

Installation and Startup Manual

CFR Boilers with Edge[®] Controller Natural Gas Modulating Boilers

Models CFR 1500 - 3000

Other documents for this product include:

- OMM-0164 CFR Operation-Service Manual
- OMM-0139 Edge Controller Manual
- OMM-0167 CFR Reference Manual
- TAG-0105 CFR Boiler Vent & Combustion Air Guide
- TAG-0106 CFR Boiler Gas Guide
- TAG-0107 CFR Boiler Application Guide
- TAG-0108 CFR Boiler Electrical Guide

Applies to serial numbers G-23-1682 and above



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FOREWORD

AERCO CFR boilers advance venting safety in the Category I boiler industry by always delivering dry flue gas. Designed for use in any closed-loop hydronic system, the CFR promotes application flexibility. Retrofit installations are reduced by accommodating a wide range of piping configurations, including primary-variable systems. It can achieve an industry-best up to 4:1 turndown ratio, allowing for the reduction of cycling losses in partial load conditions.

CFR models operate within the following ranges:

CFR Boiler Intake and Output Ranges			
MODEL	INPUT RANGE (BTU/HR.)		GROSS OUTPUT (BTU/HR.)
	MINIMUM	MAXIMUM	
CFR 1500	600,000	1,500,000	1,284,000
CFR 2000	490,000	2,000,000	1,708,000
CFR 3000	750,000	3,000,000	2,613,000

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 these instructions, the CFR 3000 complies with the **Bay Area Air Quality Management District regulation 9, Rule 7**.

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

- Room Combustion Air, Vertical Discharge
- Ducted Combustion Air, Vertical Discharge

The CFR boiler is a Category I appliance and requires careful attention to the exhaust and combustion air system design. Please consult the *CFR Venting and Combustion Air Design Guide*, TAG-0105 for a list of allowable vent materials.

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. Where applicable, the equipment shall be installed in accordance with the current Installation Code for Gas Burning Appliances and Equipment, and applicable State 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 information regarding installation within the Commonwealth of Massachusetts.

IMPORTANT!

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

⚠ WARNING!

- **Do NOT under any circumstances use matches, candles, flames, or other sources of ignition to check for gas leaks. Failure to heed this warning may result in property damage, death or serious injury.**
- **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.**
- **Shut off all gas and electrical inputs to unit before performing any maintenance.**
- **The exhaust vent pipe of the unit operates under a positive pressure and therefore must be completely sealed to prevent leakage of combustion products into living spaces.**

⚡ ELECTRICAL HAZARD WARNING! ⚡

- **Electrical voltages up to 480 VAC and 24 VAC may be used in this equipment. Therefore, to operate safely the cover on the unit's power box (located behind the front panel door) must be installed at all times, except during maintenance and servicing.**
- **A single-pole (120 VAC units) or three-pole (220+ VAC units) switch must be installed on the unit's electrical supply line. The switch must be easily accessible to quickly 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.**

Observe the CAUTION LABEL on the exhaust manifold regarding installation of vent starter, vent increaser, stack guard sensor, barometric damper and condensate trap. See sections 2.7 and 2.11 for details. Remove this label from the exhaust manifold before installation of the vent starter.

1.2 Emergency Shutdown

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

NOTE: Installer must identify the emergency shutdown manual gas valve to operating personnel.

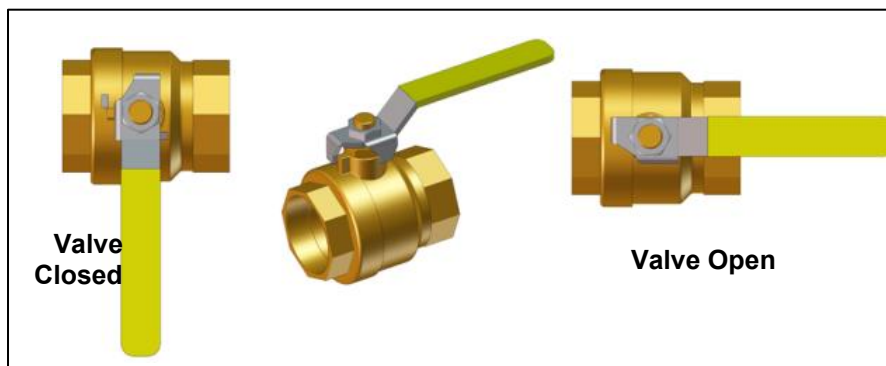


Figure 1-1: Manual Gas Shutoff Valve

An emergency shutdown procedure addressing the following points must also be implemented:

- 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

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

If the unit is being shut down for one year or more, complete the instructions in *Section 8.8: Shutting Boiler Down for Extended Period* in the *CFR Operation-Maintenance Manual* (OMM-0164). When returning a unit to service after a prolonged shutdown, it is recommended that the instructions in *Section 4: Initial Startup* and *Section 5: Safety Device Testing* be performed to verify all operating parameters.

1.4 Important Requirements for Massachusetts Installations

- Boilers must be installed by a plumber or gas fitter licensed in the Commonwealth of Massachusetts.
- Before operation, the 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.

SECTION 2: INSTALLATION

2.1 Receiving The Unit

Each CFR system is shipped as a single crated unit. The approximate shipping weight is:

CFR 1500 = 1300 lbs	CFR 2000 = 1300 lbs	CFR 3000 = 1600 lbs
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The unit must be moved with the proper rigging equipment for safety and to avoid equipment damage. The unit should be inspected for evidence of damage and for 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. Failure to abide by this warning may result in death, serious bodily injury, and damage to property or the unit.

NOTE: AERCO is not responsible for lost or damaged freight. Each unit has a Tip-N-Tell indicator on the outside of the crate to indicate 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.

2.2 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; they are packed separately within the unit's shipping container to be installed by the installer in the field:

- Pressure/Temperature Gauge
- ASME Pressure Relief Valve
- Condensate Drain Trap (P/N 24789)
- A 1", 1-1/2" or 2" Natural Gas Supply Shutoff Valve
- Exhaust Starter Kit (vent starter section plus vent increaser) – see section 2.12.1 for details
- Stack guard sensor (see section 2.12.1 for details)

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.

2.3 Site Preparation

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

- AC Input Power, as specified in the *CFR Electrical Power Design Guide (TAG-0108)*.
- Access to a natural gas supply that conforms to the pressures specified in the *CFR Gas Supply Design Guide, TAG-0106*.
- To ensure proper condensate drainage, the unit must be installed on a level concrete “housekeeping” pad. See Section 2.3.3 for pad requirements.

2.3.1 Installation Clearances

The unit must be installed with the minimum prescribed clearances for service listed below. However, if Local Building Codes require additional clearances, these codes shall supersede AERCO’s requirements. The **minimum acceptable clearances** required for CFR units are:

Front: 24 inches (61 cm) **Sides:** 24 inches (61 cm)
Rear: 24 inches (61 cm) **Top:** 18 inches (46 cm)

All gas piping, water piping and electrical conduit or cable must be arranged so it does 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: CFR units can be installed with zero side clearances in pairs only. See *Appendix A*.

If installing a Combination Plant using an ACS panel, identify the **Combination Mode** Boilers in advance and place them in the proper location. For more information refer to *Section 6.5* of OMM-0164.

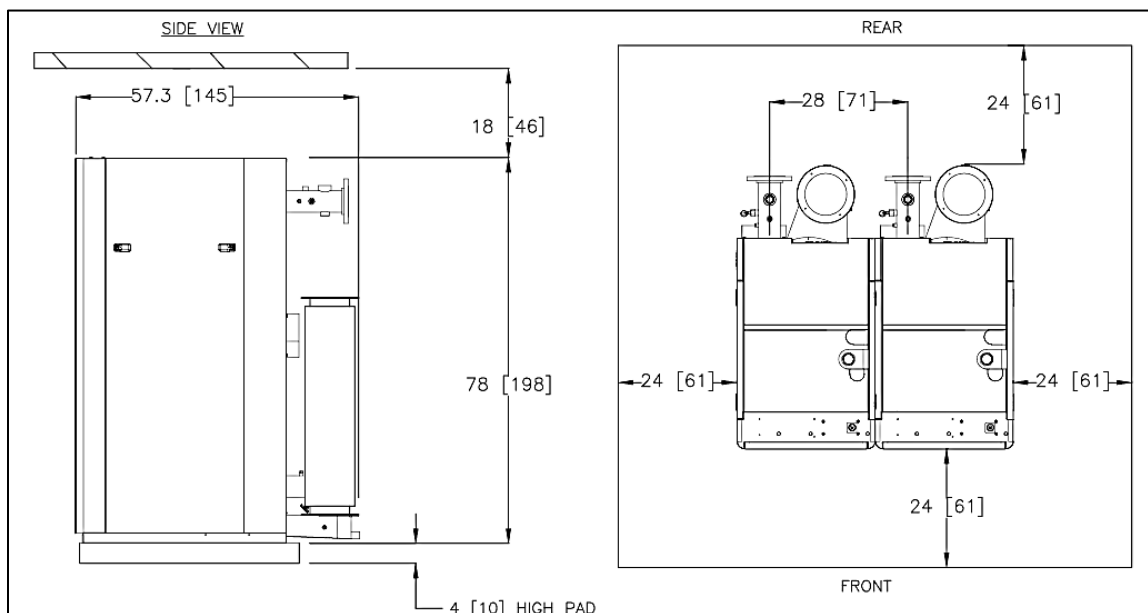


Figure 2-1: CFR 1500/2000 Clearances (in Inches)

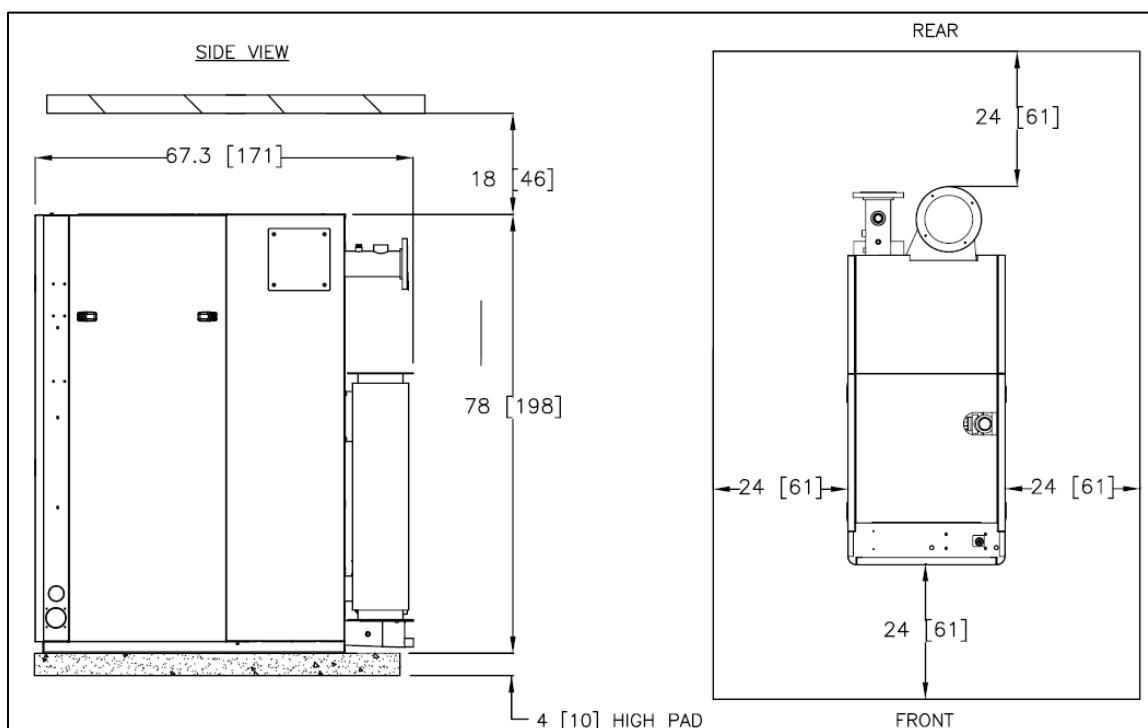


Figure 2-2: CFR 3000 Clearances (in Inches)

NOTE: Ensure condensate assembly is not located over housekeeping pad, so condensate can drain.

