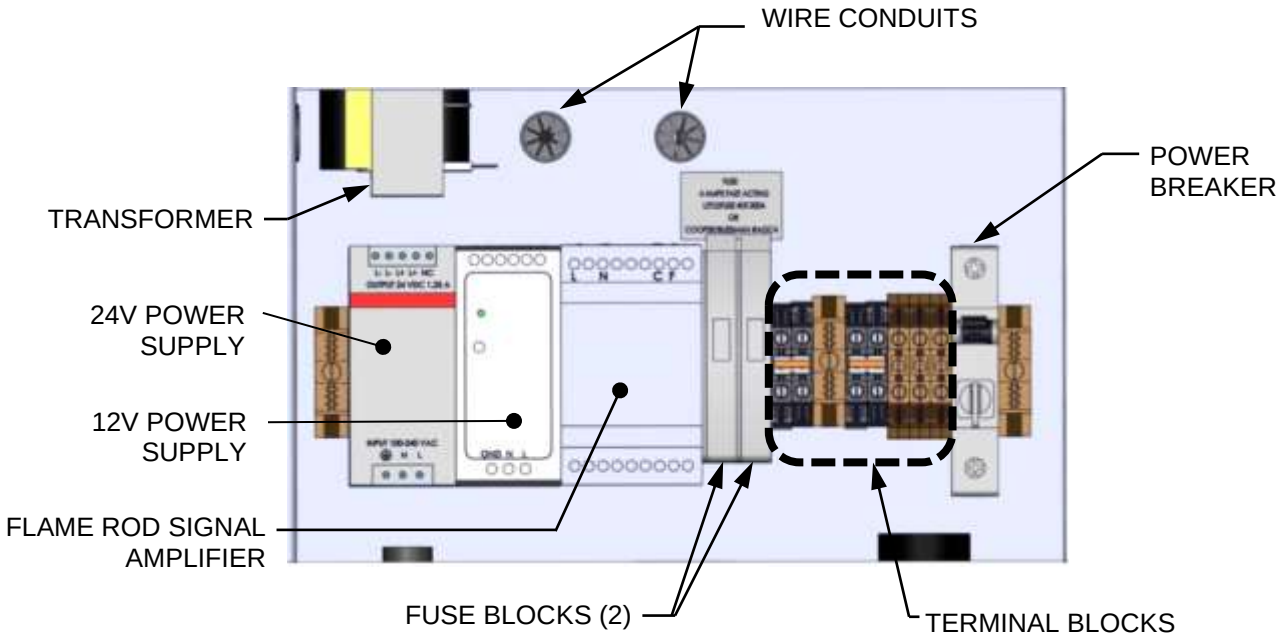


Figure 2-10b: BMK1500-2000 Power Box Internal Components

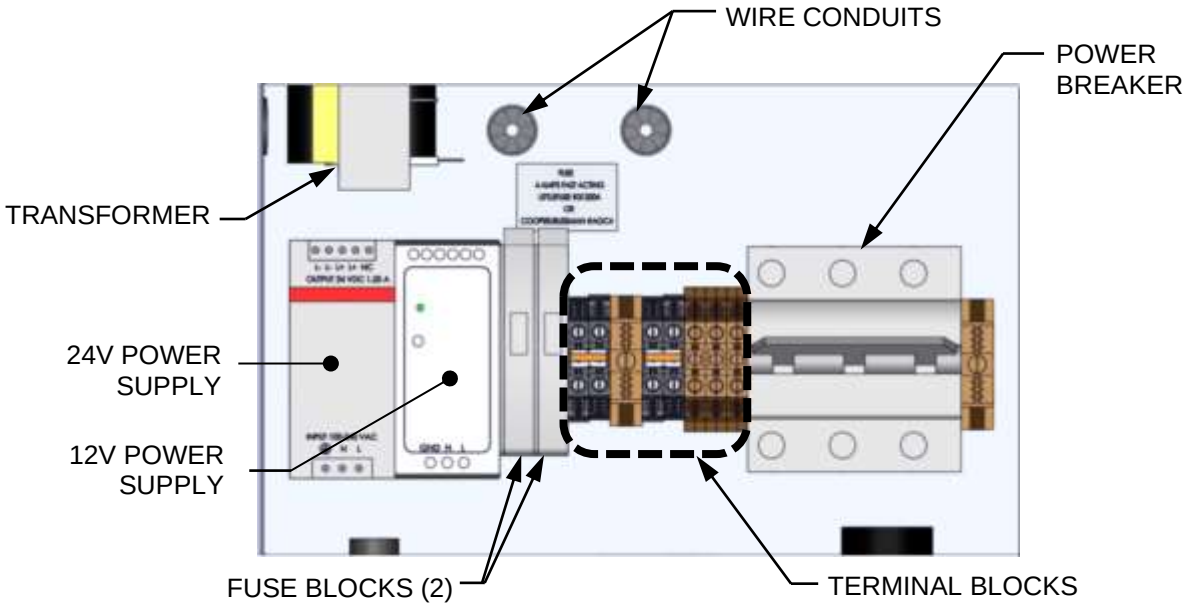


Figure 2-10c: BMK2500 – 6000 Power Box Internal Components

NOTES:

- With the exception of the transformer shown in the Figures above, all of the components in the Power Box are mounted on a DIN rail.
- All electrical conduit and hardware must be installed so that it does not interfere with the removal of any unit covers, inhibit service/maintenance, or prevent access between the unit and walls or another unit.

2.11 FIELD CONTROL WIRING – I/O Board

Each unit is fully wired from the factory with an internal operating control system. No field control wiring is required for normal operation. However, the Edge Controller used with these Benchmark units does allow for some additional control and monitoring features. Wiring connections for these features are made on the Input/Output (I/O) board located behind the removable front panel assembly of the unit. The location of the I/O board is shown in Figure 2-11. The I/O board terminal strip connections are shown in Figure 2-12. All field wiring is installed from the rear of the panel by routing the wires through one of the four bushings provided on the sides of the I/O board.

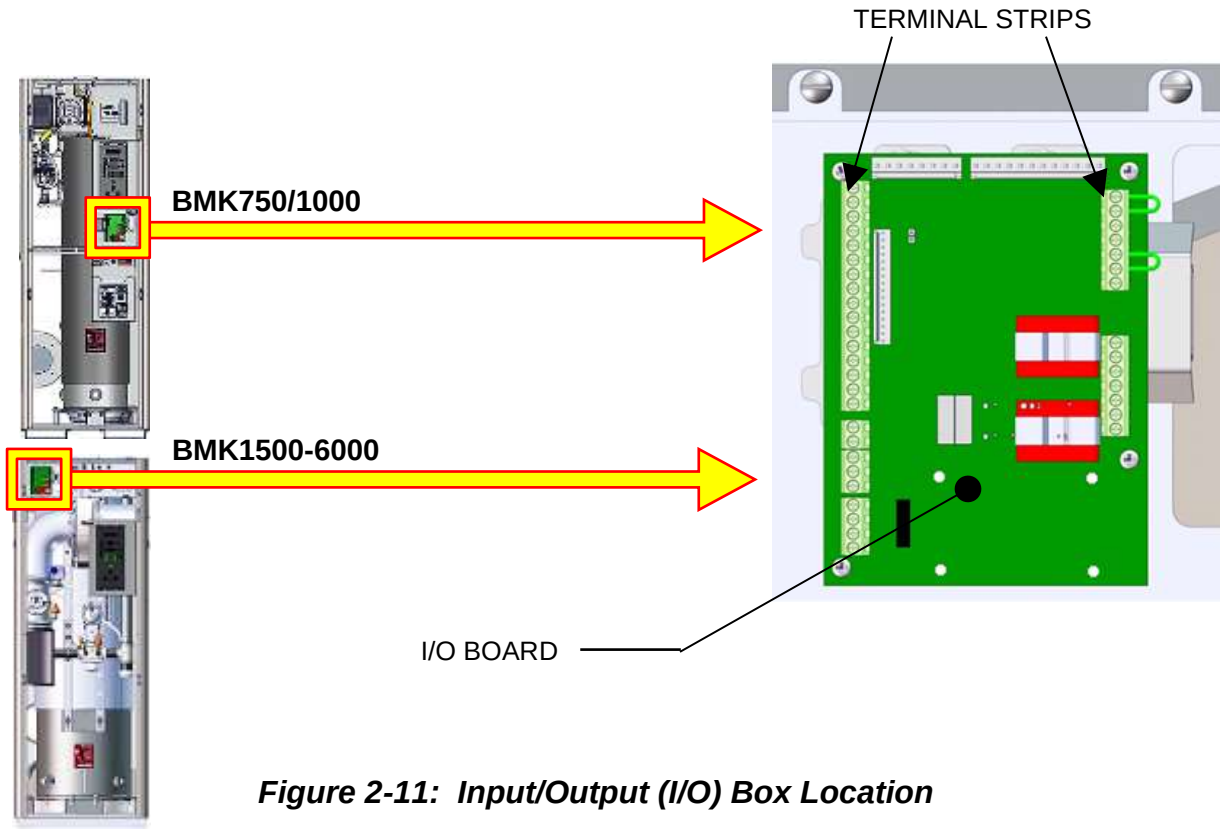
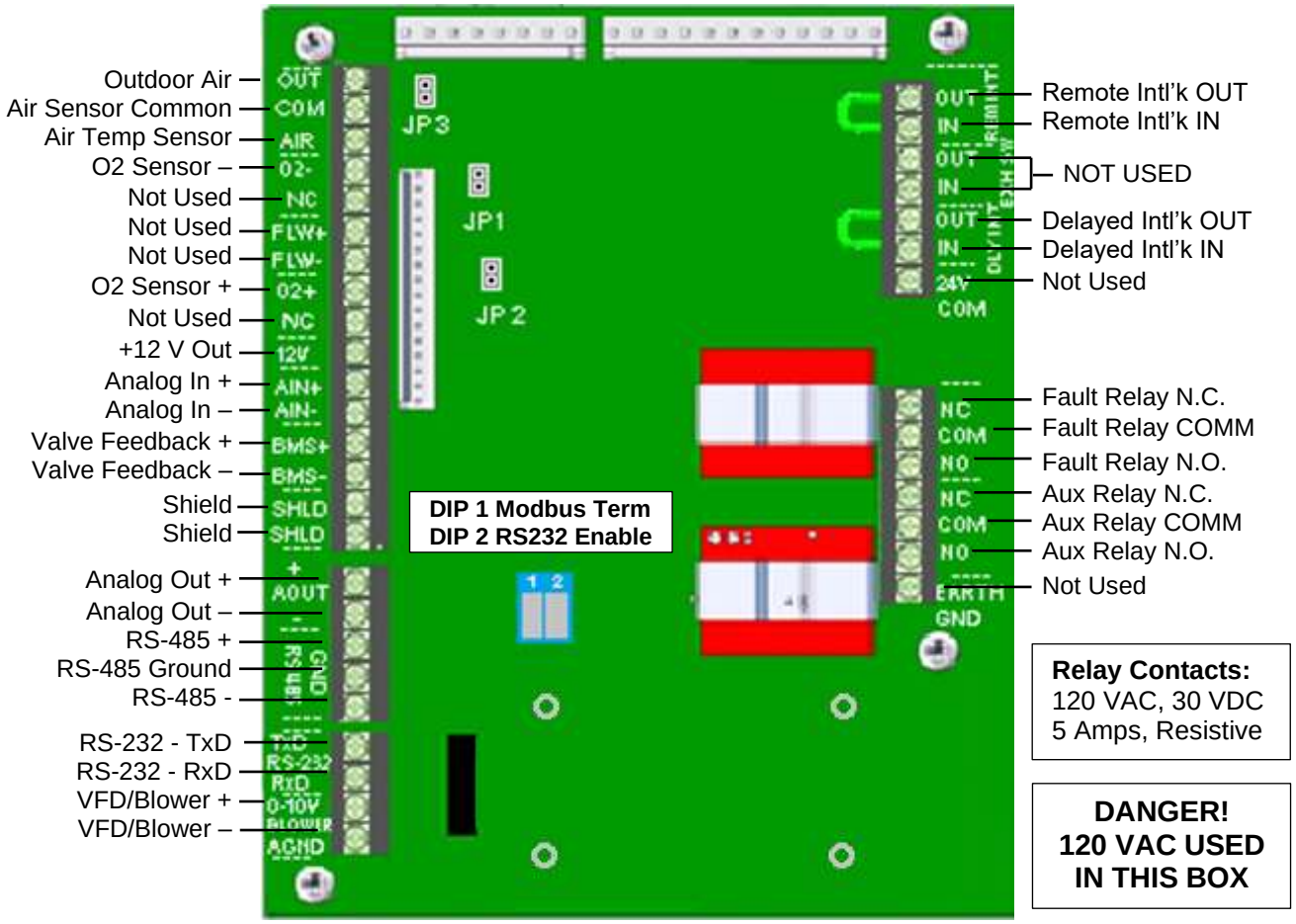


Figure 2-11: Input/Output (I/O) Box Location

NOTE: Use Figure 2-12, below, to determine the functions of the I/O board connections. Do not use the silkscreened label on the I/O board itself, as some labels may not match the functions. There is also a diagram of the connection functions on the cover of the I/O Box.

