Installation, Operation, and Maintenance Manual

Innovation® Water Heaters

Natural Gas, Propane, and Butane Units

With Edge® [i] Controller

This manual applies to models:

- INN 600N
- INN 800N
- INN 1060N
- INN 1350N

Other documents for this product include:

- GF-5036 Gas Supply Design Guide
- GF-5056 Venting & Combustion Air Design Guide
- GF-5066 Electric Power Design Guide
- GF-5086 Sizing Guide

This manual applies to serial numbers:

G-21-0400 and above

GAS-FIRED c UL us LISTED

CLASSIFIED UL LOW LEAD COMPLIANT ANSI/NSF 372

ASME HLW

Note: Model 1060N B BAH is not UL

Heating and Hot Water Solutions

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FOREWORD

The AERCO Innovation® Series Potable Water Heaters are tankless modulating units which represent a true industry advance that meets the needs of today's energy efficiency and environmental concerns. Innovation's compact size and robust venting capabilities allow maximum installation flexibility. The Innovation Series Heaters, with their load tracking controls can modulate up to 30:1 turn down ratio to match the system demand and yield high thermal efficiencies.

Innovation Water Heaters are available in four (4) different sizes ranging from 625,000 BTU/Hr. (183.2 kW) input to 1,350,000 BTU/Hr. (395.6 kW) input, all with Natural Gas gas trains. The available models are listed below.

TABLE F1: INNOVATION POTABLE WATER HEATER MODELS

Models	Description	Shipping Weight
INN 600N	Innovation Potable Water Heater, 625,000 BTU/Hr. (183.2 kW) Input	1,060 lbs. (480.8 kg.)
INN 800N	Innovation Potable Water Heater, 800,000 BTU/Hr. (234.5 kW) Input	1,080 lbs. (489.9 kg.)
INN 1060N	Innovation Potable Water Heater, 1,060,000 BTU/Hr. (310.7 kW) Input	1,100 lbs. (499.0 kg.)
INN 1350N	Innovation Potable Water Heater, 1,350,000 BTU/Hr. (395.6 kW) Input	1,150 lbs. (521.6 kg.)

All Innovation models include Water Heater Management (WHM) software, which is built into the unit's Edge Controller. When the heater is ordered with a Sequencing Valve (SV), up to 16 Innovation Water Heaters can be controlled by the WHM system utilizing RS485 Modbus protocol. Units can be ordered with or without Sequencing Valves. Plants that have 2 or more units and have implemented WHM, sequencing valves are required for proper function.

When installed and operated on natural gas in accordance with this Instruction Manual, the Innovation Series models covered herein comply with the NOx emission standards outlined in (pending approval):

1. South Coast Air Quality Management District (SCAQMD), Rule 1146.2
2. Texas Commission on Environmental Quality (TCEQ), Title 30, Chapter 117, Rule 117.465

Whether used in singular or modular arrangements, Innovation Water Heaters offer the maximum flexibility in venting with minimum installation space requirements. Innovation's advanced electronic controls offer simplified integration with today's Energy Management Systems.

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

IMPORTANT!

Unless otherwise specified, the descriptions and procedures provided in this Installation, Operation & Maintenance Manual apply to all Innovation Series Water Heaters.

Phrases, abbreviations, and acronyms used in this manual are listed in the following table:

AERCO Technical Terminology Meanings	
TERMINOLOGY	**MEANING**
A (Amp)	Ampere
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 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.
BLDG (Bldg)	Building
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)
Edge Controller	A control system developed by AERCO and used in all Benchmark, Innovation and KC1000 Series product lines.
CO	Carbon Monoxide
COMM (Comm)	Communication
Cal.	Calibration
CNTL	Control
CPU	Central Processing Unit
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
EMS	Energy Management System; often used interchangeably with BAS
FM	Factory Mutual. Used to define gas trains.
FRU	Field Replacement Unit
GF-xxxx	Gas Fired (an AERCO document numbering system)
GND	Ground
GPH	Gallons per Hour
HX	Heat Exchanger
Hz	Hertz (Cycles Per Second)
I.D.	Inside Diameter
IGN	Ignition
IGST Board	Ignition/Stepper Board, contained in Edge Controller
INN	Innovation Water Heater
I/O	Input/Output
I/O Box	Input/Output (I/O) Box currently used on Benchmark, Innovation and KC1000 Series products
IP	Internet Protocol
IRI	Industrial Risk Insurers. Used to define gas trains containing two SSOVs and a solenoid operated vent valve (See DBB above)
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)
Modbus®	A serial, half-duplex data transmission protocol developed by AEG Modicon
Nexa	The cloud-based water management software from Watts that offers real-time equipment monitoring, insight, and alerts.
NC (N.C.)	Normally Closed
NO (N.O.)	Normally Open
NOx	Nitrogen Oxide
NPT	National Pipe Thread
O_2	Oxygen
O.D.	Outside Diameter
OMM	Operation and Maintenance Manual
PCB	Printed Circuit Board
PMC Board	Primary Micro-Controller (PMC) board, contained in the Edge Controller
P/N	Part Number
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
RES.	Resistive
RS232 (or EIA-232)	Standard for serial, full-duplex (FDX) transmission of data based on RS232 Standard
RS422 (or EIA-422)	A standard for serial, full-duplex (FDX) transmission of data based on the RS422 Standard
RS485 (or EIA-485)	Standard for serial, half-duplex (HDX) transmission of data based on RS485 Standard
SETPT (Setpt)	Setpoint Temperature
SHLD (Shld)	Shield
SPDT	Single Pole Double Throw, a type of switch
SSD	Client to Client programming
SSOV	Safety Shut Off Valve
SV	Sequencing Valve (Used with Water Heater Management (WHM) system)
TEMP (Temp)	Temperature
Terminating Resistor	A resistor placed at each end of a daisy-chain or multi-drop network 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	Vacuum Fluorescent Display, also Variable Frequency Drive
W	Watt
WHM	Water Heater Management
W.C.	Water Column, a unit of pressure (1-inch W.C. = 249 Pa)
µA	Micro amp (1 millionth of an ampere)

CHAPTER 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 heaters and ANSI/NFPASB for LP gas-fired heaters. 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, below, for information on installations within the Commonwealth of Massachusetts.

IMPORTANT!

This 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.

IMPORTANT!

Read the following restrictions prior to installing the water heater:

1. The water heater can only be used for applications where the chlorine concentrations **do not exceed 4 mg/L**, the EPA limit for chlorine concentrations in drinking water.
2. Do **not** use this heater for a pool heating application.

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 and carefully decrease all trapped pressures to zero before performing maintenance.
- **ELECTRICAL CURRENT OF 110 (OR 220 VOLTS FOR INTERNATIONAL MODELS) AND 24 VOLTS AC MAY BE USED IN THIS EQUIPMENT.** The unit's power box cover (located behind the front panel door) must therefore be installed at all times, except during maintenance and servicing.
- A switch must be installed on the electrical supply line of the unit, 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 heater if any part has been under water. Call a qualified service technician to inspect and replace any part that has been under water.

1.2 Emergency Shutdown

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

IMPORTANT!

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

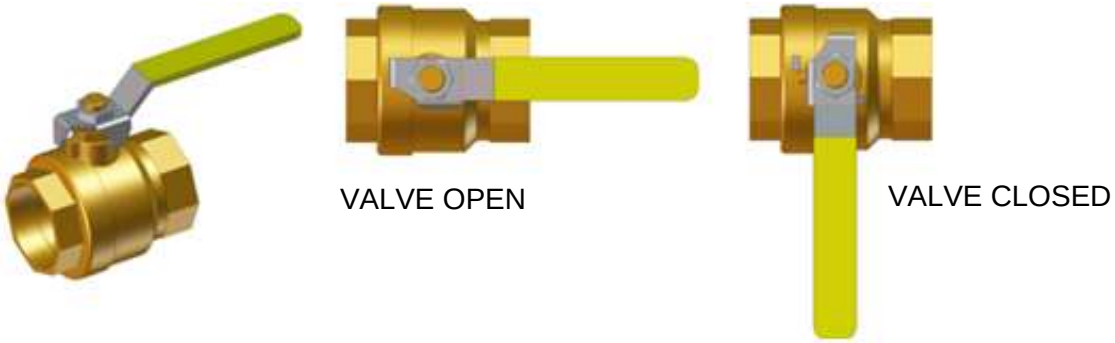


Figure 1.2: Manual Gas Shutoff Valve

1.3 Prolonged Shutdown

After prolonged shutdown, it is recommended that the initial startup procedures in Chapter 4 and the safety device test procedures in Chapter 5 of this manual be performed to verify all system-operating parameters. If there is an emergency, turn off the electrical power supply to the unit and close the manual gas valve located upstream of the unit. The installer must identify the emergency shut-off device.

1.4 For Massachusetts Installations

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

- Heater 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 (1.2m) 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 (2.1m) 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 (2.4m) 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-half (1/2) inch in size, **"GAS VENT DIRECTLY BELOW. KEEP CLEAR OF ALL OBSTRUCTIONS".**

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 Chapter 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)]

CHAPTER 2. INSTALLATION

2.1 Introduction

This Chapter provides the descriptions and procedures necessary to unpack, inspect and install AERCO Innovation Water Heaters.

2.2 Receiving The Unit

Each Innovation Water Heating System is shipped as a single crated unit. The shipping weight is shown in Table F1 in the Forward to this manual. 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.

NOTE: AERCO is not responsible for lost or damaged freight. Each unit has a Tip-N-Tell indicator on the outside of the shipping container, 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 unit's enclosure when cutting away packaging materials

After unpacking, closely inspect the unit to make sure there is no evidence of damage not indicated by the Tip-N-Tell indicator. Notify the freight carrier immediately if any damage is detected.

Each unit is shipped with the accessory kit ordered with the unit. The specific parts you receive depend on which accessory kit was ordered, but all kits include the following parts:

- Condensate Drain Trap (P/N **99259**)
- Automatic Float Vent (P/N **99285**) and Service Check Valve (P/N **99286**)
- Ignitor Kit (P/N **58023**)
- Flame Rod Kit (P/N **24356-2**)
- Air Vent

If the Innovation Water Heater is equipped for use with the AERCO Water Heater Management (WHM) system, an actuator-controlled ball valve will also be included with the unit.

If optional accessories were 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 Innovation Water Heater includes:

- Access to AC Input Power at either:
  - 110 VAC, Single-Phase, 60 Hz @ 20 Amps
  - 220 VAC, Single-Phase, 50/60 Hz @ 20 Amps – International Models only
- Access to a Natural Gas line with a **minimum** pressure of **4 inches W.C. (1.0 kPa) with the unit operating at maximum capacity**.

2.4.1 Installation Clearances

All Innovation models are packaged in enclosures having identical exterior dimensions. The unit must be installed with the prescribed clearances for service as shown in Figure 2.4.1-1 (shown with optional Sequencing Valve). The minimum clearance dimensions, required by AERCO, are listed below. However, if Local Building Codes require additional clearances, these codes shall supersede AERCO's requirements. Minimum acceptable clearances required are as follows:

Sides: 24 inches (0.61 m)
Front: 24 inches (0.61 m)
Rear: 30 inches (0.76 m)
Top: 18 inches (0.46 m)

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. Zero side clearance is also permissible.

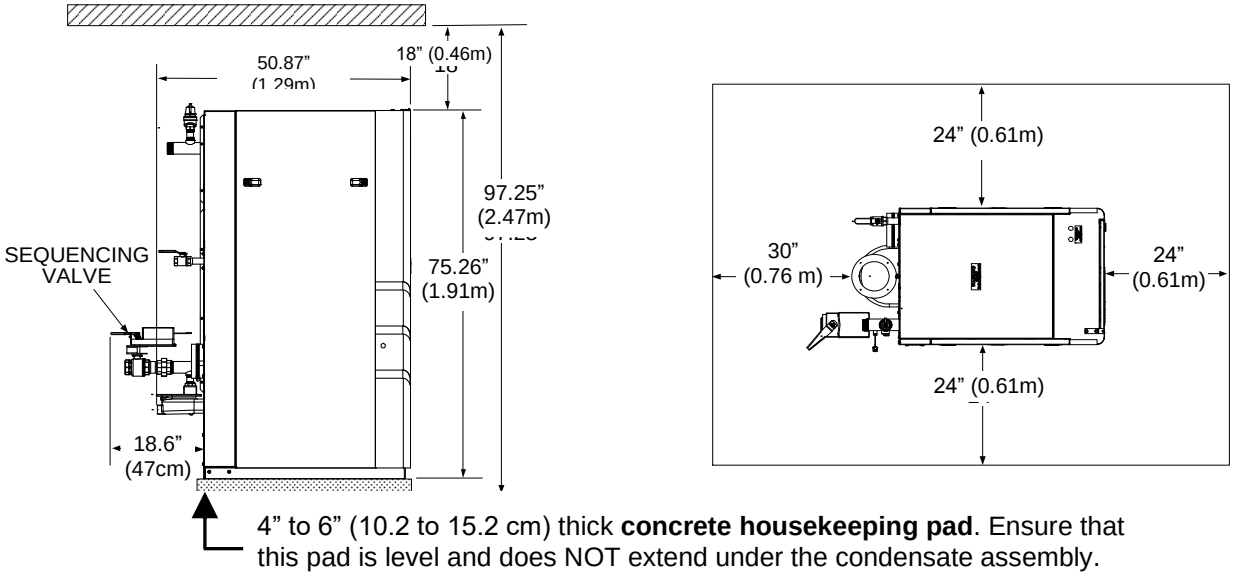


Figure 2.4.1-1: Innovation Water Heater Clearances

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

CAUTION!
While packaged in the shipping container, the unit must be moved by pallet jack or forklift from the FRONT ONLY.

FOR MASSACHUSETTS ONLY
For Massachusetts installations, the unit must be installed by a plumber or gas-fitter who is licensed within the Commonwealth of Massachusetts. In addition, the installation must comply with all requirements specified in Chapter 1, Section 1.4, above.

2.4.2 Setting the Unit

The unit must be installed on a **4 to 6-inch (10.2 to 15.2 cm)** level housekeeping pad to avoid base corrosion. Two lifting lugs are attached to the top of the heat exchanger. USE THESE TWO LUGS TO LIFT AND MOVE THE UNIT.

To use the lifting lugs, first remove the unit's left side panel, then disconnect the wire track attached to the under-side of the top sheet metal panel by pushing it towards the center of the unit; its clips should slide off the top panel's lip. You can then remove the top panel.

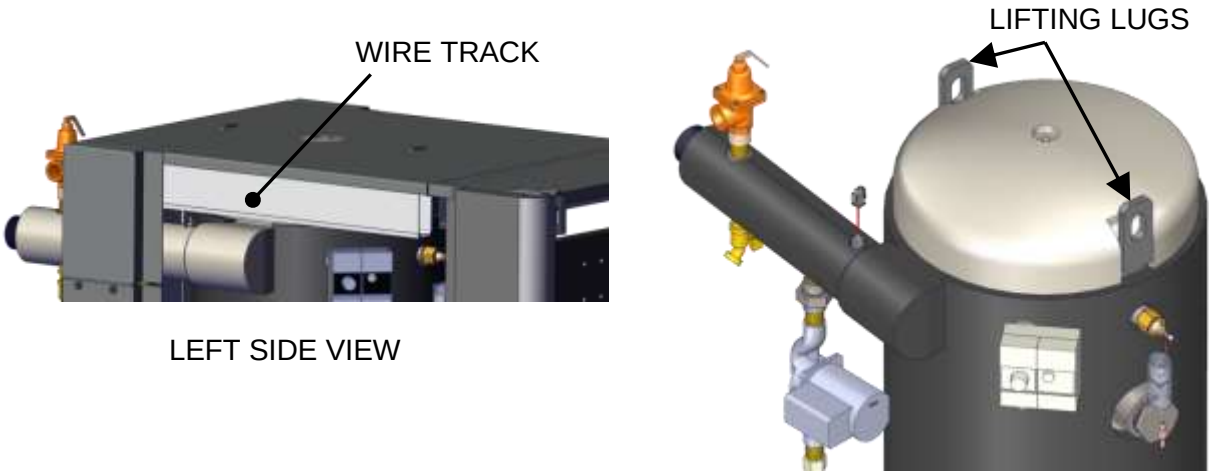


Figure 2.4.2: Partial Top View Showing Lifting Lugs

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 to 6-inch (10.2 to 15.2 cm) housekeeping concrete pad (required) in the desired location.

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**.**

2.5 Water Inlet And Outlet Piping

The locations of the 2" (5.08 cm) NPT cold water inlet and hot water outlet piping connections are shown in Figure 2.5. Flow rates through the unit are limited to 50 gallons (189 Liters) per minute continuous.

Shut-off valves and union connections must be installed in the inlet and outlet lines for maintenance. The use of dielectric unions is recommended.

When connecting the hot water outlet and cold-water inlet to building piping, first make sure the threads are thoroughly clean. AERCO recommends using Teflon tape followed by RectorSeal® T+2 when plumbing the inlet and outlet water connections.

IMPORTANT!

If the Innovation Water Heater is equipped for use with the Edge Controller's Water Heater Management (WHM) system, then an actuator-controlled ball valve will be included with the shipment. Refer to Section 2.5.1 for installation instructions prior to connecting inlet piping.

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

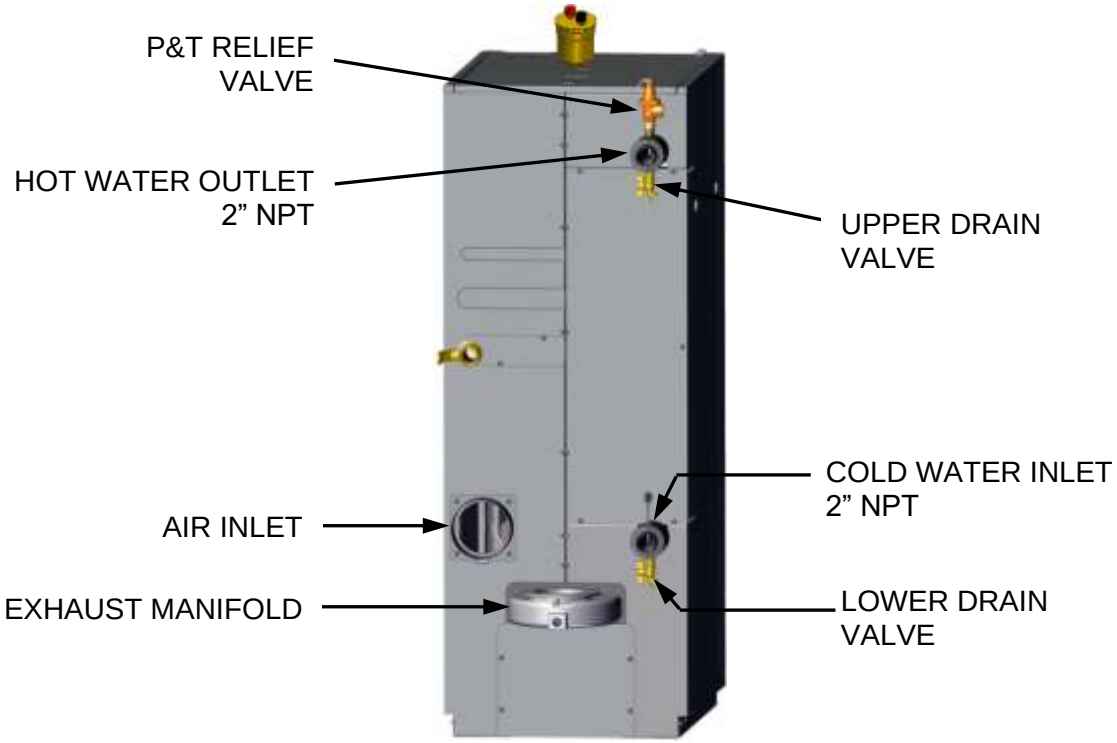


Figure 2.5: Water Inlet & Outlet Locations

2.5.1 WHM Actuator-Controlled Ball Valve Installation

If the Innovation Water Heater was ordered for use with the Water Heater Management (WHM) system and the actuator-controlled ball valve is not already installed on the unit, as shown in Figure 2.5.1, it will be packed separately within the shipping container.

NOTE: AERCO requires use of WHM sequencing valves in a multi-unit configuration. See Section 4.2.6: *Recommendations for WHM Operation* for more information.

If installation is required, proceed as follows:

WHM BALL VALVE INSTALLATION Instructions

1. Remove the ball valve from its stowed location within the shipping container.
2. Attached the valve to the cold-water inlet of the unit using the pipe union and nipple provided.
3. Ensure the valve is positioned with the actuator enclosure position as shown below.
4. AERCO recommends that another pipe nipple and union be attached to the valve inlet prior to connecting the cold-water supply piping.
5. Tighten all pipe connections after the valve is properly positioned.
6. Connect the 4-pin Molex connector on the valve to the mating connector on the Innovation harness at the rear of the unit.
7. This completes the actuator-controlled ball valve installation.

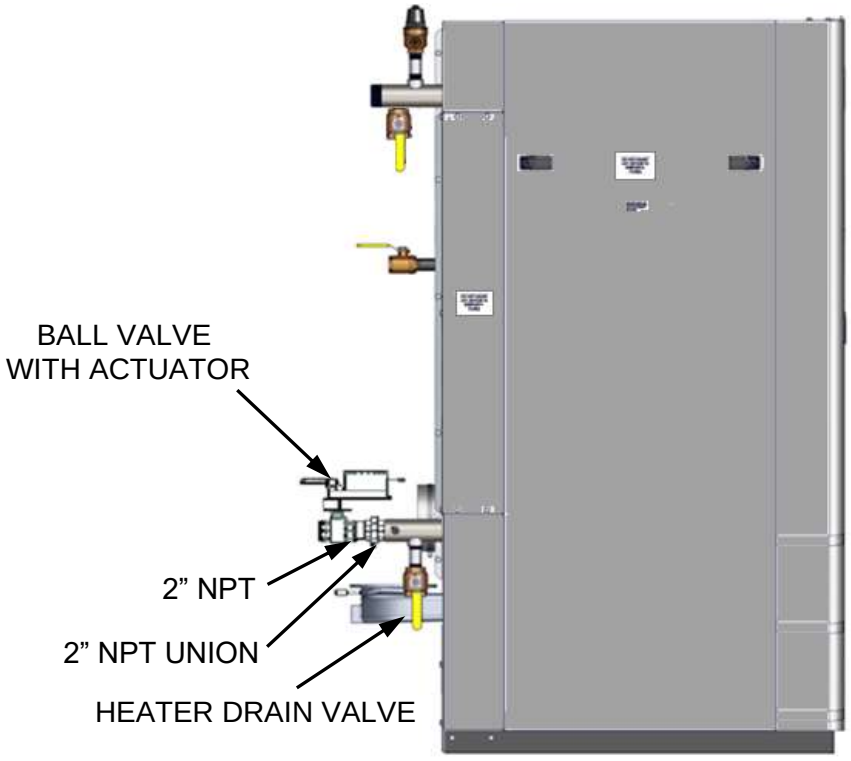


Figure 2.5.1: Innovation Water Heater Equipped with Sequencing Valve

2.5.2 Automatic Float Vent Installation

All Innovation Water Heaters require an Automatic Float Vent connected to a Safety Check valve. Both must be installed on all units, on the top of the heat exchanger dome, as shown below. Both valves are included in the Accessory Kit shipped with the unit.

AUTOMATIC FLOAT VENT Instructions

1. All units are shipped with a 1/4" plug in the center of the heat exchanger dome, which protrudes through a hole in the center of the top enclosure panel. Remove this hex nut.
2. Fasten the Automatic Float Vent (P/N **99285**) to top of the Service Check valve (P/N **99268**), as shown below. Leave the red and black plastic caps in place on the Automatic Float Vent.
3. Install the Service Check valve and Automatic Float Vent in place of the 1/4" plug removed in step 1.

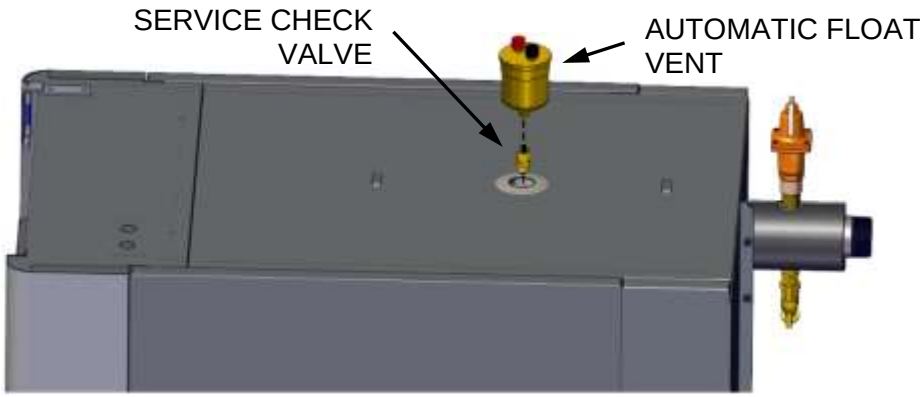


Figure 2.5.2: Automatic Float Vent Installation

2.6 Test Hose Connection

A test hose must be connected to the drain valve on the hot water outlet. This is ***required*** for startup and testing (Figure 2.6). The test hose diameter should be a minimum of 3/4" (1.9 cm).

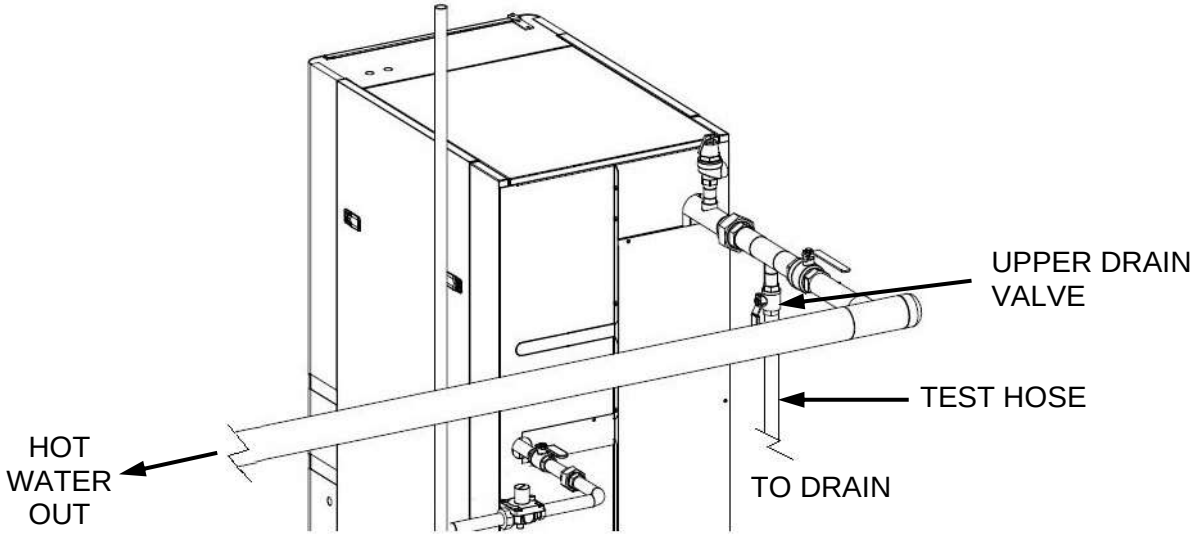


Figure 2.6: Test Hose Location

2.7 Internal Recirculation Loop

The internal Recirculation Loop Assembly is located inside the unit enclosure at the rear of the unit. To access this assembly, the right-rear panel must be removed, as shown in Figure 2.7.

This assembly contains a recirculation pump that connects the upper hot water outlet to the lower cold-water inlet to the unit's heat exchanger. The purpose of this loop is to provide feed-forward (FFWD) temperature control by mixing a portion of the hot water outlet with the cold-water inlet to the unit. Temperature sensors located in the hot water outlet and cold-water inlet provide temperature data to the Edge Controller. The Controller utilizes this data to modulate the fire rate (Air/Fuel Valve position) to precisely maintain the hot water outlet temperature at the selected setpoint temperature.