⚠ WARNING!

Keep area clear and free from all combustible materials and flammable vapors or liquids at all times. Failure to abide by this warning may result in death, serious bodily injury, and damage to property or equipment.

FOR MASSACHUSETTS ONLY:

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

2.3.2 Anchoring the Unit

If anchoring the unit, see below for anchor locations. All holes are flush with bottom of the frame.

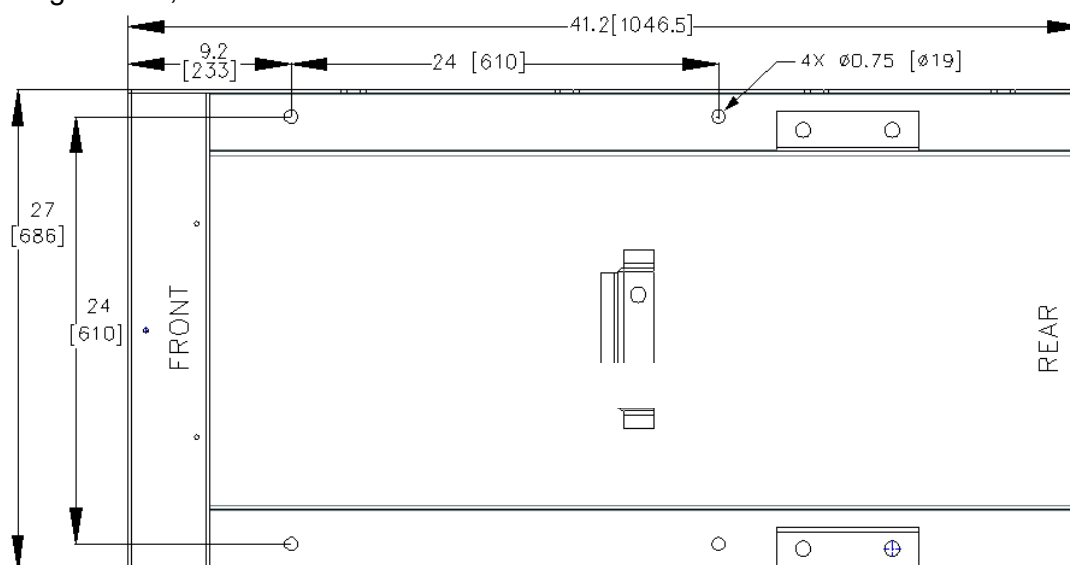


Figure 2-3: CFR 1500/2000 Anchor Bolt Locations

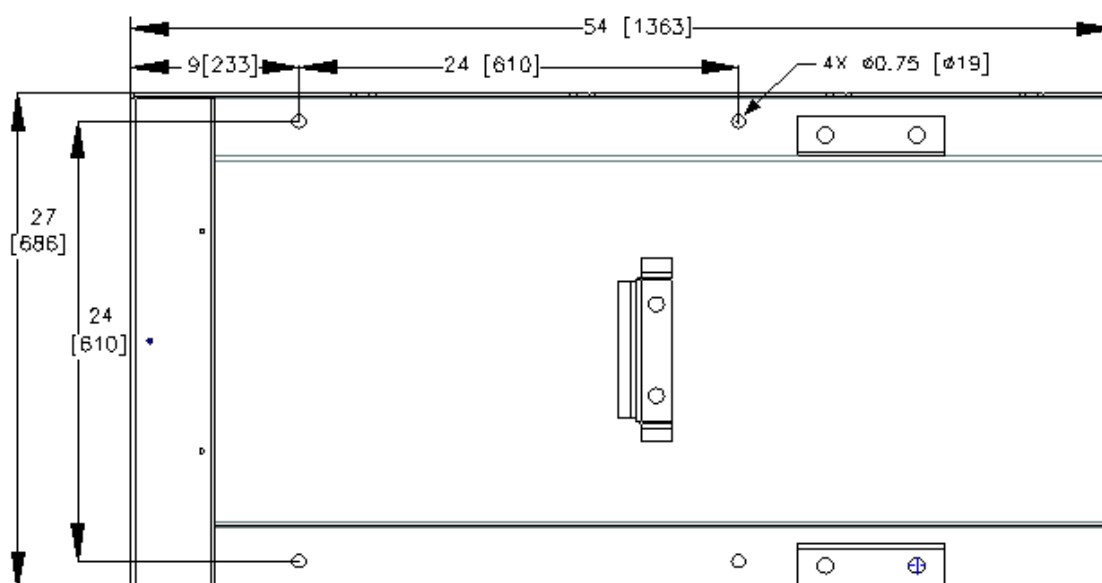


Figure 2-4: CFR 3000 Anchor Bolt Locations

2.3.3 Housekeeping Pad Requirements

To ensure proper drainage the unit must be installed on a level concrete “housekeeping” pad, with the condensate assembly supported separately away from the pad, as shown below.

The minimum pad thickness without a Condensate Neutralizer tank is **4 inches** (10.2 cm)¹. If using an 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 **1” pit** be dug for the Neutralizer Tank. For more information on the Condensate Neutralizer Tank, see Technical Instructions TID-0074.

NOTE: In all cases a **6” pad** eliminates the need for a pit.

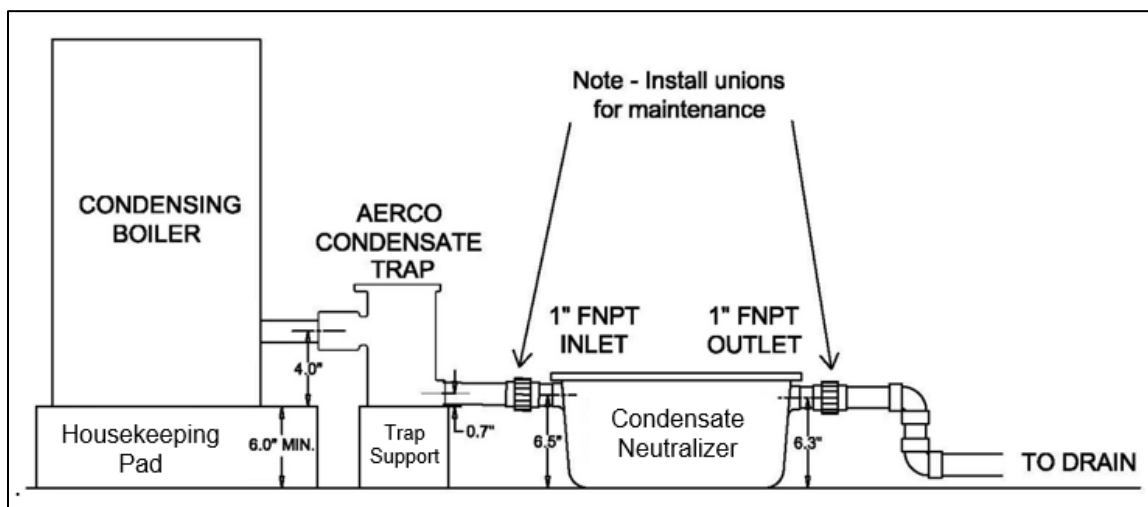


Figure 2-5: Condensate Neutralizer Tank Installation

¹ Minimum pad height without pit: 5”

2.4 Lifting Provisions

⚠ WARNING!

To avoid damaging the unit do NOT lift or move the boiler using the gas train or blower.

Three lifting lugs are provided at the top of the primary heat exchanger as shown below. 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.

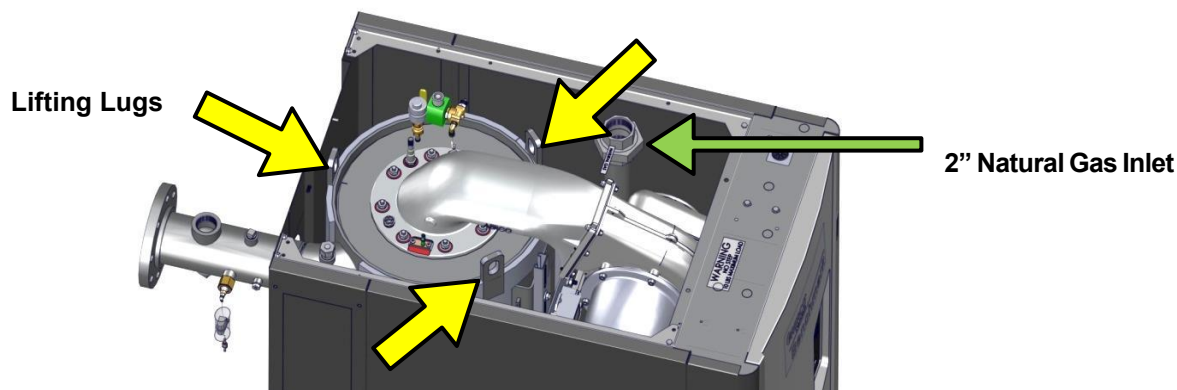


Figure 2-6: Lifting Lug Locations

2.5 Supply And Return Piping

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

CFR units have the following inlets and outlets:

- 4" (10.2 cm) 150# flange water INLET (supply) and hot water OUTLET (return) piping.