WARNING!

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



NOTE: Refer to this image for connections, not the silkscreen labels shown on the board.

Figure 2-12: I/O Box Terminal Strips

2.11.1 Outdoor Air & Air Sensor Common

An outdoor temperature sensor (P/N **61047**) is required for the **Outdoor Air Reset** operating mode. It can also be used with another mode if it is desired to use the outdoor sensor enable/disable feature, which allows the boiler to be enabled or disabled based on the outdoor air temperature.

The factory default for the outdoor sensor is **OFF**. To enable the sensor, see the **Outdoor Air Temp Sens** parameter in the **Main Menu → Advanced Setup → BST Cascade → Cascade Configuration** menu, then choose the connection method:

- **Network**: If chosen, the **SH Sensor Comm Addr** parameter appears; specify the network address.
- **Direct**
- **BAS**: If chosen, the **SH Sensor Comm Addr** parameter appears; specify the network address.

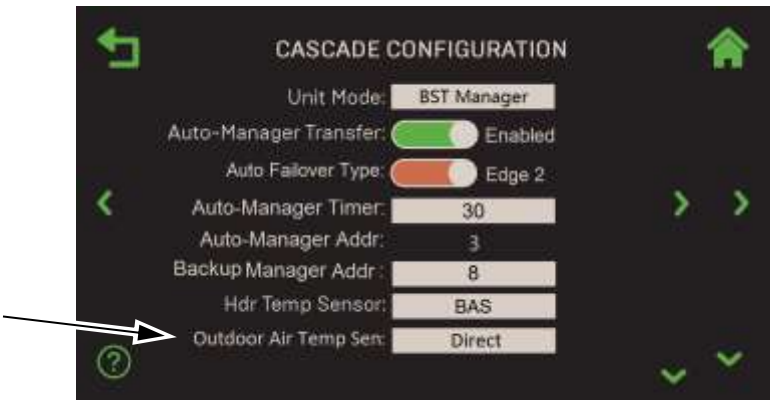


Figure 2-13: Cascade Configuration Screen

The outdoor sensor may be wired **up to 200 feet (61m)** from the boiler. It is connected to the **OUTDOOR AIR** and **AIR SENSOR COMMON** terminals of the I/O board (Figure 2-12). Wire the sensor using a twisted shielded pair wire from 18 to 22 AWG. There is no polarity to observe when terminating these wires. The shield is to be connected only to the terminals labeled *SHIELD* in the I/O Box PCB. 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 from direct sunlight as well as impingement by the elements. If a shield is used, it must allow for free air circulation.

2.11.2 AIR TEMP SENSOR

The **AIR TEMP SENSOR** terminal is used to monitor the air inlet temperature sensor (P/N **123449**). This input is always enabled and is a "view only" input. It can be seen in the **BST Outdoor Temp** parameter in the **Main Menu → Advanced Setup → BST Cascade Configuration** menu. A resistance chart for this sensor is provided in Section 6 of the *Benchmark 750-6000 with Edge [i] Controller Reference Guide* (OMM-0146, GF-219). This sensor is an active part of the combustion control system and must be operational for accurate air/fuel mixing control.

2.11.3 O_2 SENSOR (+ & –)

The two **O_2 SENSOR** terminals (+ and –) are used to connect an integrated oxygen sensor to the I/O board. The O_2 concentration is displayed in the **Main Menu → Calibration → Input/Output → O2 Sensor** menu after a 60 second warm-up period.

Figure 2-14: O2 Sensor Screen

2.11.4 ANALOG IN

The two **ANALOG IN** terminals (+ and –) are used when an external signal is used to change the setpoint of a boiler running in **Remote Setpoint** operating mode.

Either a **4 to 20 mA**, **1 to 5 VDC, 0 to 20 mA**, or a **0 – 5 VDC** signal may be used to vary the setpoint or air/fuel valve position. The factory default setting is **4 to 20 mA/1 to 5 VDC**, however this may be changed to **0 to 20 mA/0 – 5 VDC** in the **Main Menu → Advanced Setup → Unit → Application Configuration** menu.

If voltage rather than current is selected as the drive signal, a DIP switch must be set on the PMC Board located inside the Controller. Contact AERCO for information on setting DIP switches.

All supplied signals must be floating (ungrounded) signals. Connections between the source and the boiler's I/O board (Figure 2-12) must be made using twisted shielded pair of 18–22 AWG wire such as Belden 9841. 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 board.

Whether using voltage or current for the drive signal, they are linearly mapped to a 40°F to 240°F (4.4 to 116 °C) setpoint or a 0% to 100% air/fuel valve position. No scaling is provided

2.11.5 VALVE FEEDBACK

The two **VALVE FEEDBACK** terminals (+ and –) are used when the Sequencing Isolation Valve Feedback option is selected. The Valve Feedback signal is connected to the "Valve Fdbk" terminals and is used to confirm that the valve has properly opened or closed. If the Valve Feedback signal does not match the Valve-Open or Valve-Close command for the time defined in the "Valve Fdbk timer" entry, the controller will proceed as follows:

(a) If the valve fails with the Valve Stuck Open fault, the "Valve Stuck Open" message will be displayed and the unit will remain active.

(b) If the valve fails with the Valve Stuck Closed fault, the "Valve Stuck Closed" message will be displayed and the unit will shut down.

NOTE: If the Valve Feedback option is used, Shorting Jumper MUST be inserted on JP2 on the I/O Board (see Figure 2-12).

2.11.6 SHIELD (SHLD & SHLD)

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.

2.11.7 ANALOG OUT

On current model Benchmark units, the default setting in the Controller is Valve Position 0-10v, and behaves as follows:

- 0-10VDC ***must*** be selected for the voltage output used by the Controller to modulate the combustion blower via the I/O Box terminals labeled **VFD/BLOWER** (Section 2.11.11).
- If Boiler Sequencing Technology (BST) is enabled, the Analog Output terminals are used to drive the isolation valve. A 0-20 mA signal is used: 20 mA = closed, 0 mA = open.

NOTE: Shorting jumper #JP2 *MUST* be installed on I/O Board when driving an isolation valve.

On older legacy Benchmark units, the two ANALOG OUT terminals may be used to monitor Setpoint, Outlet Temperature, Valve Position 4-20 mA, Valve Position 0-10v or be set to OFF.

2.11.8 RS485 Comm (+, GND, & -)

The three **RS-485** communication terminals are used when the boiler plant is being controlled by an Energy Management System (EMS) or an AERCO Control System (ACS) using Modbus (RS485) communication.

2.11.9 RS232 Comm (TxD & RxD)

As of Firmware version 4.0 and above, these terminals are used only by factory-trained personnel to monitor onAER communications via a portable computer.

2.11.10 VFD/Blower (0-10 & AGND)

The two **VFD/BLOWER** (0-10 & AGND) terminals send an analog signal to control blower speed.

2.11.11 Interlocks

The unit has two interlock circuits for interfacing with Energy Management Systems and auxiliary equipment such as pumps, louvers or other accessories. These interlocks are called the Remote Interlock and Delayed Interlock (**REMOTE INTL'K IN** and **DELAYED INTL'K IN** in Figure 2-12). Both interlocks, described below, are factory wired in the closed position using jumpers.

NOTE: Delayed Interlock and Remote Interlock must both be closed for the unit to fire.

2.11.11.1 Remote Interlock In (OUT & IN)

The remote interlock circuit is provided to remotely start (enable) and stop (disable) the unit if desired. The circuit is 24 VAC and comes factory pre-wired closed (jumped).

2.11.11.2 Delayed Interlock In (OUT & IN)

The Delayed Interlock terminals can be used in one of two ways:

- In conjunction with the optional external sequencing valve, a component of AERCO's on-board Boiler Sequencing Technology (BST) solution (see section 2.14: *Sequencing Isolation Valve Installation* and Section 7: *Boiler Sequencing Technology* in the *Benchmark 750-6000 with Edge [i] Controller Operation Guide* (OMM-0145. GF-218). A cable of the boiler's wiring harness is connected to these terminals on all units; if BST is implemented, the other end of that cable is connected to the sequencing valve.
- If BST is *NOT* implemented, the second use is typically in conjunction with the AUXILIARY RELAY CONTACTS described in section 2.11.14, below. 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 unit's auxiliary relay. 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 unit long enough for a proving switch to make (close) can be programmed.

  To use this option, you must disconnect the harness from the Delayed Interlock terminals and connect the proving device in its place.

  Should the proving switch not prove within the programmed time frame, the unit will shut down. The **Auxiliary Delay** parameter can be programmed from 0 to 240 seconds (go to: **Main Menu → Advanced Setup → Ancillary Device → Interlocks**).

2.11.12 Fault Relay (NC, COM, & NO)

The fault relay is a single pole double throw (SPDT) relay having a normally open and normally closed 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.

2.11.13 Auxiliary Relay Contacts (NC, COM, & NO)

Each unit 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 unit status indictor (firing or not firing). Its contacts are rated for 120 VAC @ 5 amps. Refer to Figure 2-12 to locate the AUXILIARY RELAY terminals for wiring connections.

2.12 FLUE GAS VENT INSTALLATION

Consult AERCO's *Benchmark Venting and Combustion Air Design Guide,* TAG-0022 (GF-2050) before any flue or combustion air venting is designed or installed. Suitable, U/L approved, positive pressure, watertight vent materials MUST be used for safety and UL certification.

Once you have selected the vent material, enter that material in the Edge Controller:

1. Go to: **Advanced Setup → Unit → Unit Settings**. Find the **Vent Type** parameter.
2. Set the value of this parameter to match your vent material: **PVC**, **cPVC**, **Polypro** or **Stainless** Steel; the material sets the exhaust temperature limits. Note, PVC and cPVC are allowed for BMK750 and 1000 ONLY, and only where governing codes allow.