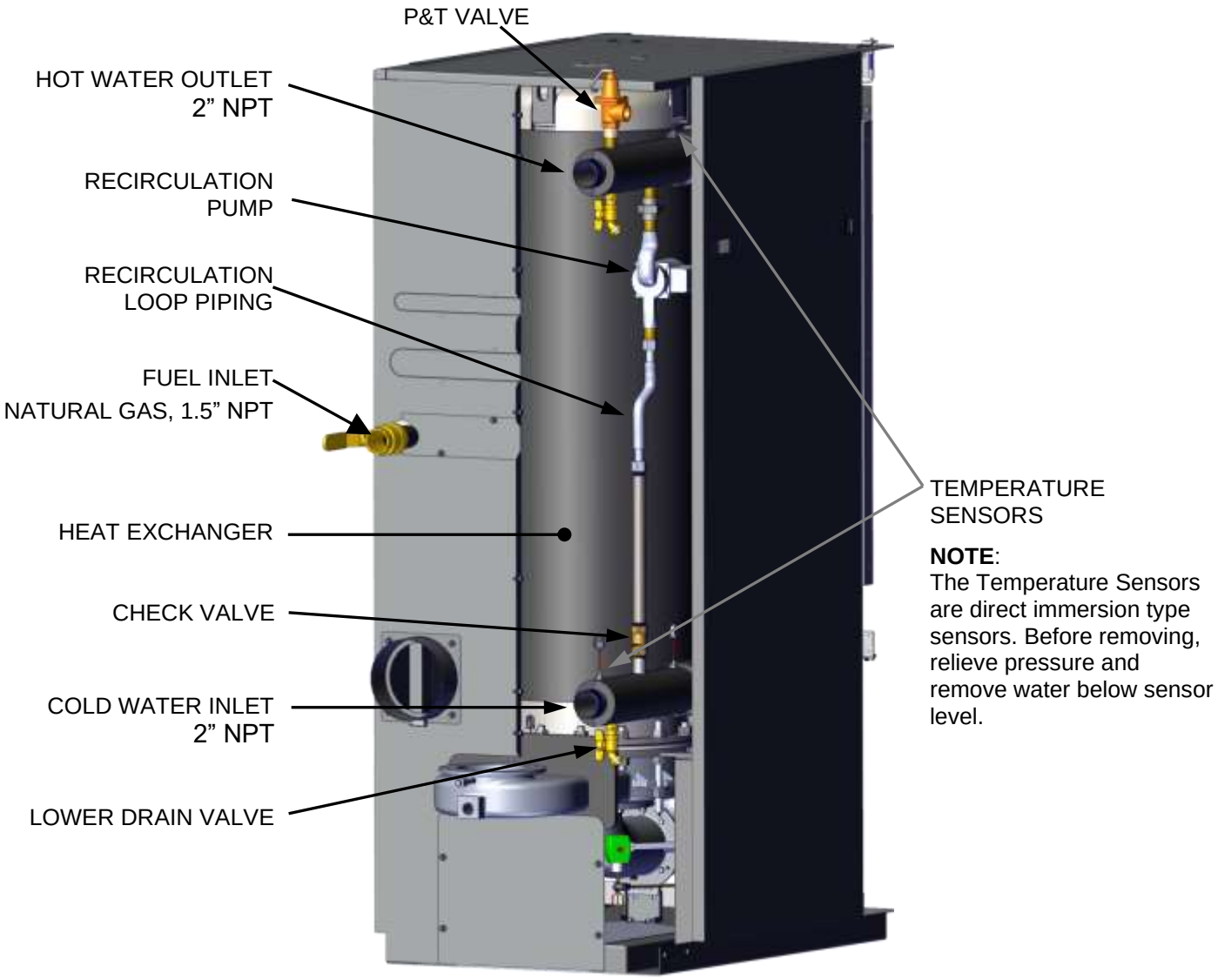


Figure 2.7. Recirculation Loop

2.8 Pressure & Temperature Relief Valve Installation

An ASME rated Pressure & Temperature (P&T) Relief Valve must be installed on each Innovation water heater, on the hot water outlet at the top of the Recirculation Loop Assembly as shown in Figure 2.7, above. The valve setpoint is 150 psig (1,034 kPa) at 210°F (98.9° C).

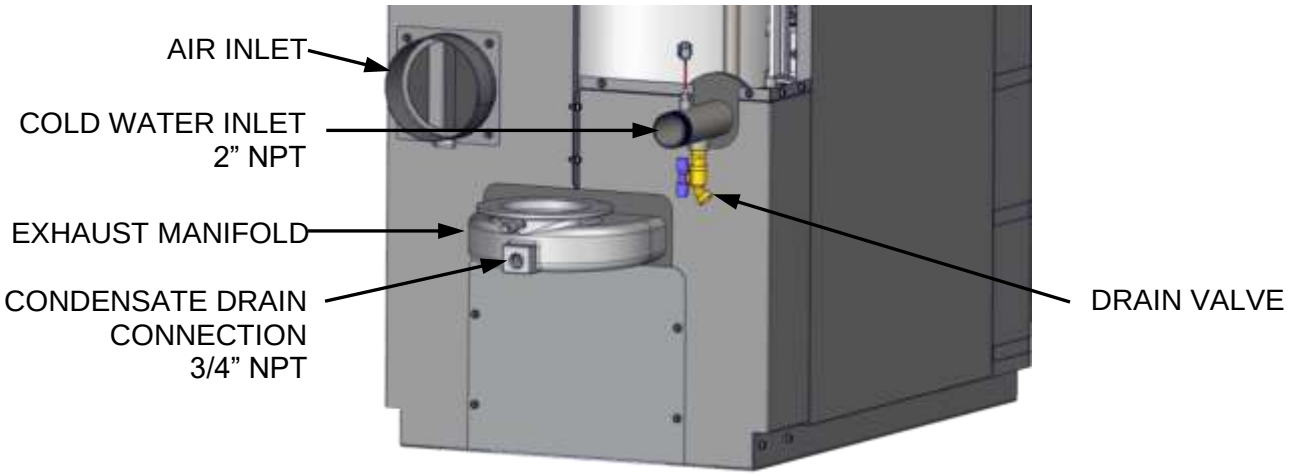
A suitable pipe joint compound should be used on the threaded connections. Any excess should be wiped off to avoid getting any into the valve body. The Relief Valve should be piped to within 6 inches (15.2 cm) of the floor to prevent injury in the event of a discharge; the piping must be designed and constructed to ensure that hot water coming out of the valve does not contact personnel or cause water damage to surrounding equipment. The Relief Valve outlet piping must be equal to the outlet size of the Relief Valve without reduction. No valves, restrictions, or other blockages are allowed in the discharge line. In multiple unit installations the discharge lines must not be manifolded together. Each must be individually run to a suitable discharge location.

NOTE: If the Relief Valve discharges periodically, this may be due to thermal expansion in a closed water supply system. Contact the water supplier or local plumbing inspector on how to correct this situation. Do not plug the relief valve

2.9 Condensate Drain & Piping

The Innovation Water Heater is designed to condense water vapor from the flue products. Therefore, the installation must have provisions for suitable condensate drainage or collection.

The condensate drain port is located on the exhaust manifold at the rear of the unit (Figure 2.9-1). This drain port must be connected to the Condensate Trap (P/N **99259**), which is packed within the unit's shipping container.



PARTIAL REAR VIEW

Figure 2.9-1: Condensate Drain Connection Location

Sample Condensate Trap installation is shown in Figure 2.9-2. 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. The following general guidelines must be observed to ensure proper condensate drainage:

- The condensate trap inlet must be level with, or lower than the exhaust manifold drain port.
- The base of the condensate trap can be supported to ensure that it's level {not required).
- The trap must be removable for routine maintenance (see Section 6.9 for instructions).
- If a floor drain is not available, use a pump to remove the condensate to a drain.
- The maximum condensate flow rate is 10 Gallons (37.85 L) per hour.

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

CONDENSATE TRAP INSTALLATION Instructions

1. Attach the 3/4" NPT nipple (P/N **94136**) to the exhaust manifold's drain port.
2. Loosen the condensate trap's cap, then install it on the open end of the 3/4" nipple.
3. Rotate the cap so the outlet faces towards the condensate drain, then tighten it.
4. Connect a length of 3/4" (1.91 cm) I.D. hose to the trap outlet. Use PVC, stainless steel, aluminum or polypropylene for condensate drain piping. **DO NOT USE carbon or copper components**
5. Route the hose from the trap outlet to a nearby floor drain and secure it with a hose clamp.

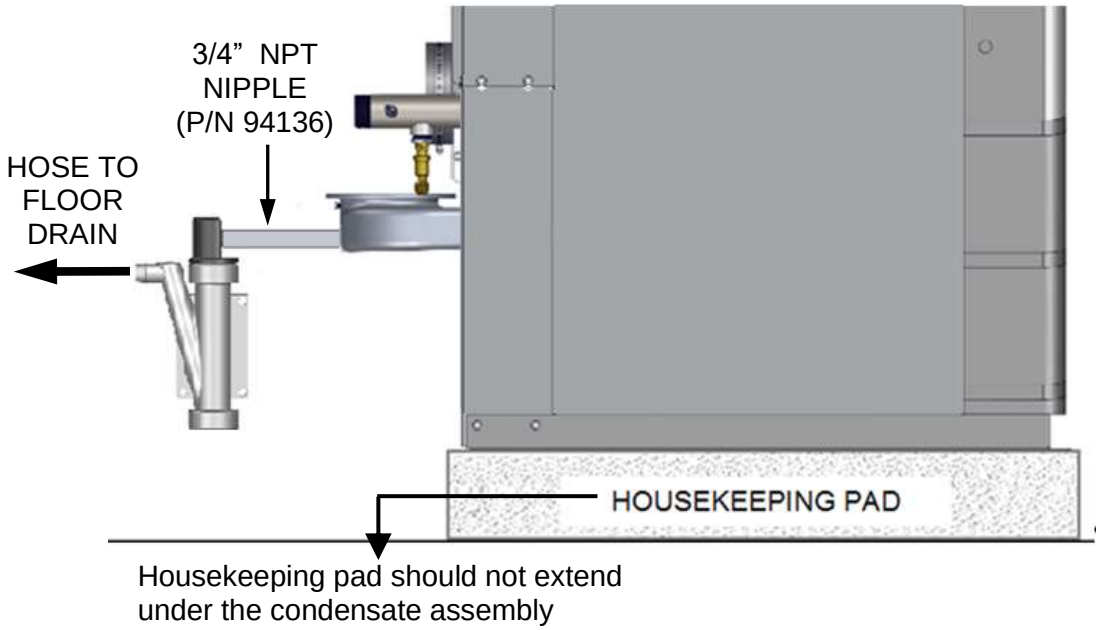


Figure 2.9-2: Sample Condensate Trap Installation – Left Side View

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.

2.10 Gas Supply Piping

The minimum, nominal and maximum allowable gas pressures are listed in the *Innovation-Edge Gas Supply Design Guide* (TAG-0091, GF-5036). This guide 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 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 between the unit and walls, or another unit.

Innovation units contain a Natural Gas inlet connection on the rear of the unit. The location of the gas inlet is shown in Figure 2.7, above.

Inlet Connection	Innovation Model
1.5 Inch (3.8 cm) Natural Gas	All INN models

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, isolate the unit from the gas supply piping. **The gas pressure applied to the unit should never exceed 14" W.C. (3.49 kPa)**. Leak test all external piping thoroughly using a soap and water solution or suitable equivalent. The gas piping used must meet all applicable codes.

2.10.1 Gas Supply Specifications.

The gas supply input specifications to the unit for Natural Gas is as follows:

- The ***maximum*** static pressure to the unit must not exceed **14" W.C. (3.49 kPa)**.
- The ***minimum*** pressure for Natural Gas is **4.0" W.C. (1.0 kPa)**.
- The gas supply pressure to the unit must be of sufficient capacity to provide the following while maintaining a recommended (nominal) gas pressure of **7" W.C. (1.74 kPa)** ***with the unit operating at maximum capacity***:
  - INN 600N: 625,000 BTU (183 kW)
  - INN 800N: 800,000 BTU (234 kW)
  - INN 1060N: 1,060,000 BTU (311 kW)
  - INN 1350N: 1,350,000 BTU (410 kW)

2.10.2 Manual Gas Shutoff Valve

A manual shut-off valve is factory-installed in the gas supply line at the unit, as shown in Figure 2.5. Additionally, if a gas regulator is installed upstream of the unit, refer to Figure 2.10.3.2 to determine the location of the manual shut-off valve installation in relation to the regulator. The maximum allowable gas pressure to the Water Heater is 14" W.C. (3.49 kPa).

2.10.3 External Gas Supply Regulator

An external gas pressure regulator is required on the gas inlet piping under most conditions (see Sections 2.10.3.1 and 2.10.3.2, below). Regulators must conform to the following specifications:

- The external natural gas regulator must be capable of regulating 50,000 BTU/Hr. to 3,180,000 BTU/Hr. (58.61 kW to 932.0 kW) of natural gas while maintaining a gas pressure of 8.0" W.C. (1.99 kPa) minimum to the unit.
- A lock-up regulator ***is required*** when gas supply pressure ***exceeds* 14" W.C. (3.49 kPa).**

2.10.3.1 Massachusetts Installations Only

For Massachusetts installations, a mandatory external gas supply regulator must be positioned as shown in Figure 2.10.3.2, below. 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.

2.10.3.2 All Installations (Except Massachusetts)

An external gas supply regulator is *recommended* for all installations (other than Massachusetts) that ***exceed* 7" W.C. (1.74 kPa)** gas pressure, positioned as shown in Figure 2.10.3.2. No regulator is required for gas pressures ***below* 7" W.C.** (1.74 kPa). Consult the local gas utility for detailed requirements concerning venting of the supply gas regulator.

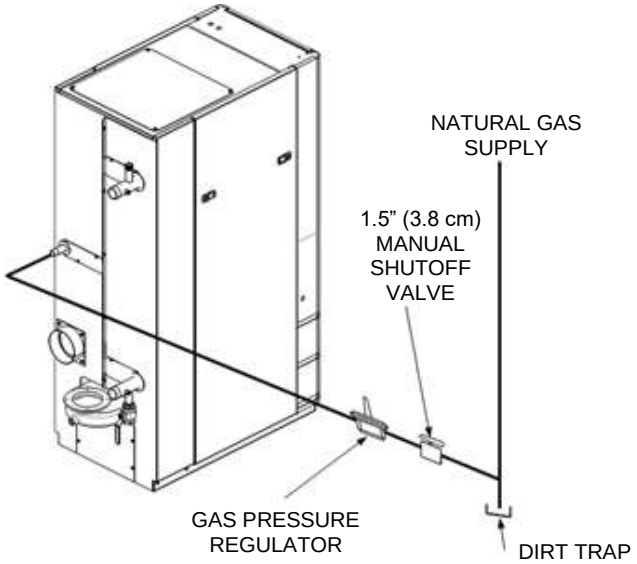


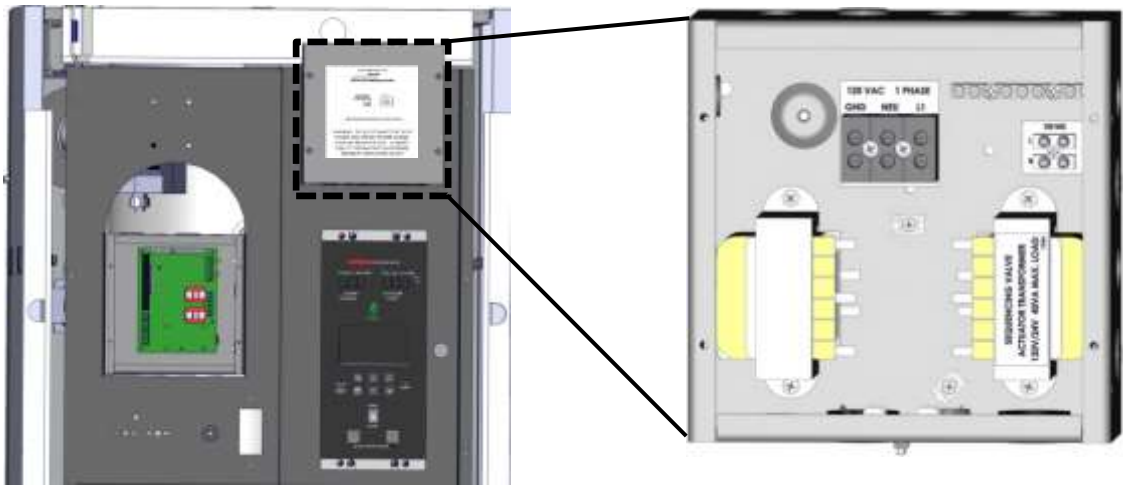
Figure 2.10.3.2: Manual Gas Shut-Off Valve Location

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

2.11 AC Electrical Power Wiring

The AERCO *Innovation-Edge Electrical Power Design Guide* (TAG-0092, GF-5066) must be consulted prior to connecting any AC power wiring to the unit. This guide includes electrical power wiring diagrams.

External AC power connections are made to the unit inside the Power Box on the front of the unit. Remove the front door of the unit to access the Power Box mounted directly above the Edge Controller. Loosen the four Power Box cover screws and remove the cover to access the AC terminal connections inside the Power Box.



POWER BOX LOCATION POWER BOX WITH COVER REMOVED

Figure 2.11-1: Power Box Location – Partial Front View, Front Panel Removed

The Power Box contains the terminal block shown in Figure 2.11-2. A wiring diagram showing the required AC power connections is mounted on the front cover of the Power Box.

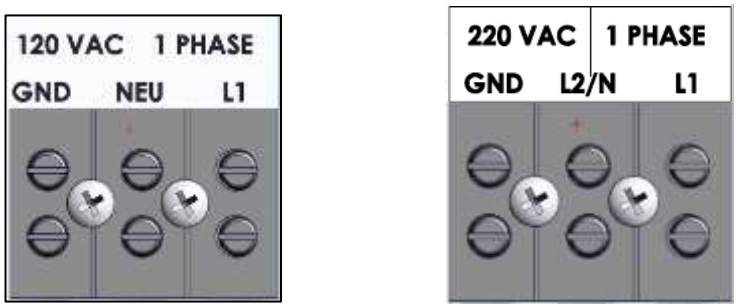


Figure 2.11-2: AC Terminal Block Configurations for 110 and 220 VAC Input

For International models only, units that connect to 220VAC power input must include a 220VAC to 120VAC transformer, shown in Figure 2.11-3. Connect the incoming 220VAC electrical line to the same terminals in the Power Box as the 120VAC line would be connected. The transformer is pre-wired to convert the power to 120VAC. No further steps are needed

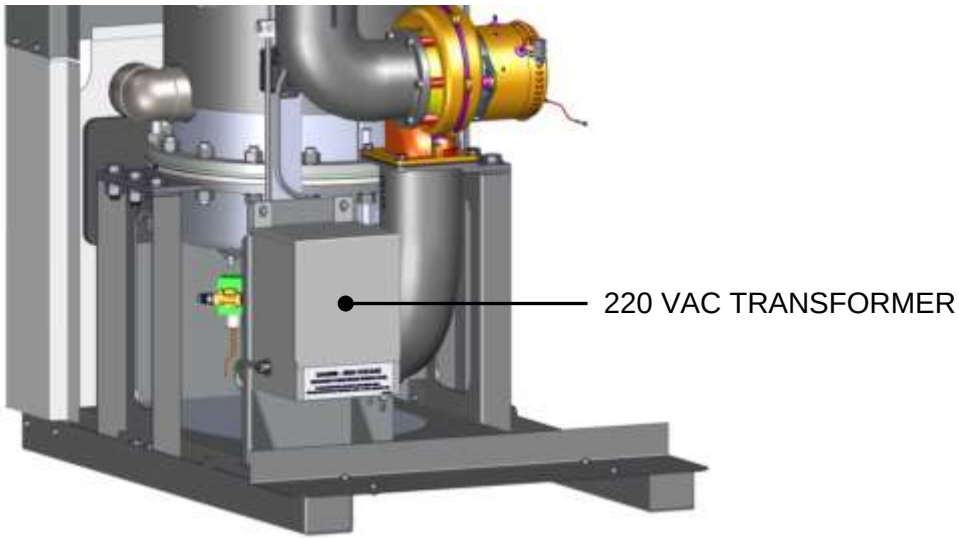


Figure 2.11-3: 220 VAC Transformer – Front and Side Panels Removed

2.11.1 Electrical Power Requirements

AERCO Innovation Heaters built for the international market require the following input voltage:

- 120 VAC, single-phase, 50/60 Hz @ 20A
- 220 VAC, single-phase, 50/60 Hz @ 20A

NOTE: 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.

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

A double-pole switch must be installed on the electrical supply line 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 water heater 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.

2.12 Field Control Wiring

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 all Innovation current generation water heaters does allow for some control and monitoring features. Wiring connections for these features are made in the Input/Output (I/O) Box. The I/O Box is located to the left of the Controller's front panel (Figure 2.12-1) behind the removable front panel door. To access the I/O Box terminal strips shown in Figure 2.12-2, loosen the four cover screws and remove the cover. All field wiring is installed from the rear of the panel by routing the wires through one of the four bushings provided.

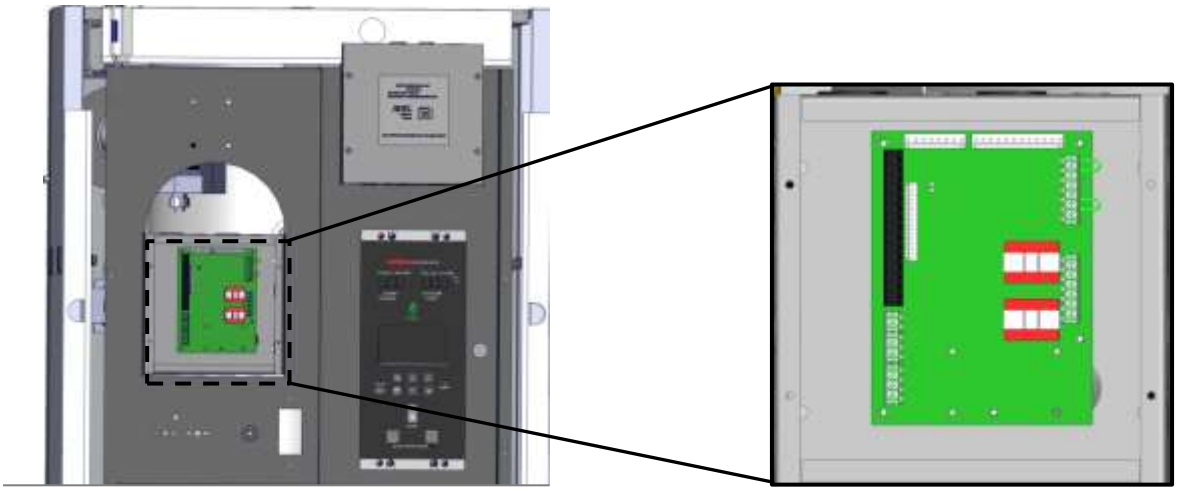


Figure 2.12-1: Input/Output (I/O) Box Location – Partial Front View

Refer to the wiring diagram provided on the cover of the I/O Box (Figure 2.12-2) when making all wiring connections.

Since identical I/O Boxes are used with both AERCO gas-fired boilers and water heaters, some of the input and output connections apply only to boilers while others are common to both boilers and heaters. These I/O Box connections are noted in the sections below.

NOTE: Use Figure 2.12-2 to determine the functions of the I/O PCB connections. Do not use the silkscreened labels on the PCB itself, as these may not match.

CAUTION!

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

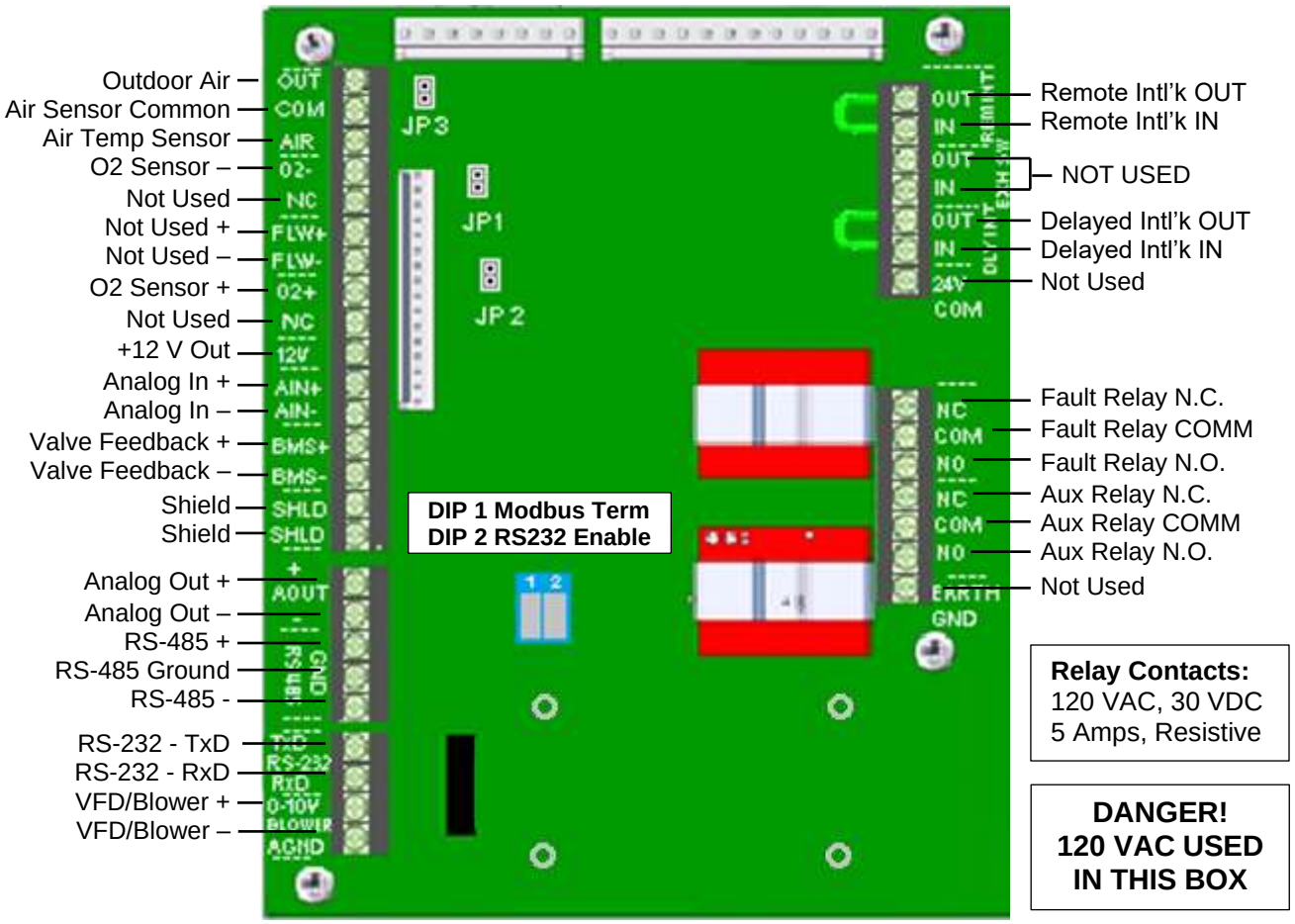


Figure 2.12-2: I/O Box Terminal Strips

2.12.1 OUTDOOR AIR Terminal

The OUTDOOR AIR IN and AIR SENSOR COMMON terminals are not applicable to this unit.

2.12.2 AIR SENSOR COMMON Terminal

The AIR SENSOR COMMON terminal is not applicable to this unit.

2.12.3 O2 SENSOR Terminals

The O2 SENSOR (–) and O2 SENSOR (+) terminals are not currently used in this unit.

2.12.4 ANALOG IN Terminals

The ANALOG IN terminals (+ & -) are used when an external signal is used to change the unit's setpoint or air/fuel valve position. The four signal types are **4 to 20 mA, 0 to 20 mA, 1 to 5 VDC** and **0 to 5 VDC.**

The factory default setting is **4 to 20 mA**, however this can be changed in the **Remote Signal** parameter in **Main Menu → Advanced Setup → Unit → Application Configuration** (note, **Operating Mode** must equal **Remote Setpoint**).

If voltage rather than current is selected as the drive signal, a DIP switch must be set on the Interface Board, located inside the Edge Controller. Refer to Appendix G – Edge [i] Controller Views for information on setting DIP switches. If **Remote Signal** is set to either **4 to 20 mA** or **0 to 20 mA**, DIP switch #4 in block SW1 must be set to **mA**. If **Remote Signal** is set to **1 to 5 VDC** or **0 to 5 VDC,** DIP switch #4 must be set to **V**.

All supplied signals must be floating (ungrounded) signals. Connections between the source and the Heater's I/O Box 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 unit's I/O Box.

Whether using voltage or current for the drive signal, they are linearly mapped to a 40°F (4.44 °C) to 240°F (115.6 °C) setpoint or a 0% to 100% air/fuel valve position. No scaling for these signals is provided.

2.12.5 VALVE FEEDBACK Terminals

The Valve Feedback terminals 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 #JP2 on the I/O Board will be inserted at the factory.

2.12.6 SHIELD Terminals

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

2.12.7 ANALOG OUT Terminals

The two ANALOG OUT terminals (+ & -) output from 0 to 20 mA and may be used to monitor Setpoint, Outlet Temperature, Valve Position 4-20 mA, Valve Position 0-10v or be set to OFF. Default setting in the Edge Controller is Valve Position 0-10 v and settings behave as follows:

1. 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 2.12.11).
2. If "On Board" Water Heater Management is enabled, the Analog Output terminals are used to drive the isolation valve, open and closed.

NOTE: When driving an isolation valve, shorting jumper #JP2 *MUST* be installed on I/O Board.

2.12.8 RS485 Comm Terminals

The RS485 communication terminals (+, GND, & -) are used when the Innovation Water Heaters are being controlled by an Energy Management System (EMS) or the Edge Controller's Water Heater Management (WHM) system using Modbus (RS485) communication. The WHM software required to control up to 8 AERCO Innovation Water Heaters is included in the Edge Control System used with each Innovation unit.

2.12.9 RS232 Comm Terminals

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

2.12.10 VFD/BLOWER Terminals

These terminals (0-10 & AGND) send an analog signal to control the blower speed. When any of the 4-20 mA options is selected for the Analog Outputs (Section 2.12.8), the output from the VFD/Blower terminals is disabled.

2.12.11 Interlock Terminals

The unit offers two interlock circuits for interfacing with Energy Management Systems and auxiliary equipment such as pumps or 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 2.12-2). Both interlocks, described below, are factory wired in the closed position.

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

2.12.11.1 Remote Intl'k Terminals

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).

2.12.11.2 Delayed Intl'k Terminals

The delayed interlock is typically used in Conjunction with the Auxiliary Relay Contacts described in Section 2.12.14. 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. The delayed interlock must be closed for the heater to fire. If the delayed interlock is connected to a proving device that requires time to close (make), a time delay (**Auxiliary Delay**) that holds the start sequence of the unit long enough for a proving switch to make (close) can be programmed.

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

2.12.12 FAULT RELAY Terminals

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. The Fault Relay connections are shown in Figure 2.12-2.

2.12.13 AUX RELAY Terminals

Each unit is equipped with a single pole double throw (SPDT) auxiliary relay that is energized when there is a demand for heat and de-energized after the demand for heat is satisfied. The relay is 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 2.12-2 to locate the AUX RELAY terminals (N.C., COM, & N.O.) for wiring connections.

2.13 Flue Gas Vent Installation

The *Innovation-Edge Venting and Combustion Air Design Guide* (TAG-0090, GF-5056) must be consulted before any flue or combustion air venting is designed or installed. The venting system shall be installed in accordance with the appliance manufacturer's installation instructions, and if applicable, the venting manufacturer's Installation instructions.