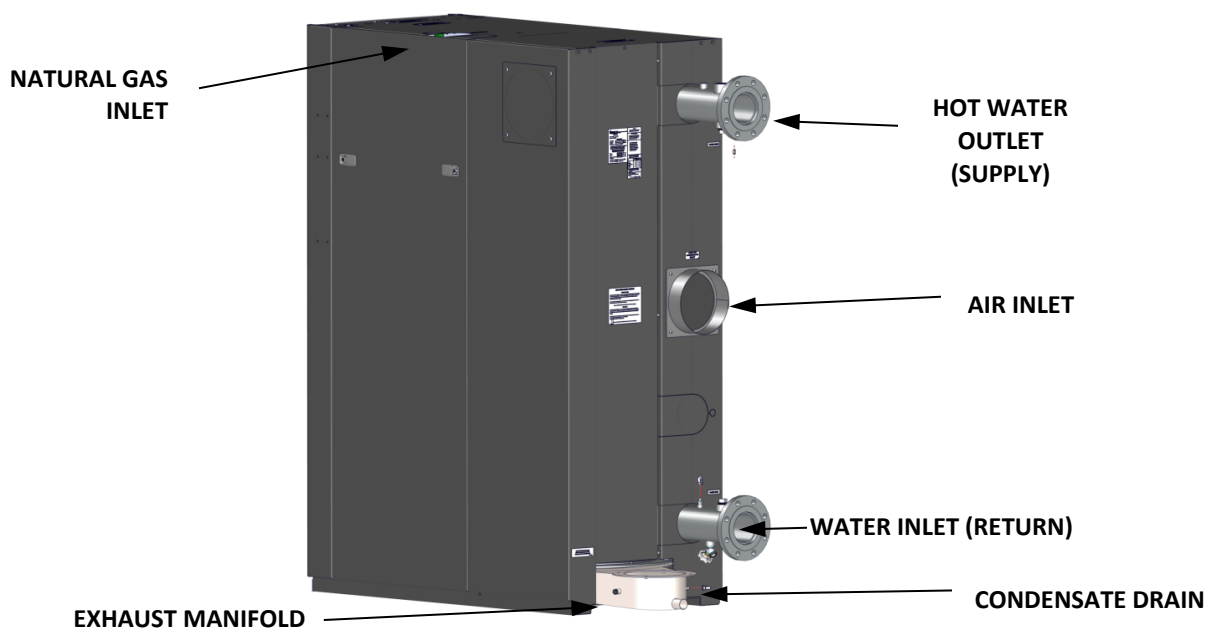


Figure 2-7: CFR Supply and Return Locations

SECTION 2: INSTALLATION

2.5.1 Pressure and Temperature Ratings

The maximum working pressure (MAWP) for CFR boilers is 160 psig (1103 kPa).

Individual ASME pressure relief valves are supplied on each boiler in setpoints of 30, 50, 60, 75, 100, 125, 150, or 160 psig (207, 414, 517, 689, 862, 1034, or 1103 kPa), as specified.

CFR boilers are applicable to systems with supply temperatures of 140°F to 190°F. The minimum return temperature is 120°F for 50% heat input or higher (2:1 turndown capability). For higher turndown capabilities, the system can be designed with higher return temperatures as shown in Table 3-1.

TABLE 3-1: Return Temperatures			
Min. Return Temp.	Lowest Heat Input CFR1500	Lowest Heat Input CFR2000	Lowest Heat Input CFR3000
150°F	40%	25%	25% (4:1 turn down)
140°F	43%	30%	33%
120°F	63%	45%	50%

2.5.2 Flow Rate Specifications

CFR boilers require the following minimum flow rate for proper and stable temperature control. To prevent erosion of construction materials, maximum flow per boiler is limited as shown.

TABLE 3-2: Minimum and Maximum Flow Rates		
Model	Min. Flow Rate	Max. Flow Rate
CFR1500	30 gpm	175 gpm
CFR2000	40 gpm	225 gpm
CFR3000	55 gpm	300 gpm

Minimum flow must be observed. Ancillary flow devices including pumps and valves must be selected and operated to provide minimum flow. Controls (internal boiler controls and/or building automation system) must be configured to operate pumps and valves to allow flow through CFR boilers in operation.

2.5.3 Pipe Design Provisions

The CFR boiler can be used in any closed-loop heating system within design limitations. It can be applied in a wide range of piping configurations, including primary-variable systems. The designer should incorporate CFR boiler in each system so as to achieve maximum operating efficiency.

Balanced Flow: For multiple boiler installations, piping must ensure balanced flow by using reverse-return piping or a balancing valve at the outlet of each boiler. Failure to balance flow evenly will prevent full delivery of boiler capability at design conditions and may cause over-cycling and unnecessary stress on the boilers.

Minimize Short Cycling: The system must be designed to prevent short cycling and maintain system efficiency. For applications with fast load transitions, a buffer tank can be utilized to dampen out fast load transitions and minimize boiler cycling. Please call your local AERCO Representative for guidance on buffer tank sizing.

Maintenance Provision: The CFR boiler is approved for zero-side clearance in two-unit pairs if space is at a premium. Piping should allow free access between boilers. For maintenance purposes, each CFR boiler shall have individual valves on supply and return from the system.

When used with a refrigeration (chiller) system, the boilers must be installed to prevent coolant from entering the boiler.

Refer to CFR Application Design Guide TAG-0107 for additional piping/application details.

SECTION 2: INSTALLATION

2.6 Water Quality – Initial System Fill

Water quality guidelines should be strictly adhered to prevent corrosion of the heat exchanger and other components. It is important to understand the chemical composition of incoming water to the boiler. **Heat exchanger failures due to water quality are not covered under warranty.**

To prevent potential corrosion, fouling, and harmful effects on the boiler, the water quality guidelines listed below should be adhered to:

- Chloride limits are set to 250 ppm to prevent corrosion of the heat exchanger. In the table below, your Chloride test result dictates which row you must be in.
- Sulfates are limited to lower ppm limits as the tested chloride levels increase and are acceptable at any ppm when chlorides are less than 100 ppm
- Allowable hardness depends on the concentration of sulfates and chlorides and should not exceed 50 ppm

EXAMPLE: If the chloride is between 175 and 250, sulfate must be 25 ppm or below, and hardness must be 10 ppm or below for the boiler to operate smoothly with minimal risk.

MAINTENANCE: Water quality should be analyzed 3 months after startup. If found in compliance with guidelines described below, water quality should be analyzed as part of annual maintenance.

NOTE: Systems with leaks can cause significant amounts of make-up water, creating a loop that is no longer considered “closed” and allowing contaminants in with the replenished make-up water. AERCO recommends the installation of a positive displacement flow meter on the make-up water line to sense any freshwater make-up introduction. Water quality should be verified in the event of freshwater being introduced into the boiler loop and treated as necessary to meet guidelines below. Contact your local AERCO Sales Representative or AERCO Technical Services if you have any questions.

Chloride (ppm)	Sulfate (ppm)	Hardness (ppm)	pH	Conductivity (umho/cm)
< 250	≤ 25	≤ 10	7-10.5	≤ 3500
< 175	≤ 50	≤ 25	7-10.5	≤ 3500
< 100	No Limit	≤ 50	7-10.5	≤ 3500

Definitions:

- Chlorides - Causes stainless steel to corrode
- Sulfates – Accelerates corrosion of stainless steel in the presence of chlorides
- Hardness - Keeping hardness values low will help to prevent scale buildup
- pH – The first step towards boiler treatment, maintain between 7-10.5
- Conductivity - The increase of total solids promotes deposition of scales

2.7 Pressure Relief Valve Installation

An ASME rated Pressure Relief Valve is supplied with each CFR Boiler. The pressure rating for the relief valve must be specified in 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 2-6.

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.

IMPORTANT: No valves, restrictions, or other blockages are allowed in the full port discharge line.

IMPORTANT: In multiple unit installations the discharge lines must **NOT** be manifolded together.

IMPORTANT: Each must be individually run to a suitable discharge location.

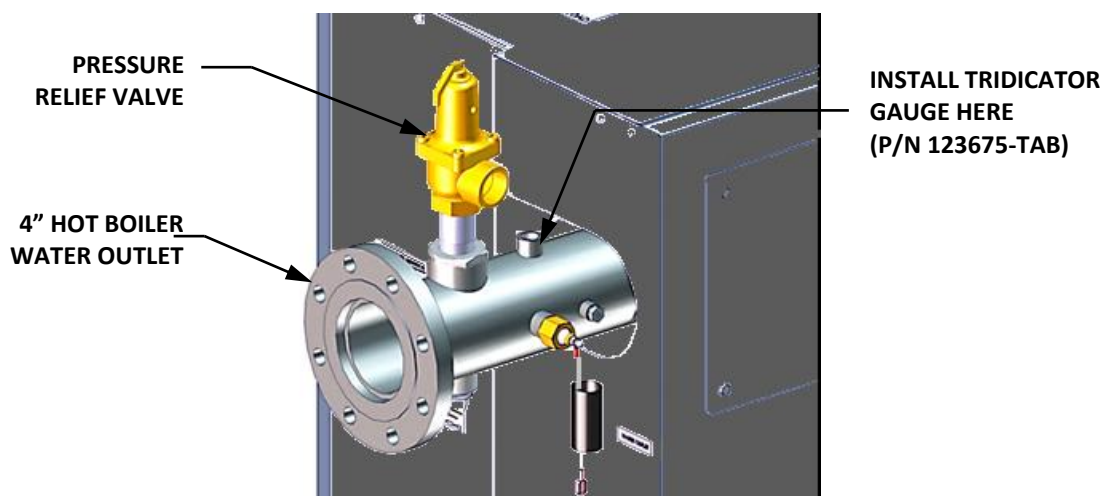


Figure 2-8: P&T Relief Valve Location

2.8 Condensate Drain and Piping

The condensate drain port located on the exhaust manifold must be connected to the condensate trap (P/N **24789**). Its inlet and outlet connections contain tapped 3/4" NPT ports. The installation details for the trap will vary depending on available clearances, housekeeping pad dimensions and other conditions.

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.

2.8.1 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 1" (2.54 cm) I.D. polypropylene hose to the trap outlet and secure with a hose clamp. The hose must be long enough to reach the condensate neutralizer or nearby floor drain.
4. Route the hose on the trap outlet to a condensate neutralizer tank or nearby floor drain.

NOTE: As a general guideline, AERCO recommends use of its Condensate Neutralizer Kit to raise the pH level of the condensate prior to drainage. At a minimum, the installation must be designed in accordance with local codes that specify acceptable pH limits. For more information, see Technical Instruction Document TID-0029, Condensate Neutralization Kit and TID-0074 Condensate Neutralization Tank.

⚠ WARNING!