Because the unit is capable of discharging low temperature exhaust gases, **the flue must be pitched back towards the unit a minimum of 1/4" per foot (0.64 cm per 0.3 m)** 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 (42.7m) or 0.8" W.C. (199 Pa)**. 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. (-62 Pa)**. 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.

2.12.1 MASSACHUSETTS INSTALLATIONS

For Massachusetts installations, the following companies provide vent systems which conform to all applicable requirements for installations within the Commonwealth of Massachusetts.

Selkirk Corporation - Heatfab Division 130 Industrial Blvd. Turners Falls, MA 01376 Phone: 1-800-772-0739 www.heatfab.com	**Watertown Supply** 33 Grove St. Watertown, MA 02472 Phone: (617) 924-2840 www.watertownsupply.com
Glover Sheet Metal, Inc. 44 Riverdale Ave. Newton, MA 02485 Phone: (617) 527-8178 www.gloversheetmetal.com	**Emerson Swan Co** 300 Pond St. Randolph, MA 02368 Phone 781-986-2555 www.emersonswan.com

2.13 COMBUSTION AIR

The *Benchmark Venting and Combustion Air Guide*, TAG-0022 (GF-2050) MUST be consulted before any inlet air venting is designed or installed. Air supply is a direct requirement of ANSI 223.1, NFPA-54, CSA B149.1 and local codes. These codes should be consulted before a permanent design is determined.

The combustion air must be free of chlorine, halogenated hydrocarbons, other chemicals that can become hazardous when used in gas-fired equipment and other combustion products. 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 and warranty validation.

If combustion air is supplied directly to the unit(s) though air duct(s), see section 2.13.1 below.

If combustion air is not supplied through air ducts, it must be supplied to the unit(s) through two permanent openings. These two openings must have a free area of **not less than one square inch (6.5 cm^2) for each 4000 BTUs (1.17 kW) input for each unit**. The free area must take into account restrictions such as louvers and bird screens.

For Canada installations, refer to the requirements specified in CSA B149.1-10, sections 8.4.1 and 8.4.3.

2.13.1 DUCTED COMBUSTION AIR

For ducted combustion air installations, the air ductwork must be attached directly to the air inlet connection on the sheet metal enclosure. Consult the *Benchmark Venting and Combustion Air Guide*, TAG-0022 (GF-2050) when designing combustion air ducting.

In a ducted combustion air application, the combustion air ducting pressure losses must be taken into account when calculating the total maximum allowable venting run. When using the unit in a ducted combustion air configuration, the minimum diameter connection at the unit is:

TABLE 2-4: Air Duct Minimum Diameter

Benchmark Model	Duct Diameter
BMK750 – BMK1500	6 inch (15.2 cm) diameter connection
BMK2000 – BMK3000	8 inch (20.3 cm) diameter connection
BMK4000 and 5000N	10 inch (25.4 cm) diameter connection
BMK5000 & BMK6000	14 inch (35.6 cm) diameter connection

2.14 BENCHMARK PUMP RELAY

Benchmark units include a pump relay (P/N **69102-2** for BMK750 & 1000, **69102-3** for BMK1500 - 6000) as standard equipment. The pump relay allows the user to turn a pump on/off and open/close a motorized valve as the boiler cycles on and off on demand. The Pump Delay Timer feature allows the user to keep the pump running and keep the motorized valve open for up to 30 minutes after the boiler has shut down and the demand is satisfied. To enable this feature, go to **Main Menu → Advanced Setup → Ancillary Devices → Relays** and set the **Pump Off Delay** parameter to the desired delays time.

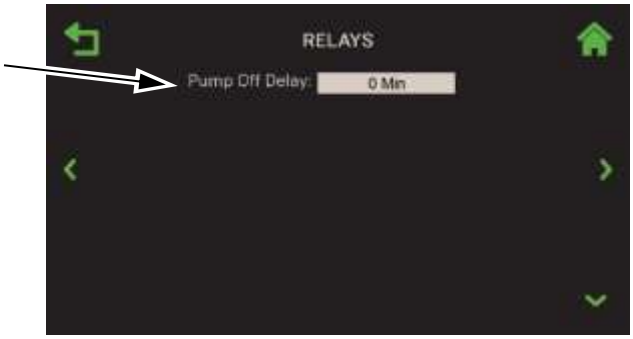


Figure 2-15: Pump Relay Screen

The pump relay is attached to the outside of the power box, as shown below. Boilers equipped with the pump relay have a label on the power box cover adjacent to the relay.

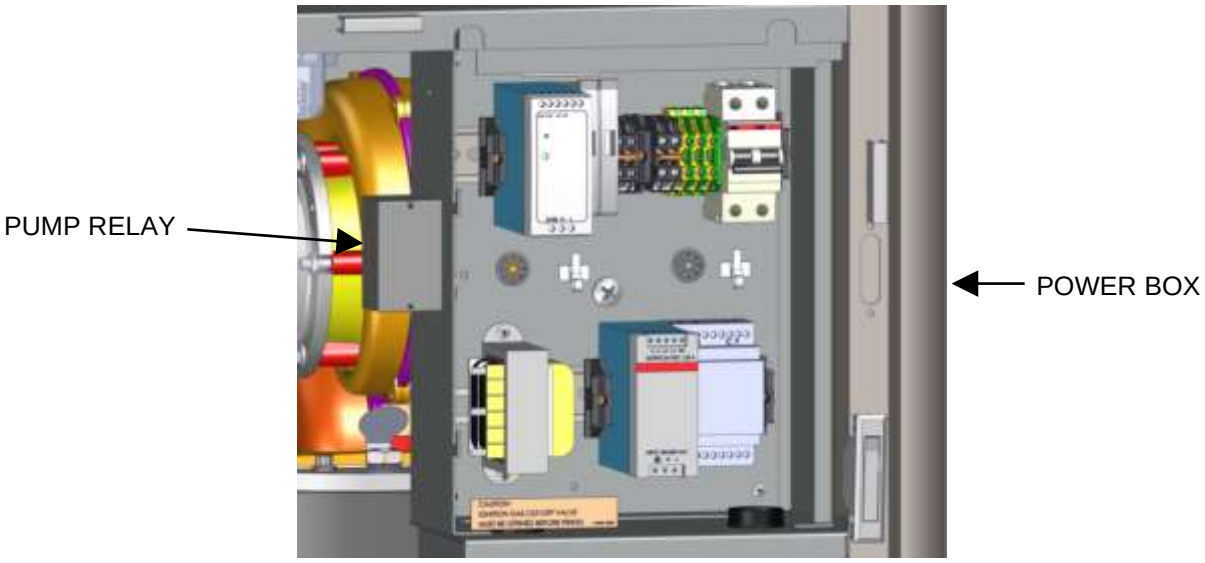


Figure 2-16a: BMK750/1000 Pump Relay Location

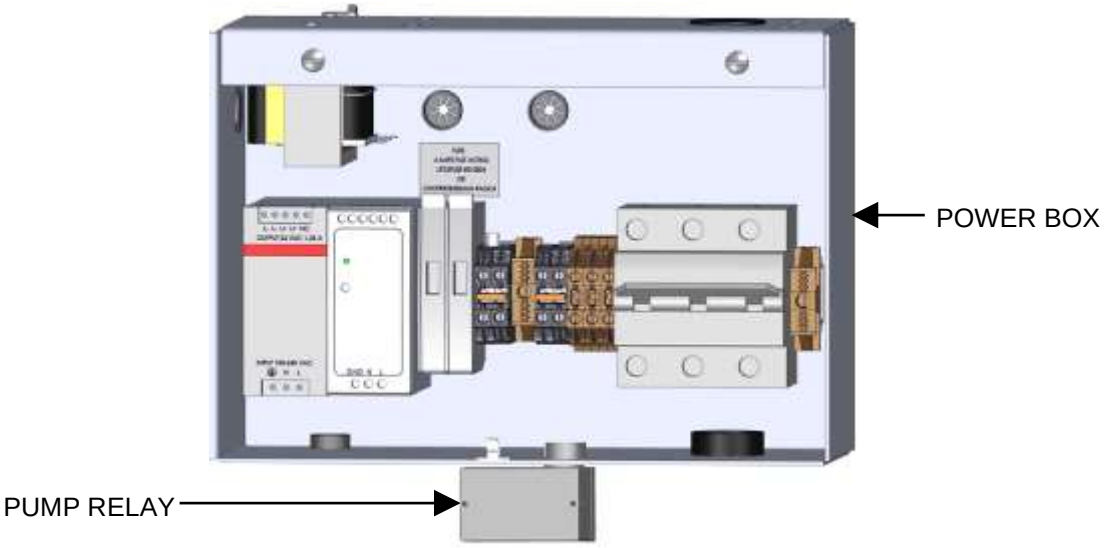


Figure 2-16b: BMK1500 – 6000 Pump Relay Location (BMK2500/3000 Shown)

See Figures 2-17 and 2-18, below, for wiring details.

The Benchmark pump relay (SPDT) contact is rated for:

- 10 A Resistive @ 277 VAC/28 VDC
- 1/3 HP N/O @ 120/240 VAC
- 1/6 HP N/C @ 120/240 VAC
- 480 VAC Pilot Duty @ 240-277 VAC Pilot Duty

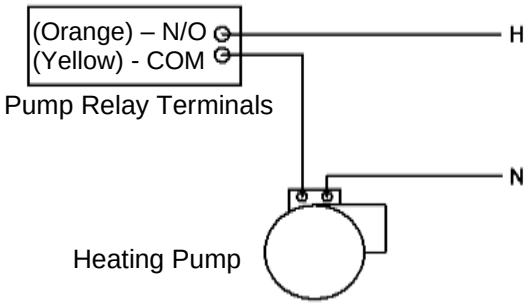


Figure 2-17: Schematic – System Pump Start using Boiler Pump Relay

If pump/valve load exceeds the above contact ratings, use a separate contact relay, as shown in Figure 2-18.

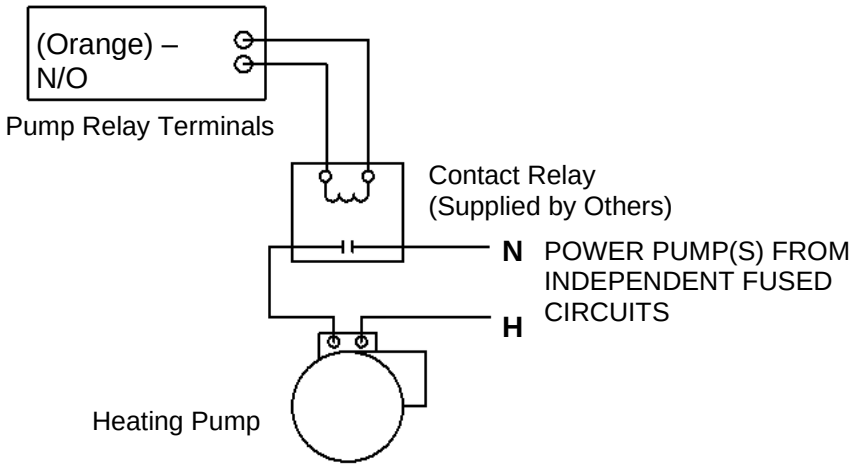


Figure 2-18: Schematic – System Pump Start using a Separate Contact Relay

2.15 BST SEQUENCING ISOLATION VALVE INSTALLATION

All Benchmark units are pre-wired with a connection for an optional motorized external sequencing isolation valve (P/N **92084-TAB**). This valve is an integral component of AERCO's on-board Boiler Sequencing Technology (BST) solution. BST allows sites with multiple boilers to have one boiler, designated the "Manager," manage the other boilers at the site, designated as "Clients" in such a way that the efficiency of the entire boiler array is maximized.