Suitable, U/L approved, positive pressure, watertight vent materials MUST be used for safety and UL certification. Because the unit is capable of discharging low temperature exhaust gases, the

flue must be pitched back towards the unit a minimum of 1/4" per foot (21 mm per m) to avoid any condensate pooling and to allow for proper drainage. In addition, you must add a bead of high temperature red silicon sealant (such as Permatex Hi-Temp Red RTV or Loctite Superflex Red High Temp RTV) between the exhaust manifold and the mating flange of the exhaust connector, as shown in Figure 2.13.

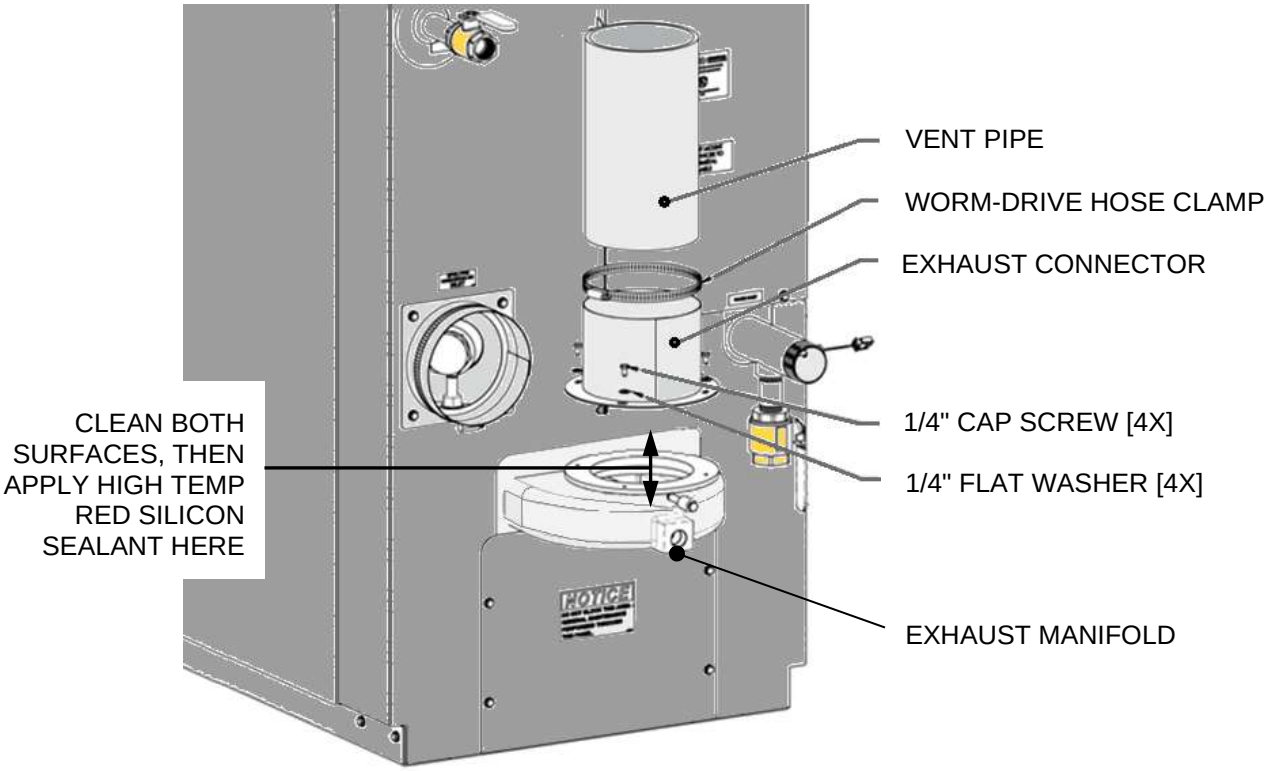


Figure 2.13. Exhaust Vent Connection

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 0.81" W.C. (201 Pa) with 6" (15.24 cm) piping**. 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 - 0.10" W.C. (-24.9 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.

For Massachusetts installations, the following companies provide vent systems which conform to all applicable requirements for installations within the Commonwealth of Massachusetts. Contact information is as follows:

Selkirk Corporation - Heatfab Division
130 Industrial Blvd.
Turners Falls, MA 01376
Phone: 1-800-772-0739
http://www.heatfab.com

Glover Sheet Metal, Inc.
44 Riverdale Ave.
Newton, MA 02485
Phone: (617) 527-8178
www.gloversheetmetal.com

Watertown Supply
33 Grove St.
Watertown, MA 02472
Phone: (617) 924-2840
http://www.watertownsupply.com/

Emerson Swan Co
Engineering Products Department
300 Pond St.
Randolph, MA 02368
Phone 781-986-2555
www.emersonswan.com

2.14 Combustion Air

The *Innovation-Edge Venting and Combustion Air Design Guide* (TAG-0090, GF-5056) must be consulted before any flue or 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 or other chemicals that can become hazardous when used in gas-fired equipment. Common sources of these compounds are swimming pools, degreasing compounds, plastic processing, and refrigerants. Whenever the environment contains these types of chemicals, combustion air ***MUST*** be supplied from a clean area outdoors for the protection and longevity of the equipment and warranty validation.

The more common methods of combustion air supply are outlined in the next two sections, below. For combustion air supply from ducting, see Section 2.15: *Ducted Combustion Air*, or consult the *Innovation-Edge Venting and Combustion Air Design Guide* (TAG-0090, GF-5056).

2.14.1 Combustion Air from Outside the Building

Air supplied from outside the building must be provided through two permanent openings. For each unit these two openings must have a free area of not less than one sq. in. (6.45 sq. cm) for each 4000 BTUs (1.172 kW) input of the equipment or 250 sq. in. (1613 sq. cm) of free area. The free area must must take into account restrictions such as louvers and bird screens.

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

2.14.2 Combustion Air from Inside the Building

When combustion air is provided from within the building, it must be supplied through two permanent openings in an interior wall. Each opening must have a free area of not less than one sq. in. (6.45 sq. cm) per 1000 BTU (0.293 kW) of total input or 1000 sq. in. (6,451 sq. cm) of free area. The free area must take into account any restrictions, such as louvers.

2.15 Ducted Combustion Air

See the *Innovation-Edge Venting and Combustion Air Design Guide* (TAG-0090, GF-5056).

The Innovation Water Heater is UL listed for 100%-ducted combustion air. For ducted combustion air installations, the inlet air ductwork must then be attached directly to the unit's air inlet.

In a ducted combustion air application, the combustion air ducting pressure losses must be considered when calculating the total maximum allowable venting run. When using the heater in a ducted combustion air configuration, each unit must have a minimum 6-inch (15.24 cm) diameter connection at the unit.

CHAPTER 3. OPERATION

3.1 Introduction

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

CAUTION!

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

WARNING!

Electrical voltages in this system include 110 or 220 and 24 volts ac. It must be serviced only by factory certified service technicians.

WARNING!

DO NOT ATTEMPT TO DRY FIRE THE UNIT. Starting the unit without a full water level can seriously damage the unit and may result in injury to personnel or property damage. This situation will void any warranty.

3.2 Edge Controller Description

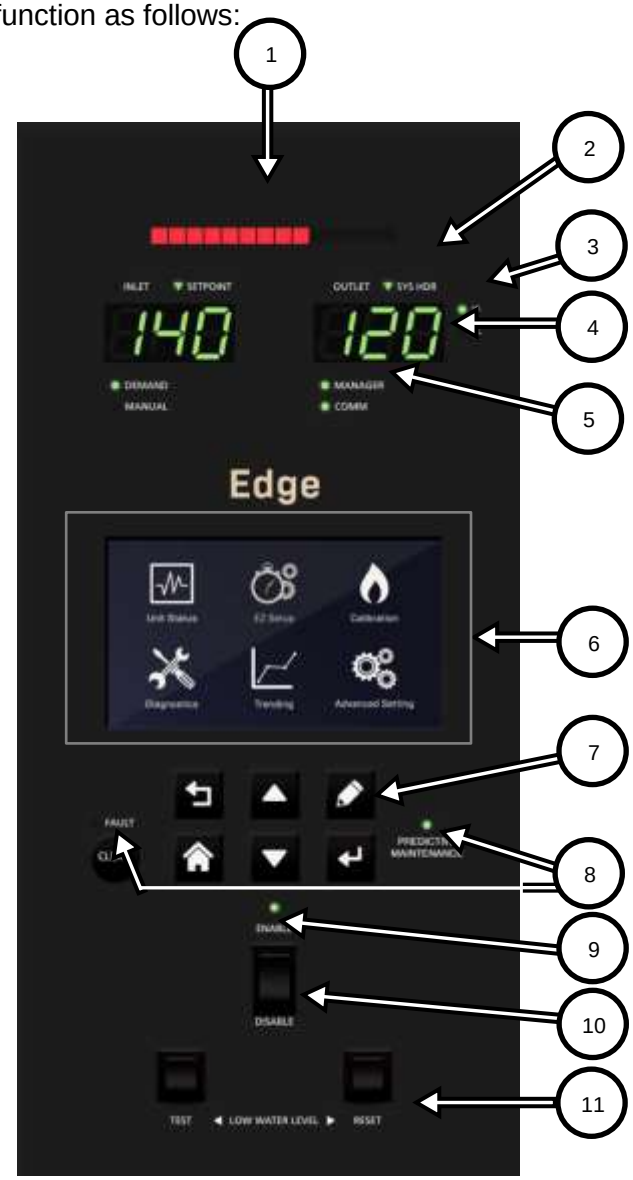
The Innovation's Edge Controller, shown in Figure 3.1, contains all the controls, indicators and displays necessary to operate, adjust and troubleshoot your Innovation Water Heater.

The Edge Controller contains a capacitive touchscreen, which is a highly sensitive device. It continuously checks for user interaction at a very high frequency.

Mechanical room environments are sometimes harsh, electromagnetically noisy and dirty, and can experience wide temperature ranges, and can be difficult for sensitive electronic components. Care should be taken to not damage the touchscreen or get any grease or pipe dough on the touchscreen.

Figure 3.2: Edge Controller Front Panel Layout

The Soft-Keys on the Controller's front face function as follows:



1	Multi-Function Bar, shows either: • Fire Rate • Valve Position
2	Parameter Indicator for both temperature read-outs: • LEFT: **Inlet temperature** or **Setpoint temperature** • RIGHT: **Outlet temperature** or **System Header temperature**
3	Temperature scale indicator: Fahrenheit or Celsius
4	Configurable temperature read-outs (2): • LEFT: **Inlet** or **Setpoint temperature** • RIGHT: **Outlet** or **System Header temperature**
5	Operation Mode Indicators (2): • LEFT: **Demand** or **Manual** • RIGHT: **Manager** (BST only), **COMM** when communicating
6	Edge Controller Touchscreen: see Section 1.8, below
7	Soft Keys: see table below
8	Nexa Indicator Light Fault Indicator Light
9	Ready Light
10	Enable/Disable Switch
11	Low Water Level Test buttons (2): • **TEST**: Initiates Low Water test • **RESET**: Resets unit after Low Water test

TABLE 3.2: Controller Front Panel Controls

Icon	Name	Description
	Previous	Takes you to the previous screen.
	Home	Takes you to the touchscreen's Main Menu (see Figure 1.2). If pressed during a procedure, it aborts the procedure.
	Up/Down	These buttons activate a selection box that can then be moved sequentially through the editable/selectable parameters starting from top left (not the title bar with home/previous icons) and moving right and then down as in reading a book.
	Edit	This button allows the editing of the parameter that is currently selected through use of up/down arrows.

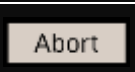
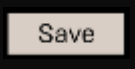
	Enter	This button allows you to finalize a selection (for instance, a selected from a menu or from a pop-up (for example, password entry input completion). Note, all alphanumeric data entry is entered in the touchscreen.
	Fault	A red light Indicates that the Controller is in a Fault condition.
	Clear	Clears a fault – the red Fault light goes out.

If the touchscreen becomes non-responsive at any time, simply press the **CLEAR** button; this resets the touchscreen and should clear the problem.

3.2.1 Touchscreen Button Functionality

Some of the same Soft-Key controls, as well as some additional controls, appear within the Controller's touchscreen. They function as follows:

TABLE 3.2.1: Touchscreen Controls

Icon	Name	Description
	Previous	Takes you to the previous screen.
	Home	Takes you to the touchscreen's Main Menu (see Figure 3.3). If pressed during a procedure, it aborts the procedure.
	Left Right	The **LEFT** arrow moves to previous point in the array or list and **RIGHT** arrow moves to next point in the array or list.
	Up/Down	The **UP** arrow increases a value, **DOWN** decreases value.
	Page Left Page Right	The arrows on left and right edges of the touchscreen scroll **Page Left** or **Page Right** in a round-robin sequence.
	Page Up Page Down	On screens with multiple pages, the **Page Up** and **Page Down** buttons moves up and down the pages.
	Abort	The **Abort** button appears when a process may need to be exited prior to completion.
	Next	Pressing **Next** takes you to the next screen in a multi-step procedure. Some procedures have a **Proceed** button instead.
	Save	1. Pressing **SAVE** on a pop-up screen saves the entered data and returns you to the previous screen. 2. Pressing **SAVE** on a non-popup screen saves the entered data and takes you to the next screen.
	Retry	Pressing **Retry** takes you to the previous screen and re-attempts the process step that caused the notification message to appear.
	Help	Takes you to a Help screen specific to the subject.

3.2.2 Logging In

The Edge Controller user interface is protected by password levels to prevent unauthorized use. The Level 1 password, which allows some basic setting changes, is **159**. Higher level passwords (appropriate for AERCO Trained Technicians), are distributed on an individual basis when after technicians have complete AERCO certified training.

Complete the instructions below to log in to the Edge Controller.

LOGGING IN Instructions

1. Go to the **Main Menu**, press **Advanced Setup**, then press the **Access** button. The **Enter Password** screen appears.

Figure 3.2.2: Enter Password Screen

2. Use the number keypad to enter the password (each number appears as a X), then press **Save**.
3. You are now directed to the Main Menu (see Figure 3.3) or returned to the last screen opened before the unit timed out. You have access to the functionality associated with your password level.

3.3 Menu Structure

The Main Menu give you access to all Edge Controller user functionality. There are four major divisions within the menu structure.

Figure 3.3: The Edge Controller Main Menu

3.3.1 Unit Status Menu

The Unit Status menu contains the following sections and parameters. Unlike other Edge menus, navigation starts at the **Unit Status** screen and proceeds from there by scrolling to the right.

Main Menu → Unit Status			
	Target Fire Rate	Read Only	The target Fire Rate (0% to 100%).
	Current Fire Rate	Read Only	The current Fire Rate (0% to 100%).
	Flame Strength	Read Only	The current Flame Strength (0% to 100%).
	Feed Forward	Read Only	The current Feed Forward temperature.
	Inlet Temp	Read Only	The current Inlet Water temperature
	Air Inlet	Read Only	The current Air Inlet temperature.
	Setpoint	Read Only	The unit's current Setpoint.
	Outlet	Read Only	The current Outlet temperature.
	Exhaust	Read Only	The current Exhaust temperature.
Main Menu → WHM Cascade Status			
	Avg Fire Rate	Read Only	The average Fire Rate (0% to 100%).
	Units Online	Read Only	The number of units in the WHM cascade online.
	Setpoint	Read Only	The WHM cascade's current Setpoint.
	Units Available	Read Only	The number of units in the WHM cascade.
	Avg Outlet	Read Only	The average outlet temperature.
	Units Firing	Read Only	The number of units in the WHM cascade firing.
Main Menu → Runtime Statistics			
	Average Cycles Per Hour	Read Only	The unit's average number of cycles per hour.
	Run Hours	Read Only	The number of hours the unit has run since startup.
	Cycle Count	Read Only	The number of cycles during unit run hours.
Main Menu → Unit Event History			
	Event	Read Only	Lists the unit's warning and fault events.
Main Menu → Plant Event History			
	Event	Read Only	Lists the plant's warning and fault events.

3.3.2 Calibration Menu

The Calibration menu contains the following sections and parameters:

Main Menu → Calibration → Combustion Calibration			
	NOx Requirement	Select	Select the unit's NOx requirement: **None**, **<= 20** or **<= 9 PPM**.
	Valve Position - Target	Read Only	The unit's target Valve Position.
	Valve Position - Reading	Read Only	The unit's actual Valve Position.
	Blower Voltage - Target	Read Only	Target blower voltage for current Valve Position.
	Blower Voltage - Reading	Read Only	The unit's actual blower voltage.
	O2% - Target	Read Only	The unit's target O_2% in the exhaust.
	O2% - Reading	Numeric Entry	The unit's actual O_2% in the exhaust.
	CO - Target	Read Only	The target CO amount in the exhaust, in ppm.
	CO - Reading	Numeric Entry	The actual CO amount in the exhaust, in ppm.
	NOx - Target	Read Only	The target NOx amount in the exhaust, in ppm
	NOx - Reading	Numeric Entry	The actual NOx amount in the exhaust, in ppm.
	Flame Strength - Reading	Numeric Entry	The unit's Flame Strength, from Multimeter
	Air Temperature - Reading	Read Only	The current air temperature.
	Downstream Gas pressure	Numeric Entry	Appears only when fire rate = 100%.
	Blower Voltage	Adjust	Adjust as needed to match targets to actual readings.

3.3.2.1 Main Menu → Calibration → Input/Output

Main Menu → Calibration → Input/Output → Temperature Sensors			
	Sensor	Select	Select: **Feed Forward**, **Exhaust**, **Outside Temp**, **Air Inlet**, **Lower Inlet**, **Outlet**.
	Offset	Numeric Entry	Optional offset applied to current Sensor
	Current Reading	Read Only	Current sensor's current reading. (Flow In Adj & Flow Rate removed) .
Main Menu → Calibration → Input/Output → Analog Inputs			
	Analog Name	Select	Select: **Flow** or **Remote Analog In**.
	Offset	Numeric Entry	A correction value to selected input, if needed.
	Current Reading	Read Only	Current reading of selected input.
Main Menu → Calibration → Input/Output → Analog Outputs			
	Analog Name	Read Only	The name **Analog Output**.
	Level	Numeric Entry	Set the output's level (0.00 to 20.00 mA)
	Offset	Numeric Entry	A correction value to the analog output, if needed (-2.00 to 2.00).
	Feedback	Read Only	Displays feedback from **Analog Output**.

3.3.2.2 Main Menu → Calibration → Subsystems

Main Menu → Calibration → Subsystems → Air Fuel Valve			
	Valve Position	Manual Adjust	Set to desired Valve Position.
	A/F Sensitivity	Numeric Entry	Set Air/Fuel Valve sensitivity (1% to 5%)
Main Menu → Calibration → Subsystems → Spark Monitor			
	Spark Monitor	Enabled/Disabled	Enables/Disables the Spark Monitor.
	Min Spark	Numeric Entry	Minimum spark. (0.00 to 0.29 amps)

	Max Spark	Numeric Entry	Maximum spark. (0.30 to 2.50 amps)

3.3.2.3 Main Menu → Calibration → Combustion Summary

Main Menu → Calibration → Combustion Summary			
	Valve Position	Read Only	Displays combustion calibration valve steps.
	O2	Read Only	Displays combustion calibration O2 results.
	NOx	Read Only	Displays combustion calibration NOx results.
	CO	Read Only	Displays combustion calibration CO results.
	Flame Strength	Read Only	Displays combustion calibration flame strength.

3.3.3 Diagnostics Menu

The Diagnostics menu contains the following sections:

3.3.3.1 Main Menu → Diagnostics → Manual Run

Main Menu → Diagnostics → Manual Run			
	Manual Mode	Enable/Disable	Enables/disables running in Manual Mode.
	Fire Rate	Adjust	Manual fire rate adjustment, 0 to 100%
	Flame Strength	Read Only	The flame strength sensed in the burner, 0 to 100%

3.3.3.2 Main Menu → Diagnostics → Front Panel

Main Menu → Diagnostics → Front Panel			
	Touchscreen Display Test	On/Off	Starts the Touchscreen Display Test.
	Touchscreen Test	On/Off	Starts the Touchscreen Test.
	Status Light Test	On/Off	Starts the Status Light Test.
	Keypad and Switch Test	On/Off	Starts the Keypad and Switch Test.

3.3.3.3 Main Menu → Diagnostics → Analog Outputs And Relays

Main Menu → Diagnostics → Analog Outputs and Relays → Relays			
	Ignition Relay	Enable/Disable	Enables/Disables the Ignition Relay.
	Blower Relay	Enable/Disable	Enables/Disables the Blower Relay.
	Pump Relay	Enable/Disable	Enables/Disables the Pump Relay.
	Aux Relay	Enable/Disable	Enables/Disables the Aux Relay.
	Fault Relay	Enable/Disable	Enables/Disables the Fault Relay.
Main Menu → Diagnostics → Analog Outputs and Relays → Analog Outputs			
	Valve	Read/Adjust	Adjustable display of the A/F valve Position.
	Blower	Read/Adjust	Adjustable display of the Blower.

3.3.3.4 Main Menu → Diagnostics → Subsystems

Main Menu → Diagnostics → Subsystems → Air Fuel Valve Stepper Motor			
	Auto Stroke	Toggle	Initiates A/F cycle, 0 to 100 to 0%
	Valve Position In	Adjust	Manual adjustment of A/F Valve 0 to 100%.
Main Menu → Diagnostics → Subsystems → Blower			
	Profile	Select	Select the profile to run (default = **Profile 1**).
	Profile Run	Enable/Disable	Enables running the selected profile.
	Blower	Numeric Entry	Manually adjust the Blower's voltage.
Main Menu → Diagnostics → Subsystems → Ignition			
	Ignition Spark	Enable/Disable	Enables testing the unit's ignition spark.
	Spark Current	Read Only	The current Spark Current.

3.3.3.5 Main Menu → Diagnostics → System

Main Menu → Diagnostics → System → Pre-Start Up			
	Pre-Start Up Mode	Enable/Disable	Enables Pre-Start Up Mode, a test of various system components without firing the unit.
	Valve Position Out	Read Only	The current A/F valve position.
	Blower (voltage)	Read Only	The current Blower voltage.
	Blower (RPM)	Read Only	The current Blower RPM.
	Spark Current	Read Only	The current Spark Current.
Main Menu → Diagnostics → System → Versions			
	Serial Number	Read Only	The unit's serial number.
	Software Version	Read Only	The Controller's software version.
	Graphic Data Version	Read Only	The Controller's graphic version.
	Display Version	Read Only	The Controller's display version.
	I/O Board Version	Read Only	The I/O board version.
	Touch Version	Read Only	The touch screen version.
	Bluetooth Version	Read Only	The Bluetooth version.
	Framework Version	Read Only	The Framework version.
	Bootloader version	Read Only	The Bootloader version.
	Display BL Version	Read Only	Display Bootloader version.
	I/O PCB BL Version	Read Only	I/O Board PCB Bootloader version.

3.3.3.6 Main Menu → Diagnostics → Comm & Network

Main Menu → Diagnostics → Comm & Network → IP Network			
	Unit IP Address	Read Only	The unit's IP address.
	Subnet Mask	Read Only	The unit's subnet mask address.
	Gateway IP Address	Read Only	The unit's gateway IP address.
	DSN 1	Read Only	The unit's DSN 1 address.
	DSN 2	Read Only	The unit's DSN 2 address.
	Unit MAC Address	Read Only	The unit's MAC address.
	Network Status	Read Only	The unit's current network status.
Main Menu → Diagnostics → Comm & Network → BAS			

	BAS	Read Only	The Building Automation System protocol.
	Communication Address	Read Only	The unit's BAS address.
	Device Instance	Read Only	The unit's Device Instance within BAS.
	Unit IP Address	Read Only	The unit's IP address on the network.
	Unit MAC Address	Read Only	The unit's MAC address within BAS.
	Last Command Received	Read Only	The last command received by the unit.
	BAS IP	Read Only	If Security is enabled, this is the IP of the BAS system that the unit can only communicate with.
	Network Status	Read Only	The unit's BAS network's current status.
Main Menu → Diagnostics → Comm & Network → Nexa			
	Unit IP Address	Read Only	The unit's IP address.
	Upload Time	Read Only	Frequency at which the unit transmits data to Nexa.
	Test Setup	Enable	Initiates test of Nexa functionality.
	Test Heartbeat	Enable	Initiates test of the Nexa heartbeat.
Main Menu → Diagnostics → Comm & Network → USB Storage			
	Status	Read Only	Status of the USB device.
	Serial Number	Read Only	The serial number of the USB device.
	Size	Read Only	The size of the USB device.
	Available Space	Read Only	The amount of free space on the USB device.

3.3.3.7 Main Menu → Diagnostics → Input/Output Summary

Main Menu → Diagnostics → Input/Output Summary			
	Air Inlet	Read Only	Displays the current air inlet temperature.
	Exhaust	Read Only	Displays the current exhaust temperature.
	Outlet	Read Only	Displays the current outlet water temperature.
	Lower Inlet	Read Only	Displays the current lower inlet temperature.
	Feed Forward	Read Only	Displays the current Feed Forward temperature.
	Blower	Read Only	Displays the current Blower voltage.
	Remote Ain	Read Only	Displays the value of Remote Analog In.
	Cascade Valve	Read Only	Displays the state of the Cascade Valve.
	Cascade Vlv Fdbk	Read Only	Displays the Cascade Valve feedback.
	Outside Temp	Read Only	Not in use.

3.3.4 Advanced Setup Main

The Advanced Setup menu contains the following sections:

Main Menu → Advanced Setup → Access		
Password	Numeric Entry	Enter **159** or your password, then press **Save**.

3.3.4.1 Main Menu → Advanced Setup → Unit

Main Menu → Advanced Setup → Unit → Unit Settings		
Unit Serial #	Entry	The unit's factory-set serial number. Do ***NOT*** change except when replacing the Controller.
Unit Type	Enter	Displays unit's product and model. Do ***NOT*** change except when replacing the Controller.
Unit Size	Select	Displays the unit's sizes. Do ***NOT*** change except when replacing the Edge Controller.
Date	Numeric Entry	Allows you to set the current date.
Time Format	Toggle	Choose the **12 Hour** or **24-Hour** time format.
Time	Numeric Entry	Allows you to set the current time.
Vent Type	Select	Choose the vent material: PVC, cPVC, Polypro, Stainless Steel.
Exhaust Safety	Enable/Disable	Depending on exhaust temperature and value of Vent Type, triggers an exhaust temperature warning, reduced fire rate or unit shutoff.
Fuel Type	Toggle	Choose **Natural Gas, Propane or Butane**
Control Type	Read Only	Displays the controller type: Edge [i].
Language	Select	Choose the language of the Controller's display: **English**, **Spanish**, **French**.
Unit of Measurement	Toggle	Choose unit of measure: **Metric** or **English**.
Temperature Sensor	Read Only	Displays the sensor type in use: **Balco**.
Standby Pump On Time	Numeric Entry	The amount of time internal recirculation pump runs when unit is in standby. Pump has a continual operation.
Standby Pump Off Time	Numeric Entry	The amount of time internal recirculation pump is disabled during unit standby. Pump is continually cycled during standby (0 to 30 min.).
Post-Fire Pump Time	Numeric Entry	The amount of time internal recirculation pump runs after unit has entered standby mode (0 to 30 min.).
Beeper	Toggle	Enables/disables the audible fault alarm.
Run Cycles	Numeric Entry	Displays number of run cycles since last system reset. Can be reset to 0 or any number.
Run Hours	Numeric Entry	Displays the number of run hours since the last system reset. Can be reset to 0 or any number.
Reset All Settings	Select Yes/No	Press **Yes** to restore all settings to default values.
Clear Fault Log	Select Yes/No	Press **Yes** to clear the Unit Event History.
Main Menu → Advanced Setup → Unit → Front Panel Configuration		
Upper Left Display	Select	Choose **Setpoint** or **Water Inlet**.
Upper Right Display	Select	Choose **Water Outlet** or **System Header**.
Multi-Function Bar	Select	Choose the Multi-Function Bar display: **Fire Rate** or **Valve Position**.
Brightness	Numeric Entry	Adjusts Touchscreen brightness.
Screensaver Password	Enable/Disable	If set to **Enabled**, all access to the Controller requires a Password.
Screen Timeout Minutes	Numeric Entry	Specifies touchscreen timeout in minutes (**Screensaver Password** = **Enabled**).
Screen Timeout Now	Toggle	Choose **Yes** to put Controller into sleep mode. (**Screensaver Password** = **Enabled**).

Main Menu → Advanced Setup → Unit → Settings Transfer			
	Restore All Settings	Select	Restores all settings to the factory default.
	Restore Common Settings	Select	Restores common settings to the factory default.
	Save All Settings	Select	Saves all settings to USB or onboard memory.
Main Menu → Advanced Setup → Unit → Fault Management			
	Power Reset	Toggle	Choose if power fault reset mode, **Manual** or **Automatic**.
	Water Temp Reset	Toggle	Choose water temperature fault reset mode, **Manual** or **Automatic**.
	Gas Pressure Reset	Toggle	Choose if gas pressure fault reset mode, **Manual** or **Automatic**.
Main Menu → Advanced Setup → Unit → Freeze Protection			
	Freeze Protection	Enable/Disable	Enables/disables Freeze Protection functionality.
	Pump On Temperature	Numeric Entry	If enabled, ambient temperature below this value triggers the system pump to start (20 to 245°F **, Freeze Protection** = **Enabled**).
	Unit On Temperature	Numeric Entry	Ambient temperature below this value triggers the unit to fire (20 to 245°F **, Freeze Protection** = **Enabled**).
	Stop Temperature	Numeric Entry	Ambient temperature above this value returns system to normal operation (20 to 245°F**, Freeze Protection** = **Enabled**).
Main Menu → Advanced Setup → Unit → Unit Application Configuration			
	Unit Application	Select	Select unit's application: **DHW**
	Operating Mode	Toggle	Choose either **Constant** or **Remote Setpoint**.
	Setpoint	Numeric Entry	Sets the unit's setpoint (**Operating Mode = Constant Setpoint**).
	Setpoint Low Limit	Numeric Entry	Sets the minimum setpoint.
	Setpoint High Limit	Numeric Entry	Sets the maximum setpoint.
	Remote Signal	Select	Select the source of the (**Operating Mode = Remote Setpoint**).
	Unit Address	Toggle	Specifies the unit's Modbus address (**Operating Mode = Remote Setpoint, Remote Signal = Network)**).
	Cascade Baud Rate	Numeric Entry	Specifies Modbus baud rate (**Operating Mode = Remote Setpoint**, **Remote Signal = Network**).
Main Menu → Advanced Setup → Unit → Maintenance			
	12 Month Maintenance Complete?	Yes/No	Specifies 12 Month Maintenance completed.
	Fire Side Inspection	Yes/No	Specifies Fire Side Inspection completed.
	Optical Burner Inspection	Yes/No	Specifies Optical Burner Inspection completed
	Water Side Inspection	Yes/No	Specifies Water Side Inspection completed.
	CSD-1 Safety Device Inspection	Yes/No	Specifies CSD-1 Safety Device inspection completed.
	Combustion Calibration Check	Yes/No	Specifies Combustion Calibration Check completed.