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

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
CFR1500	9 gallons per hour
CFR2000	10 gallons per hour
CFR3000	13 gallons per hour

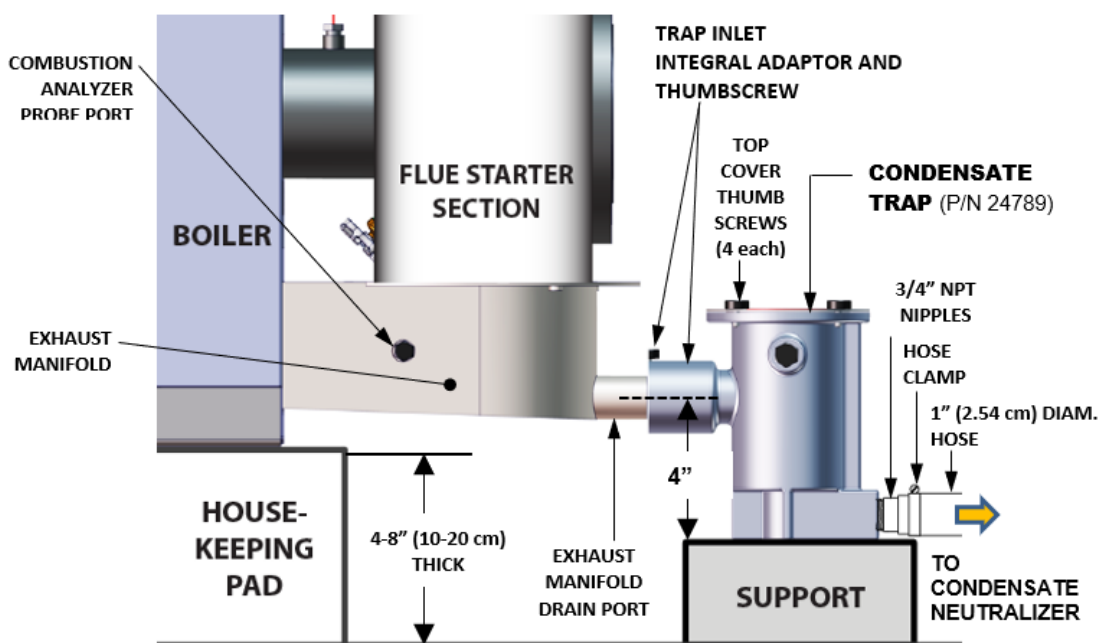


Figure 2-9: Sample Condensate Trap Installation

2.9 Gas Supply Piping

Consult TAG-0106, *CFR Gas Supply Design Guide* before designing or installing any gas supply piping.

⚠ WARNING!

Do NOT under any circumstances use matches, candles, flames, or other sources of ignition to check for gas leaks. Failure to heed this warning may result in death, bodily harm, or damage to equipment or property.

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.

CFR boilers have a 2" (5.08 cm) gas inlet pipe. 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 not be supported by the unit. Use a suitable piping compound approved for use with natural gas. 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

CFR Low NOx series boilers require stable natural gas input pressure. It must comply with the allowable gas inlet pressure range specified in the *CFR Gas Supply Design Guide*, TAG-0106.

2.9.2 External Gas Supply Regulator

An external gas pressure regulator is required on the gas inlet piping under most conditions. Regulators must conform to the specifications in the *CFR Gas Supply Design Guide*, TAG-0106.

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.

SECTION 2: INSTALLATION

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 below.

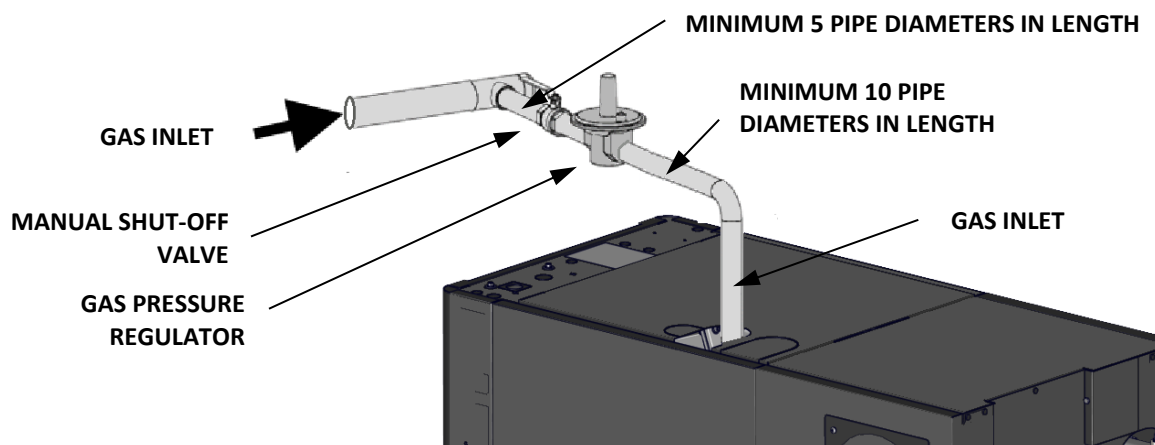


Figure 2-10: Gas Regulator and Manual Shut-Off Valve

2.9.3 Massachusetts Installations

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

2.9.4 Manual Gas Shutoff Valve

A manual shut-off valve must be installed in the gas line upstream of the boiler as shown above.

2.10 AC Electrical Power Wiring

All electrical power requirements are listed in AERCO's *CFR Electrical Power Design Guide*, TAG-0108. This guide must be consulted prior to connecting any AC power wiring to the unit.

2.10.1 Electrical Power Requirements

CFR boilers are available with the following power options:

Model	Voltage	Phase	Amperage
CFR 3000	208 V	3Ø / 60 Hz	20A
	480 V	3Ø / 60 Hz	15A
CFR 1500/CFR 2000	120 V	3Ø / 60 Hz	20A

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.

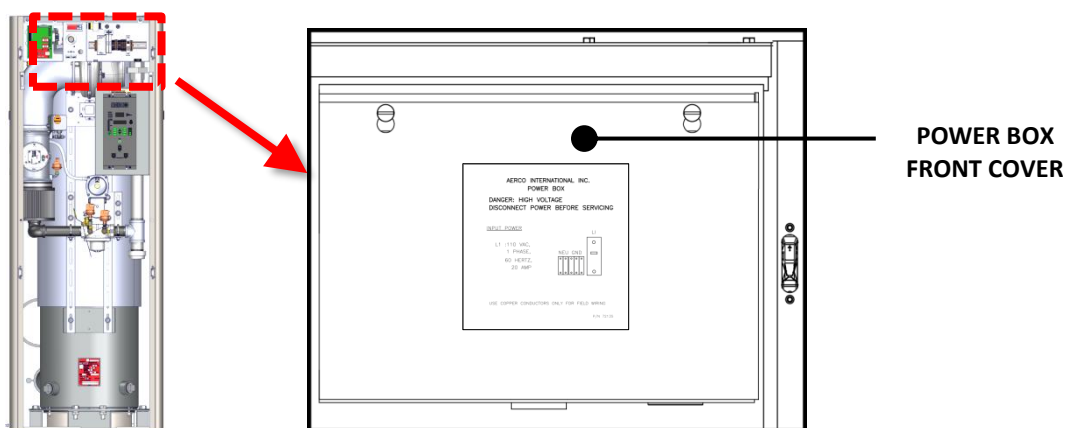


Figure 2-11: Power Box with Closed Cover

Each unit must be connected to a dedicated electrical circuit. No other devices should be on the same electrical circuit as the boiler.

A service disconnect switch must be installed on the electrical supply line, external to the unit, in an easily accessible location to quickly 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 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 the National Electrical Code (NEC) and ANSI/NFPA 70.

For electrical power wiring diagrams, see the *CFR Electrical Power Design Guide*, TAG-0108.

SECTION 2: INSTALLATION

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 with the Power Panel cover label (see Figure 2-11).

⚠ WARNING!

The power breaker does NOT remove power from the terminal blocks. When servicing the unit, power down the external disconnect switch (see section 2.9.2) to ensure power is removed from the boiler.

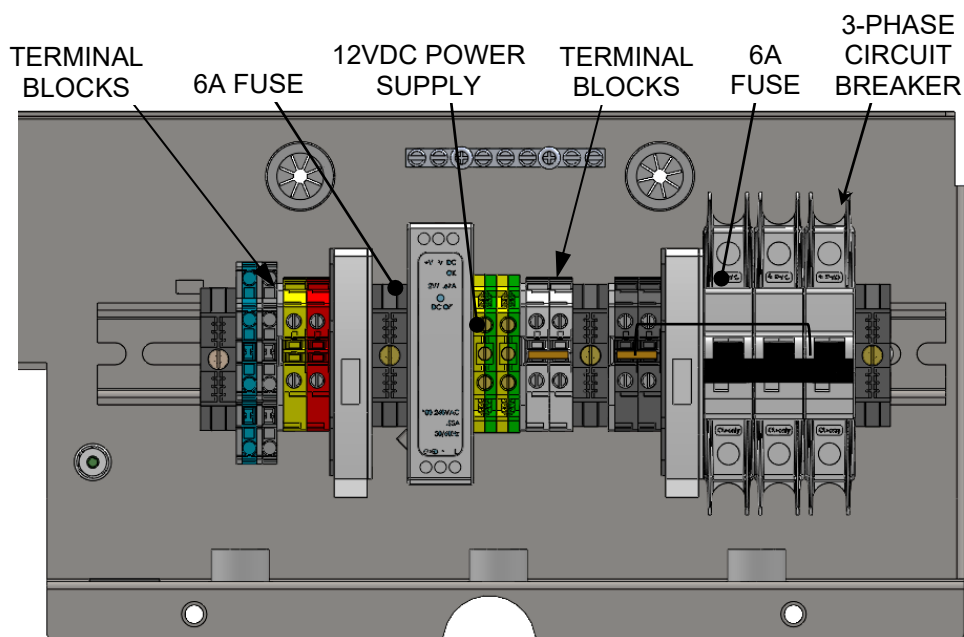


Figure 2-12: Power Box Components, CFR 3000

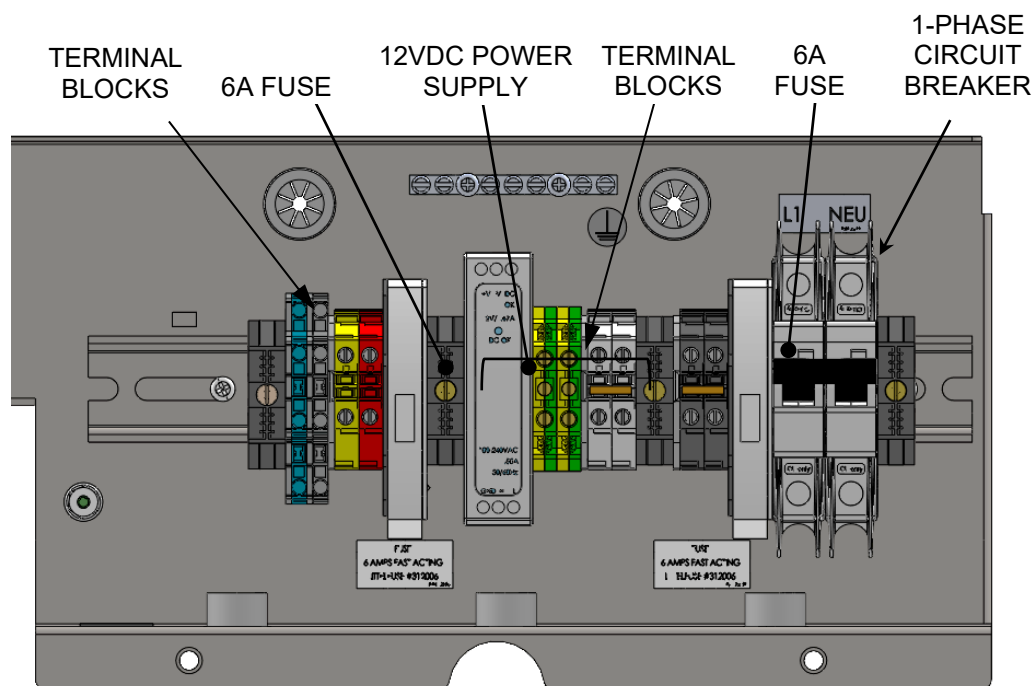


Figure 2-13: Power Box Components, CFR 1500/2000

NOTE: All 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 allows for some additional control and monitoring features. Wiring connections for these features are made on the I/O board located behind the removable front panel. 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.