When operated with the BST system, the BST Manager controls its own isolation valve and sends signals to BST Clients to open or close their isolation valves. After boiler load is satisfied, its isolation valve remains opens for a time interval defined in the **SH Valve Close Delay** parameter in the **Main Menu → Advanced Setup → BST Cascade → Operating Controls → Sequencing Controls** menu (default = 1 minute), then closes.

NOTE: SH Valve Close Delay appears only if **Unit Mode** (in **Main Menu → Advanced Setup → BST Cascade → Cascade Configuration**) equals **BST Manager**.

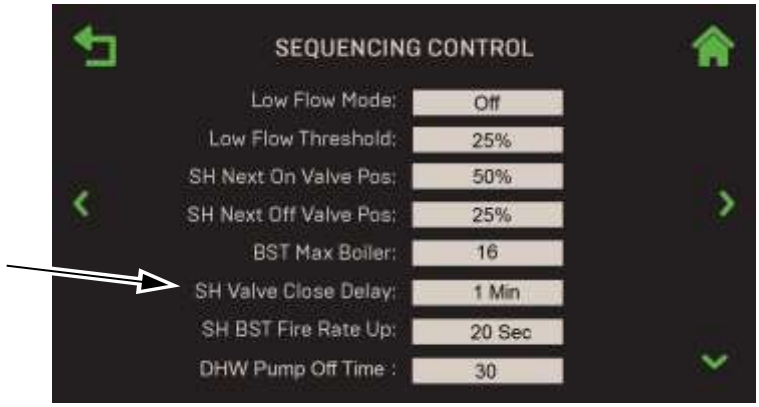


Figure 2-19: Sequencing Control Screen

Once system load is satisfied and all Client units have stopped firing, the BST Manager opens the isolation valves of all Client units.

The implementation of BST, and the installation and use of this valve, is optional. However, **when BST is implemented**, **use of this valve is strongly recommended**.

Installation consists of installing the sequencing isolation valve in the hot water outlet pipe, and then connecting it to the pre-wired connector on the shell harness, as described below.

NOTE: The Sequencing Isolation Valve control is a pre-programmed valve, available only from AERCO. It is installed only on boilers that are part of a Boiler Sequencing Technology cascade. Refer to section 2.11.12.2 for wiring information and Section 7: *Boiler Sequencing Technology* in the *Benchmark 750-6000 with Edge [i] Operation-Maintenance Manual* (OMM-0145, GF-218) for configuration instructions.

Sequencing Isolation Valve Installation Instructions

1. Install the sequencing isolation valve in the boiler's hot water outlet pipe.

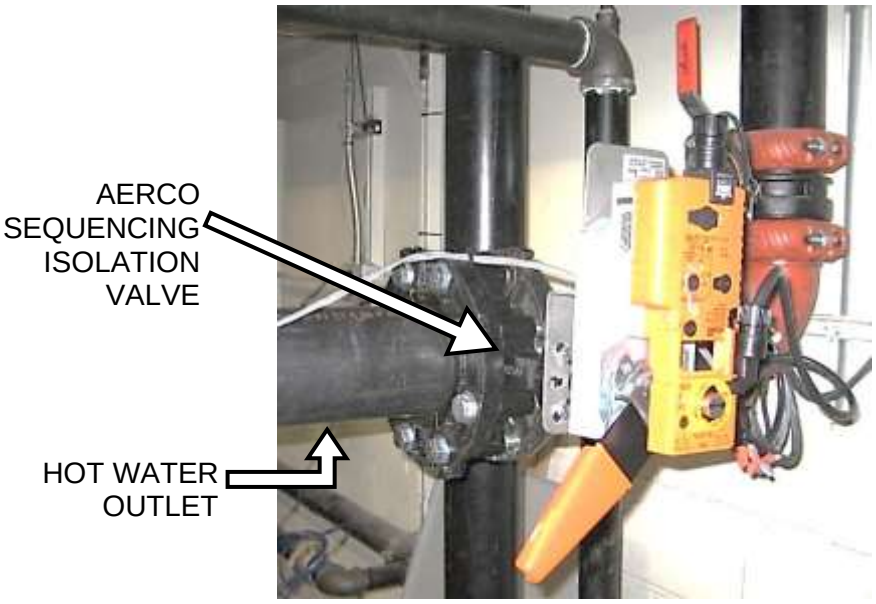


Figure 2-20: Sequencing Isolation Valve Installed

2. Find the grey cable inside the unit's enclosure with the unused Molex connector with a cap containing a jumper wire inserted in it (the jumper wire allows units that do not have a sequencing isolation valve to operate normally). The other end is connected to the I/O board and to a power supply.

Figure 2-21: Sequencing Isolation Valve Molex Connector and Jumper Wire

Isolation Valve Harness		
Wire #	**Color**	**Signal**
1236	Black	24V Common
1237	Red	24V Hot
1238	White	Valve analog input
1239	Green	Valve analog feedback
1240	Black	Delayed interlock
1241	Black	

3. Remove and dispose of the cap with jumper wire attached.
4. Plug the Molex connector into the sequencing isolation valve's connector.

Sequencing Isolation Valve Installation Instructions

5. When the Sequencing Isolation Valve is used, the Controller's **Auxiliary Delay** setting must be set to 120 seconds. Go to **Main Menu → Advanced Setup → Ancillary Device → Interlocks** and set the **Auxiliary Delay** setting to **120**.

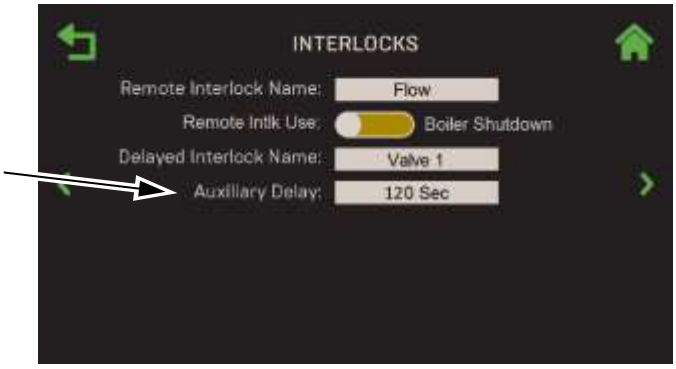


Figure 2-22: Intelocks Screen – Auxiliary Delay Parameter

2.16 Next Steps

Once the unit is physically installed per the instructions above, the next steps are:

- Optionally, implement the onAER option, which allows your unit to be monitored remotely. To implement this option, complete the instructions in the next section, *onAER Setup*.
- Start the unit for the first time and perform the combustion calibration procedure. For instructions, see the *Benchmark-Edge [i] Operation and Service Manual*, OMM-0145 (GF-218), Section 4: *Initial Startup*.

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SECTION 3: onAER SETUP

3.1 INTRODUCTION

AERCO has developed new connectivity capabilities to make its IoT offering, onAER, easier for its broad customer base to implement. The onAER feature lets AERCO boilers be monitored remotely. As in the past, AERCO has taken precautions to make onAER secure for both the customer's heating equipment and networks.

All Benchmark boilers include AERCO's onAER feature.

onAER communication can be established in one of two ways:

- **Through an Ethernet cable from the site's network**. This is plugged into the Ethernet jack in the left side of the Edge Controller.
- **Wirelessly via Wi-Fi.** This solution requires the purchase and installation of the optional AERCO Wi-Fi module (P/N **24526-1**). This module is then connected directly to the boiler's I/O board, eliminating the need for an Ethernet cable.

The sections below provide instructions for implementing only the first option, enabling communication through an Ethernet cable connected to the site's network. If you ordered a Benchmark boiler with the Wi-Fi module, it is included in a separate container inside the unit's shipping container. The instructions for installing both the Wi-Fi module are in Technical Instruction document TID-0178, included with the Wi-Fi module.

If you did *not* order the Wi-Fi module but are now interested in it, contact your AERCO representative and ask about purchasing the Wi-Fi module (P/N **24526-TAB**).

Before onAER can be used, it must be enabled. Go to: **Main Menu → Advanced Setup → Comm & Network → onAER**.

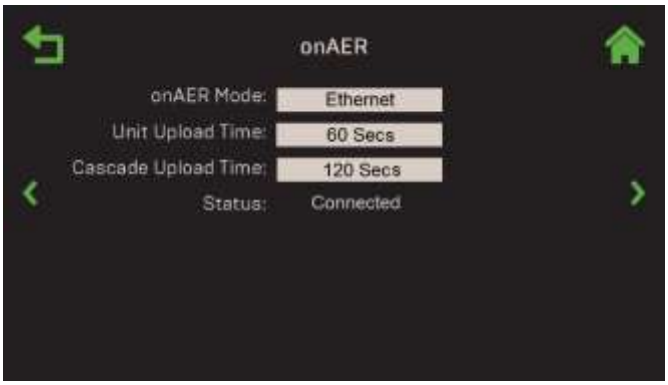

Figure 3-1: onAER Screen

1. Set the **onAER Mode** parameter to one of the following:
    - **Ethernet**: Requires an Ethernet cable to plugged into the Controller. See next section, below.
    - **Wi-Fi**: Requires the AERCO Wi-Fi module (P/N 24526-TAB) to be installed on the unit; see the *onAER Wi-Fi Module Installation Guide* (TID-0178) for instructions.
    - **Wiznet**: This option intended for units on which the Edge Controller was installed as a replacement for the C-More Controller.

2. Once enabled, the following additions parameters appear:

- **Unit Upload Time**: Determines how frequently unit data will upload to the server, in seconds. This will be split between unit data and cascade data (Manager unit only). (Range: 30 to 9999)
- **Cascade Upload Time**: Determines how cascade data will upload to the server, in seconds. (Range: 60 to 9999)
- **Status:** Displays the communication interface status, which varies depending on the interface selected in Step 2.

3.1.1 Connecting the Ethernet Cable

Connecting The Ethernet Cable Instructions

1. Connect a CAT 5 or better Ethernet cable to the wall jack or box provided at the site.
2. Route the Ethernet cable to the left side of the Edge Controller, avoiding hot locations.
3. Plug the Ethernet cable into the Edge Controller's Ethernet jack (see Figure 3-2).

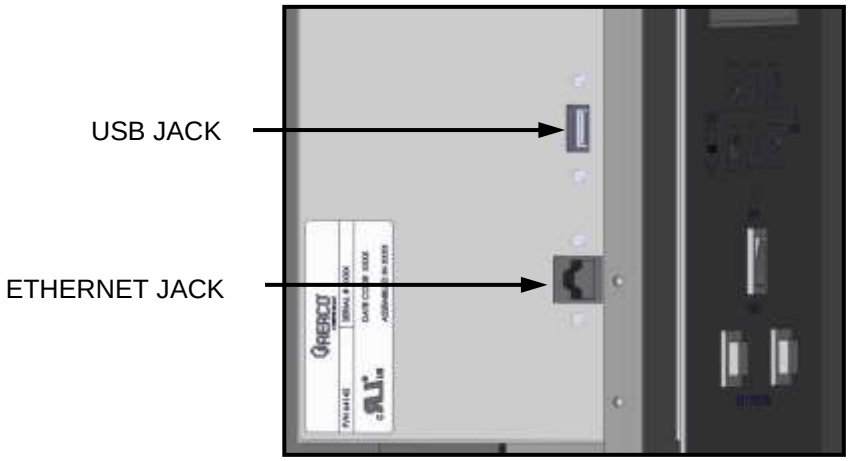

Figure 3-2: Edge Controller – Left Side View

3.1.2 Confirming the Ethernet Connection

Refer to Figure 3-3, below, and complete the following instructions to confirm that the Ethernet cable connection is working.