3.3.4.2 Main Menu → Advanced Setup → WHM Cascade

Main Menu → Advanced Setup → WHM Cascade → Cascade Configuration			
	WHM Unit Mode	Select	Specifies Unit Mode: **Off**, **WHM Client** or **WHM Manager**.
	Auto-Manager Transfer	Enable/Disable	Allows WHM Manger functionality to be transferred to another unit if the WHM Manger malfunctions (**WHM Unit Mode** = **WHM Manager**).
	Auto-Manager Timer	Numeric Entry	Specifies duration of WHM Manger malfunction that triggers **Auto-Manager Transfer** (10 to 120, **WHM Unit Mode** = **WHM Manager**).

	Auto-Manager Addr	Read Only	The address of the WHM Manger (0 to 16, **WHM Unit Mode** = **WHM Manager**).
	Backup Manager Addr	Numeric Entry	The address of the unit designated as the Backup WHM Manger (0 to 16) (**WHM Unit Mode** = **WHM Manager**).
Main Menu → Advanced Setup → WHM Cascade → Cascade Communication			
	Unit Address	Numeric Entry	The unit's address in the WHM cascade.
	Min Address	Numeric Entry	The minimum address in the WHM cascade (1 to 16, **WHM Unit Mode** = **WHM Manager**).
	Max Address	Numeric Entry	The maximum address in the WHM cascade (1 to 16, **WHM Unit Mode** = **WHM Manager**).
	Cascade Baud Rate	Select	The communication baud rate in the cascade.
	Network Timeout	Numeric Entry	The timeout before a Modbus Fault is declared (5 to 999 sec.).
	Error Threshold	Numeric Entry	The number of Modbus Comm errors allowed before invoking a Modbus comm fault (1 to 9).
	Comm Error 1-8	Read Only	The number of comm errors on ports 1 - 8.
	Comm Error 9-16	Read Only	The number of comm errors on ports 9 – 16.
	SSD Address	Numeric Entry	The Client/Client Device address (0 to 250).
	SSD Temp Format	Toggle	Choose either **Points** or **Degrees** (**WHM Unit Mode** = **WHM Manager**).
	Unit/Plant Failsafe Mode	Toggle	The unit or plant's operating mode if communication is lost: **Shutdown** or **Constant Setpoint**.
	Unit/Plant Failsafe Setpoint	Numeric Entry	The unit or plant's setpoint if communication is lost (**Unit Failsafe Mode** = **Constant Setpoint**).
	Time & Date Sync	Enable/Disable	If Enabled, all Client units in the Cascade will synchronize time and date with the WHM Manager (**WHM Unit Mode** = **WHM Manager**).
	WHM Min Units	Numeric Entry	The minimum number of units in the WHM cascade (1 to 16, **WHM Unit Mode** = **WHM Manager**).
	WHM Max Units	Numeric Entry	The maximum number of units in the WHM cascade (1 to 16, **WHM Unit Mode** = **WHM Manager**).
	WHM On Timeout	Numeric Entry	Specifies the time the WHM Manager must wait for a backup Client unit to turn on (15 – 300, **WHM Unit Mode** = **WHM Manager**).
Main Menu → Advanced Setup → WHM Cascade → WHM Application Configuration			
	Application	Read Only	The WHM Cascade's application: **DHW**.
	Operating Mode	Read Only	The WHM Cascade's operating mode, **Constant Setpoint**.
	WHM Setpoint	Numeric Entry	The WHM Cascade's Setpoint (**Operating Mode** = **Constant Setpoint**).
Main Menu → Advanced Setup → WHM Cascade → Operating Controls			
	Main Menu → Advanced Setup → WHM Cascade → Operating Controls → *Sequencing Controls*		
	Low Flow Threshold	Numeric Entry	Specifies the valve position below which the plant enters this mode (10% to 35%).
	Next On Valve Pos	Numeric Entry	The valve position that triggers the next unit to come on line (16% to 100%).
	Next Off Valve Pos	Numeric Entry	The valve position that triggers the next unit to go off line (16% to 100%).
	WHM Max Units	Numeric Entry	The maximum number of units that will fire (1 to 16, **WHM Unit Mode** = **WHM Manager**).
	Valve Close Delay	Numeric Entry	The time an open Isolation Valve will remain open once a unit cycles off (0 to 15 min., **WHM Unit Mode** = **WHM Manager**).
	Main Menu → Advanced Setup → WHM Cascade → Operating Controls → *Anti-Cycling Control*		
	On Delay	Enter	Minimum length of time a unit must stay off after shutting down/going standby (30 to 300 sec.).
	WHM Off Delay	Numeric Entry	Specifies the amount of time full shut down will be delayed (30 to 300 sec).

	Shutoff Delay Temp	Numeric Entry	The temperature above setpoint the unit may rise to during delay shutdown (0°F to 25°F).
Main Menu → Advanced Setup → WHM Cascade → Operating Controls → *Valve Configuration*			
	Select Output	Read Only	Displays **Standard Setup**.
	Output Signal Type	Toggle	Select the output signal type of the selected output: **Current** or **Voltage**.
	Control Mode	Read Only	Displays **On/Off**.
	Valve Feedback	Enable/Disable	Choose **Enabled** or **Disabled**.
	Valve Feedback Status	Read Only	Displays the selected valve's current status (**Valve Feedback** = **Enabled**).
Main Menu → Advanced Setup → WHM Cascade → Operating Controls → *Lead/Lag*			
	Lead/Lag Setting	Select	Select: **Run Hours**, **Unit Size** or **Select Lead Lag**.
	Hours	Numeric Entry	The number of hours after which the Lead unit is rotated (25 – 225 hours, **Lead/Lag Setting** = **Run Hours**).
	Lead Unit	Numeric Entry	Specify the address of the Lead unit (0 to 16, (**Lead/Lag Setting** = **Select Lead Lag**).
	Lag Unit	Numeric Entry	Specify the address of the Lag unit (0 to 16, **Lead/Lag Setting** = **Select Lead Lag**).

3.3.4.3 Main Menu → Advanced Setup → Com & Network

Main Menu → Advanced Setup → Comm & Network → BAS			
	BAS	Select	To enable communication with a BAS, select **Off, BACnet IP** or Modbus **TCP**.
	Communication Address	Numeric Entry	Specify the network address of the Edge Controller on the BAS network (0 – 127)
	Node Offset	Numeric Entry	The starting address range for AERCO units (for BACnet IP only).
	Device Instance	Read Only	The unit's Device Instance within BAS (for BACnet IP only).
	Port Number	Numeric Entry	Specify the BAS port to which the unit will communicate. (Range: 47808 to 47823) (for BACnet IP only).
	Local IP Address	Read Only	Displays the local IP address of the Edge Controller.
	Status	Read Only	Displays the status of BAS communications.
	BAS Comm Timeout	Numeric Entry	Specifies the period for BAS Communication timeout (1-10 min)
	BAS Temp Format	Toggle	Choose: **Fahrenheit** or **Celsius**
	Security	Enable/Disable	Set to **Enabled** to enable BAS security
	BAS IP	Numeric Entry	Specifies the IP address of the BAS server (appears if **Security** = **Enabled**).
	BAC MAC	Numeric Entry	Specifies the MAC address of the BAS server (appears if **Security** = **Enabled**).
Main Menu → Advanced Setup → Comm & Network → Nexa			
	Nexa Mode	Select	To enable Nexa, select the communication method: **Ethernet**, **Wi-Fi** or **Wiznet** (for units where the Edge Controller replaced a C-More. Nexa is NOT compatible with a C-More controller).
	Unit Upload Time	Numeric Entry	Determines how frequently unit data is uploaded to the server (30 to 9999 sec.).
	Cascade Upload Time	Numeric Entry	Determines how cascade data is uploaded to the server (60 to 9999 sec.).
	Status	Read Only	The communication interface status.
Main Menu → Advanced Setup → Comm & Network → Ethernet			
	DHCP	Enable/Disable	Enables/disables DHCP (Dynamic Host Configuration Protocol).
	IP Address	Numeric Entry	The static IP address of the unit (**DHCP** = **Disabled**).

	Subnet	Numeric Entry	The subnet address of the network (**DHCP** = **Disabled**).
	Gateway	Numeric Entry	The IP address of the Gateway (**DHCP** = **Disabled**).
	DNS1	Numeric Entry	The IP address of DNS Server 1 (**DHCP** = **Disabled**).
	DNS2	Numeric Entry	(The IP address of DNS Server 2 **DHCP** = **Disabled**).
	ICMP PING	Enable/Disable	Allows the unit to be pinged.
Main Menu → Advanced Setup → Comm & Network → Communication Failsafe			
	Unit Failsafe Mode	Toggle	Choose how the unit will operate when either the Manager communication or a Remote Signal is lost: **Constant Setpt** or **Shutdown**.
	Unit Failsafe Setpoint	Numeric Entry	The unit's default setpoint when communication fails (60 to 150°F, **Unit Failsafe Mode** = **Constant Setpt**).

3.3.4.4 Main Menu → Advanced Setup → Ancillary Devices

Main Menu → Advanced Setup → Ancillary Device → Interlocks			
	Remote Interlock Name	Select	Choose the Remote Interlock: **Flow**, **Damper**, **Louver**, **Other**.
	Remote Interlock Use	Read Only	Displays what will shut down if the selected Remote Interlock is open: **Unit Shutdown**.
	Delayed Interlock Name	Select	Choose the Delayed Interlock: **Valve 1**, **Valve 2**, **Louver 1** or **Louver 2**.
	Auxiliary Delay	Numeric Entry	Select the Delayed Interlock's delay (0 to 240 sec.).

3.3.4.5 Main Menu → Advanced Setup → Performance

Main Menu → Advanced Setup → Performance → Temperature Control			
	Main Menu → Advanced Setup → Performance → Temperature Control → *PID Setting*		
		Proportional Band	Numeric Entry	Generates a fire rate based on the error that exists between the setpoint and the actual outlet temperature. If the error is less than Proportional Band, fire rate will be less than 100%. If the error is equal to or greater than proportional band, the fire rate will = 100% (1°F to 120°F).
		Integral Band	Numeric Entry	Specifies the fraction of the output, due to setpoint error, to add or subtract from the output each minute to move towards the setpoint. (0.00 to 5.00)
		Derivative Band	Numeric Entry	Specifies the time that this action advances the output; it responds to the rate of change of the setpoint error (0.00 to 2.00 min.).
		Warm-up Prop Band	Numeric Entry	These three parameters eliminate Temperature Overshoots during the "Warmup" period of a cold ignition cycle by temporarily modifying the PID Gain parameter during warmup.
		Warm-up Integral Band	Numeric Entry	
		Warm-up Derivative Band	Numeric Entry	
		Restore Defaults	Yes/No	Choose **Yes** to reset all parameters to the factory default.
	Main Menu → Advanced Setup → Performance → Temperature Control → *Temperature Conformance*			
		Deadband High	Numeric Entry	These two settings create an "outlet temperature zone" (between Active Setpoint + Deadband High and Active Setpoint – Deadband Low) in which no Valve Position corrections are attempted. (0 to 25°F for both)
		Deadband Low	Numeric Entry	
		Temperature High Limit	Numeric Entry	The unit's maximum allowable working temperature. If the unit reaches this limit, it will fault and shut down (40 to 210 °F).
	Main Menu → Advanced Setup → Performance → Temperature Control → *Setpoint Range*			
		Setpoint Low Limit	Numeric Entry	Determines the upper and lower limit within which the setpoint can vary.
		Setpoint High Limit	Numeric Entry	

Setpoint Limiting	Enable/Disable	Enables/disables Setpoint Limiting functionality.
Setpoint Limit Band	Numeric Entry	Sets the number of °F *below* **Setpoint High Limit** the unit's outlet temperature must fall before the unit restarts (0 to 10°F, **Setpoint Limiting** = **Enable**).
Setback Schedule	Enable/Disable	Enables/disables Setback Schedule functionality
Setback Setpoint	Numeric Entry	The Setpoint that will be in effect during the Setback period. (60°F to 245°F, **Setback Schedule** = **Enabled**).
Setback Start Time	Numeric Entry	The **Setback** period's ***start*** time (**Setback Schedule** = **Enable**).
Setback Stop Time	Numeric Entry	The **Setback** period's ***end*** time (**Setback Schedule** = **Enable**).
Main Menu → Advanced Setup → Performance → Temperature Control → *FFWD Settings*		
FFWD Temp	Read Only	Displays the current FFWD temperature.
PID Output	Read Only	Displays the calculated PID output.
FFWD Output	Read Only	Displays the current FFWD output.
Min Load Adj	Numeric Entry	Adjusts the output by adding an offset to the breakpoint chart at minimum flow. This is used to fine tune Feed-Forward (FFWD) output at low flow levels. (-50 - + 50°F)
Max Load Adj	Numeric Entry	Adjusts the output by changing the scaling of the breakpoint chart at maximum flow. (-50 - +50°F)
Outlet Feedback	Yes/No	Enables Outlet Feedback functionality.
Feedback Gain	Numeric Entry	The percentage of feedback from the water outlet sensor the algorithm factors to determine fire rate (0.01 – 1.00).
Fdback Start Pos	Numeric Entry	The Feedback start position (0 – 100%).
Fdback End Pos	Numeric Entry	The Feedback end position (0 – 100%).
Max Feedback	Numeric Entry	Specifies the maximum Feedback position (0 – 100%).
Fdback Value	Read Only	Displays the current feedback value.
Breakpt at 100 to Breakpt at 0	Numeric Entry	Allows breakpoint temperature settings to be entered for 100% to 0% in 10% increments (60 – 260°F).
Temp Gov	Enable/Disable	Enables temperature governor limiting functionality, which aggressively reduces the effective Fire Rate as the Outlet Temperature approaches the High Temperature Limit.
GOV Limit-5 – GOV Limit-15	Numeric Entry	When the Outlet Temperature exceeds the **Temperature Hi Limit** by 5 to 15°F, the effective Fire Rate will be reduced by the value entered in GOV Limit-5 through GOV Limit-15 (0 – 100°F).
Above 70F Val	Numeric Entry	If the inlet water temp is above 70°F, an algorithm adds an offset provided by this item to all 11 breakpoints ("breakpoint at 100" – "breakpoint at 0"), (-10 - +10°F).
Below 70F Val	Numeric Entry	If the inlet water temp is below 70F, algorithm adds offset provided by this item to all the 11 breakpoints ("breakpoint at 100" – "breakpoint at 0"), (-10 - +10°F).
No FFWD Above FR	Read Only	No Feed Forward above this fire rate.
No FFWD Feature	Read Only	No Feed Forward above fire rate feature status.
Menu → Advanced Setup → Performance → Fire Control		
Main Menu → Advanced Setup → Performance → Fire Control → *Purge Control*		
Purge Blower Voltage	Numeric Entry	Sets the blower speed (blower output voltage) during the Purge cycle (2.0 to 10.0 V).
Purge Timer	Numeric Entry	Allows adjustment of the pre-ignition purge time (5 to 60 sec.).
Post Purge Timer	Numeric Entry	Allows adjustment of the post purge time before the unit shuts down (0 to 60 sec.).
Main Menu → Advanced Setup → Performance → Fire Control → *Ignition Control*		

Ignition Position	Numeric Entry	Sets the air fuel valve position at which the unit will operate during the ignition sequence (5% to 60%).
Ignition Blower Voltage	Read Only	Displays the actual blower voltage during ignition.
Ignition Voltage Offset	Numeric Entry	Allows an adjustment to the blower voltage during ignition (-5.00 to 5.00).
Low Fire Timer	Numeric Entry	Specifies how long to remain in the low fire position after ignition, before going to the desired output (2 to 600 sec.).
Ignition Hold Timer	Numeric Entry	Sets the length of time the unit stays in ignition position (0 to 60 sec.).
IGN Time Setting	Read Only	Displays the maximum time between confirmation of gas valve opening (POC) and a stable flame detected.
Main Menu → Advanced Setup → Performance → Fire Control → *Operating Control*		
Start Valve Position	Numeric Entry	Specifies the valve position at Start Level (0 to 40%).
Stop Valve Position	Numeric Entry	Specifies the valve position at Stop Level (0 to 40%).
Max Valve Position	Numeric Entry	The maximum valve position for unit (40 to 100%).
Standby Blower Voltage	Numeric Entry	Specifies the blower voltage in Standby Mode, during which the blower motor remains "ON" at low speed, to limit power cycles. AERCO recommends keeping the default, however, may set this between **2.00** and **0** volts on individually vented units in positive pressure mechanical rooms to compensate (0.0 to 10.0V).
Air Compensation	Enable/Disabled	**Innovation Only!**
Vlv Position Change Rate	Numeric Entry	Defines the rate at which the **valve position** will progress from one step to the next (0.5 to 60 sec.).
Skip Range Cntr	Numeric Entry	Together, these 3 parameters define an optional Fire Rate the Controller will skip-over (**Skip Range Cntr** = center of the range). These can be used to reduce objectionable noise at a certain Fire Rate, if there is no other remedy.
Skip Range Span	Numeric Entry	
Skip Speed	Numeric Entry	
Main Menu → Advanced Setup → Performance → Fire Control → *Anti-Cycling Control*		
On Delay	Numeric Entry	Sets the minimum time a unit must stay ***off*** after shutting down or going into standby (0 to 600 sec.).
Shutoff Delay Temp	Numeric Entry	Specifies the number of degrees above setpoint that the outlet temperature can rise without triggering a unit shut down (0°F to 25°F).

3.4 Start Sequence

When the Edge Controller's Enable/Disable switch is set to the **Enable** position, it checks all pre-purge safety switches to ensure they are closed. These switches include:

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

NOTE: The **Blocked Inlet** and downstream **Blower Proof** switches are ***not*** checked prior to starting the pre-purge.

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

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

NOTE: If any of the Pre-Purge safety device switches are open, the appropriate fault message will be displayed. Also, if the required conditions are not observed at any point during the start sequence, appropriate messages will be displayed and the unit will go into fault mode.

START SEQUENCE Instructions

1. The **DEMAND** LED status indicator will light.
2. The unit checks to ensure that the **Proof of Closure** (POC) switch in the downstream Safety Shut-Off Valve (SSOV) is closed. See Figure 3.4-1 for SSOV location.

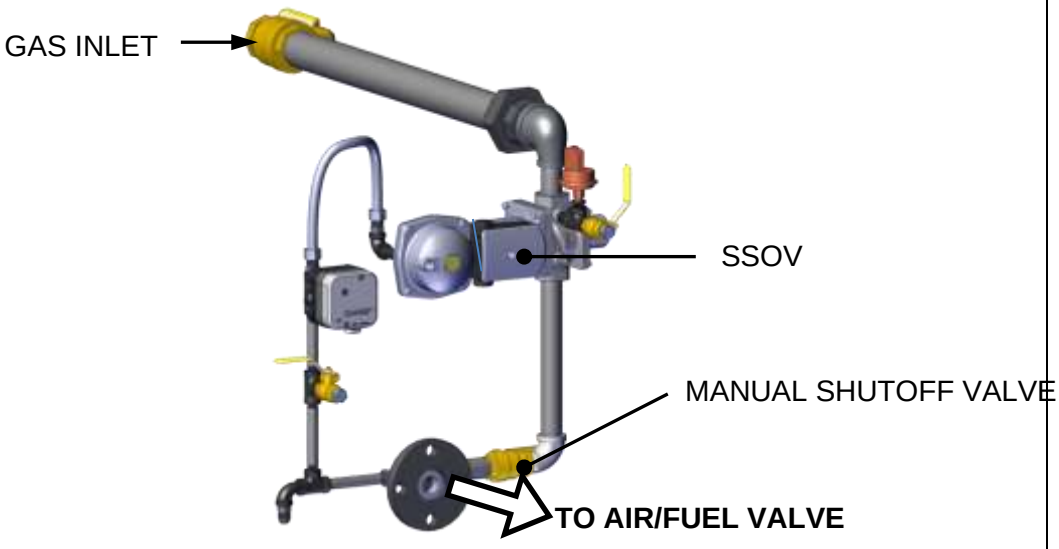


Figure 3.4-1: SSOV Location (INN 600N–INN 1060N Gas Train shown)

3. With all required safety device switches closed a purge cycle initiates and:
   a. The Blower relay energizes and turns on the blower.
   b. The Air/Fuel Valve rotates to the full-open purge position and closes purge position switch. The dial on the Air/Fuel Valve (Figure 3.4-2) will read **100** to indicate that it is full-open (100%).
   c. The **VALVE POSITION** bar graph will show 100%.

START SEQUENCE Instructions

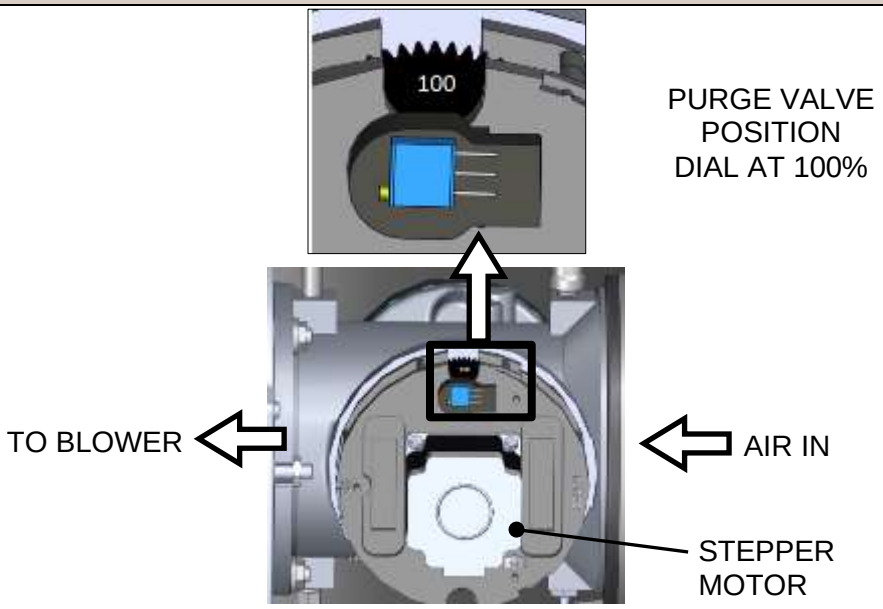


Figure 3.4-2: Air/Fuel Valve in Purge Position

4. Next, the **Blower Proof** switch on the Air/Fuel Valve (Figure 3.4-3) closes. The display will show ***Purging*** and indicate the elapsed time of the purge cycle in seconds.

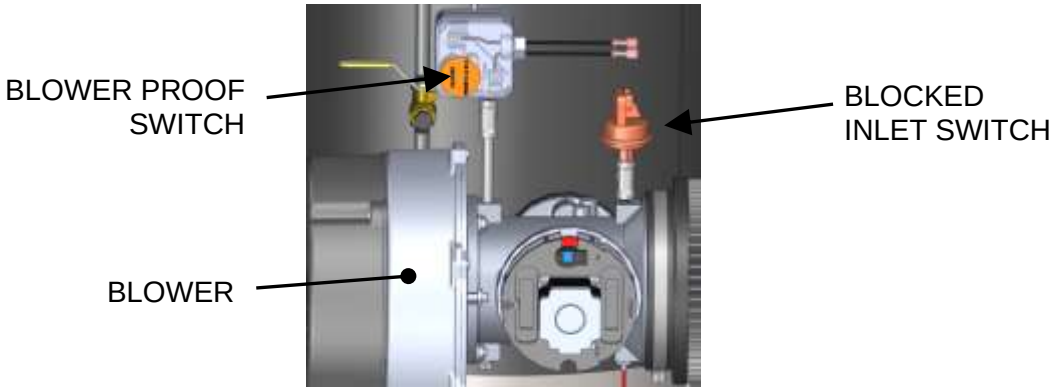


Figure 3.4-3: Blower Proof Switch

5. Upon completion of the purge cycle, the Edge Controller initiates an ignition cycle and the following events occur:
   a. The Air/Fuel Valve rotates to the low-fire ignition position and closes the **Ignition** switch. The dial on the Air/Fuel Valve will read between **25** and **35** (Figure 3.4-4) to indicate that the valve is in the low-fire position.
   b. The gas Safety Shut-Off Valve (SSOV) is energized (opened) allowing gas to flow into the Air/Fuel Valve.

START SEQUENCE Instructions

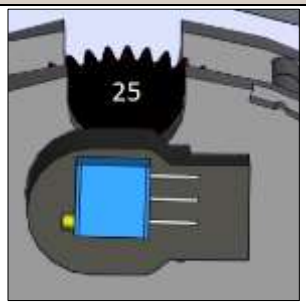


Figure 3.4-4: 25% Air/Fuel Valve Ignition Position

6. Up to 7 seconds will be allowed for ignition to be detected. The igniter-injector relay will be turned off one second after flame is detected.
7. After 2 seconds of continuous flame, ***FLAME PROVEN*** will be displayed and the flame strength will be indicated. After 5 seconds, the current date and time will be displayed in place of the flame strength.
8. With the unit firing properly, it will be controlled by the temperature controller circuitry. The heater's ***VALVE POSITION*** will be continuously displayed on the front panel bar-graph.

Once the demand for hot water has been satisfied, the Edge Controller will turn off the SSOV gas valve, the blower relay will be deactivated, the Air/Fuel Valve will be closed and the Controller will display ***Standby***.

3.5 Start/Stop Levels

The ignition position (start) and stop levels are the Air/Fuel Valve positions (% open) that start and stop the unit, based on load. These levels are Factory preset as follows:

Fuel	Model	Stop Level	Ignition Position
Natural Gas	All	20%	35%

Normally, these settings should not require adjustment.

Note that the energy input is not linearly related to the Air/Fuel Valve position. Refer to Table 3-5 for the relationship between the energy input and Air/Fuel Valve position for units running on natural gas.

TABLE 3-5. Relationship Between Air/Fuel Valve Position and Energy Input

Valve Position (%)	INN 600N		INN 800N		INN 1060N		INN 1350N	
	BTU/Hr.	kWh	BTU/Hr.	kWh	BTU/Hr.	kWh	BTU/Hr.	kWh
20	50,000	14.65	50,000	14.65	50,000	14.65	50,000	14.65
30	93,000	27.26	99,000	29.01	108,000	31.65	124,000	36.34
40	161,000	47.18	210,000	61.54	222,000	65.06	260,000	76.20
50	272,000	79.72	344,000	100.82	372,000	109.02	445,000	130.42
60	367,000	107.56	478,000	140.09	563,000	165.00	637,000	186.69
70	446,000	130.71	586,000	171.74	686,000	201.05	845,000	247.65
80	500,000	146.54	660,000	193.43	823,000	241.20	1,050,000	307.72
90	591,000	173.20	768,000	225.08	981,000	287.50	1,259,000	368.98
100	625,000	183.17	800,000	234.46	1,060,000	310.66	1,350,000	395.65

CHAPTER 4. INITIAL START-UP

4.1 Initial Start-Up Requirements

The requirements for the initial start-up of the Innovation Water Heater consists of the following:

- Complete installation (Chapter 2)
- Set proper controls and limits (Chapter 3)
- Perform combustion calibration (Chapter 4)
- Test safety devices (Chapter 5)

All applicable installation procedures in Chapter 2 must be fully completed prior to performing the initial start-up of the unit. The initial start-up must be successfully completed prior to putting the unit into service. Starting a unit without the proper piping, venting, or electrical systems can be dangerous and may void the product warranty. The following start-up instructions should be followed precisely in order to operate the unit safely and at a high thermal efficiency, with low flue gas emissions.

Initial unit start-up must be performed ONLY by AERCO factory trained start-up and service personnel. After performing the start-up procedures in this Chapter, it will be necessary to perform the Safety Device Testing procedures specified in Chapter 5 to complete all initial unit start-up requirements.

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

AERCO International, Inc.
100 Oritani Drive
Blauvelt, New York 10913
(FAX: 845-580-8090)

WARNING!

DO NOT ATTEMPT TO DRY FIRE THE HEATER. Starting the unit without a full water level may result in injury to personnel or property damage. this situation will void any warranty.

4.2 Tools & Instruments for Combustion Calibration

To properly perform combustion calibration, the proper instruments and tools must be used and correctly attached to the unit. The following sections outline the necessary tools and instrumentation as well as their installation.

4.2.1 Required Tools & Instrumentation

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

- Digital Combustion Analyzer: Oxygen accuracy to ± 0.4%; Carbon Monoxide (CO) and Nitrogen Oxide (NOx) resolution to 1 PPM.
- 16-inch W.C. (4.0 kPa) manometer or equivalent gauge and plastic tubing.
- Multimeter (Capable of measuring 0 – 10 µA)
- 1/4-inch NPT-to-barbed fittings for use with gas supply manometer or gauge.
- Small and large flat blade screwdrivers.
- Tube of silicone adhesive

4.2.2 Installing Gas Supply Manometer

The gas supply manometer is used to verify that the upstream gas pressure is within the allowable range, and it is then installed on the downstream side of the SSOV to measure gas pressure during the combustion calibration process.

INSTALLING GAS SUPPLY MANOMETER Instructions

1. Close the main manual gas supply shut-off valve upstream of the unit.
2. Remove the front door and left side panels from the heater to access the gas train components.
3. Remove the 1/4-inch NPT pipe plug from the leak detection ball valve on the *upstream* side of the Safety Shut Off Valve (SSOV) (see Figure 4.2.2).
4. Install an NPT-to-barbed fitting into the tapped plug port.
5. Attach one end of the plastic tubing to the barbed fitting and the other end to the 16-inch W.C. (4.0 kPa) manometer.