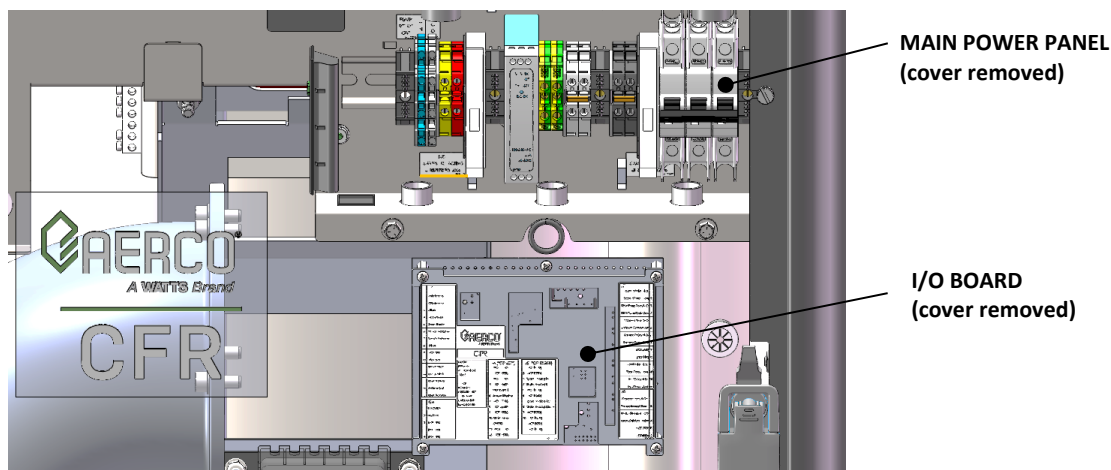


Figure 2-14: Input/Output (I/O) Location

⚠ WARNING!

DO NOT make connections to terminals labeled "NOT USED". Attempting to do so may damage equipment.

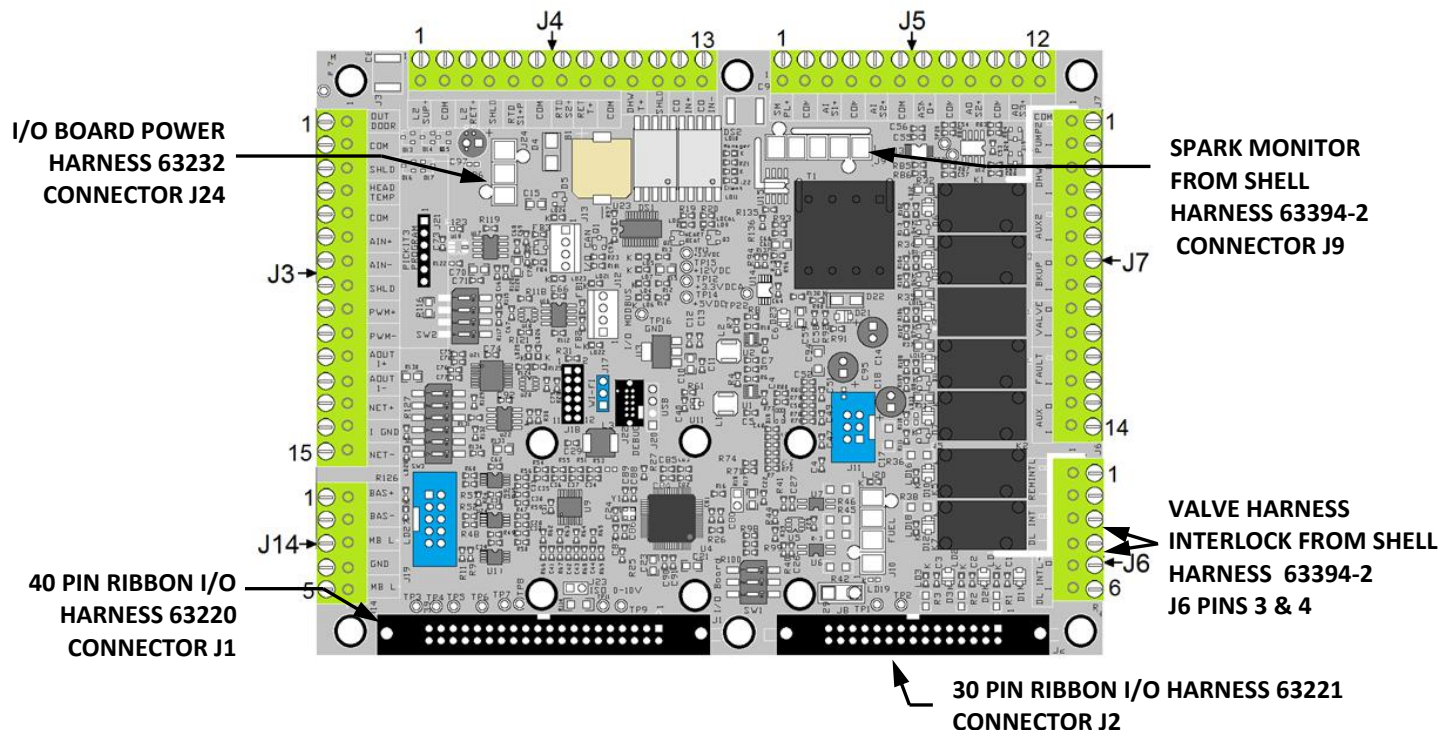


Figure 2-15: Terminal Block Terminal Strips

SECTION 2: INSTALLATION

2.11.1 I/O Board Connections

The I/O board contains the terminal listed below, arranged on removable, named connector strips J3 through J7 and J14, plus Molex connectors for unit harnesses. The maximum gauge of wires connecting to the I/O board is 14.

NOTE: To facilitate connections, these strips can be lifted off the I/O board. The entire strip is then remounted on the I/O board after all connections have been made. If a connector strip is removed, it must be re-mounted in its original orientation (connecting wires arranged around the **outside** perimeter of the I/O board).

Connector Strip J3 Terminals		
Pin #	Name	Description
1	Outside Temp +	Connections to Outside Air Temperature (OAT) sensor (P/N 61048). Used on Manager and Backup Manager units. Required for the OUTDOOR RESET mode of operation. To enable this mode, go to the Controller's Main Menu → Advanced Setup → Unit → Application Configuration and set SH Operating Mode to Outdoor Reset , then configure the related parameters.
2	Outside Temp -	
3	Shield	Connection to the shield from any cable.
4	Supply Header +	Connection to the Supply Header temperature sensor (2 wire sensor P/N 24410 , or 4 wire sensor P/N 61058) for: <ul style="list-style-type: none"> • Main Loop (in a Variable-Primary application) • Secondary Loop (in a Primary-Secondary application) • Loop 1 (in a Multi-application) Typically, used on Manager and Backup Manager units. For more information, refer to the <i>CFR Boiler Application Guide</i> (TAG-0107)
5	Supply Header -	
6	Remote Analog In +	Connection to the Analog Remote Signal, if Operating Mode = Remote Setpoint. Used on Manager and Backup Manager units.
7	Remote Analog In -	
8	Shield	Connection to the shield from any cable.
9	(NOT USED)	
10	(NOT USED)	
11	BLR V.S. Pump +	Connection for a 0 – 10 V signal to drive a Boiler Variable Speed Pump if desired when doing BST. To enable this feature, go to the Controller's Main Menu → Advanced Setup → BST Cascade → Cascade Configuration and set VSP Pump Mode to Fire Rate , then configure the related parameters.
12	BLR V.S. Pump -	
13	BST/WHM RS485 +	Dedicated to internal communication between units in a BST system. ACS (legacy) panel should also be connected to this terminal.
14	RS485 Iso Gnd	
15	BST/WHM RS485 -	

Connector Strip J4 Terminals		
Pin #	Name	Description
1	(NOT USED)	
2	(NOT USED)	
3	(NOT USED)	
4	(NOT USED)	
5	RTD Spare 1	Reserved. Spare temp sensor
6	Sensor Ground	Ground connection for RTD Spare 1
7	(NOT USED)	
8	(NOT USED)	
9	(NOT USED)	
10	DHW Temp	Connect the DHW tank temperature or DHW Loop Supply Temperature sensor
11	Shield	Connection to the shield from any cable.
12	(NOT USED)	
13	(NOT USED)	

SECTION 2: INSTALLATION

Connector Strip J5 Terminals		
Pin #	Name	Description
1	(NOT USED)	
2	(NOT USED)	
3	Spare Analog In 1 +	Connection to one of the following signals: <ul style="list-style-type: none"> • SmartPlate Valve input • VS Pump Feedback (Variable Speed Pump Feedback) • Remote Setpoint 2 To assign function, go to the Controller's Main Menu → Advanced Setup → Ancillary Devices → Analog Inputs , then set the Input parameter to Spare Analog In 1 .
4	Spare Analog In 1 -	
5	(NOT USED)	
6	(NOT USED)	
7	Spare Analog Out 1 +	Connection to one of the following signals: • Fire Rate • Cascade Valve To assign/program function, go to the Controller's Advanced Setup → Ancillary Devices → Analog Outputs , then set the Output parameter to Spare Analog Out 1 .
8	Spare Analog Out 1 -	
9-12	(NOT USED)	

Connector Strip J6 Terminals		
Pin #	Name	Description
1	Remote Interlock Out	Connection to an auxiliary device interlock - requires delay before firing.
2	Remote Interlock Return	
3	Delayed Interlock 1 Out	Connection to an auxiliary device interlock - requires delay before firing.
4	Delayed Interlock 1 Return	
5-6	(NOT USED)	