Confirming The Ethernet Connection Instructions

1. Powered the unit on and look for the green LED on the Controllers front face above the onAER soft-key.
2. If the green LED is blinking periodically, there is normal communication with the network.

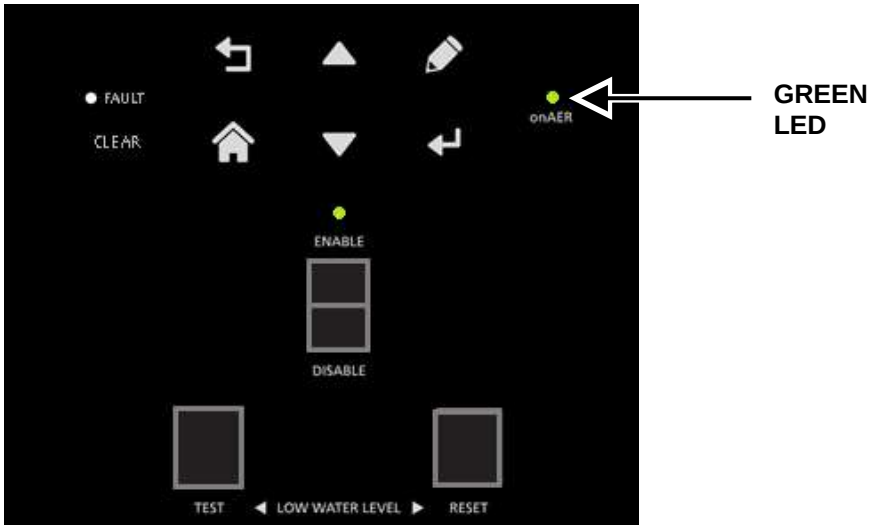

Figure 3-3: Edge Controller Front Face – Ethernet Indicator LED

3.1.3 Confirm Ethernet DHCP Configuration

Once you have confirmed that the Ethernet connection is working, complete the following steps to confirm that the connection is active.

Confirming Ethernet DHCP Configuration Instructions

1. Connect your computer to the network jack that will be used by the Controller. Your computer should be configured to automatically get a network address. Boot or reboot your computer.
2. Open a web browser and go to www.google.com.
3. Confirm that you can access the Google home page without entering a password, which confirms that the connection is active, provides DHCP addresses, and allows access without a password.

NOTE: Static addresses are not required or recommended by AERCO. Reserved addresses are a simpler solution.

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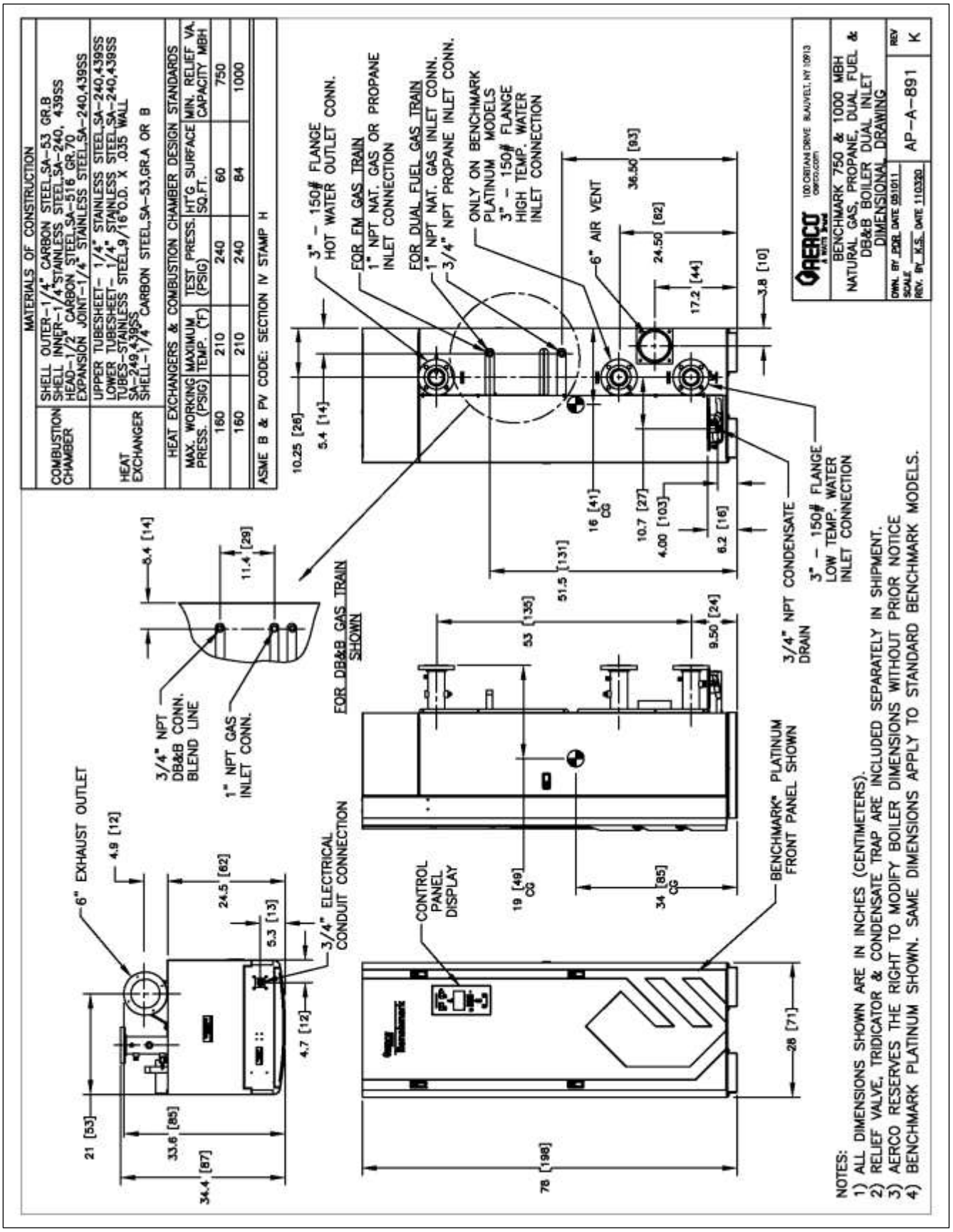
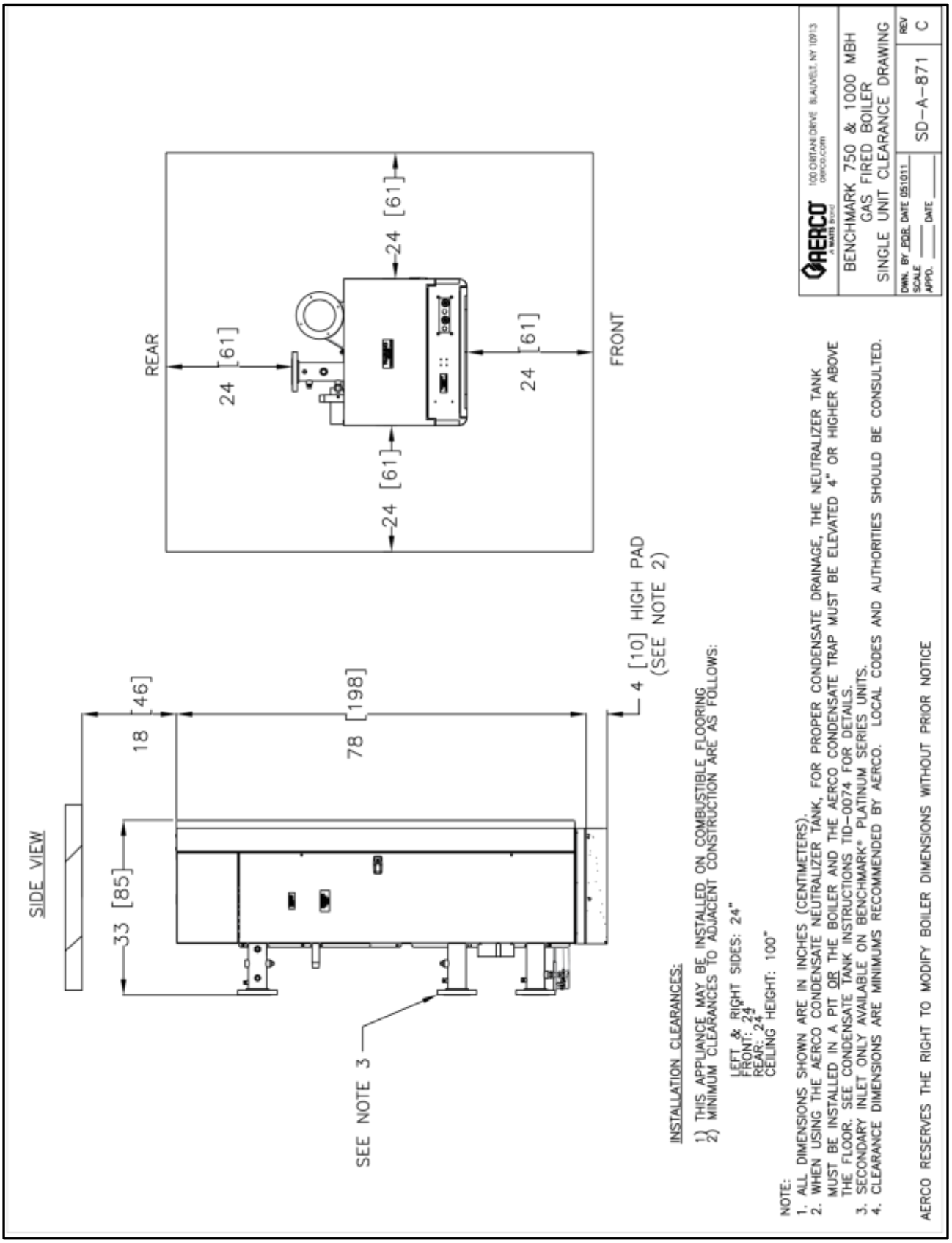
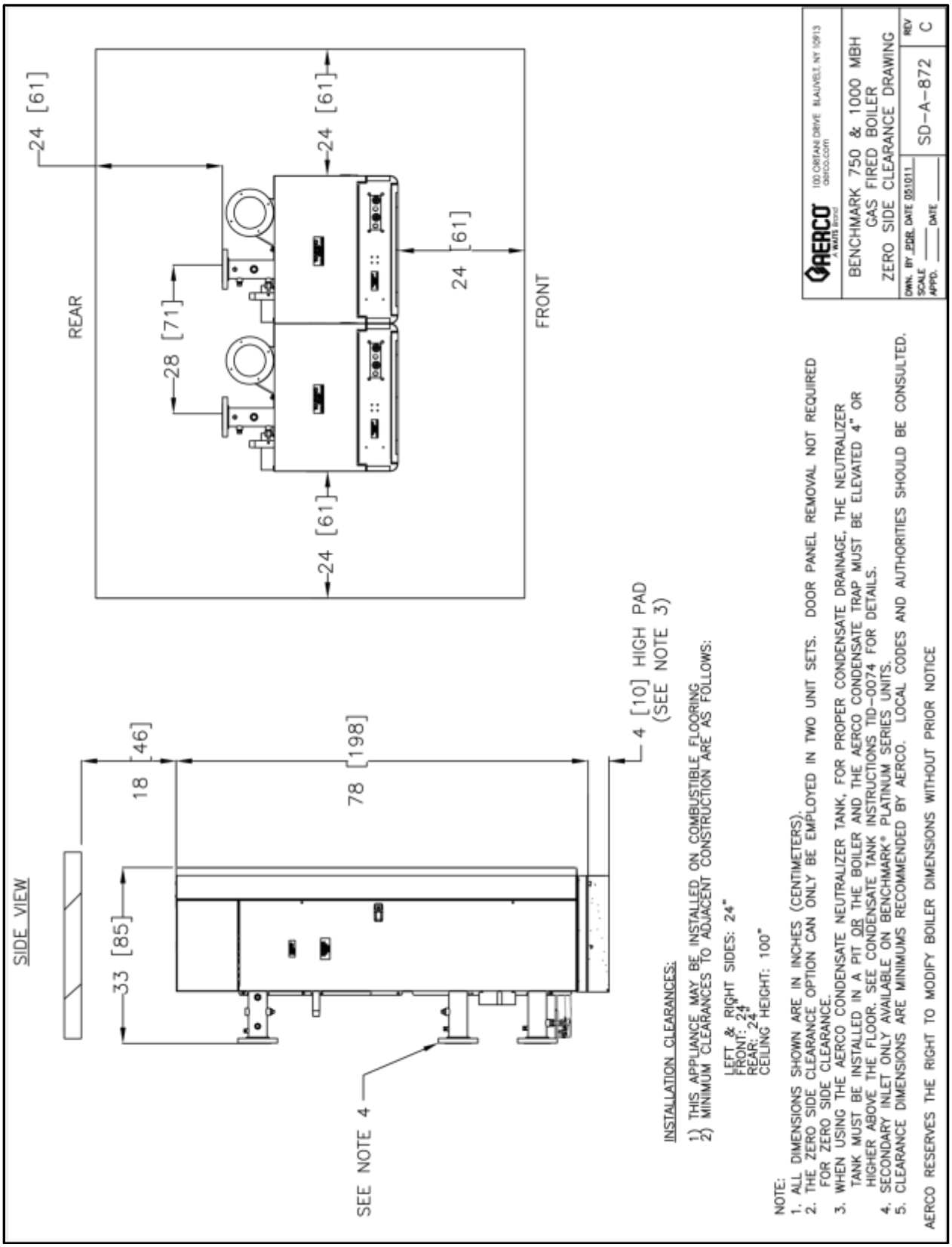
APPENDIX A: DIMENSIONAL AND CLEARANCE DRAWINGS