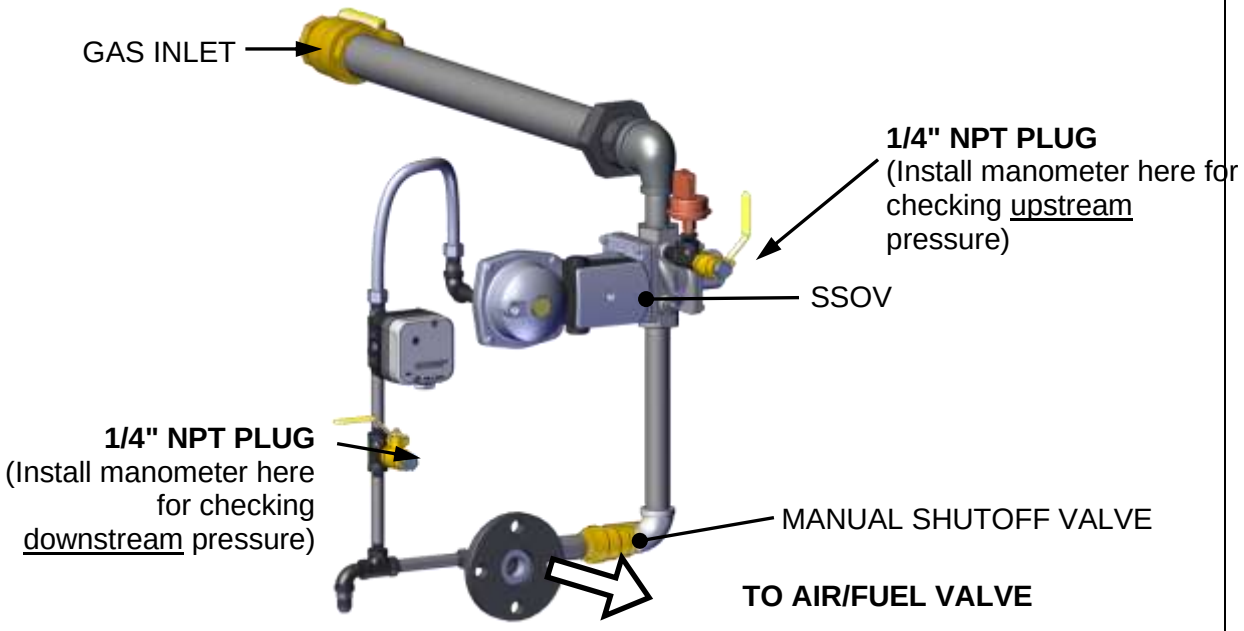


Figure 4.2.2: 1/4 Inch Gas Plug Location (INN 600N – INN 1060N Gas Train Shown)

6. Open manual gas supply shut-off valve, then start the unit and raise the fire rate to 100%.
7. Check that the manometer reading is within the allowable gas pressure range, 4.0” W.C. and 14” W.C. If it is outside that range, you must take whatever steps necessary to correct this issue. Proceed to the next step only if the gas pressure is within the allowable range.
8. Shut off the unit and close the main manual gas supply shut-off valve.
9. Remove the manometer from the upstream port and replace the 1/4” plug.
10. Remove the 1/4” plug from the *downstream* ball valve and install the manometer on that port. It will remain in this position until combustion calibration is complete.

4.2.3 Accessing the Analyzer Probe Port

The unit contains a 1/8" NPT port at the rear of the exhaust manifold. This port is located above the condensate drain connection as shown in Figure 4.2.3. Prepare the port for the combustion analyzer probe as follows:

ACCESSING ANALYZER PROBE PORT Instructions

1. Refer to Figure 4.2.3 and remove the 1/8" NPT plug from the rear of the exhaust manifold.
2. If necessary, adjust the stop on the combustion analyzer probe so it will extend mid-way into the flue gas flow. DO NOT install the probe at this time.

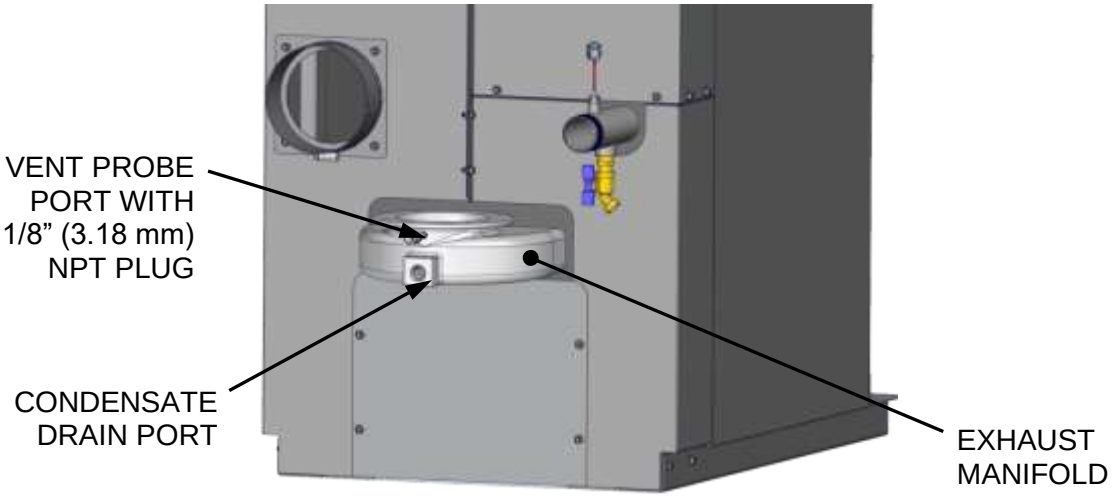


Figure 4.2.3: Analyzer Probe Hole Location

4.2.4 Connecting Multimeter to Flame Detector

During Combustion Calibration, the flame strength generated by the flame detector is measured using a multimeter set to the µA scale. The flame detector is mounted on the intake manifold flange as shown in Figure 4.2.4.

Proceed as follows to set up the multimeter to measure the flame strength current:

CONNECTING MULTIMETER TO MEASURE FLAME STRENGTH Instructions

1. Refer to Figure 4.2.4 and remove the right-side panel from the unit to access the flame detector.
2. Disconnect the flame detector wire lead #135 from the detector and connect the multimeter in series with the wire lead using alligator clips as shown in Figure 4.2.4.
3. Ensure that the multimeter is set to the µA scale.

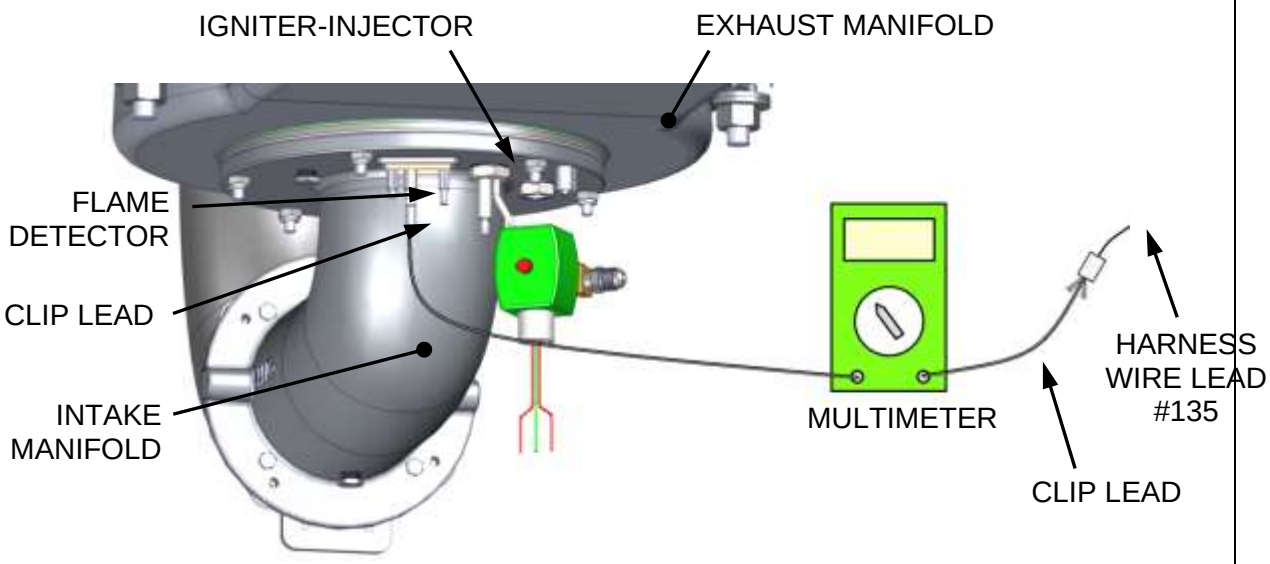


Figure 4.2.4: Flame Strength Set-Up Using Multimeter – Rear View

IMPORTANT!

The unit is shipped from the factory set up for Natural Gas, as specified by the Style Number on the Sales Order. Perform the Combustion Calibration procedure in Section 4.3.

4.2.5 Recommendations for Temperature Calibration

Carefully follow the procedures of Section 4.6 **Temperature Control Calibration**, below, to properly set up the temperature control for the unit. Ignoring this commissioning step may cause water temperature faults, poor water temperature control, and rapid cycling of the unit.

4.2.6 Recommendations for WHM Operation

Installations with multiple Innovation units must operate in Water Heater Management (WHM) mode (see Section 2.5.1 for instructions on installing the actuator-controlled ball valve). Operation in WHM mode ensures that the system flow will be divided between at least 2 units as demand increases. In addition, WHM ensures that all units receive equal run time and additional water heaters are activated based on the "NEXT ON" firing rate setting.

In case of pre-heated DHW systems with multiple Innovation units, it is highly recommended to lower the "NEXT ON" setting to 30 - 40% (Default = 50%), so that subsequent Water Heaters are engaged sooner to provide more rapid response and divide the system flow over additional units. In case of DHW pre-heat systems, the required temperature rise through an individual unit can be much lower to ensure that flow per unit does not exceed 50 gal. (189 L) per minute at any time.

4.3 Combustion Calibration

Innovation Water Heaters are combustion calibrated at the factory prior to shipping. However, recalibration is necessary as part of initial start-up due to changes in the local altitude, gas BTU (kW) content, gas supply piping and supply regulators. It is important to perform the combustion calibration procedure, as it provides optimum performance and keep readjustments to a minimum. Start-Up & Registration Test Data sheets are shipped with each unit. These sheets must be filled out and returned to AERCO for proper Warranty Validation.

The unit is shipped from the factory set up for Natural Gas, Propane, Butane (80% Butane 20% Propane mix or Butane 100%) as specified by the Style Number on the Sales Order.

If you press the **Back** or **Home** buttons at any time before completion, the calibration operation is disabled and normal operation resumes.

Complete the instructions below to perform combustion calibration.

Combustion Calibration Instructions

1. Ensure that the Controller's Enable/Disable switch is set to **Disable**.
2. Ensure that external AC power to the unit is **ON**.
3. Ensure that the water supply and return valves to the unit are open and that the system pumps are running.
4. Open the main manual gas supply shut-off valve upstream of the unit.
5. On the Controller, go to: **Main Menu → Calibration → Combustion**.
6. The first **Combustion Calibration** screen appears lists the three steps that must be completed before continuing. Complete these steps then press **Next** to continue.

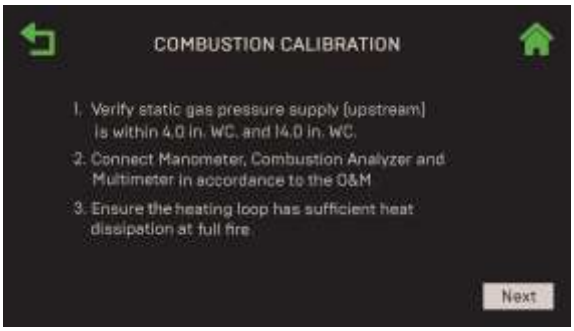


Figure 4.3-1: First Combustion Calibration Screen

- Verify that the incoming (upstream) gas pressure to the unit is within the allowable range, **either 4.0 to 14 in. W.C. for Natural Gas, or 11 to 14 in. W.C. for Propane, or 6.0 to 14 in W.C. for Butane**.
- Install the following devices on the unit:
  - A gas pressure manometer ***downstream*** of the SSOV (see Section 4.2.2).
  - A combustion analyzer probe in the exhaust manifold (see Section 4.2.3).
  - A multimeter to read flame strength and combustion analysis (see Section 4.2.4).
- Ensure the unit has sufficient heat dissipation at full fire to avoid over-temperature conditions. If demand is low, you can reduce the amount of heat that needs to be dissipated, either by completing combustion calibration quickly or using a hose attached to the drain valve on the hot water outlet to generate additional flow.

7. Choose the Nitrogen Oxide NOx requirement for the unit. For Natural Gas, choose either **None** or **<= 20 PPM**, but for Propane, or Butane choose **None** (**<= 20 PPM** is for Natural Gas only).

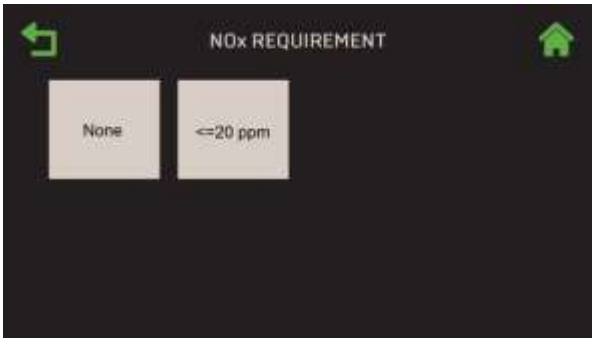


Figure 4.3-2: Choose NOx Requirement

8. The main **Combustion Calibration** screen now appears. It provides two methods to ramp the unit's valve position up or down:
    - **Method 1**: Toggle through the pre-set calibration points till you reach the desired valve position, then press **Go** to go to that point (left image below).
    - **Method 2**: Enable **Fine VP Step**, then manually press the **+** or **–** buttons once per 1% to bring the unit to the desired valve position (right image below).

PRE-SET CALIBRATION STEPS

FINE VALVE POSITION CONTROLS

PRESET CALIBRATION POINTS METHOD

FINE VP STEP METHOD

Figure 4.3-3: Combustion Calibration Screens

9. Set the Controller's Enable/Disable switch to **Enable**.
10. Change the valve position to 30%, press the **Go** button, then verify that the unit has ignited and is operating as expected.
11. Use the ▸ (Right) arrow key to change the valve position to **100%**, then press **Go**.
12. Verify that the gas pressure on the ***downstream*** side of the SSOV is within the required range shown in Table 4.3-1. If it isn't, remove the brass hex nut on the SSOV actuator to access the gas pressure adjustment screw (Figure 4.3-4). Make adjustments using a flat-tip screwdriver, slowly rotating the gas pressure adjustment (in 1/4-turn increments) ***clockwise*** to ***increase*** gas pressure or ***counterclockwise*** to ***reduce*** it. The resulting gas pressure reading on the ***downstream*** manometer should fall in the range listed below.

Combustion Calibration Instructions

TABLE 4.3-1: Gas Pressure Downstream of SSOV

Models	Natural Gas	Propane	Butane
INN 600N	1.9 ± 0.2" W.C.(473 ± 50 Pa)	1.8 ± 0.2" W.C. (448 ± 50 Pa)	-
INN 800N	1.7 ± 0.2" W.C. (423 ± 50 Pa)	2.2 ± 0.2" W.C. (548 ± 50 Pa)	-
INN 1060N	1.9 ± 0.2" W.C. (473 ± 50 Pa)	2.3 ± 0.2" W.C. (573 ± 50 Pa)	3.2 ± 1.0" W.C. (797 ± 50 Pa)
INN 1350N	1.9 ± 0.2" W.C. (473 ± 50 Pa)	3.7 ± 0.2" W.C. (922 ± 50 Pa)	-

Figure 4.3-4. SSOV Gas Pressure Adjustment Screw Location

13. With the valve position still at 100%, and the combustion analyzer probe in the exhaust manifold probe opening (see Section 4.2.3):
    a. Allow enough time for the combustion analyzer reading to stabilize.
    b. Note the combustion analyzer's oxygen (O_2) reading.
    c. If it doesn't match the value in the O2 Target cell, adjust the **Blower Voltage** using either the **+** or **–** controls, or press on the field and type the value directly, until the **O_2** value matches the O2 Target.
    d. Once it matches the O2 Target, press the **O2** Reading cell and enter the value.
14. Enter the downstream manometer's gas pressure reading in the **Downstream Gas Pressure** field. Note, this field appears only when **Valve Position** = **100%**.
15. Enter the **Flame Strength**, **NOx** and **CO** readings from the Combustion Analyzer and multi-meter in the **Reading** cells.
16. Enter the same values, plus the **O_2** value, on the Combustion Calibration Data Sheet provided with the unit.
17. Compare the NOx and carbon monoxide (CO) values in the **Reading** and **Target** columns. If NOx readings exceed the target values in Table 4.3-2, below, repeat Step 13c to increase the O_2 level up to 1% higher. You must then record the increased O_2 value on the Combustion Calibration sheet (repeat Step 16).

NOTE: These instructions assume that the **inlet air temperature is between 50°F and 100°F (10°C – 37.8°C)**.

18. Lower the Valve Position to the 80% calibration point using either the ◄ (Left) arrow key or the Fine Valve Position **–** (Minus) key, then repeat step 13 and 17 at that valve position. The O_2, NOx and CO should stay within the ranges shown in these tables. If they are not in the ranges shown, check the following:
    - Verify that the gas supply conforms to the requirements in the *Innovation-Edge Gas Supply Design Guide* (TAG-0091, GF-5036).
    - Verify that the regulator (if one is used) is properly sized.
    - Verify that there was no sudden drop in gas pressure or that gas pressure is steady, with no variations or pulsations.
    - Verify that venting is conforms to the requirements in the *Innovation-Edge Venting and Combustion Air Design Guide* (TAG-0090, GF-5056).
    - Verify that condensate is draining properly.
19. Repeat the previous step for the remaining valve positions in **Table 4.3-2a for Natural Gas** units, or **Table 4.3-2b for Propane** units. This table applies to all Innovation models.

TABLE 4.3-2a: Combustion Calibration Readings – NATURAL GAS

Valve Position	Oxygen (O_2) %	Nitrogen Oxide (NOx)	Carbon Monoxide (CO)	Flame µA
100%	6.0% ± 0.2%	<20 ppm	<100 ppm	> 7
90%	6.0% ± 0.2%	<20 ppm	<100 ppm	> 7
80%	6.0% ± 0.2%	<20 ppm	<100 ppm	> 7
60%	6.0% ± 0.2%	<20 ppm	<100 ppm	> 7
50%	6.0% ± 0.2%	<20 ppm	<100 ppm	> 7
40%	6.0% ± 0.2%	<20 ppm	<100 ppm	> 7
30%	6.0% ± 0.2%	<20 ppm	<100 ppm	> 7
20%	5.5% ± 0.2%	<20 ppm	<100 ppm	> 4

TABLE 4.3-2b: Combustion Calibration Readings – PROPANE

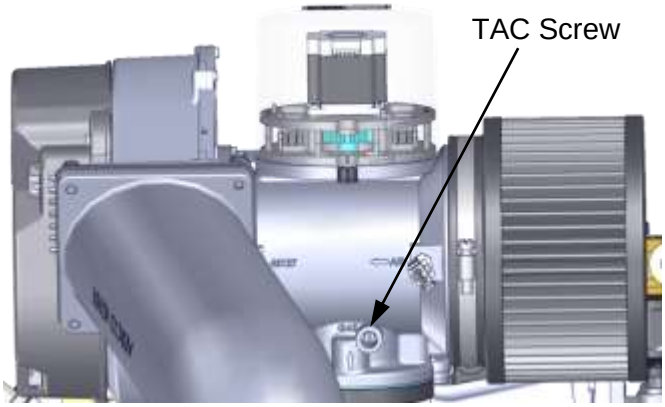
Valve Position	Oxygen (O_2) %	Nitrogen Oxide (NOx)	Carbon Monoxide (CO)	Flame µA
100%	5.0% ± 0.2%	<30 ppm	<100 ppm	> 7
90%	5.0% ± 0.2%	<30 ppm	<100 ppm	> 7
80%	5.0% ± 0.2%	<30 ppm	<100 ppm	> 7
60%	5.0% ± 0.2%	<30 ppm	<100 ppm	> 7
50%	5.0% ± 0.2%	<30 ppm	<100 ppm	> 7
40%	5.0% ± 0.2%	<30 ppm	<100 ppm	> 7
30%	5.0% ± 0.2%	<30 ppm	<100 ppm	> 7
20%	5.0% ± 0.2%	<30 ppm	<100 ppm	> 4

Combustion Calibration Instructions

TABLE 4.3-2c: Combustion Calibration Readings – Butane

Valve Position	Oxygen (O_2) %	Nitrogen Oxide (NOx)	Carbon Monoxide (CO)	Flame µA
100%	5.0% ± 0.2%	<60 ppm	<100 ppm	> 7
90%	5.0% ± 0.2%	<60 ppm	<100 ppm	> 7
80%	5.0% ± 0.2%	<60 ppm	<100 ppm	> 7
60%	5.0% ± 0.2%	<60 ppm	<100 ppm	> 7
50%	5.0% ± 0.2%	<60 ppm	<100 ppm	> 7
40%	5.0% ± 0.2%	<60 ppm	<100 ppm	> 7
30%	5.0% ± 0.2%	<60 ppm	<100 ppm	> 7
20%	5.0% ± 0.2%	<60 ppm	<100 ppm	> 4

20. If the oxygen level at the lowest valve position is too high, and the Blower voltage is at the minimum value, you can adjust the TAC screw, which is recessed in the bottom of the Air/Fuel Valve. Rotate the screw 1/2 turn **clockwise** (CW) **to add fuel and reduce the O_2** to the specified level. Recalibration MUST be performed again from 60% or 50% down to the lowest valve position after making a change to the TAC screw.



VIEWED FROM BELOW, LOOKING STRAIGHT UP

Figure 4.3-5: TAC Screw Location

21. Once combustion calibration has been completed, you can view the results by going to **Main Menu → Calibration → Combustion Summary**. This screen will remain accessible and unchanged until the next time combustion calibration is performed.

Combustion Calibration Instructions

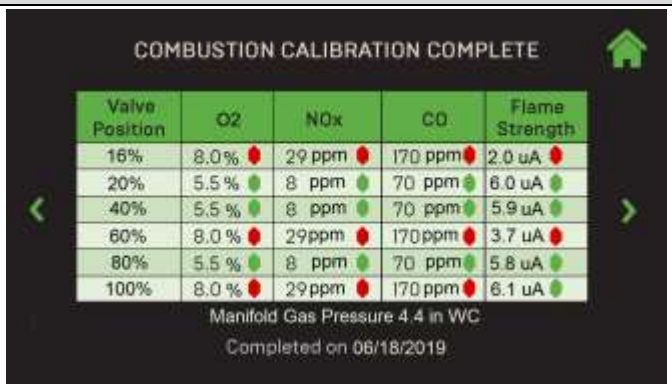


Figure 4.3-6: Combustion Calibration Complete Screen

4.4 Reassembly

Once the combustion calibration adjustments are properly set, the unit can be reassembled for service operation.

Reassembly

1. Set the Controller's **Enable/Disable** switch to the **Disable** position.
2. Disconnect AC power from the unit.
3. Shut off the gas supply to the unit.
4. Remove the manometer and barbed fittings and reinstall the NPT plug using a suitable pipe thread compound.
5. Remove the combustion analyzer probe from the 1/8" (3.18 mm) vent hole in the exhaust manifold. Replace the 1/8" NPT plug in the manifold.
6. Replace the unit's side panels and front door.

4.5 Temperature Control Calibration

Carefully follow the procedures below to properly set up the temperature control for the unit. Ignoring this commissioning step may cause water temperature faults, poor water temperature control, and rapid cycling of the unit.

The unit normally comes factory set and calibrated for a 130°F (54.4°C) setpoint (default value). However, if a different setpoint temperature is desired, it can be changed using the procedure in Section 4.6.1. Temperature control calibration should be performed each time the setpoint is changed.

There are two primary adjustments for performing temperature calibration: **Min Load Adj** and **Max Load Adj** (minimum and maximum load adjustment). Adjustments to these settings are made at minimum and maximum load conditions and should be made in small increments, from 1 to 3 degrees F (0.55 to 1.65 degrees C). After making an adjustment, the outlet water temperature must be allowed to settle for several minutes prior to making any further adjustments.

When calibrating temperature controls, observe the following:

- The unit must be in the Auto mode of operation.

- The **Outlet Feedback** option (in **Main Menu → Advanced Setup → Performance → Temperature Control → *FFWD Settings***) is typically turned on in normal operation, but it must be **disabled** while performing **Min Load Adj** (Section 4.5.2).
- Monitor the outlet temperature displayed on the Controller and Valve Position bar-graph to set load conditions and observe the effect of adjustments.
- Calibration is performed the using the Edge Controller's Tuning Menu.
- Make small adjustments and allow time between adjustments for the outlet water temperature to stabilize.
- Maintain water flow as constant as possible during these adjustments.
- Ensure that recirculation loops are operational while the calibration is being performed.
- Upon completion of calibration, set the Outlet Feedback back to **ENABLE**.

Temperature control calibration is accomplished by first performing the procedure in Section 4.5.2: *Minimum Load Adjustment*. Once that is complete, you can then perform the procedure in Section 4.5.3: *Maximum Load Adjustment*, below.

4.5.1 Setting the Outlet Water Temperature Setpoint

If the setpoint is already set to the correct values for the site, skip this step and proceed to Section 4.5.2. However, if necessary, the current setpoint can be changed using the instructions below.

Setting Outlet Water Temperature Setpoint – Standalone Unit

1. On a standalone unit, go to: **Main Menu → Advanced Setup → Unit → Application Configuration**.
2. Set the **Setpoint** parameter to the desired setpoint.

Setting Outlet Water Temperature Setpoint – WHM Manager Units

1. On the WHM Manager unit, go to: **Main Menu → Advanced Setup → WHM Cascade → Application Configuration**.
2. The Setpoint for the WHM Cascade can be a constant, or received from a remote source, such as a BAS (building automation system).
   - If **Operating Mode** = **Constant Setpoint**: Set **WHM Setpoint** to the desired setpoint.
   - If **Operating Mode** = **Remote Setpoint**: Choose the source of the remote setpoint:
     - 4-20mA
     - 0-20mA
     - 1-5V
     - 0-5V
     - Network
     - BAS

4.5.2 Minimum Load Adjustment

With the unit in operation, check the temperature control at minimum load as described below.

Minimum Load Adjustment

1. Go to: **Main Menu → Advanced Setup → Performance → Temperature Control → FFWD Settings**.

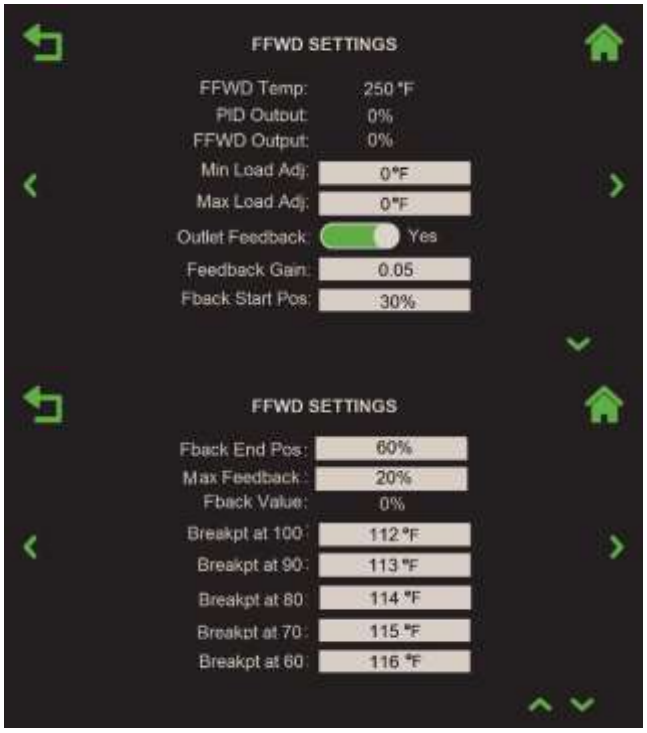


Figure 4.5.2: FFDW Settings Screens

2. Set the **Outlet Feedback** parameter to **No**.
3. While monitoring the Valve Position bar-graph, create a minimum load on the system that will yield a steady valve position between 25% and 35%.

> **NOTE:**
> It may be desirable to shut off the outlet valve and use the drain valve on the hot water outlet pipe (see Figure 2.6) to simulate a minimum load condition.

4. Wait several minutes to allow the outlet temperature to stabilize under load conditions.
5. Once stabilized, the outlet temperature displayed on the Controller should read no more than 2 to 3 °F (1.1 to 1.65 °C) above the unit's setpoint.
6. If the outlet temperature is stabilized, proceed to Section 4.5.3: *Maximum Load Adjustment*. If the temperature is not stabilized, proceed to step 7.
7. Raise or lower the **Min Load Adj** by one or two degrees (*increasing* it will *increase* outlet water temperature), then allow time for the system to stabilize.
8. Repeat step 7 as needed until the temperature is stabilized at no more than 2 to 3 °F (1.1 to 1.65 °C) above the unit's setpoint.
9. Return the **Outlet Feedback** parameter to **Yes**.