Connector Strip J7 Terminals		
Pin #	Name	Description
1	Spare 2 Relay N.O.	Connection to an auxiliary device enable/disable signal, such as: <ul style="list-style-type: none"> • System Pump • Pump 2 • Louver • Louver 2 • Damper • Other To assign/program its function, go to the Controller's Main Menu → Advanced Setup → Ancillary Devices → Relays , then set the Relay to Spare 2 Relay and the Name to one of the above devices.
2	Spare 2 Relay Com	
3	DHW Pump Relay N.O.	Connection to a DHW Pump enable/disable signal.
4	DHW Pump Relay Com	
5	V2/Spare 1 Relay N.O.	Connection to an auxiliary device enable/disable signal, such as: <ul style="list-style-type: none"> • System Pump • Pump 2 • Louver • Louver 2 • Damper • Other To assign/program its function, go to the Controller's Main Menu → Advanced Setup → Ancillary Devices → Relays , then set the Relay to V2/Spare 1 Relay and the Name to one of the above devices.
6	V2/Spare 1 Relay Com	
7	Reserve Relay N.O.	Connection to a reserve/backup boiler enable/disable signal.
8	Reserve Relay Com	
9-10	(NOT USED)	
11	Fault Relay N.O.	Connection to a Fault/Remote Alarm enable/disable signal.
12	Fault Relay Com	
13	Aux Relay N.O.	Connection to an auxiliary device enable/disable signal.
14	Aux Relay Com	

Connector Strip J14 Terminals		
Pin #	Name	Description
1	BAS RS485 +	Connection to the building automation system (BAS) network (Modbus RTU, BACnet MSTP). For IP network, use the Ethernet port.
2	BAS RS485 -	
3	(NOT USED)	
4	(NOT USED)	
5	(NOT USED)	

2.12 Flue Gas Vent Installation

The CFR gas-fired boiler is a fan-assisted Category I appliance with the following venting capabilities:

1. Room Combustion Air, Vertical Discharge
2. Ducted Combustion Air, Vertical Discharge

Please consult the *CFR Venting and Combustion Air Design Guide*, TAG-0105 before any flue or combustion air venting is designed or installed.

The following vent materials are allowed and must be installed in accordance with the manufacturer's installation instructions:

- Factory-built chimneys listed in accordance with ANSI/UL 103, ANSI/UL 2561, or ANSI/UL 959.
- Type B gas vents listed in accordance with ANSI/UL 441.

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 this parameter to match your vent material: **Category I**; this sets the exhaust temp limits.

It is critical that the flue gas vent be designed to prevent condensation in the flue gas vent for safe operation. Condensation can occur in the CFR boiler, so each unit is fitted with a condensate removal trap (see Section 2.8). However, with its advanced technology, the CFR boiler always delivers dry flue gas for safe exhaust into Category I venting. A stack guard sensor is supplied with each boiler.

Exterior Masonry Chimneys, defined as masonry chimneys exposed to the outdoors on one or more sides below the roof line, cannot be used due to high flue heat loss which can affect the draft produced. When venting into interior masonry chimneys, refer and adhere to the latest publication of NFPA54 for chimney lining material, sizing, and termination requirements. When using an existing chimney, it must be approved for Cat I appliance, and inspected/cleaned to ensure it is structurally sound and free of blockage for proper operation. If the condition of the existing chimney is deemed unsuitable it must be relined, repaired, or replaced to comply with the latest publication of NFPA54.

Horizontal vent runs must slope upwards towards the direction of flue gas path at a minimum of ¼" per foot.

The exhaust system shall be sized in accordance with the latest publication of the National Fuel Gas Code (ANSI Z223.1/ NFPA54) as a fan-assisted Category I appliance.

For individually vented units, the exhaust system must be designed so that the exhaust pressure measured is within the range of **-0.01 to -0.08" w.c.** Exhaust pressure measurement shall be taken at the location shown in Figure 2-16.

For common vented units, the exhaust system must be designed so that the exhaust pressure measured is within the range of **-0.01 to -0.08" w.c.** Exhaust pressure measurement shall be taken at the location shown in Figure 2-16.

SECTION 2: INSTALLATION

2.12.1 Exhaust Starter Kit and Stack Guard Sensor

An exhaust vent starter (PN 99324) and an eccentric vent increaser are provided by AERCO to be field installed (see Figure 2-16). The vent increaser shipped with the boiler was based on the individual vent or connector size selected for the venting layout:

- 8" Flg x 10" crimped (PN 99325-10). Use this when Category I vent sizing from NFPA54 tables require the following individual vent or connection size: 9", 10", 12" and 14".
- 8" Flg x 18" crimped (PN 99325-18). Use this when Category I vent sizing from NFPA54 tables require the following individual vent or connection size: 16", 18", 20" and 22". 10".

IMPORTANT: For retrofit applications, replacing a system with the same total BTU capacity does not necessarily mean the existing vent size will work. Size the vent in accordance with NFPA54 as a fan-assisted Category I appliance to determine the correct size.

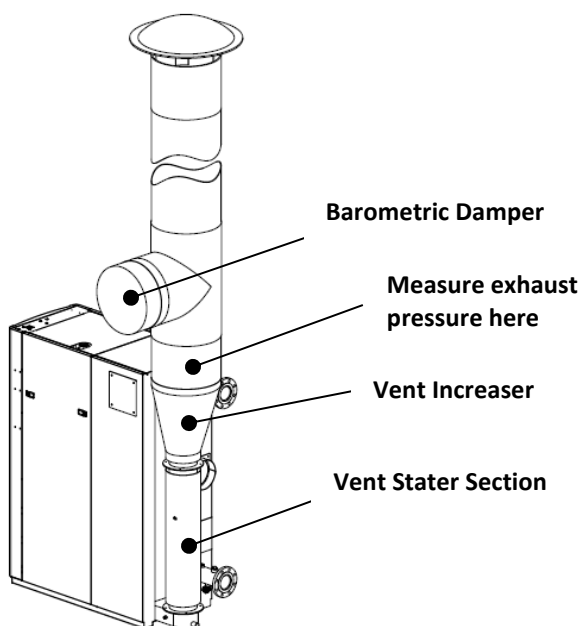


Figure 2-16: Vent Starter Section, Vent Increaser, Barometric Damper



Figure 2-17: Installation Caution Label

The supplied stack guard sensor must be field installed on the vent starter section. The sensor comes with a molex connector that must be connected to the mating wiring harness from the rear of the boiler.

Observe the CAUTION LABEL on the exhaust manifold. Remove this label from the exhaust manifold before installation of the vent starter.

2.12.2 Barometric Damper

To ensure the proper pressure range is maintained, the CFR boiler requires a barometric damper to be installed immediately after the factory supplied starter piece. Do not use the appliance vent connection size to determine the size of barometric damper. Refer to latest edition of NFPA 54/ANSI Z223.1 for sizing Category I venting systems to size the vent. Then use that same diameter to size a barometric damper that will be installed immediately after the factory provided starter piece. Refer to the manufacturer's instruction on barometric damper installation, operation, and maintenance.



Figure 2-18: Stack Guard Sensor

2.12.3 Exhaust Fans

The CFR boiler is a Category I appliance. The exhaust system must be designed to run at negative pressure. It is suggested that this be accomplished by sizing the system in accordance with the latest publication of National Fuel Gas Code (ANSI Z223.1/ NFPA54) as a fan-assisted Category I appliance. If the CFR boiler's exhaust system incorporates an exhaust fan, the system designer must size the vent pipe diameters, select the fan, an exhaust pressure of -0.01 to -0.08" w.c. at the location shown in Figure 2-16. Also, the designer must ensure that the exhaust fan material is acceptable for use with Category I appliances.

During startup, see Section 4.1 of the CFR Boiler Operations Manual (OMM-0164) for **Standby Blower Voltage** parameter setting on applications with exhaust fans.

2.13 Combustion Air

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, and 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 and warranty validation.

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 cm²) 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.

SECTION 2: INSTALLATION

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 *CFR Venting and Combustion Air Guide*, TAG-0105 when designing combustion air ducting.

CFR units have the following air inlet connections. When using the unit in a ducted combustion air configuration, the minimum diameter connection at the unit is as follows:.

- CFR1500/2000 boilers have a 6" (15.2 cm)
- CFR3000 boilers have an 8" (20.3 cm)

2.14 CFR Pump Relay

The CFR power panel includes a pump relay terminal block providing 120VAC with a maximum pilot duty of 3 amps. If the pump power requirement under all conditions is greater than 3 amps, use this relay to activate the pump through an intermediate relay with a higher power.

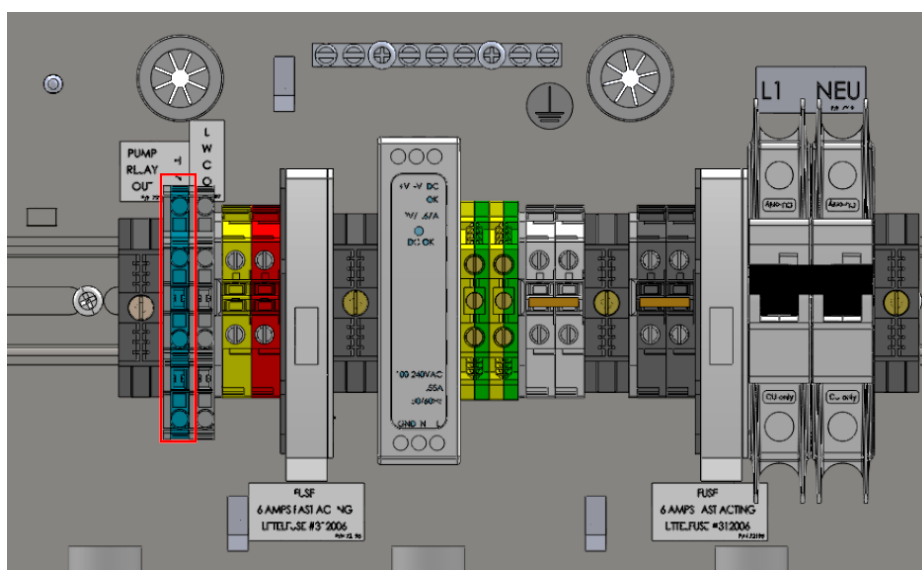


Figure 2-19: Pump Relay Terminal Block (in Red Rectangle)

The Pump Delay Timer feature allows pump to run for up to 30 minutes after the boiler has shut down and the demand is satisfied. To enable, go to **Advanced Setup → Ancillary Devices → Relays** and set the **Pump Off Delay** setting to the desired delays time.

2.15 BST Sequencing Isolation Valve Installation

All CFR 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 open for a time interval defined in the **SH Valve Close Delay** parameter in the **Advanced Setup → BST Cascade → Operating Controls → Sequencing Controls** menu (default = 1 minute), then closes.

SECTION 2: INSTALLATION

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

Once the 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 pre-programmed Sequencing Isolation Valve control is available only from AERCO. It is installed only on boilers that are part of a Boiler Sequencing Technology cascade. Refer to **OMM-0164** Section 7: *Boiler Sequencing Technology* for configuration.