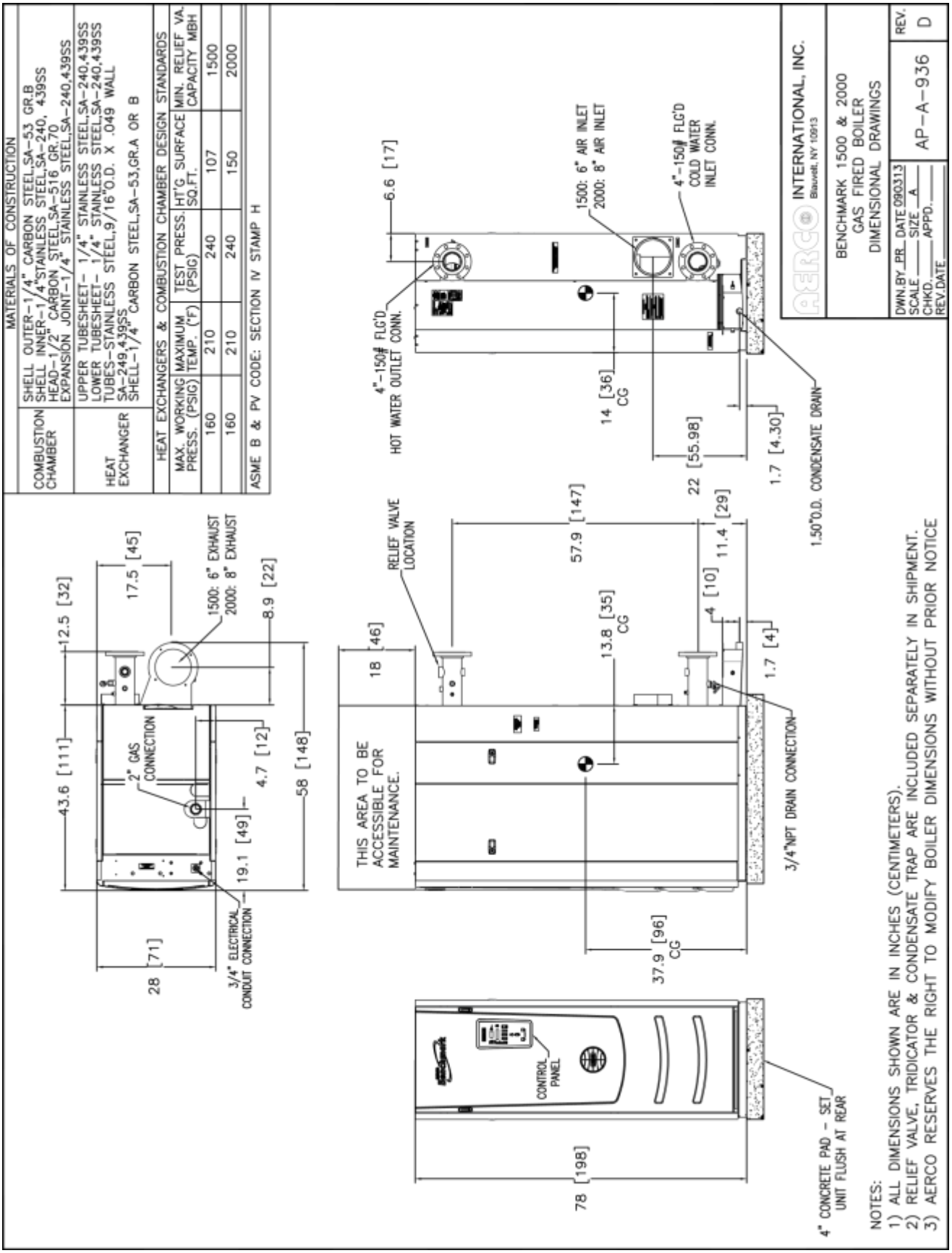
Benchmark 750-1000 Dimension Drawing AP-A-891 rev K



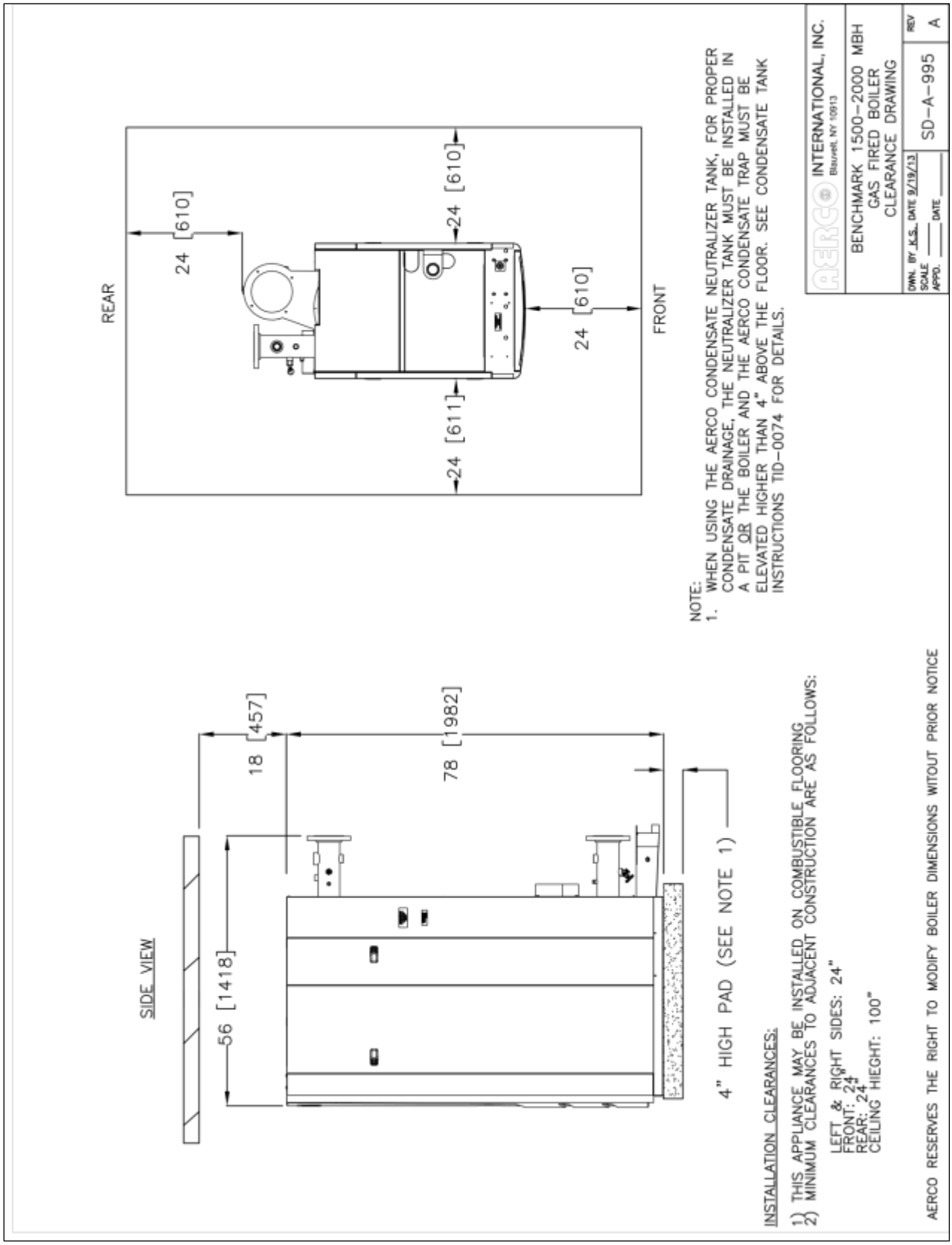
Benchmark 750-1000 Clearance Drawing AP-A-871 rev C