4.5.3 Maximum Load Adjustment

Check the temperature control at maximum load as follows:

Maximum Load Adjustment

1. Go to: **Main Menu → Advanced Setup → Performance → Temperature Control → FFWD Settings** (see Figure 4.5.2, above).
2. Set the **Outlet Feedback** parameter to **Yes**.
3. While monitoring the Valve Position bar-graph, create a maximum load on the system that will yield a steady valve position between 80% and 90%.
4. Wait several minutes to allow the outlet water temperature to stabilize under load conditions.
5. Once stabilized, the outlet temperature displayed on the Controller should read no more than 2 to 3 °F (1.1 to 1.65 °C) below the unit's setpoint.
6. If the outlet temperature is stabilized, no adjustment is necessary. If the temperature is not stabilized, proceed to step 7.
7. Raise or lower **Max Load Adj** (*increasing* it will *increase* outlet water temperature), then allow time for the system to stabilize.
8. Repeat step 7 as needed until the temperature is stabilized 2 to 3 °F (1.1 to 1.65 °C) below the unit's setpoint.
9. If the outlet temperature does not maintain setpoint after a reasonable amount of time and adjustment, contact your local AERCO representative.

4.6 Over-Temperature Limit Switches

The unit contains both **Automatic Reset** and **Manual Reset Over-Temperature Limit** switches, shown in Figure 4.6. They can be accessed by opening the front panel door of the unit.

The **Manual Reset Over-Temperature Limit** switch is not adjustable and is permanently fixed at 190°F (87.7°C). This switch will shut down and lock out the unit if the water temperature exceeds 190°F (87.7°C). Following an over-temperature condition, it must be manually reset by pressing the **RESET** button before the unit can be restarted.

The **Automatic Reset Over-Temperature Limit** switch is adjustable and allows the unit to restart, once the temperature drops below its temperature setting. Set the **Automatic Reset Over-Temperature Limit** switch to the desired setting.

Figure 4.6: Over-Temperature Limit Switch Location

CHAPTER 5. SAFETY DEVICE TESTING

5.1 Introduction

Periodic safety device testing is required to ensure that the control system and safety devices are operating properly. The unit control system comprehensively monitors all combustion-related safety devices before, during and after the start sequence. The following tests check to ensure that the system is operating as designed.

Operating controls and safety devices should be tested on a regular basis or following service or replacement. All testing must conform to local codes.

NOTE: Manual and **Auto** modes are required to perform the following tests. It will also be necessary to remove the front door and side panels from the unit to perform the following tests.

WARNING!

ELECTRICAL CURRENT OF 110 OR 220 AND 24 VOLTS AC MAY BE USED IN THIS EQUIPMENT. POWER MUST BE REMOVED PRIOR TO PERFORMING WIRE REMOVAL OR OTHER TEST PROCEDURES THAT CAN RESULT IN ELECTRICAL SHOCK.

5.2 Low Gas Pressure Fault Test

To simulate a low gas pressure fault, refer to Figure 5.2 and proceed as follows:

Low Gas Pressure Fault Test Instructions

1. Refer to Figure 5.2 and ensure that the leak detection ball valve located at the **Low Gas Pressure** switch is closed.
2. Remove the 1/4“ plug from the ball valve at the **Low Gas Pressure** switch.
3. Install a **0 – 16“ W.C. (0 – 4.0 kPa)** manometer (or a W.C. gauge) where the 1/4" plug was removed.
4. Slowly open the ball valve near the **Low Gas Pressure** switch.
5. Put the unit in Manual Mode by going to the **Main Menu → Diagnostics → Manual Run** and setting the **Manual Mode** toggle to **Enabled**.
6. Adjust the air/fuel valve position (% open) between 25 and 30%.
7. While the unit is firing, slowly close the external manual gas shut-off valve.
8. The unit should shut down and display a ***Low Gas Pressure*** fault message at approximately 2.6” W.C. (648 Pa). The **FAULT** indicator should also start flashing.
9. Fully open the external manual gas shut-off valve and press the **CLEAR** button on the Controller.
10. The fault message should clear, and the **FAULT** indicator should go off. The unit should restart.
11. Upon test completion, close the ball valve and remove the manometer. Replace the 1/4“ plug removed in step 2.

Low Gas Pressure Fault Test Instructions

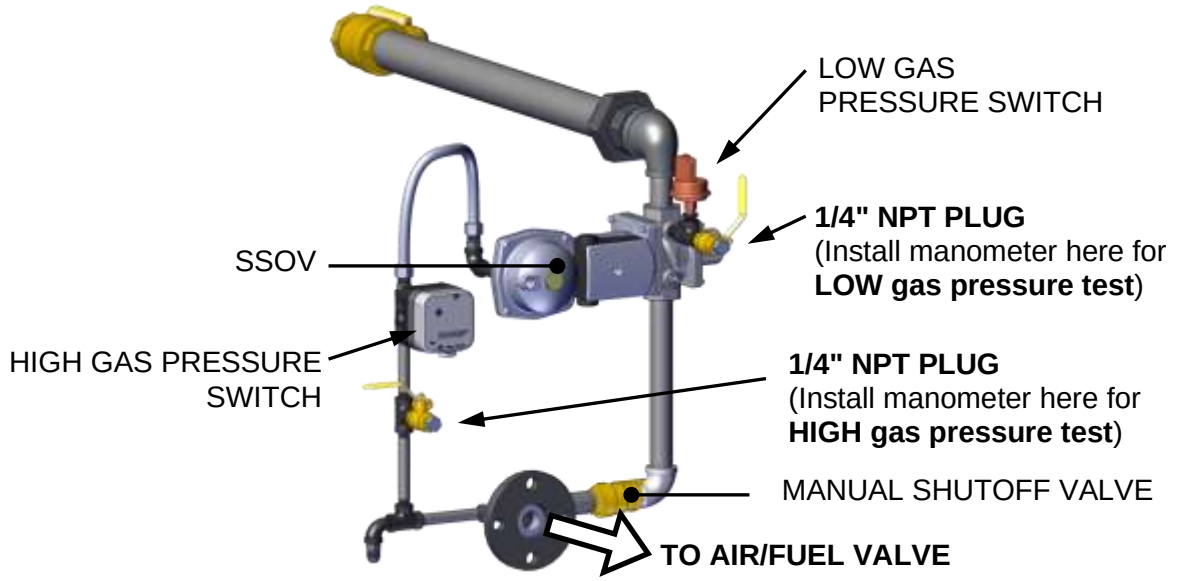


Figure 5.2: Low & High Gas Pressure Testing (INN600N–800N Gas Train Shown)

5.3 High Gas Pressure Fault Test

To simulate a high gas pressure fault, refer to Figure 5.2 and proceed as follows:

High Gas Pressure Fault Instructions

1. Put the unit in Manual Mode by going to the **Main Menu → Diagnostics → Manual Run** and setting the **Manual Mode** toggle to **Enabled**.
2. Remove the 1/4“ plug from the leak detection ball valve located at the **High Gas Pressure** switch (see Figure 5.2).
3. Install a **0 – 16” W.C. (0 – 4.0 kPa)** manometer (or W.C. gauge) where the 1/4” plug was removed.
4. Slowly open the leak detection ball valve
5. Start the unit at a valve position (firing rate) of 25%.
6. Slowly increase the gas pressure using the adjustment screw on the SSOV.
7. The unit should shut down and display a ***High Gas Pressure*** fault message when the gas pressure exceeds the setting on the high gas pressure switch. The **FAULT** indicator should also start flashing. The switch should be set for 1” W.C. more than the “Manifold Pressure Setpoint” written on the Manifold Gas Pressure Setting tag. For example: if the tag states that the unit was set up at 1.9” W.C. full input rate as the factory calibration, then the high gas pressure switch will be set for 2.9” W.C. (1.0 kPa).
8. Reduce the gas pressure back to the original setting listed on the tag.
9. Press the **CLEAR** button on the Controller to clear the fault.
10. The fault message should clear, the **FAULT** indicator should go off and the unit should restart.
11. Upon test completion, close the ball valve and remove the manometer. Replace the 1/4“ plug removed in step 2.

5.4 Low Water Level Fault Test

To simulate a low water level fault:

Low Water Level Fault Test Instructions

1. Set the Controller's **Enable/Disable** switch to the **Disable** position.
2. Close the water shut-off valves in the supply and return piping to the unit.
3. Slowly open the drain valve on the rear of the unit. If necessary, the unit's relief valve may be opened to aid in draining.
4. Continue draining the unit until a ***Low Water Level*** fault message is displayed and the **FAULT** indicator flashes.
5. Put the unit in Manual Mode by going to the **Main Menu → Diagnostics → Manual Run** and setting **Manual Mode** to **Enabled**.
6. Start the unit and raise the valve position above 30%.
7. Set the **Enable/Disable** switch to the **Enable** position. The **READY** light should remain off and the unit should not start. If the unit does start, shut the unit off immediately and refer the fault to qualified service personnel.
8. Close the drain and pressure relief valve used in draining the unit.
9. Open the water shut-off valve in the return piping to the unit.
10. Open the water supply shut-off valve to the unit to refill.
11. After the shell is full, press the **Low Water Level Reset** button to reset the low water cutoff.
12. Press the **CLEAR** button to reset the **FAULT** LED and clear the displayed error message.
13. Set the **Enable/Disable** switch to the **Enable** position. The unit is now ready for operation.

5.5 Water Temperature Fault Test

A high-water temperature fault is simulated by adjusting the **Automatic Reset Over-Temperature Limit** switch on the front of the unit (see Figure 5.5).

Water Temperature Fault Test Instructions

1. Start the unit in the normal operating mode. Allow the unit to stabilize at its setpoint.
2. Lower the adjustable **Automatic Reset Over-Temperature Limit** switch setting to match the outlet temperature displayed on the Controller.
3. Once the **Automatic Reset Over-Temperature Limit** switch setting is approximately at, or just below, the actual outlet water temperature, the unit should shut down. The **FAULT** indicator should start flashing and a ***High-Water Temp Switch Open*** fault message should be displayed. It should not be possible to restart the unit.
4. Reset the adjustable over-temperature switch to its original setting.
5. The unit should start once the **Automatic Reset Over-Temperature Limit** switch setting is above the actual outlet water temperature.

NOTE: The (non-adjustable) **Manual Reset Over-Temperature Limit** switch is calibrated to trip if the discharge water exceeds 190° F (87.8° C). Testing of this device must be done by authorized personnel only.

Figure 5.5: Over-Temperature Limit Switch Setting

5.6 Interlock Tests

The unit is equipped with two interlock circuits called the Remote Interlock and Delayed Interlock. Terminal connections for these circuits are located in the I/O Box (Figure 2.12-2) and are labeled REMOTE INTL'K IN and DELAYED INTL'K IN. These circuits can shut down the unit in the event that an interlock is opened. These interlocks are shipped from the factory jumpered (closed). However, each of these interlocks may be utilized in the field as a remote stop and start, an emergency cut-off, or to prove that a device such as a pump, gas booster, or louver is operational.

5.6.1 Remote Interlock

Remote Interlock Instructions

1. Remove the cover from the I/O Box and locate the REMOTE INTL'K IN terminals (see Figure 2.12-2).
2. Put the unit in Manual Mode by going to the **Main Menu → Diagnostics → Manual Run** and setting the **Manual Mode** toggle to **Enabled**, then set the valve position between 25% and 30%.
3. If there is a jumper across the REMOTE INTL'K IN terminals, remove one side of the jumper. If the interlock is being controlled by an external device, either open the interlock via the external device or disconnect one of the wires leading to the external device.
4. The unit should shut down and display ***Interlock Open***.
5. Once the interlock connection is reconnected, the ***Interlock Open*** message should automatically clear and the unit should restart.

5.6.2 Delayed Interlock

Delayed Interlock Instructions

1. Remove the cover from the I/O Box and locate the DELAYED INTL'K IN terminals (see Figure 2.12-2).
2. Put the unit in Manual Mode by going to the **Main Menu → Diagnostics → Manual Run** and setting the **Manual Mode** toggle to **Enabled**, then set the valve position between 25% and 30%.
3. If there is a jumper across the DELAYED INTL'K IN terminals, remove one side of the jumper. If the interlock is connected to a proving switch of an external device, disconnect one of the wires leading to the proving switch.
4. The unit should shut down and display a ***Delayed Interlock Open*** fault message. The **FAULT** LED should be flashing.
5. Reconnect the wire or jumper removed in step 3 to restore the interlock.
6. Press the **CLEAR** button to reset the fault.
7. The unit should start.

5.7 Flame Fault Tests

Flame faults can occur during ignition or while the unit is already running. To simulate each of these fault conditions, proceed as follows:

Flame Fault Tests Instructions

1. Set the Controller's **Enable/Disable** switch to the **Disable** position.
2. Put the unit in Manual Mode by going to the **Main Menu → Diagnostics → Manual Run** and setting the **Manual Mode** toggle to **Enabled**, then set the valve position between 25% and 30%.
3. Close the manual gas shutoff valve, located between the Safety Shut-Off Valve (SSOV) and the Air/Fuel Valve (see Figure 5.7).
4. Set the Controller's **Enable/Disable** switch to the **Enable** position to start the unit.
5. The unit should shut down after reaching the Ignition cycle and display ***Flame Loss During Ignition***.
6. Open the valve closed in step 3 and press the **CLEAR** button.
7. Restart the unit and allow it to prove flame.
8. Once flame is proven, close the manual gas shut-off valve.
9. The unit should shut down and execute an IGNITION RETRY cycle by performing the following:
    a) The unit will execute a shutdown purge cycle for a period of 15 seconds and display ***Wait Fault Purge***.
    b) The unit will execute a 30 second re-ignition delay and display ***Wait Retry Pause***.
    c) The unit will then execute a standard ignition sequence and display ***Wait Ignition Retry***.
10. Since the manual gas shutoff valve is still closed, the unit will shut down and display ***Flame Loss During Ignition*** following the IGNITION RETRY cycle.
11. Open the valve closed in step 8.
12. Press the **CLEAR** button. The unit should restart and fire.

Flame Fault Tests Instructions

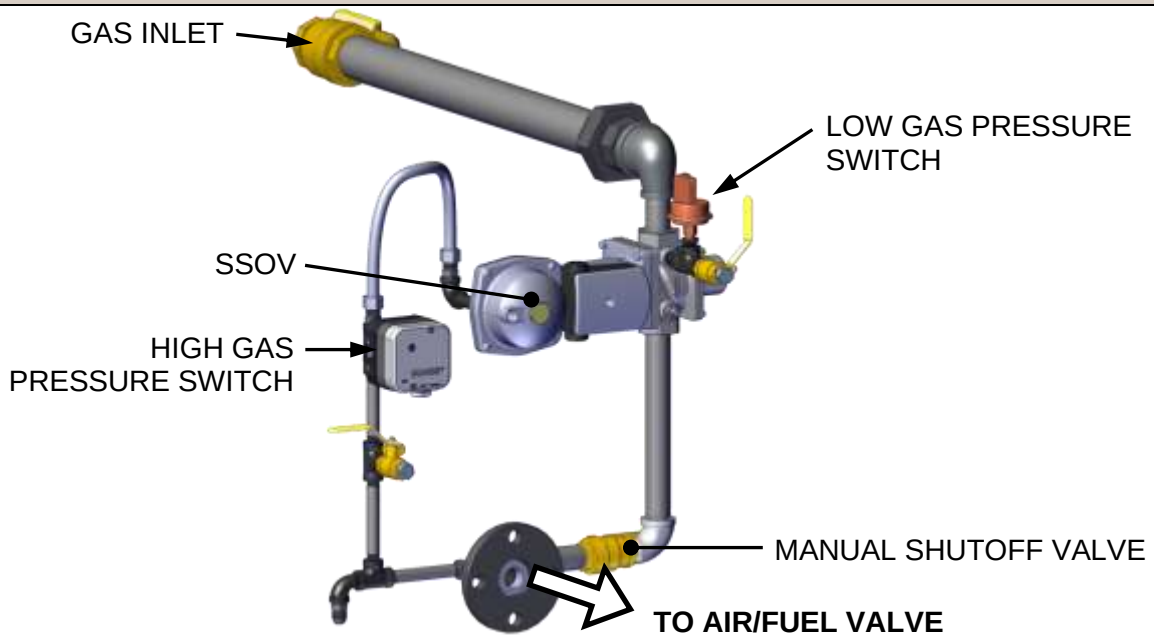


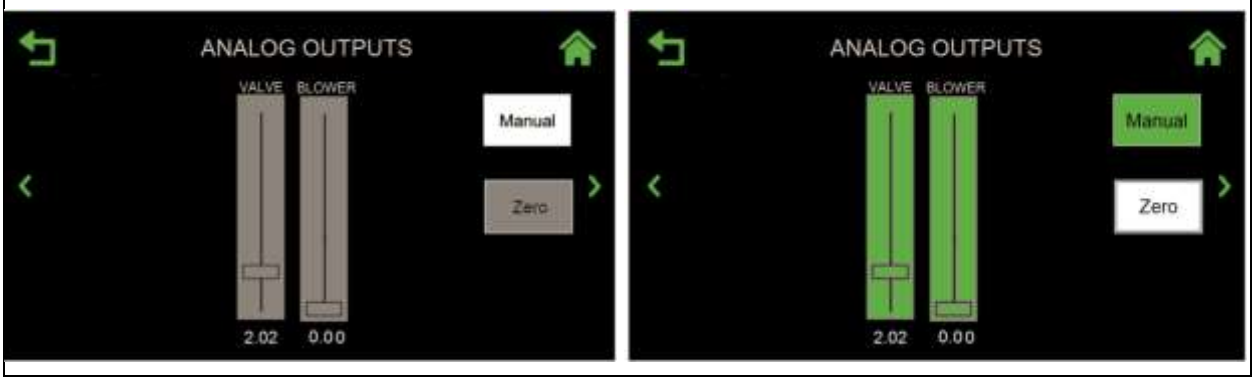
Figure 5.7: Manual Gas Shut-Off Valve Location (INN600N-800N Gas Train Shown)

5.8 Air Flow Fault Tests

These tests check the operation of the **Blower Proof** switch and **Blocked Inlet** switch shown in Figure 5.8-2.

Air Flow Fault Tests Instructions

1. Put the unit in Manual Mode by going to the **Main Menu → Diagnostics → Manual Run** and setting the **Manual Mode** toggle to **Enabled**, then set the valve position to 25%.
2. Disable the blower output drive voltage as follows:
   (a) Go to: **Main Menu → Diagnostics → Analog Outputs and Relays → Analog Outputs.**
   (b) Press the **Manual** button, then press the **Zero** button. The Blower slider now read 0.00.

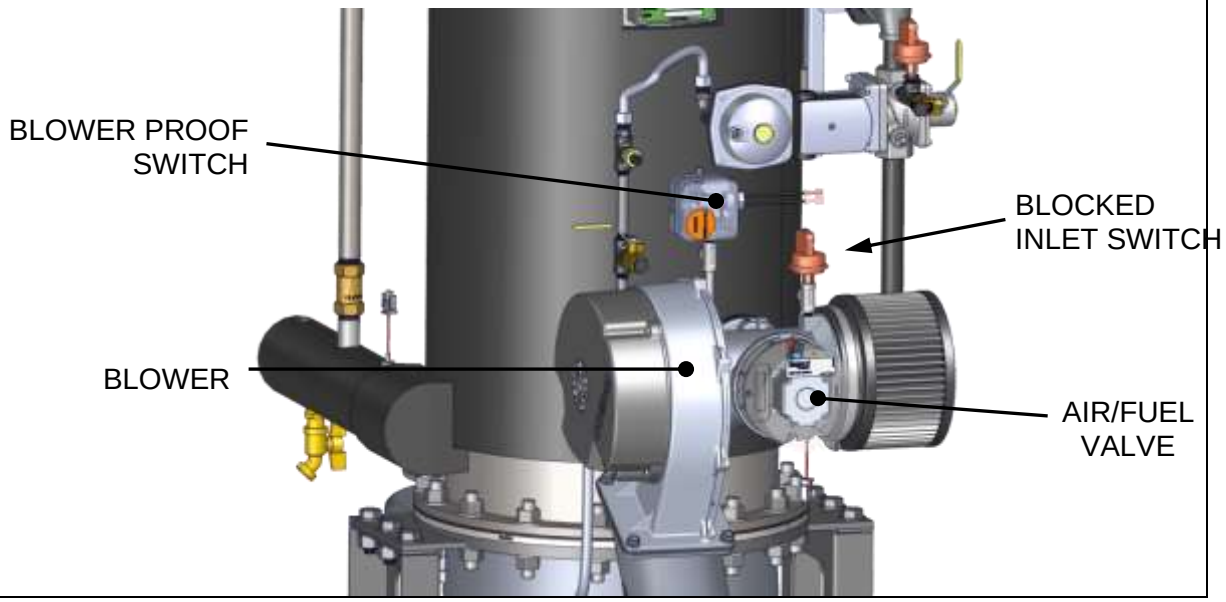


Air Flow Fault Tests Instructions

DEFAULT MODE MANUAL MODE

Figure 5.8-1: Analog Outputs Screen

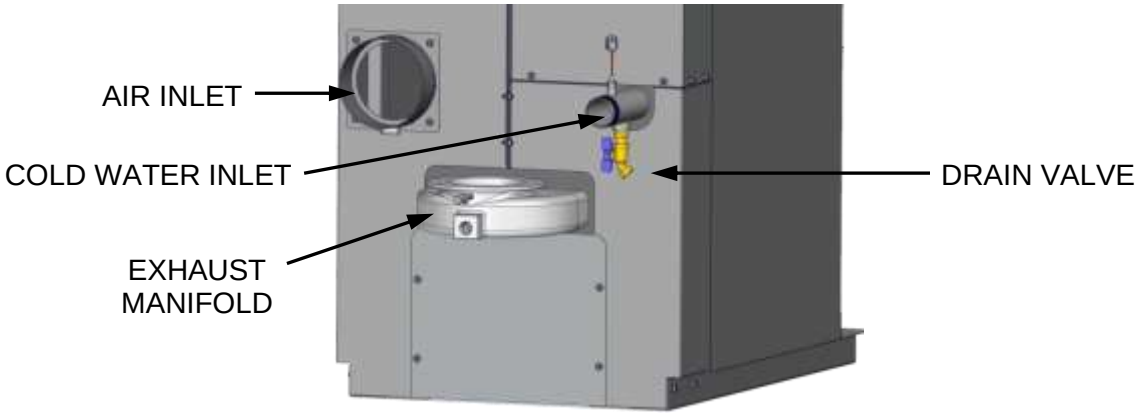
3. The unit should shut down and execute an IGNITION RETRY cycle by performing the following steps:
   (a) The unit will execute a 30 second re-ignition delay and display ***Wait Retry Pause***.
   (b) The unit will then execute a standard ignition sequence and display ***Wait Ignition Retry***.
4. The unit should perform two IGNITION RETRY cycles and then shut down on the third successive ignition attempt. The unit will display ***Airflow Fault During Purge***.
5. Re-enable the blower output drive voltage by performing the following steps:
   (a) Go to: **Main Menu → Diagnostics → Analog Outputs and Relays → Analog Outputs**.
   (b) Press the **Manual** button; the Blower is now operational again.
   (c) Press the **CLEAR** button; the unit should restart.
6. Once the unit has proved flame, turn off the blower again by repeating Step 1.
7. The **Blower Proof** switch will open and the blower should stop. The unit should shut down and display ***Airflow Fault During Run***.
8. Re-enable the blower output drive voltage by repeating Step 5, then press the **CLEAR** button; the unit should restart.
9. Next, check the operation of the **Blocked Inlet** switch located on the inlet side of the Air/Fuel Valve (Figure 5.8-2).
10. Ensure that the sheet metal panels are securely installed on the water heater and the unit is running.
11. At the rear of the unit, partially block the air inlet (Figure 5.8-3) with a plywood sheet or metal plate.
12. The unit should shut down and again display ***Airflow Fault During Run***.
13. Unblock the air inlet and press the **CLEAR** button. The unit should restart.



Air Flow Fault Tests Instructions

PARTIAL FRONT VIEW

Figure 5.8-2: Blower Proof & Blocked Inlet Switch Locations



PARTIAL REAR VIEW

Figure 5.8-3: Water Heater Rear View Showing Air Inlet Location

5.9 Ssov Proof Of Closure Switch

The SSOV shown in Figure 5.9 contains the **Proof Of Closure** switch. The **Proof Of Closure** switch circuit is checked as follows:

SSOV Proof of Closure Switch Instructions

1. Set the Controller's **Enable/Disable** switch to the **Disable** position.
2. Put the unit in Manual Mode by going to the **Main Menu → Diagnostics → Manual Run** and setting the **Manual Mode** toggle to **Enabled**, then set the valve position between 25% and 30%.
3. Locate the SSOV (see Figure 5.9) and remove its cover by loosening the Actuator Cover screw, then lifting the cover off to access the terminal wiring connections.
4. Disconnect wire #148 from the SSOV to "open" the **Proof Of Closure** switch circuit.
5. The unit should fault and display ***SSOV Switch Open***.
6. Replace wire #148 and press the **CLEAR** button.
7. Set the Controller's **Enable/Disable** switch to the **Enable** position.
8. Remove the wire again when the unit reaches the purge cycle and ***Purging*** is displayed.
9. The unit should shut down and display ***SSOV Fault During Purge***.
10. Replace the wire on the SSOV and press the **CLEAR** button. The unit should restart.

SSOV Proof of Closure Switch Instructions

Figure 5.9: SSOV Actuator Cover Location

5.10 Purge Switch Open During Purge

The **Purge** switch (and **Ignition** switch) is located on the Air/Fuel Valve. To check the switch, proceed as follows:

Purge Switch Open During Purge Instructions

1. Set the Controller's **Enable/Disable** switch to the **Disable** position.
2. Put the unit in Manual Mode by going to the **Main Menu → Diagnostics → Manual Run** and setting the **Manual Mode** toggle to **Enabled**, then set the valve position between 25% and 30%.
3. Remove the Air/Fuel Valve cover by rotating the cover counterclockwise to unlock it (see Figure 5.11-1).
4. Remove one of the two wires (#171 or #172) from the **Purge** switch (Figure 5.11-2).
5. Initiate a unit start sequence.
6. The unit should begin its start sequence, then shut down and display ***PRG Switch Open During Purge***.
7. Replace the wire on the **Purge** switch and depress the **CLEAR** button. The unit should restart.

5.11 Ignition Switch Open During Ignition

The **Ignition** switch (and the **Purge** switch) is located on the Air/Fuel Valve. To check the switch, proceed as follows:

Ignition Switch Open During Ignition Instructions

1. Set the Controller's **Enable/Disable** switch to the **Disable** position.
2. Put the unit in Manual Mode by going to the **Main Menu → Diagnostics → Manual Run** and setting the **Manual Mode** toggle to **Enabled**, then set the valve position between 25% and 30%.
3. Remove the Air/Fuel Valve cover (see Figure 5.11-1) by rotating the cover counterclockwise to unlock and lift up to remove.
4. Remove one of the two wires (#169 or #170) from the **Ignition** switch (Figure 5.11-2).
5. Initiate a unit start sequence.

Ignition Switch Open During Ignition Instructions

6. The unit should begin its start sequence and then shut down and display ***Ign Switch Open During Ignition***.
7. Replace the wire on the **Ignition** switch and press the **CLEAR** button. The unit should restart.

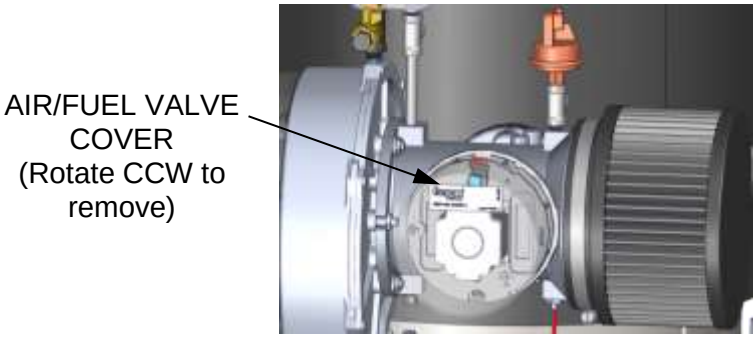


Figure 5.11-1: Typical Air/Fuel Valve Cover Location

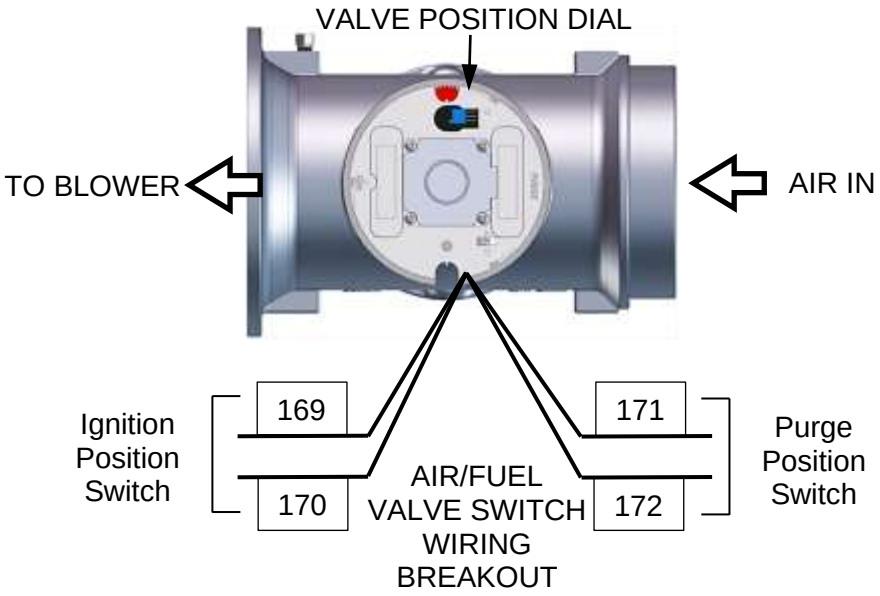


Figure 5.11-2: Air/Fuel Valve Purge and Ignition Switch Locations

5.12 Safety Pressure Relief Valve Test

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

CHAPTER 6. MAINTENANCE

6.1 Maintenance Schedule

The Innovation Water Heater requires regular maintenance to ensure continued reliable operation throughout the service life of the unit. For optimum operation, AERCO requires the following routine maintenance procedures be performed in the time periods specified in Table 6-1.

Appendix I contains a list of the recommended spare parts for maintenance.

WARNING!