Sequencing Isolation Valve Installation Instructions

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

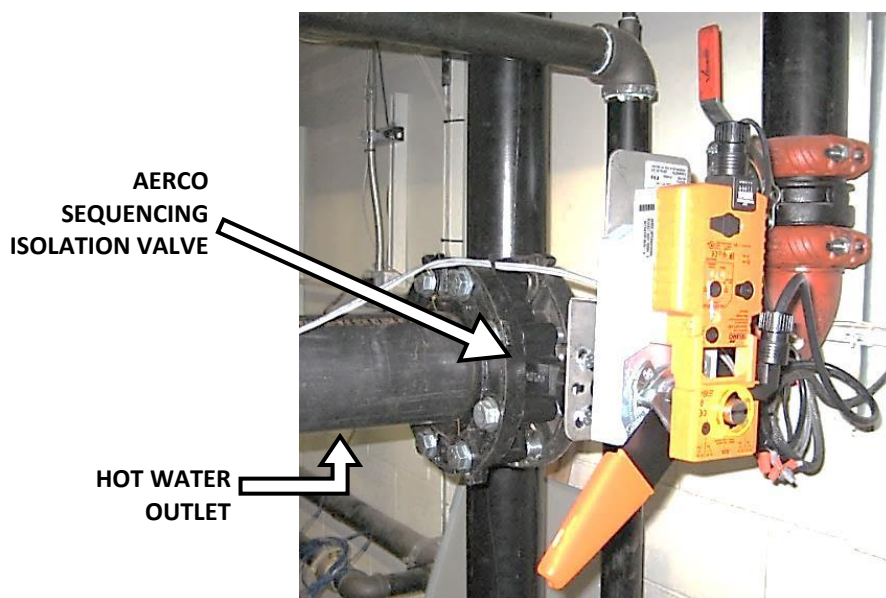


Figure 2-20: Sequencing Isolation Valve Installed

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.

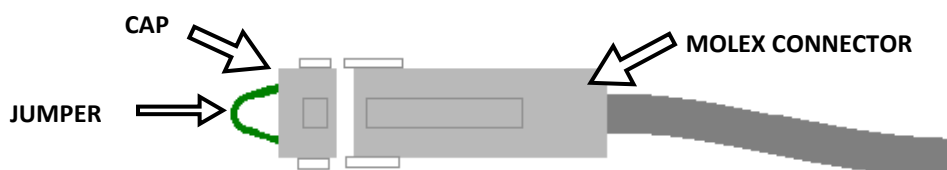


Figure 2-21: Sequencing Isolation Valve Molex Connector and Jumper Wire

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.
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**.

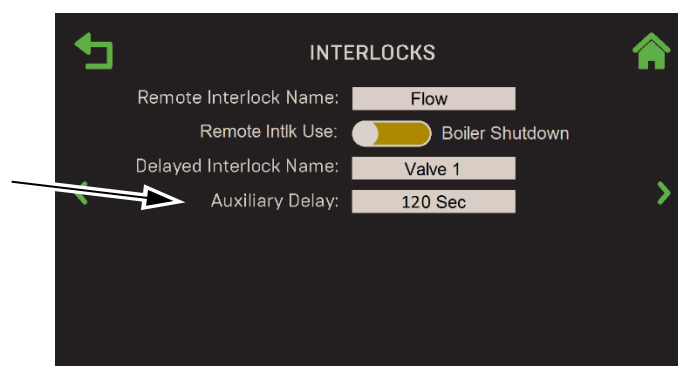
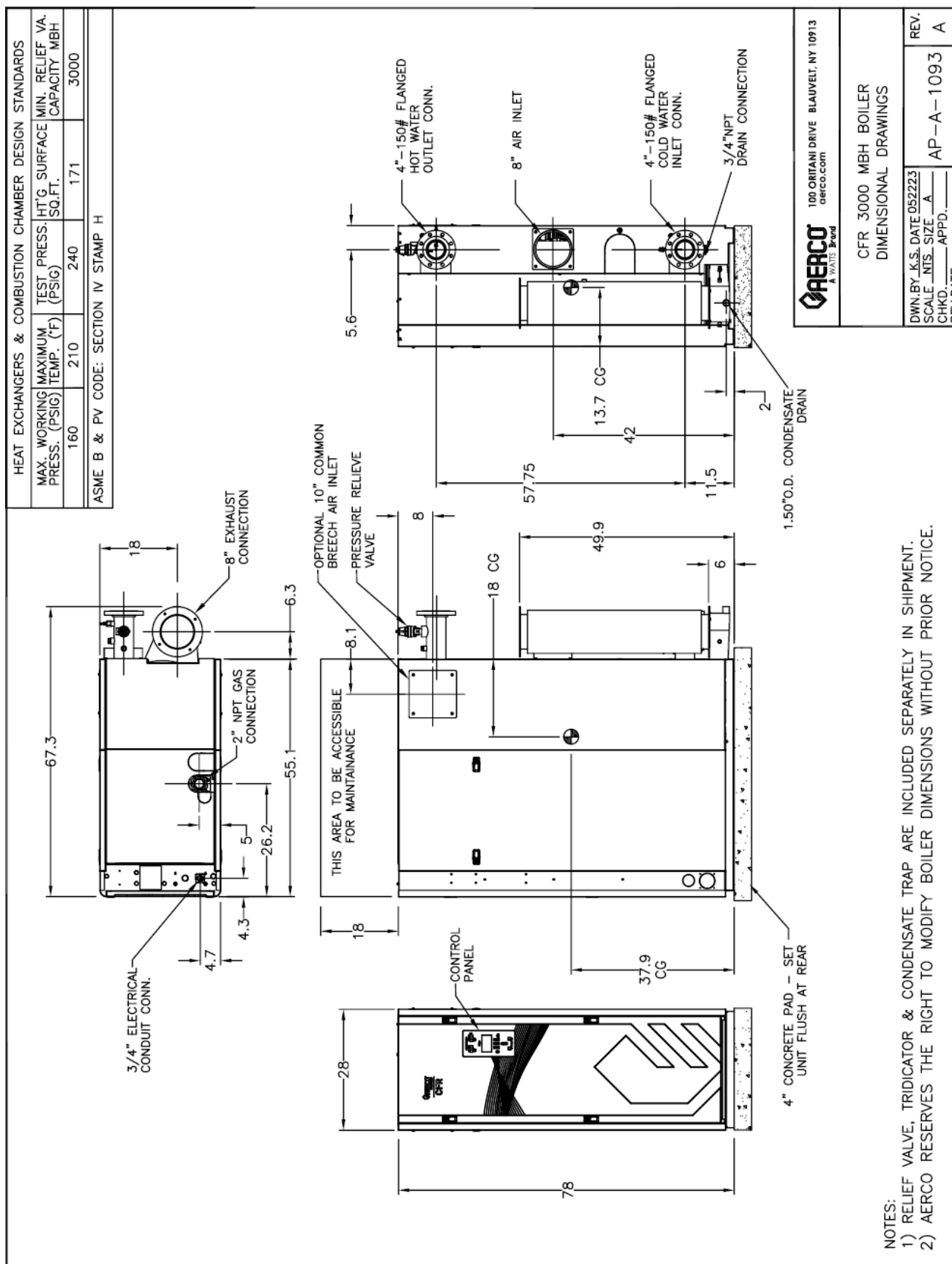


Figure 2-22: Interlocks Screen – Auxiliary Delay Parameter

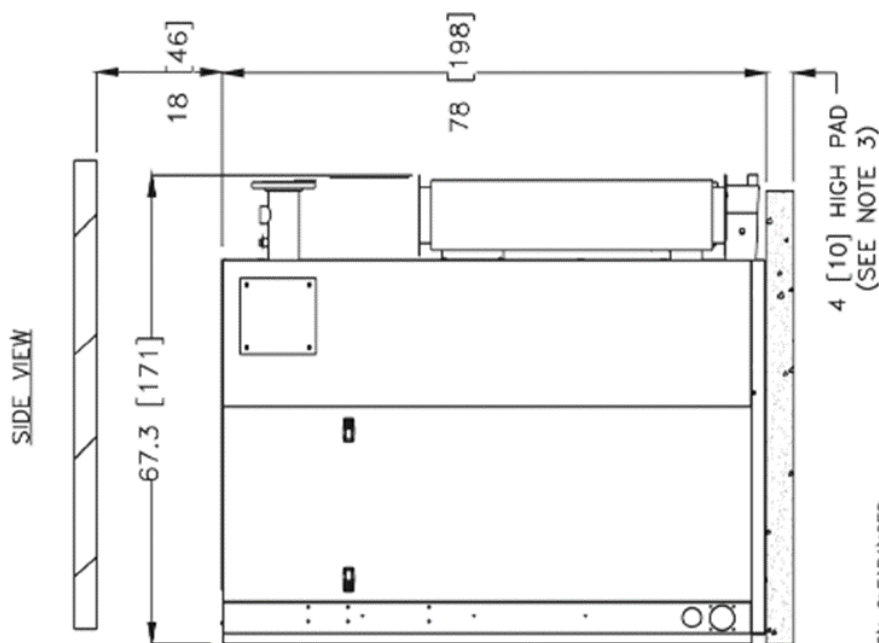
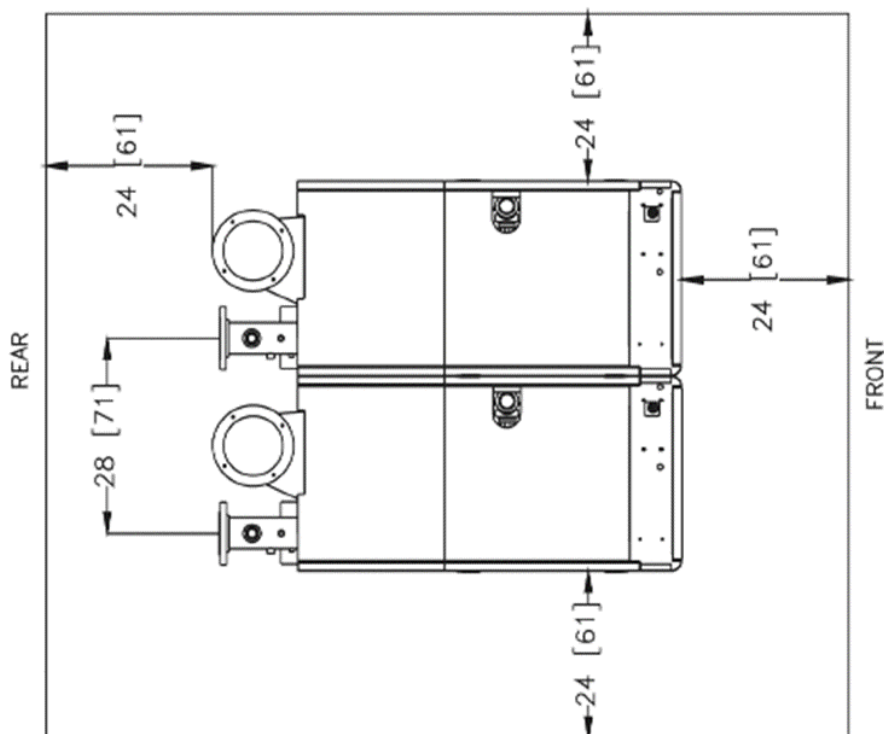
2.16 Next Steps

Once the unit is physically installed per the instructions above, the next step is to start the unit for the first time and perform the combustion calibration procedure. For instructions, see the CFR-Edge [i] Operation and Service Manual, OMM-0164, Section 4: Initial Startup.