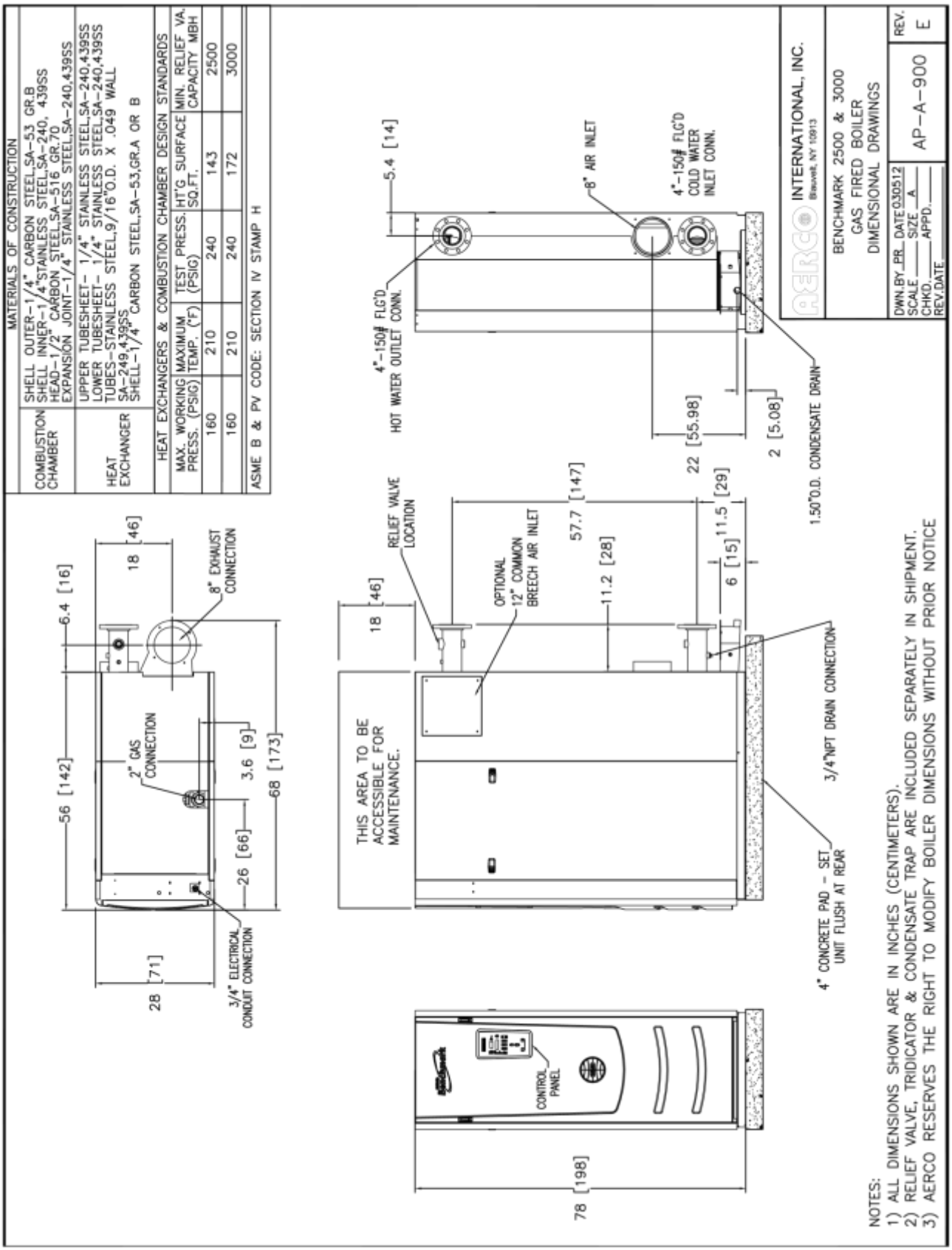
Benchmark 750-1000 Zero Side Clearance Drawing SD-A-872 rev C



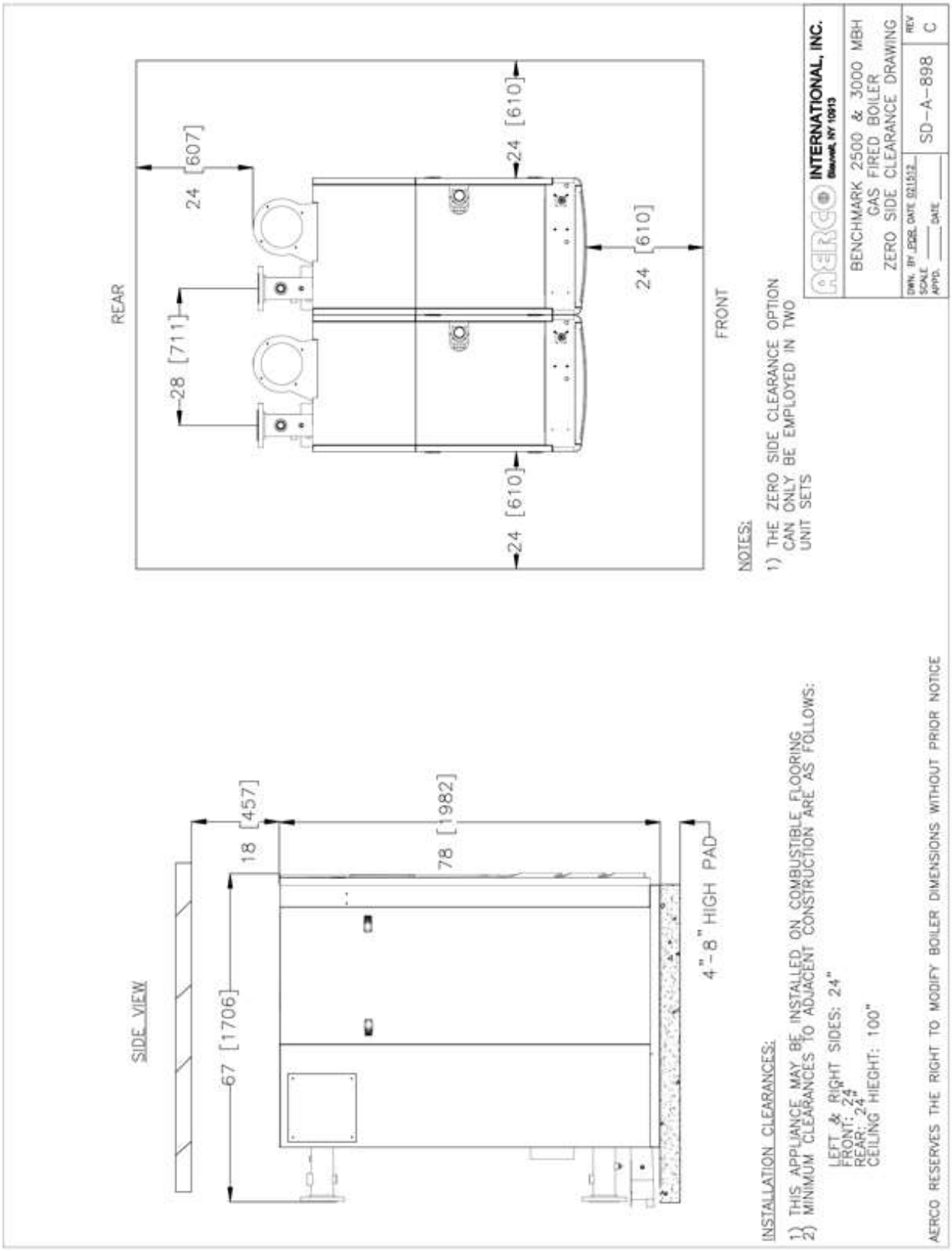
Benchmark 1500-2000 Dimension Drawing AP-A-936 rev D



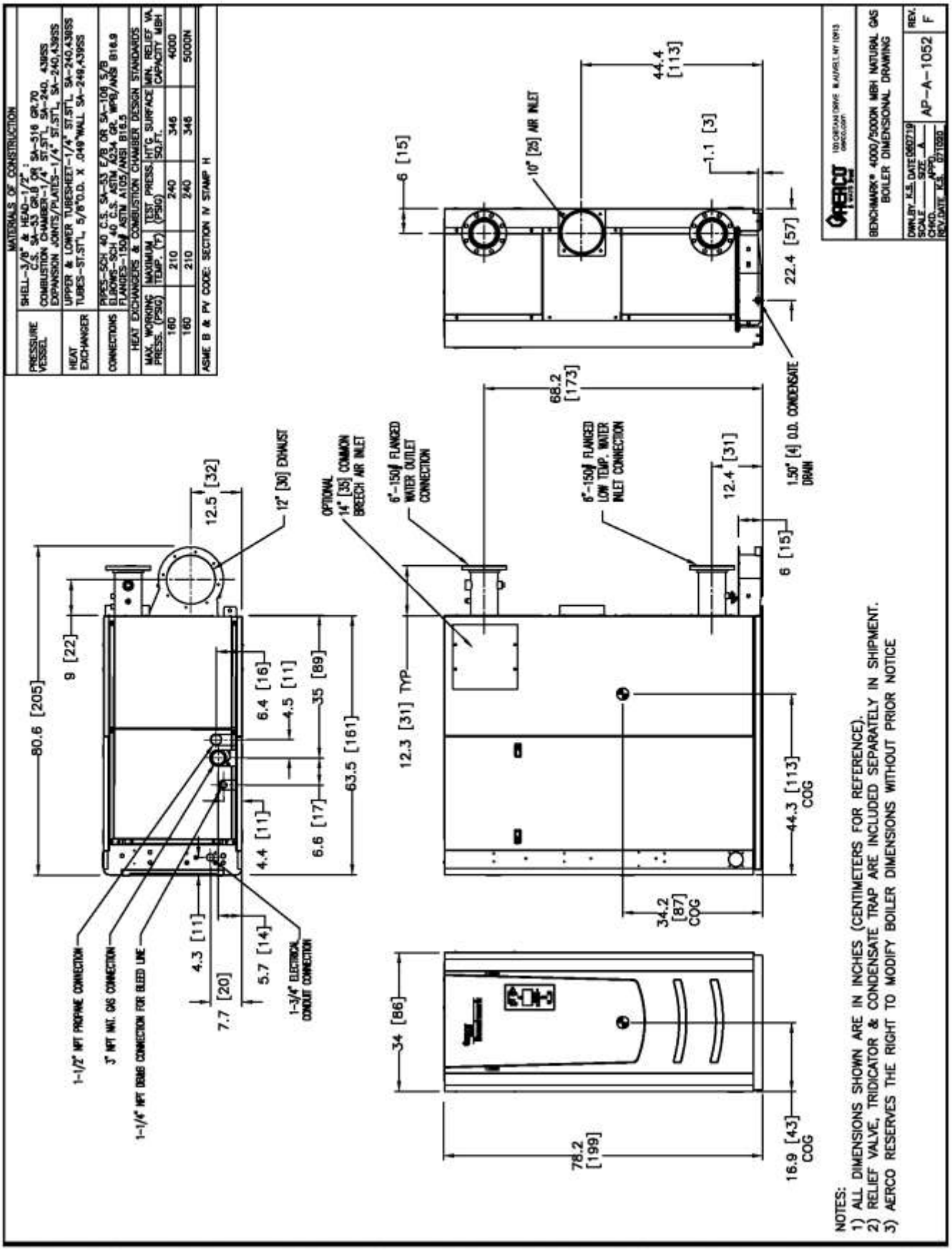
Benchmark 1500-2000 Clearance Drawing SD-A-995 rev A