TO AVOID PERSONAL INJURY, OBSERVE THE FOLLOWING GUIDELINES:

- Disconnect the AC supply by turning off the service switch and ac supply circuit breaker.
- Shut off the gas supply at the manual shut-off valve provided with the unit
- Allow the unit to cool to a safe water temperature to prevent burning or scalding

TABLE 6-1: Maintenance Schedule

Section	Item	6 Mos.	12 Mos.	24 Mos.	Labor Time
6.3	Igniter-Injector (Kit P/N **58023**)	*Inspect	Inspect, replace if necessary	Replace	15 min.
6.4	Flame Detector (Kit P/N **24356-2**)	*Inspect	Inspect, replace if necessary	Replace	15 min.
6.5	Combustion Calibration	*Check	Check		1 hr.
6.6	Testing of Safety Devices		Test		20 min.
6.7	Fireside Inspection			Inspect & Clean	3 hrs.
6.8.2	Waterside Port Inspection	*Inspect	Inspect	Inspect	30 min.
6.8.3	Waterside Heat Exchanger Inspection		Inspect & Clean (as required)	-	2 hrs.
6.9	Condensate Trap & Neutralizer	*Inspect	Inspect & Clean	-	30 min.
6.10	Air Filter (P/N **59138**)		Clean or Replace	-	5 min.
6.11	Low Water Cutoff (LWCO) Probe Capacitor (Kit P/N **69126**)	-	Test	Replace & Test	15 min.
6.15	Exhaust Vent Inspection		Inspect & Clean		15 min.

* *Only performed after initial 6-month period after initial startup.*

6.2 Water Quality Guideline

To keep your water heater operating efficiently it is critical to make sure the chemical composition of incoming water is not harmful to the heater. To prevent corrosion, fouling, and other harmful effects on the heater, the following water quality guideline should be adhered to:

TABLE 6-2: Water Quality Guideline	
Total Dissolved Solids:	500 ppm
Hardness ($CaCO_3$):	See Table 6-8, Section 6.8.1
Chlorides:	250 ppm
Free Chlorine	0.5 ppm

Total dissolved solids are a measure of overall risk of water corrosivity/hardness/salinity/color. The EPA recommends keeping a level below 500 ppm.

For calcium hardness limits, see Table 6-8 in Section 6.8.1, below. The allowable calcium hardness depends on temperature set point as well as concentration.

Many water systems also carry orthophosphate chemicals for corrosion protection. These chemicals form orthophosphate scale. Conventional water softening techniques that treat calcium scale may not treat orthophosphate scale. If the system contains orthophosphates, the unit must be inspected every 6 months and cleaned as needed. Systems may also contain polyphosphates that sequester and mitigate water hardness. Over time, these chemicals break down in the system to form orthophosphates. Therefore, any water entering the water heater that contains polyphosphates warrants that the heat exchanger be inspected every 6 months and cleaned as needed.

Chloride limits are set to prevent corrosion of the heat exchanger. The EPA also recommends levels lower than 250 ppm for potable systems.

Free chlorine is added to systems to protect from harmful microbes. Most public water supplies have been treated to a safe level, but care must be taken when building owners perform supplemental treatment. Batch feeding or poorly controlled methods will cause free chlorine spikes that will damage any equipment in the system. When added in excess, free chlorine is a powerful oxidant that can cause corrosion. Inlet water fed to the heater should always be below 0.5 ppm free chlorine, regardless of where in the system the chemical feed pump is positioned.

6.3 Igniter-Injector

The igniter-injector (Kit P/N **58023**) is located on the flange of the intake manifold, at the bottom of the unit's heat exchanger. Figure 6.3-1 shows the intake manifold (removed from the unit) showing the location of the igniter-injector (Kit P/N **58023**), flame detector and gasket (Kit P/N **24356-2**) and other related components.

The igniter-injector may be hot; therefore, care should be exercised to avoid burns. It is easier to remove the igniter-injector from the unit after the unit has cooled to room temperature.

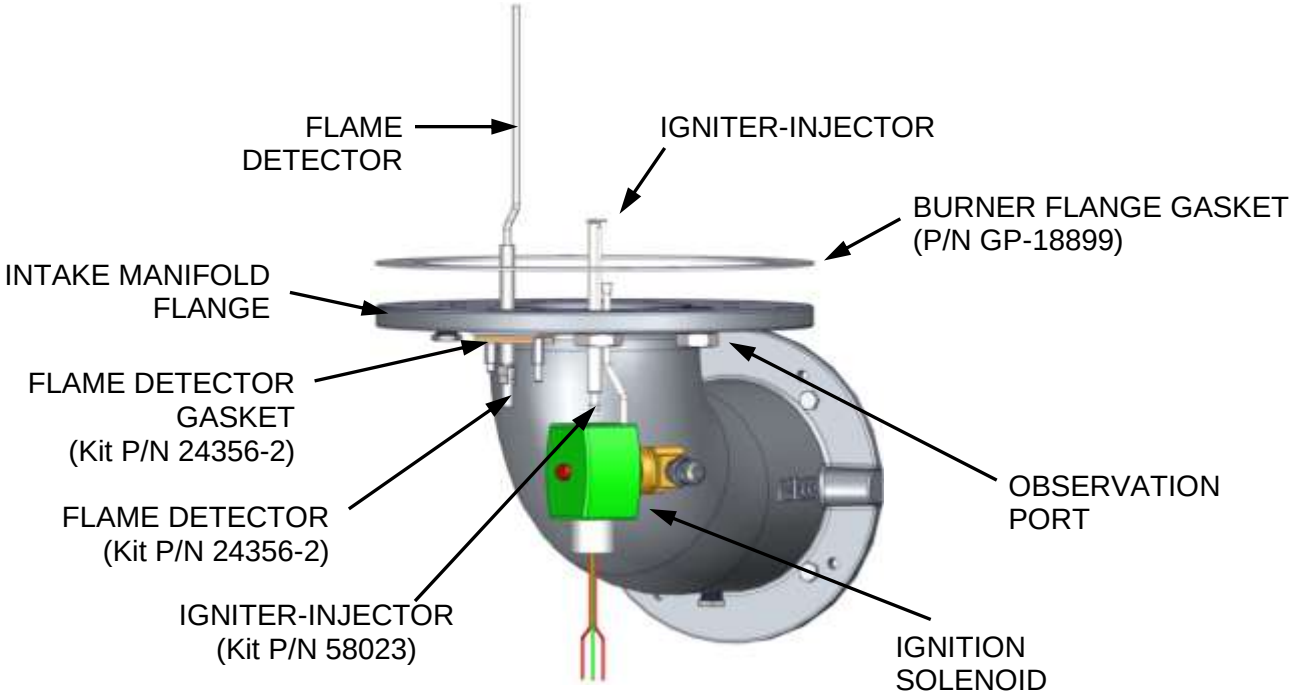


Figure 6.3-1: Intake Manifold with Igniter-Injector & Flame Detector

Igniter-Injector Inspection/Replacement Instructions

1. Set the Controller's **Enable/Disable** switch to the **Disable** position, then disconnect AC power from the unit.
2. Remove the side and rear panels from the unit.
3. Disconnect the ignition cable and ground wire from the igniter-injector.
4. Referring to Figure 6.3-1, disconnect the compression nut securing the gas injector tube of the igniter-injector to the elbow of the ignition assembly. Disconnect the ignition assembly from the igniter-injector.
5. Loosen and remove the igniter-injector from the burner plate.
6. Check the igniter-injector for evidence of erosion or carbon build-up. If there is evidence of substantial erosion or carbon build-up, the igniter-injector should be replaced. If carbon build-up is present, clean the component using fine emery cloth. Repeated carbon build-up is an indication that the combustion settings of the unit should be checked. Refer to Chapter 4 for combustion calibration procedures.
7. Prior to reinstalling the igniter-injector, apply a high temperature, conductive, anti-seize compound to the threads.
8. Install the igniter-injector on the intake manifold flange. Use the number of clocking washers required to rotate the Ignitor-Injector so that the injector tube is ***inside*** the approximately 60° arc shown in Figure 6.3-2**.**

Igniter-Injector Inspection/Replacement Instructions

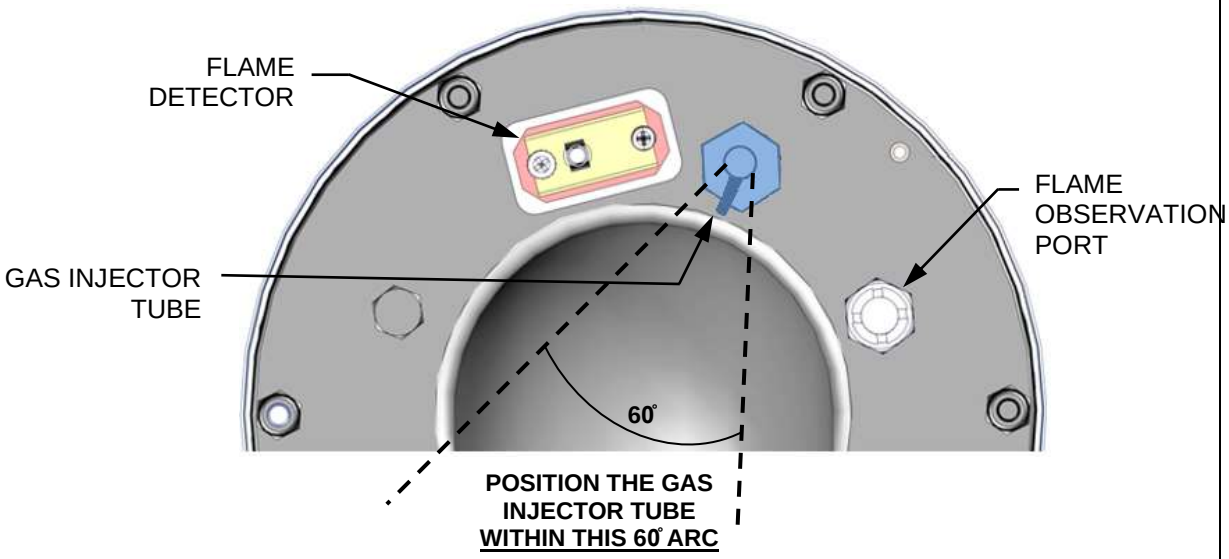


Figure 6.3-2: Igniter-Injector & Flame Detector Mounting Details

9. **Torque the ignitor-injector to 15 ft-lbs. *Do Not Over Tighten***
10. Connect the ignition assembly to the gas injector tube of the igniter-injector by securing the compression nut to the elbow of the ignition assembly.
11. Reconnect the igniter-injector cable and ground wire.
12. Reinstall the side and rear panels on the unit.

6.4 Flame Detector

Flame detector (Kit P/N **24356-2**) is used on ALL Innovation Water Heater models. The flame detector is also located on the flange of the intake manifold as shown in Figures 6-1 and 6-2. The flame detector may be hot. Allow the unit to cool sufficiently before removing the flame detector.

To inspect or replace the flame detector:

Flame Detector Inspection/Replacement Instructions

1. Set the Controller's **Enable/Disable** switch to the **Disable** position, then disconnect AC power from the unit.
2. Remove the side and rear panels from the unit.
3. Disconnect the flame detector lead wire.
4. Remove the two (2) hex standoffs securing the flame detector to the intake manifold (Figures 6-1 and 6-2). The flame detector is secured to the burner intake manifold with one (1) #10-32 and one (1) #8-32 hex standoff.
5. Remove the flame detector and gasket from the manifold flange.
6. Thoroughly inspect the flame detector. If eroded, the detector should be replaced. Otherwise, clean the detector with a fine emery cloth.
7. Reinstall the flame detector and flame detector gasket.
8. Reconnect the flame detector lead wire.
9. Reinstall the side and rear panels on the unit.

6.5 Combustion Calibration

Combustion settings must be checked at the intervals shown in Table 6-1 as part of the maintenance requirements. Refer to Chapter 4 for combustion calibration instructions.

6.6 Safety Device Testing

Systematic and thorough tests of the operating and safety devices should be performed to ensure that they are operating as designed. Also, certain code requirements specify that these tests be performed on a scheduled basis. Test schedules must conform to local jurisdictions. The results of the tests should be recorded in a log book. See Chapter 5 for Safety Device Test Procedures.

6.7 Fireside Inspection

NOTE: In addition to the inspection described below after the unit has shut down, the burned flame should be visually inspected periodically while the unit is in operation to ensure that it is operating normally and the there is no change to its appearance from pervious inspections.

Fireside inspection of the Innovation Water Heater includes removing the exhaust manifold, intake manifold, and the burner assembly from the unit.

The purpose of this inspection is to check for the formation of deposits on the inside of the heat exchanger tubes, exhaust manifold, and/or the burner assembly. These deposits can be caused by the presence of even trace amounts of chlorides and/or sulfur, in the combustion air and fuel sources. Such deposits can be influenced by the extent of the condensing operation and the chloride and sulfur levels that can vary significantly from application to application.

Since the fireside inspection will include removal of the exhaust manifold, burner assembly and intake manifold from the Innovation Water Heater, the following replacement gaskets will be necessary for reassembly upon completion of the inspection:

Part Number	Quantity	Description
GP-18899	2	Burner Flange Gasket
81048	1	Flame Detector Gasket
81198	1	Intake Manifold Flange Gasket
GP-122537	1	Manifold-To-Heat Exchanger Gasket

The intake manifold may be hot. Therefore, allow the unit to cool sufficiently before starting the removal process described in the following steps.

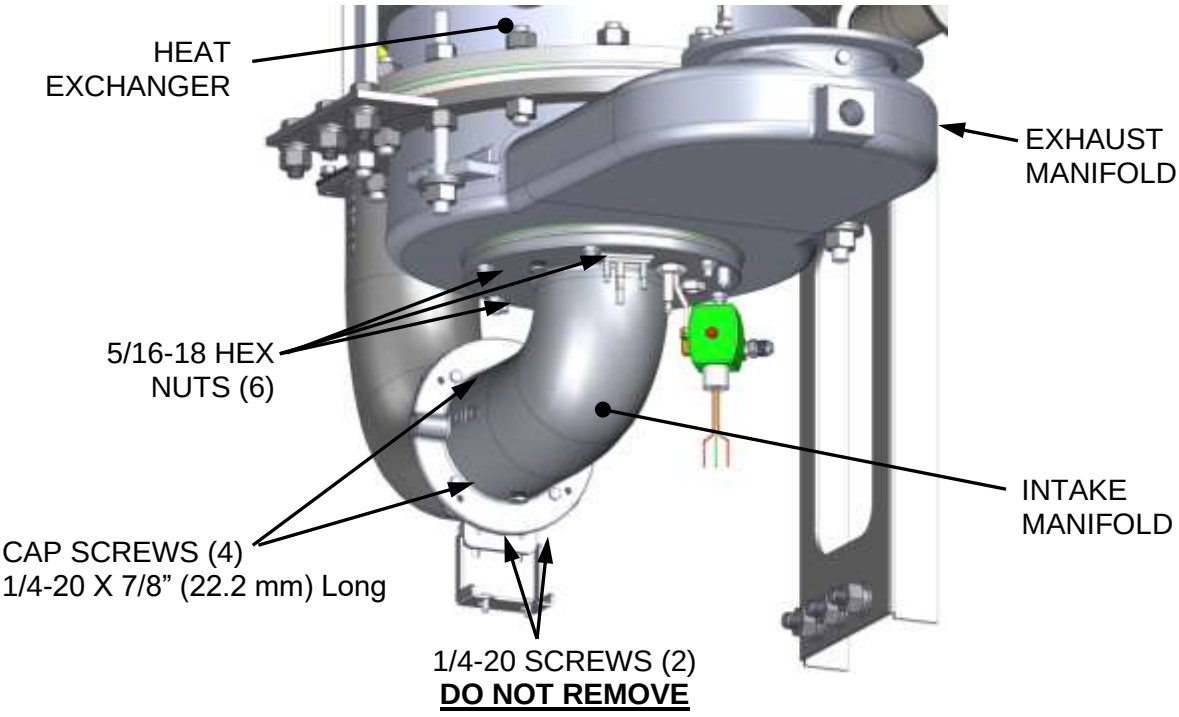
Fireside Inspection Instructions

1. Set the Controller's **Enable/Disable** switch to the **Disable** position. Disconnect AC power from the unit and turn off the gas supply.
2. Remove the exhaust vent from the exhaust manifold. Use a scraper or blade to separate the high temperature silicon sealant between the exhaust manifold and vent connector and remove all sealant from both surfaces in preparation for reassembly.
3. Remove the side and rear panels from the unit. Also remove the bottom panel of the cabinet to expose the mechanical room floor beneath the burner. This is needed to provide clearance for pulling the burner.
4. Locate the intake manifold at the bottom of the unit's heat exchanger (see Figure 6.7-1 and 6.7-2).
5. Disconnect the lead wire from the flame detector installed on the intake manifold flange (Figure 6.3-1).
6. Remove the two (2) hex standoffs securing the flame detector to the intake manifold (see Figure 6.3-1 and 6.3-2).
7. Remove the flame detector and gasket from the intake manifold flange.
8. Disconnect the cable from the igniter-injector, loosen the compression nut and elbow from the gas injector tube (Figure 6.3-1), and remove the entire ignition assembly (nut/elbow, solenoid valve, hose nipple, and gas flex hose) from the manifold flange.

Fireside Inspection Instructions

9. Loosen and remove the igniter-injector from the intake manifold flange. Retain the clocking washers (if present), for later reassembly.

10. Refer to Figure 6.7-1. Loosen and remove the four (4) 1/4-20 cap screws securing the blower side of the intake manifold (P/N **44106**). DO NOT REMOVE the two 1/4-20 screws and nuts securing the manifold support bracket.



PARTIAL RIGHT-SIDE VIEW – BASE & SUPPORT BRACKET REMOVED FOR CLARITY

Figure 6.7-1: Intake Manifold & Exhaust Manifold Locations

CAUTION!

The intake manifold, burner and exhaust manifold assemblies weigh approximately 25 pounds. Use care when removing these assemblies in the following steps.

11. While supporting the intake manifold, loosen and remove the six (6) 5/16-18 hex nuts securing it to the studs protruding from the exhaust manifold.

12. Carefully lower and remove the intake manifold, burner assembly, two burner gaskets (P/N **GP-18899**), and the intake manifold flange gasket (P/N **81198**). See Figures 6-3 and 6-4.

13. Disconnect the exhaust temperature sensor (Figure 6.7-3) by unscrewing it from the exhaust manifold.

14. While supporting the exhaust manifold, remove the two (2) side nuts (Figure 6.7-3) securing the manifold to the heat exchanger. Loosen, but ***do not remove*** the third nut nearest to the front of the unit.

15. Remove the exhaust manifold from the unit.

Fireside Inspection Instructions

16. Inspect the exhaust manifold and burner assemblies for debris. Clean out debris as necessary.
17. This completes the fireside inspection of the unit. Proceed to step 18 to reassemble the unit.

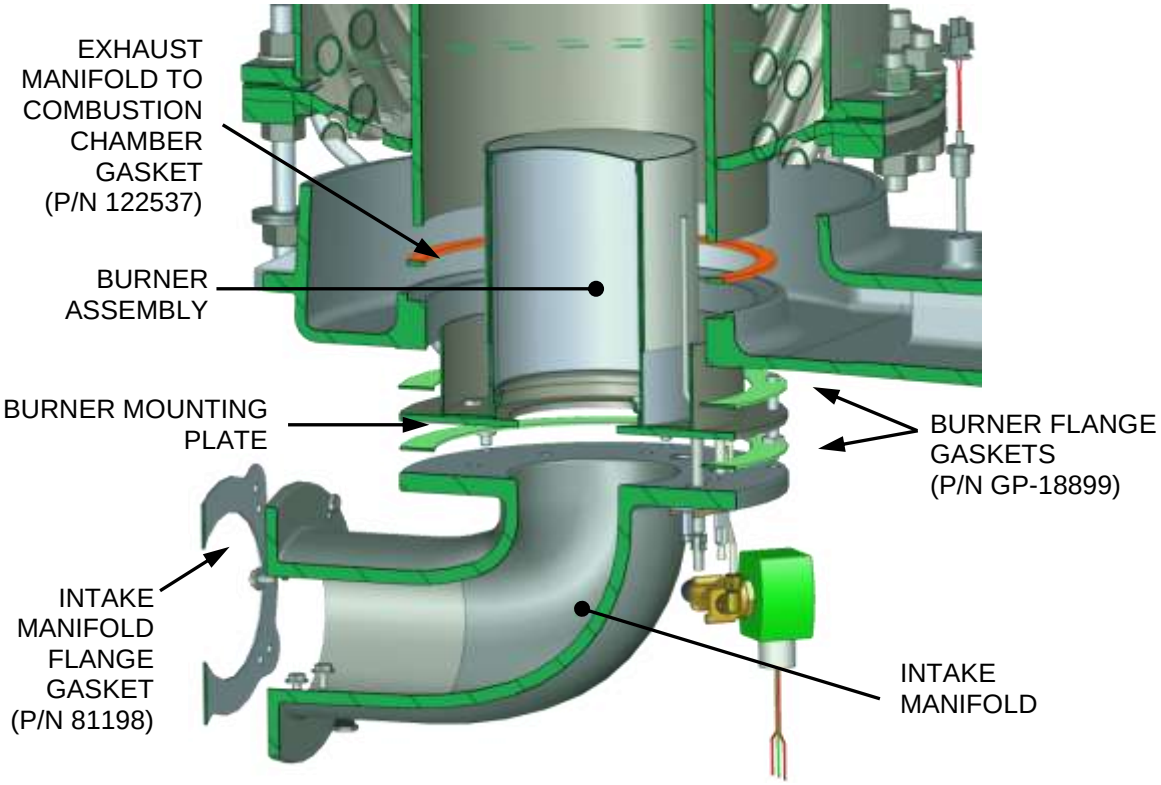


Figure 6.7-2: Intake Manifold and Burner – Cross-Section, Exploded

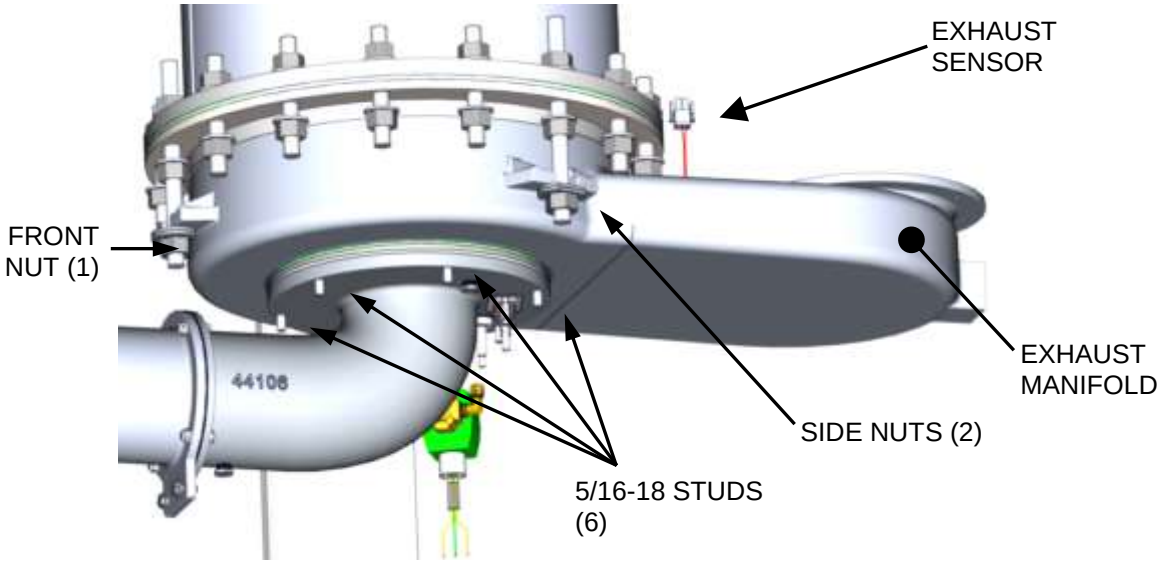


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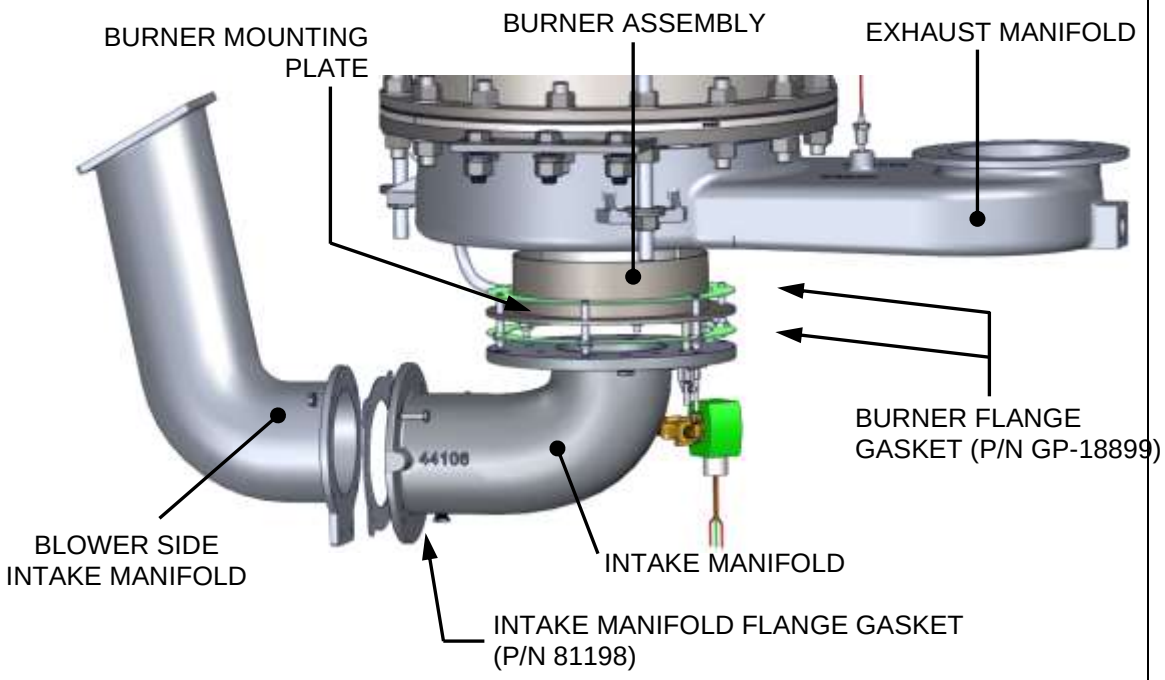
Figure 6.7-3: Intake and Exhaust Manifolds

Fireside Inspection Instructions



BURNER, INTAKE AND EXHAUST MANIFOLDS

Figure 6.7-4: Combustion Chamber Gasket Locations

IMPORTANT!

During reassembly, apply high-temperature, anti-seize lubricant to the threads of the igniter-injector and grounding screw. Also, ensure that the igniter-injector is properly positioned and not contacting other components. **Torque the igniter-injector to 15 ft/lbs. (20.3 Nm)**.

18. Reinstall all components in the reverse order in which they were removed, beginning with the exhaust manifold assembly removed in step 15.
19. When attaching the intake manifold to the exhaust manifold (removed in step 11), **torque the six 5/16 hex nuts to 146 in/lbs. (16.5 Nm)**.

WARNING!

The manifold-to-heat exchanger gasket must be held in place with High Temp RTV Silicone sealant. The exhaust manifold must be carefully raised into place, centered, and leveled to insure the gasket makes a good seal between the manifold and heat exchanger.

20. Reinstall the exhaust vent onto the exhaust manifold using a High Temp Red RTV silicon sealant, such as sealants available from Permatex or Loctite.

Fireside Inspection Instructions

21. Start the unit and fire it **for approximately 20 minutes**, to bring it up to working temperature, then shut it down and repeat Step 19, **re-torqueing the six 5/16 hex nuts attaching the intake manifold to the exhaust manifold to 146 in/lbs. (16.5 Nm)**.

6.8 Waterside Inspection And Cleaning

6.8.1 Waterside Inspection-Cleaning Schedule

For units installed at sites with hard water (>3.5 grains/gal, >59.9 mg/L), AERCO strongly recommends use of Watts **OneFlow**® anti-scaling system (note, this system does not protect against orthophosphates, which can also cause scale deposits). It provides an economical, chemical free treatment of hard water, allowing the water heater to perform at its peak heat transfer efficiency, thereby reducing heating cost.

AERCO requires that the unit's heat exchanger be inspected per the schedule in Table 6-8, below. If scale deposits are observed at the top inspection port (the most likely area for scale deposits), the heat exchanger must be cleaned, as described in Section 6.8.3.

The frequency of cleaning can be determined at each site based on inspection results, performance of the unit, and/or experience with similar equipment. The cleaning frequency may be affected by the quality of the inlet water (see Section 6.2: Water Quality Guideline), but it generally follows the inspection schedule shown in Table 6-2.

If the inlet water contains orthophosphates, the unit must be inspected every 6 months and cleaned as needed.

TABLE 6-8: Required Heat Exchanger Inspection and Cleaning Schedule

Operating Conditions	Inspection/Cleaning Frequency			
	24-months	12-months	6-months	Monthly
Domestic Water Setpoint	<130ºF (54.4 ºC)	140 - 160ºF (60 - 71ºC)	160 - 180ºF (71 - 82ºC)	>15 grains/gal (>257 mg/L*)
Calcium Hardness Level at water inlet	<7 grains/gal (<120 mg/L*)	3.5 – 9.9 grains/gal (60 - 170 mg/L*)	3.5 – 15 grains/gal (60 - 257 mg/L*)	

* 1 mg/L = 1 ppm

NOTE: In Table 6-8, if calcium hardness level, and domestic water setpoint fall under different cleaning intervals, the heat exchanger must be cleaned at the most frequent interval. During the next few cleaning intervals observe how much scale is removed to determine if less frequent intervals can be followed.

For example, if: Domestic water setpoint = 125ºF (51.7ºC) and
Calcium Hardness level = 9.5 grains/gal (163 mg/L)

Start with a 12-month cleaning frequency (125ºF setpoint falls under "24-months" and calcium hardness falls under "12-months"). Observe the next few cleanings to determine how much scale is removed to decide if 18-month cleaning frequency is more appropriate.