APPENDIX A: DIMENSIONAL AND CLEARANCE DRAWINGS



CFR 3000 Dimension Drawing AP-A-1093 rev A



INSTALLATION CLEARANCES:

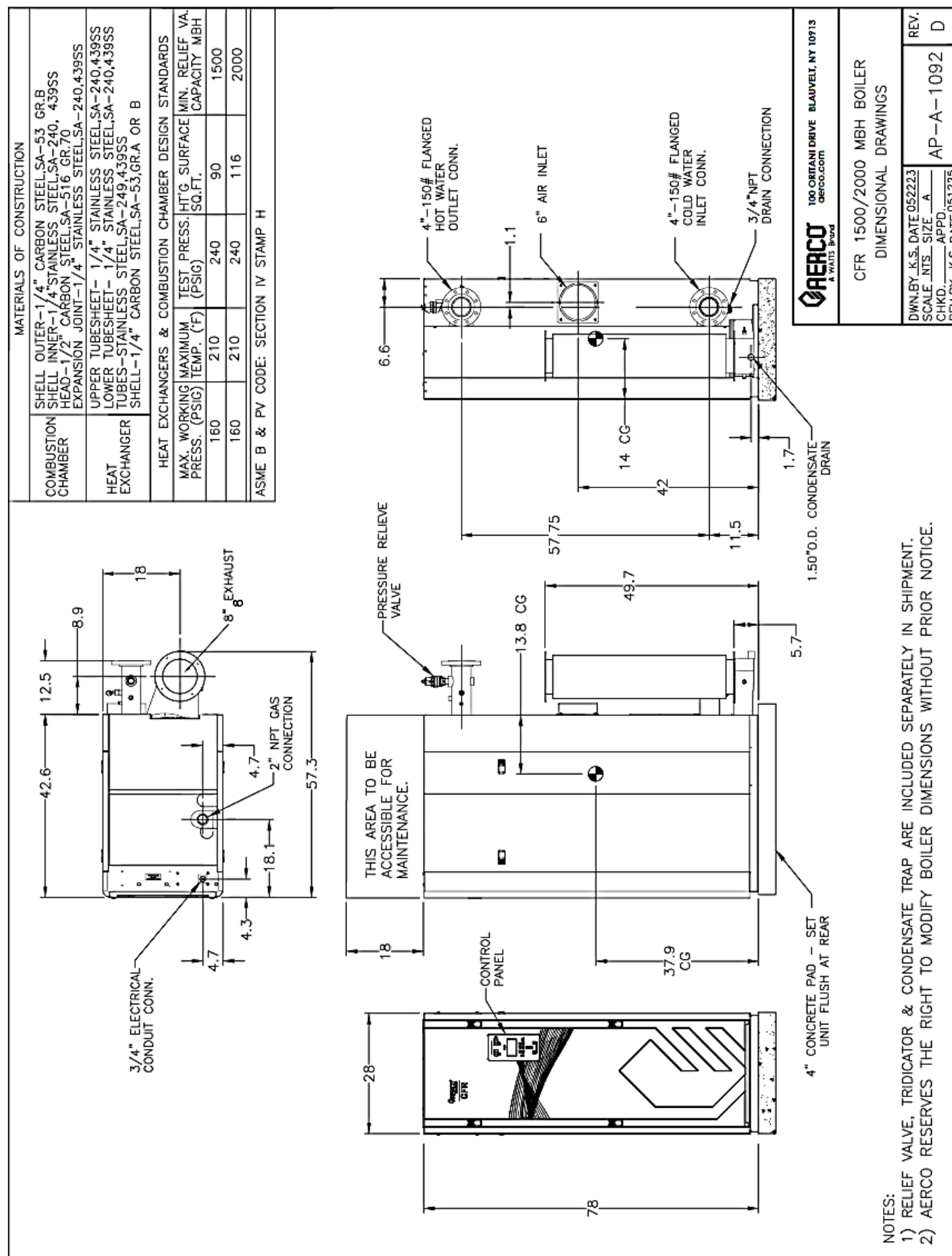
- 1) THIS APPLIANCE MAY BE INSTALLED ON COMBUSTIBLE FLOORING
- 2) MINIMUM CLEARANCES TO ADJACENT CONSTRUCTION ARE AS FOLLOWS:
LEFT & RIGHT SIDES: 24"
FRONT: 24"
REAR: 24"
CEILING HEIGHT: 100"
- 3) THE INNER SIDE PANELS MUST BE REMOVED FROM BOTH UNITS FOR ZERO SIDE CLEARANCE INSTALLATIONS.
- 4) THE ZERO SIDE CLEARANCE OPTION CAN ONLY BE EMPLOYED IN TWO UNIT SETS.
- 5) THE ZERO SIDE CLEARANCE KIT (P/N# 58079-2) MUST BE INSTALLED

NOTE:

1. ALL DIMENSIONS SHOWN ARE IN INCHES (CENTIMETERS).
2. WHEN USING THE AERCO CONDENSATE NEUTRALIZER TANK, FOR PROPER CONDENSATE DRAINAGE, THE NEUTRALIZER TANK MUST BE INSTALLED IN A PIT OR THE BOILER AND THE AERCO CONDENSATE TRAP MUST BE ELEVATED 4" OR HIGHER ABOVE THE FLOOR. SEE CONDENSATE TANK INSTRUCTIONS TID-0074 FOR DETAILS.
3. CLEARANCE DIMENSIONS ARE MINIMUMS RECOMMENDED BY AERCO. LOCAL CODES AND AUTHORITIES SHOULD BE CONSULTED.

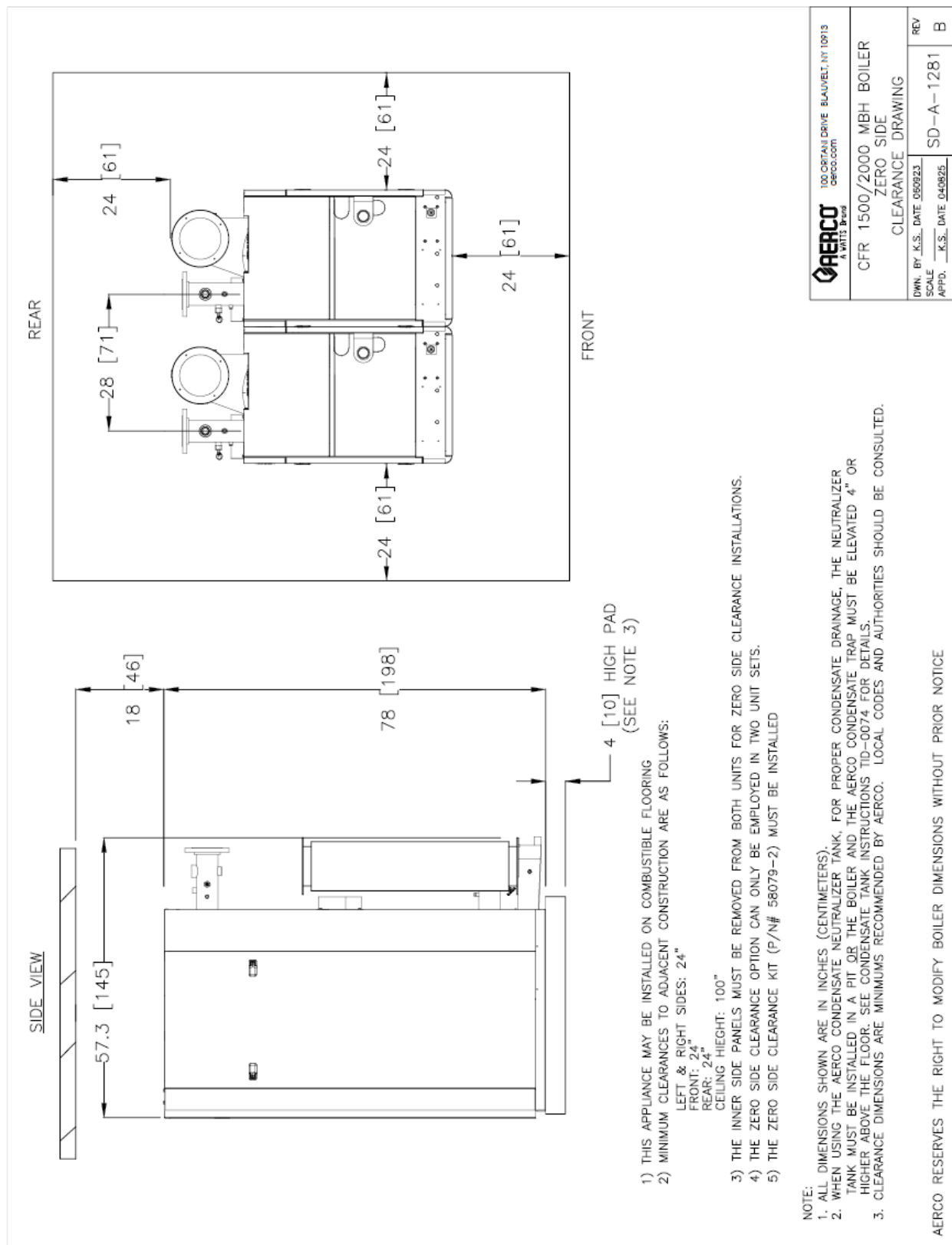
AERCO A WATTS Brand 100 ORTANI DRIVE BLAUVELT, NY 10913 aerco.com		CFR 3000 MBH BOILER ZERO SIDE CLEARANCE DRAWING	
DWG. BY: K.S. DATE 06/13/23 SCALE: _____ APPD: _____	REV: _____ SD-A-1283 DATE: _____	A	

CFR 3000 Zero-Side Clearance Drawing SD-A-1283 rev A



CFR 1500 Dimension Drawing AP-A-1092 rev D

- NOTES:
- 1) RELIEF VALVE, TRIDICATOR & CONDENSATE TRAP ARE INCLUDED SEPARATELY IN SHIPMENT.
 - 2) AERCO RESERVES THE RIGHT TO MODIFY BOILER DIMENSIONS WITHOUT PRIOR NOTICE.



CFR 1500 Zero-Side Clearance Drawing SD-A-1281 rev B



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