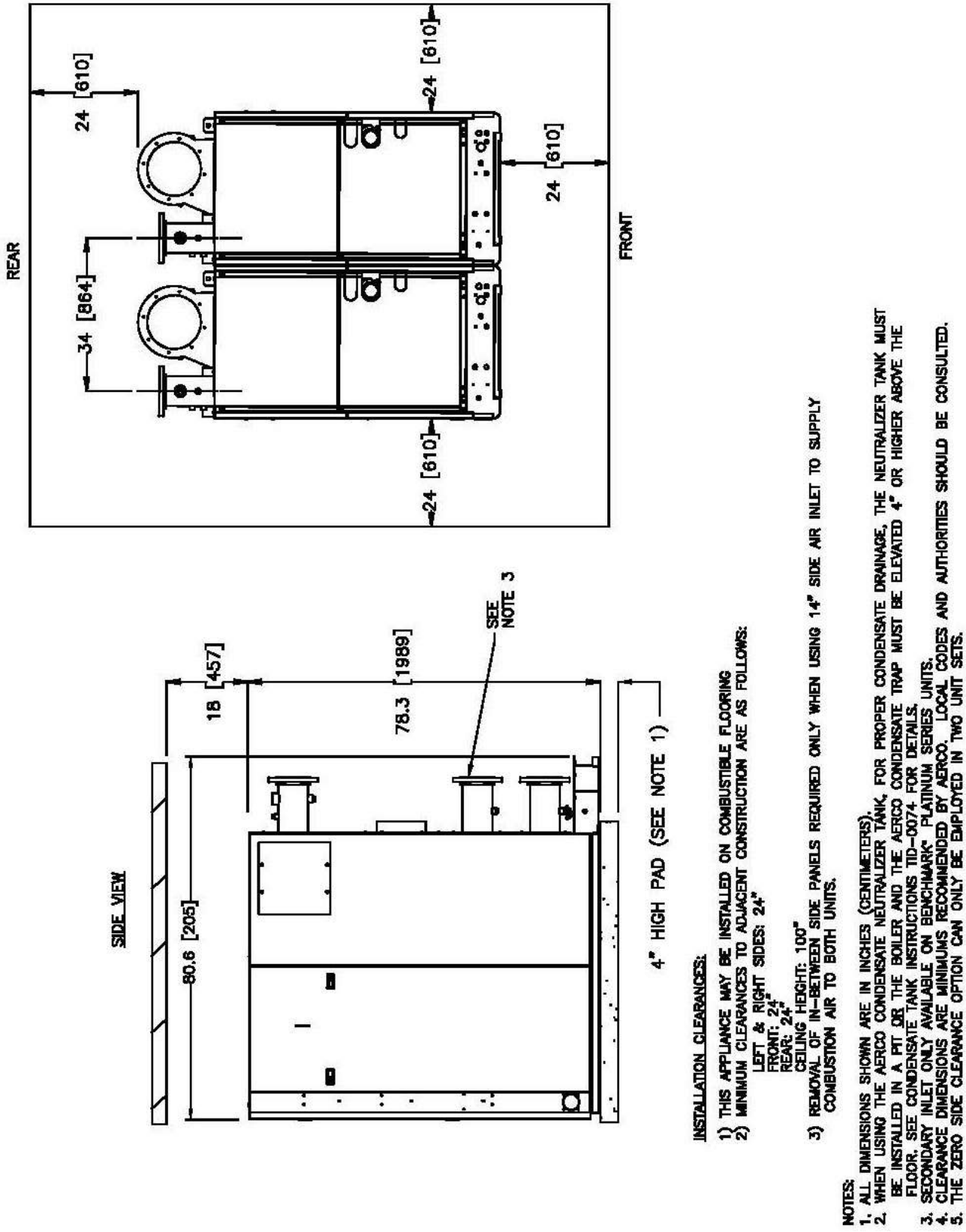
Benchmark 2500-3000 Dimension Drawing AP-A-900 rev E



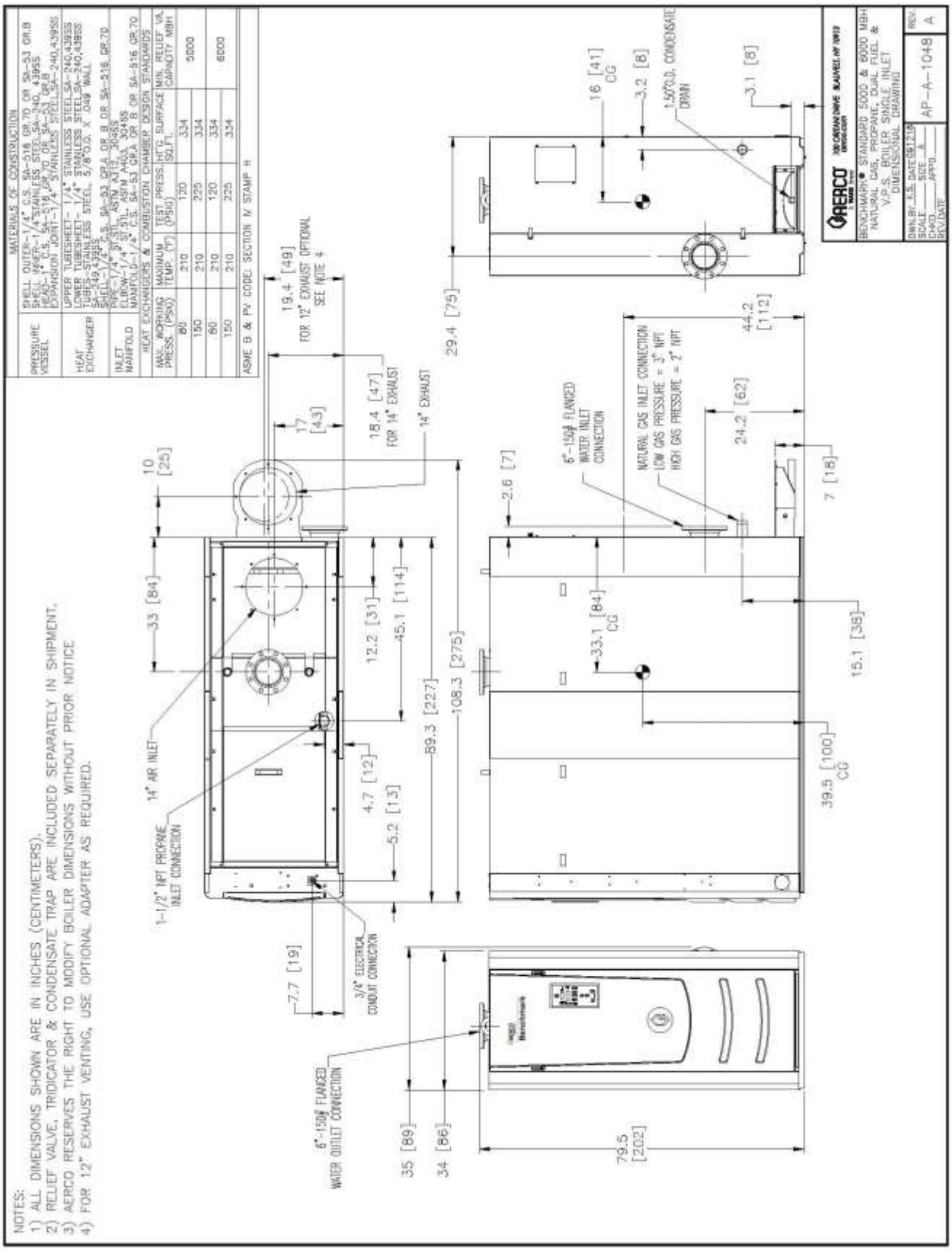
Benchmark 2500-3000 Zero-Side Clearance Drawing SD-A-898 rev C



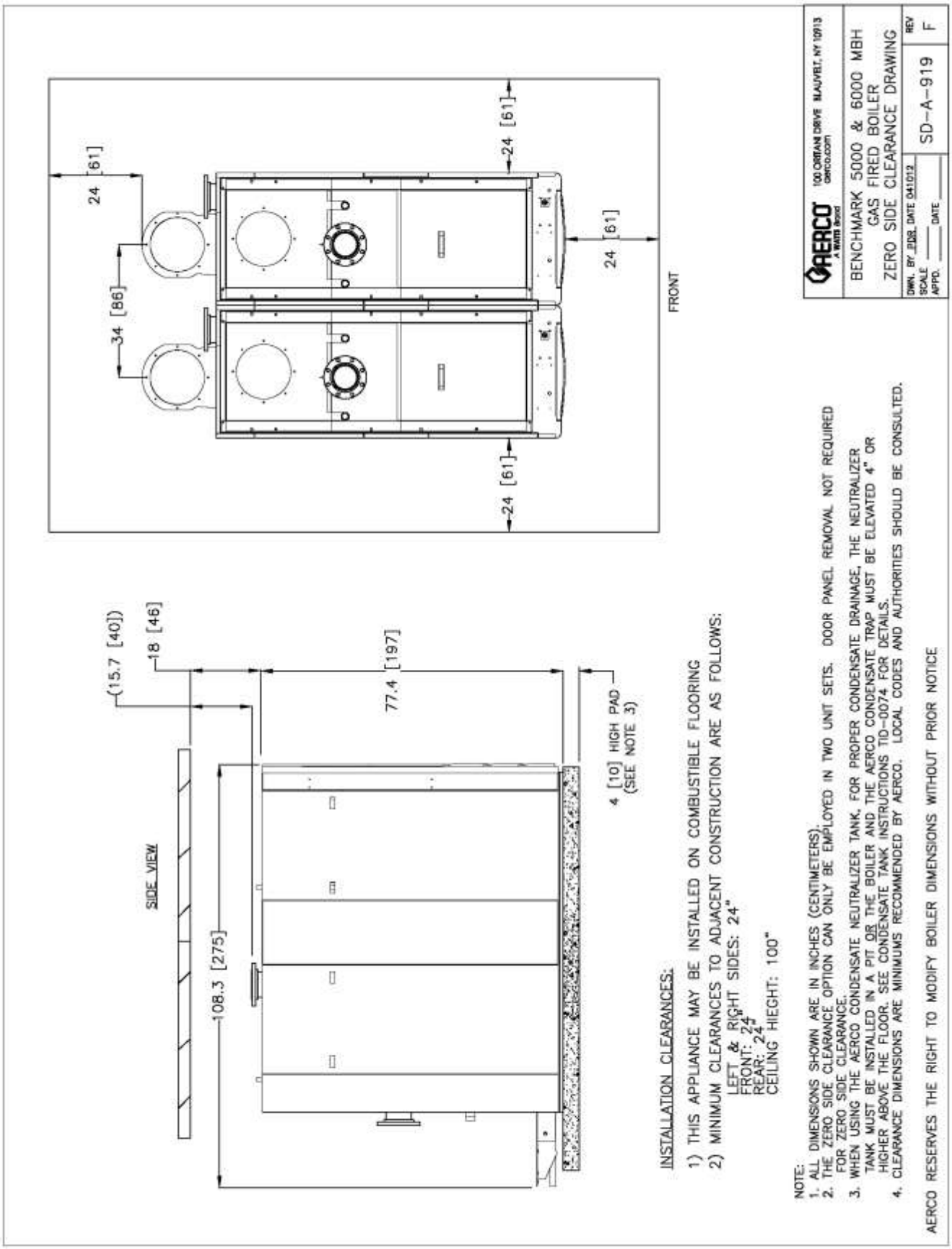
Benchmark 4000-5000N Dimensional Drawing AP-A-1052 rev F



Benchmark 4000-5000N Clearance & Dimensional Drawing Number: SD-A-1191 rev C



Benchmark 5000-6000 Dimension Drawing AP-A-1048 rev A



Benchmark 5000-6000 Zero-Side Clearance Drawing SD-A-919 rev F

Change Log:

Date	Description	Changed By
8/20/2020	**Rev C:** Removed specific site requirements in Section 2.4 in favor of references to *Benchmark Electrical Power Design Guide,* TAG-0048 (GF-2060), *Benchmark Gas Supply Design Guide,* TAG-0047 (GF-2030). Added new Section 2.4.3: *Housekeeping Pad Requirements.* **DIR 20-23**: Addition of BMK 4000 & 5000N Dual Fuel units, Propane pipe diameter changed from 2" to 1.5", Sections 2.4, 2.6.2, 2.9. (reference ECN **1624-17**). Updated BMK 4000/5000N Dimensional drawing AP-A-1052, Appendix A. Added new Section 2.16: *Next Steps*.	Chris Blair & Linley Thobourne
1/6/2021	**Rev D:** Added instructions for enabling the Pump Delay Timer feature, Section 2.14. Added BMK 750/1000 Dual Fuel models to Figure 2-7.	Linley Thobourne
5/2/2022	**Rev E:** Removed section 2.11.4 and updated Figure 2-12 per ECN 1811	D.W. Barron