6.8.2 Waterside Port Inspection

Inspection of the heat exchanger tubes and tubesheet area is done using the two 2” NPT inspection ports, in the upper and lower sections of the shell, as shown in Figure 6.8.2.

Waterside Port Inspection Instructions

1. Disconnect the electrical power to the unit.
2. Close the water inlet, water outlet, and recirculation shut-off valves to the unit.
3. Open the upper drain valve, to allow air to enter the chamber, then open the lower drain valve and allow all water to drain from the shell.
4. Remove the lower 2” NPT plug (a little additional water may flow from the port).
5. Use a boroscope, or a camera and flashlight, to inspect and take photos of the visible tubes and tubesheet area.
6. If sediment and deposits exist on the lower tubesheet, and/or there is a buildup of scale deposits, follow instructions (Section 6.8.3) for descaling and flushing the unit to remove excess debris.
7. Remove the upper NPT plug and repeat the inspection, looking for signs of scale buildup or other damage in the upper portion of the shell.

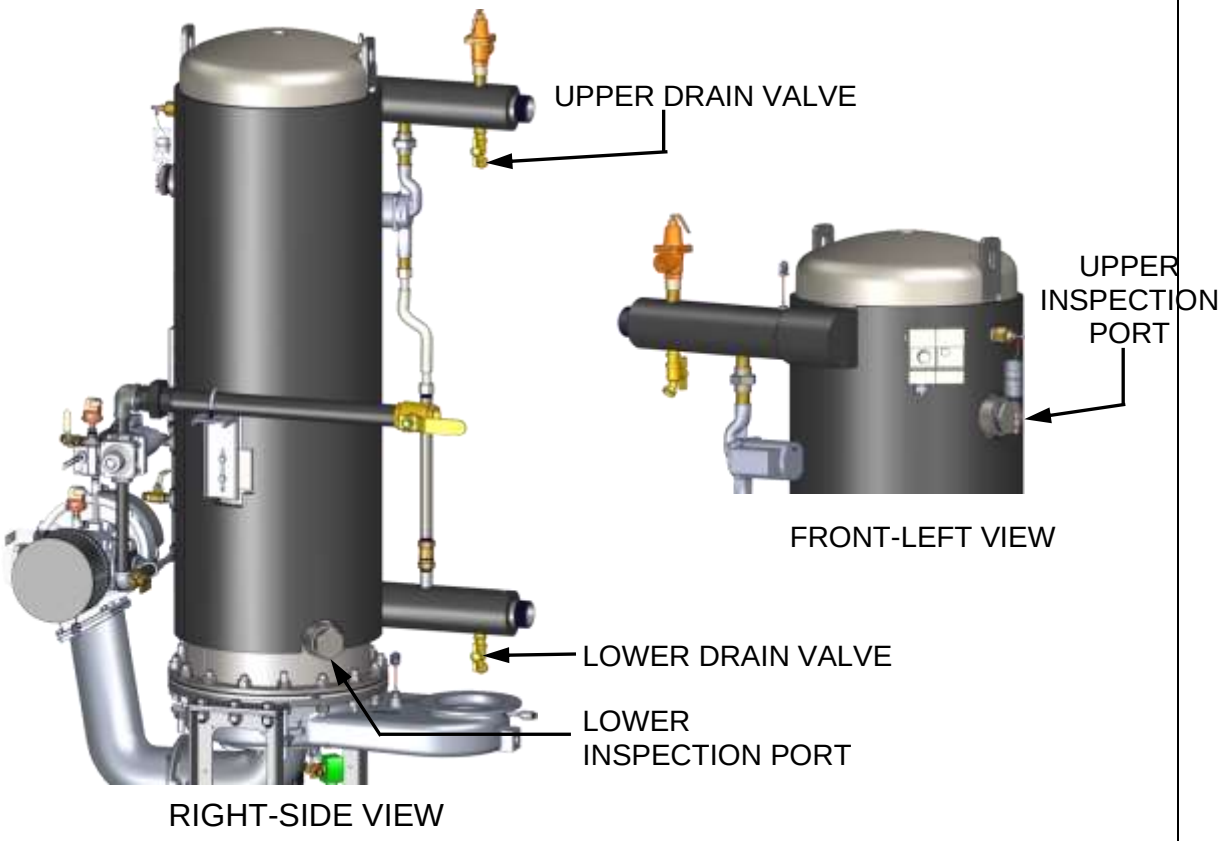


Figure 6.8.2: Waterside Inspection Port Locations

6.8.3 Waterside Heat Exchanger Cleaning

If the inspection of the waterside components revealed sediment and/or scale buildup, complete the instructions below to flush the shell with a cleaning solution.

To clean the heat exchanger, AERCO recommends using a cleaning solution of Rydlyme Chemical Descaler (or equivalent) and clean water. This product, available from Apex Engineering Products Corp., is designed to dissolve water scale, lime scale, calcium and rust. To obtain this product, or for specifications and instructions for its use contact Apex Engineering Products, or call AERCO Technical Service at (800) 526-0288.

6.8.3.1 Pumping System Set-Up Instructions

A sample pumping set-up diagram is shown in Figure 6.8.3.1. The heat exchanger is cleaned by pumping cleaning solution from a circulating bucket to the heat exchanger drain valve, through the heat exchanger and out through the output connection. Set up the pumping system as follows:

Pumping System Set-Up Instructions

1. Turn off the water heater.
2. Close the hot water outlet and cold water inlet isolation valves.
3. Open the drain valve at the rear of the unit and drain at least half of the heat exchanger water-side volume. When full, Innovation models hold the approximately gallons of water listed below. Drain at least the amount of water shown, depending on the model.

Model	Capacity	Volume to be Drained
INN 600N	24.5 gallons (92.7 L)	12.25 gallons (46.37 L)
INN 800N	24.5 gallons (92.7 L)	12.25 gallons (46.37 L)
INN 1060N	23.0 gallons (87.01 L)	11.5 gallons (43.53 L)
INN 1350N	20.6 gallons (77.97 L)	10.3 gallons (38.98 L)

4. Close the lower drain valve and connect a suitable size bucket and pump to the lower drain.

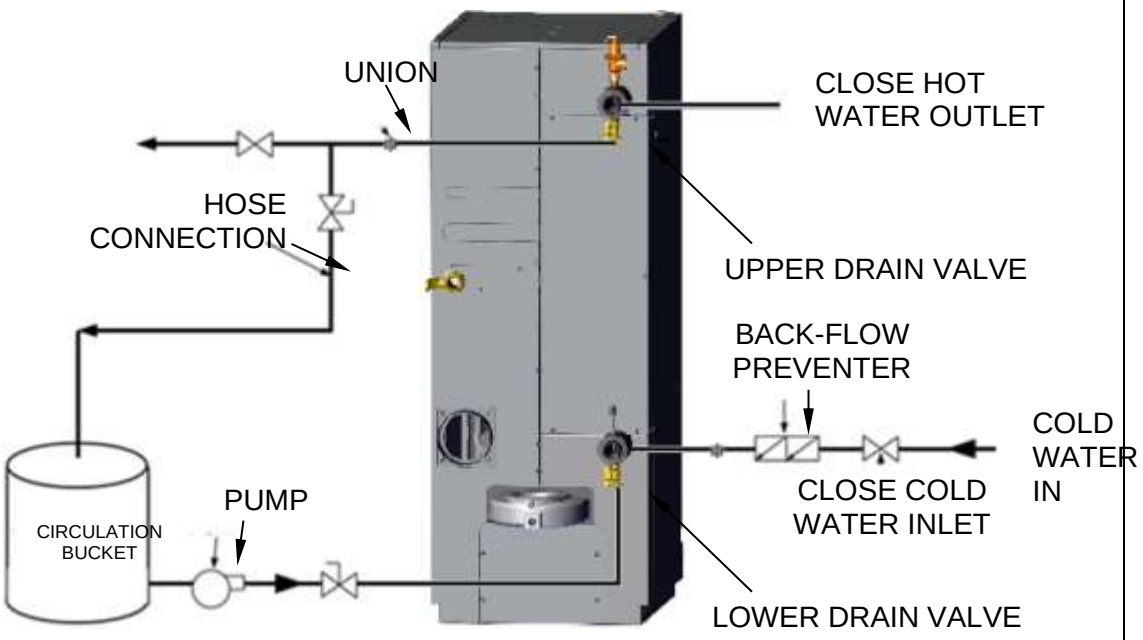


Figure 6.8.3.1: Sample Heat Exchanger Cleaning Set-Up

5. Install a hose to the upper drain valve and route it back to the circulation bucket.

6.8.3.2 Cleaning Procedure

Cleaning Procedure Instructions

1. Prepare a cleaning solution of Rydlyme Chemical Descaler and clean water according to manufacturer's instructions. The amount of the solution should be approximately equal to the full volume of water that the heat exchanger holds.
2. Slowly add the prescribe amount of the cleaning solution to the circulating bucket.
3. Open the upper and lower drain valves, and then turn on the pump. Periodically check for leaks and maintain the liquid level in the bucket. A lowering volume level is an indication that there is an open drain in the system.
4. Check the cleaning circuit to ensure that the cleaning solution is flowing from the circulation bucket, through the pump and the unit and back to the top of the top of the bucket.
5. Return discharge foaming indicates an active cleaning solution and the presence of mineral deposits in the equipment.
6. Additional cleaning solution and/or water may be required to maintain circulation and to prevent the pump from cavitating.
7. Circulate the cleaning solution through the heat exchanger and piping for 1 to 3 hours. Estimate the circulation period based on the time in service and water hardness. When the foaming action stops, cleaning solution strength is depleted (two pounds of deposits removed per gallon used) or the equipment is free from calcium and other water-formed mineral deposits.
8. Periodically test the solution for effectiveness to determine if more cleaning solution is needed. Refer to "**Testing Cleaning Effectiveness**" in the next section for details. If the cleaning solution is expended before circulation time is up, additional cleaning solution will be needed and circulation time may be extended to complete the cleaning.
9. Upon completion of the cleaning process, begin flushing the solution by adding clean water to the circulation bucket, then disconnect the return valve and hose connection from the top of the circulating bucket and thoroughly flush. Continue water flushing the equipment for a minimum of 10 minutes or until discharge runs clear.
10. Rydlyme Chemical Descaler is biodegradable, and in most instances may be purged down sewers. Check with local authorities before disposing of any complex compositions
11. Turn off water, shut off the pump and immediately close discharge valves to prevent backflow.
12. Completely drain pump bucket. Disconnect the hoses from equipment and thoroughly rinse the bucket, pump, and associated hoses used.

6.8.3.3 Testing Cleaning Effectiveness

There are two methods of testing the effectiveness of the cleaning solution during cleaning: the calcium carbonate spot test of the circulating solution and the charting of a trend in the pH of the cleaning solution.

Calcium Carbonate Spot Test

A calcium carbonate spot test is performed by exposing a form of calcium carbonate to the cleaning solution. Samples of the deposit, a Tums or Rolaids tablet, or bare concrete can be used. Observe the reaction of the cleaning solution on the calcium carbonate. Foaming and bubbling indicates the solution is still active. Little or no reaction indicates that the solution is expended. This test should be performed near the end of the circulating time. If

the solution has been expended, more cleaning solution will be required to complete the job. If the solution is still active at the end of the time, all the scale has been dissolved.

pH Trend Charting

The initial pH of the cleaning solution will measure between 1-3 (See pH sheet on Rydlyme Chemical Descaler packaging). To test the effectiveness of the circulating solution as a function of pH, take readings at regular intervals and chart as a trend. Note that the deposits can cause a premature jump in the pH. After circulating for approximately 75% of the cycle time, begin testing the pH at 10-15 minute intervals. Once the solution's pH reads 6.0-7.0 on three or more consecutive readings, the solution is expended. If the pH reads below 6.0 after the circulating time, the application is clean.

6.9 Condensate Drain Trap

Innovation Water Heaters are shipped with a condensate trap (P/N **99259**). The trap must be installed external to the unit and attached to the exhaust manifold's condensate drain port, as described in Section 2.9 (see Figure 2.9-1 and 2.9-2). This trap should be inspected and, if necessary, cleaned according to the schedule in Table 6-1 to ensure proper operation. If the installation includes a condensate neutralization system, it must also be inspected and, if necessary, cleaned at the same time.

To inspect and clean the trap, proceed as follows:

Condensate Trap Inspection and Cleaning Instructions

1. Disconnect the condensate trap by loosening and then removing connections on the inlet and outlet sides of the trap (see Figure 6.9).
2. Unscrew and remove both the top and bottom caps.
3. Run water through the body of the trap to thoroughly clean the inside of the trap and float. Also inspect the drain piping for blockage. If the trap cannot be thoroughly cleaned, replace the entire trap.
4. Replace the caps and tighten them.
5. Reassemble all piping and hose connections to the condensate trap inlet and outlet.
6. If the installation includes an optional Condensate Neutralizer system, inspect and if necessary clean it and the piping leading to the drain.

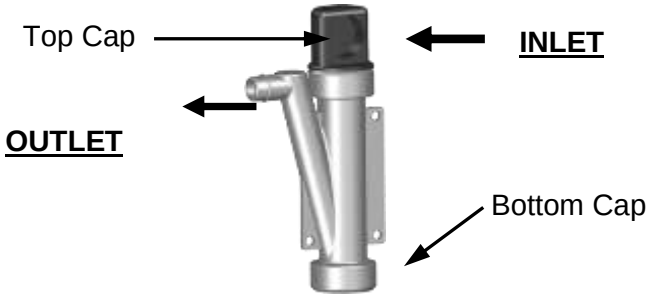


Figure 6.9: Condensate Trap P/N 99259

6.10 Air Filter Replacement

The Innovation heater is equipped with an air filter (P/N **59138**), which should be cleaned or replaced according to the schedule in Table 6-1. The air filter is attached to the air fuel valve.

To inspect/replace the air filter, proceed as follows:

Air Filter Replacement Instructions

1. Set the Controller's **Enable/Disable** switch to the **Disable** position. Disconnect AC power from the unit
2. Remove the side panels from the unit.
3. Refer to Figure 6.10 and locate the air filter attached to the air/fuel valve inlet.
4. Using a flat-tip screwdriver or 5/16 nut driver, loosen the clamp securing the filter to the inlet flange of the air/fuel valve. Remove the filter and clamp.
5. Each replacement air filter is equipped with its own clamp. Therefore, simply install the replacement air filter on inlet flange of the air fuel valve and tighten the clamp with a flat-tip screwdriver or 5/16 nut driver.
6. Replace the side panels on the unit and return heater to service use.

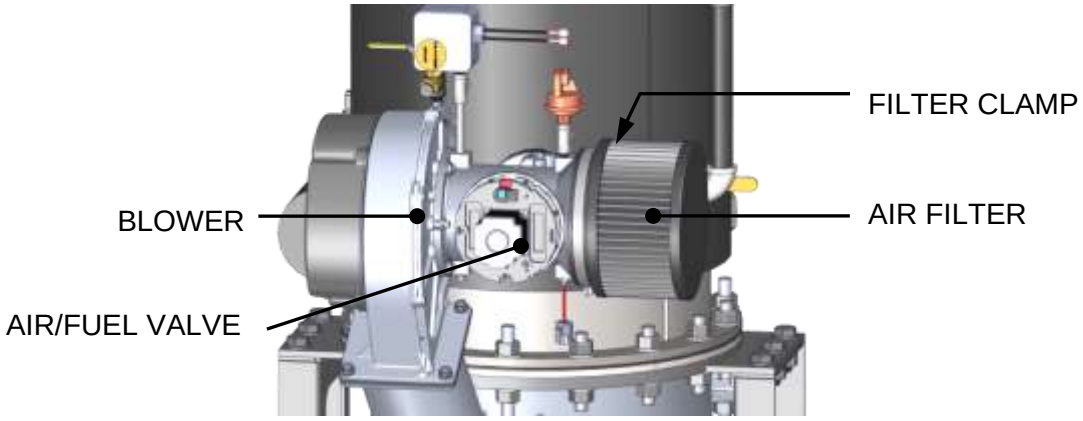


Figure 6.10: Air Filter Mounting Location

6.11 Low Water Cutoff (Lwco) Capacitor Integrity Test

If the LWCO capacitor has failed, order the LWCO capacitor Kit, P/N **69126**, from AERCO, and consult the Innovation 24 Month Maintenance Technical Instructions Document (TID-0094) for replacement instructions.

The LWCO capacitor should be tested for electrical shorts every 12 months and replaced, then tested, every 24 months. The LWCO capacitor integrity test consists of two parts as described in the next two sections. The first procedure explains how to test for electrical shorting of the LWCO probe capacitor, while the second procedure instructs how to perform the standard Low Water Cutoff test using the Edge Controller.

The LWCO probe is located on the front of the heat exchanger body near the top. Figure 6.11 shows its location and components.

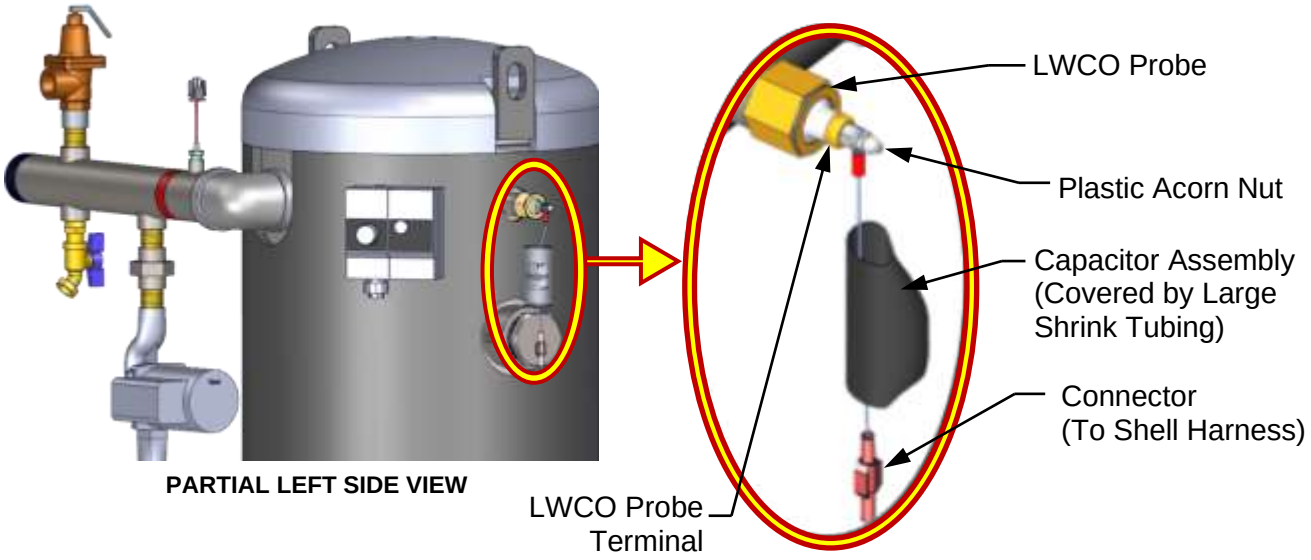


Figure 6.11: LWCO Probe Location (INN 1350 Shown)

6.11.1 Low Water Cutoff (LWCO) - Capacitor Electrical Short Test

This test determines if there is an electrical short between the LWCO capacitor and the heat exchanger. Perform the capacitor electrical short test as described below.

LWCO Capacitor Electrical Short Test Instructions

1. Turn OFF AC power to the unit.

WARNING!

VOLTAGES OF 220 OR 110 AND 24 ARE USED TO POWER THESE UNITS, SO POWER APPLIED TO THESE UNITS ***MUST*** BE REMOVED BEFORE PERFORMING THE PROCEDURE DESCRIBED BELOW. SERIOUS PERSONAL INJURY OR DEATH MAY OCCUR IF THIS WARNING IS NOT OBSERVED.

2. Remove the Shell Harness Cable (male) connector from the P-5 (female) connector on the rear panel of the Edge Controller (see Figure 6.11.1-1).

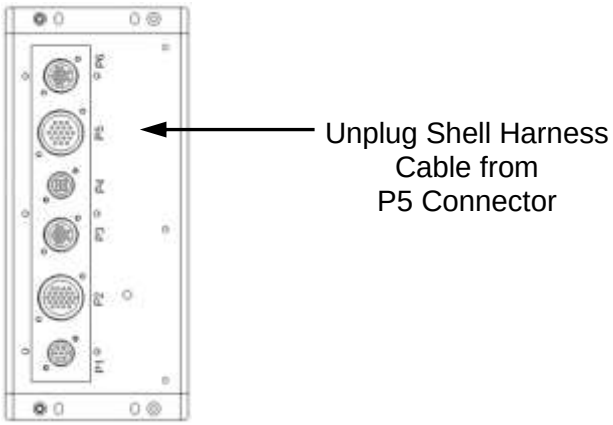


Figure 6.11.1-1: Removing Shell Harness Cable from P5 Connector on Rear Panel

LWCO Capacitor Electrical Short Test Instructions

3. Using an ohmmeter, connect one ohmmeter probe to the LWCO capacitor terminal on the unit shell as shown on left in Figure 6.11.1-2.
4. Connect the second ohmmeter probe to Pin #6 of Shell Harness Connector (removed from the Edge Controller) as shown on right in Figure 6.11.1-2.

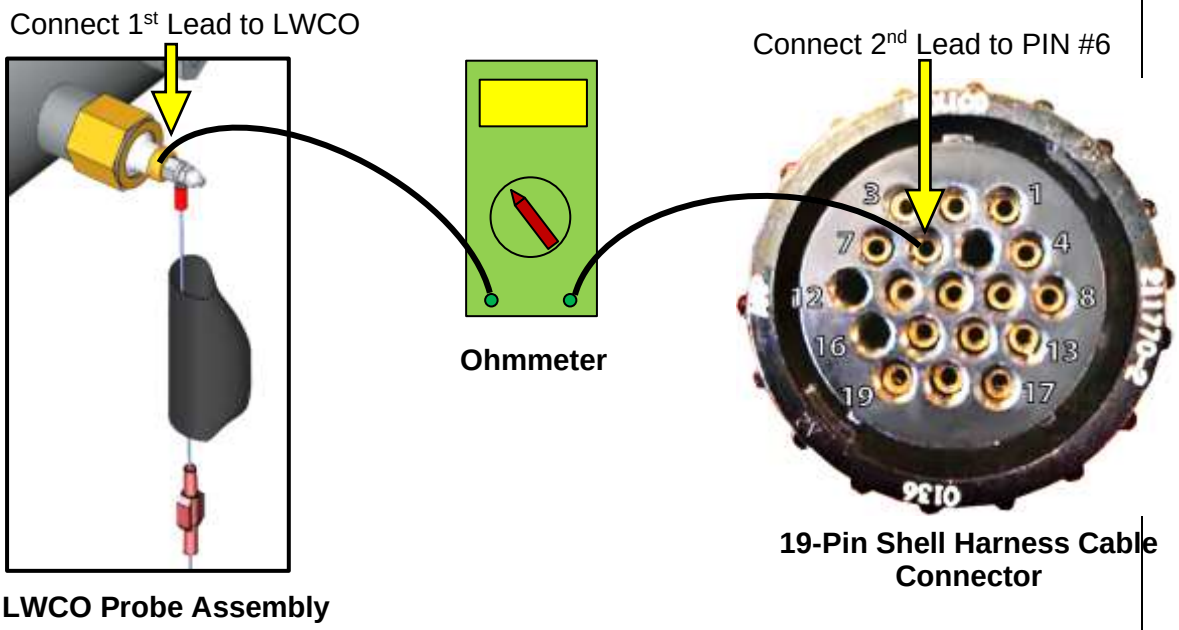


Figure 6.11.1-2: Connecting Ohmmeter – LWCO Probe & Shell Harness Cable

5. Confirm that the ohmmeter does NOT read a short.

NOTE: If the ohmmeter reads a short the capacitor assembly needs replacing. Refer to document TID-0094 provided with 24-month maintenance kit for instructions.

6. Remove both ohmmeter probes and reconnect the Shell Harness connector to the P5 connector on the rear of the Edge Controller.

6.11.2 Low Water Cutoff (LWCO) - Standard Test

Perform the standard Low Water Cutoff test using the Edge Controller as described below.

Standard Low Water Cutoff Edge Test Instructions

1. Turn on the AC power to the unit.
2. Press the **TEST** switch on the Edge Controller and confirm that the blinking ***Low Water Level*** message appears on the Edge display within 4 seconds.
3. Press the **RESET** key, followed by the **Clear** button, and confirm that the ***Low Water Level*** message is cleared.

6.12 Shutting Down for an Extended Period Of Time

If the unit is to be taken out of service for an extended period of time (one year or more), complete the following instructions.

Extended Period Shut-Down Instructions

1. Set the Controller's **Enable/Disable** switch to the **Disable** position to shut down the unit's operating controls.
2. Disconnect AC power from the unit.
3. Close the water inlet and outlet valves to isolate unit.
4. Close external gas supply valve.
5. Open relief valve to vent water pressure.
6. Open the drain valve and drain all water from the unit.
7. If the temperature in the storage location will ever get below freezing, **for even a short time**, you must drain ***all*** water from the unit ***before*** the temperature falls below freezing. Step 6 is not sufficient, as it leaves some water in the bottom of the heat exchanger chamber. You must then use a suction pump inserted through the inspection port to remove ***all*** water from the bottom of the heat exchanger chamber and base assembly.

6.13 Returning To Service After Prolonged Shutdown

After a prolonged shutdown (one year or more), the following procedures must be followed:

Placing Heater Back In Service After Prolonged Shutdown Instructions

1. Review installation requirements included in Chapter 2.
2. Inspect all piping and connections to the unit.
3. Inspect exhaust vent, air duct (if applicable).
4. Perform initial startup per Chapter 4.
5. Perform safety device testing and scheduled maintenance per Sections 5 and 6, above.

6.14 Exhaust Vent Inspection

The exhaust vent system should be visually inspected for leaks, damage and obstructions every 12 month. If the vent terminates in a screen, it must be inspected and if necessary cleaned to ensure it is not obstructed.

CHAPTER 7. TROUBLESHOOTING GUIDE

7.1 Introduction

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

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

General Troubleshooting Instructions

1. Observe the fault messages displayed in the Edge Controller display.
2. Refer to the Fault Indication column in Troubleshooting Table 7-1 which follows and locate the Fault that best describes the existing conditions.
3. Proceed to the Probable Cause column and start with the first item (1) listed for the Fault Indication.
4. Perform the checks and procedures listed in the Corrective Action column for the first Probable Cause candidate.
5. Continue checking each additional Probable Cause for the existing fault until the fault is corrected.
6. Section 7.2 and Table 7-2 contain additional troubleshooting information which may apply when no fault message is displayed.

If the fault cannot be corrected using the information provided in the Troubleshooting Tables, contact your local AERCO Representative.

NOTE: The unit's I/O board contains an RS232 port. This port is used only by factory-trained personnel to monitor Nexa communications via a portable computer.

TABLE 7-1. WATER HEATER TROUBLESHOOTING		
FAULT INDICATION	**PROBABLE CAUSES**	**CORRECTIVE ACTION**
AIRFLOW FAULT DURING IGNITION	1. Blower stopped running due to thermal or current overload.	1. Check combustion blower for signs of excessive heat or high current drain that may trip thermal or current overload devices.
	2. Blocked **Blower Inlet** or inlet ductwork.	2. Inspect the inlet to the combustion blower including any ductwork leading up to the combustion blower for signs of blockage.
	3. Blocked **Blower Proof** switch.	3. Remove the **Blower Proof** switch and inspect for signs of blockage, clean or replace as necessary.
	4. Blocked **Blocked-Air Inlet** switch.	4. Remove the **Blocked-Air Inlet** switch and inspect for signs of blockage, clean or replace as necessary.
	5. Defective **Blower Proof** switch.	5. Measure the **Blower Proof** switch for continuity with the combustion blower running. If there is an erratic resistance reading or the resistance reading is greater than zero ohms, replace the switch.
	6. Defective **Blocked-Air Inlet** switch.	6. Measure the **Blocked-Air Inlet** switch for continuity with the combustion blower running. If there is an erratic resistance reading or the resistance reading is greater than zero ohms, replace the switch.
	7. Loose temperature to AUX connection in I/O Box.	7. Check the actual inlet air temperature and measure voltage at AUX input in the I/O Box. Verify that the voltage conforms to the values shown in the tabular listing provided in Appendix C.
	8. Defective temperature sensor.	8. Refer to item 7, above, and verify that the voltage conforms to the values shown in Appendix C.
	9. Loose wire connection between the 0-10V signal from I/O box to the Blower Motor input.	9. Check wire connection from I/O Box 0-10V signal to the Blower Motor.
	10. Defective I/O box.	10. Measure voltage at the I/O box 0-10V output. A voltage of 8.2V equates to a 100% open valve position.
	11. Wrong 0-10V output selection on the Edge Controller.	11. Check that the blower Analog Out terminal on the I/O board has a corresponding signal for the A/F valve.
	12. Defective Air-Fuel Valve potentiometer.	12. Check Air/Fuel Valve position at 0%, 50% and 100% open positions. The positions on the VALVE POSITION bargraph should match the dial readings on the Air/Fuel Valve dial.
AIRFLOW FAULT DURING PURGE	1. Blower not running or running too slow.	1. Start the unit. If the blower does not run check the blower solid state relay for input and output voltage. If the relay is okay, check the blower.
	2. Defective **Air Flow** switch.	2. Start the unit. If the blower runs, check the airflow switch for continuity. Replace the switch if there is no continuity.

TABLE 7-1. WATER HEATER TROUBLESHOOTING		
FAULT INDICATION	**PROBABLE CAUSES**	**CORRECTIVE ACTION**
	3. Blocked **Air Flow** switch.	3. Remove the air flow switch and inspect for signs of blockage, clean or replace as necessary.
	4. Blocked blower inlet or inlet ductwork.	4. Inspect the inlet to the combustion blower including any ductwork leading up to the combustion blower for signs of blockage.
	5. No voltage to switch from Edge Controller.	5. Measure for 24 VAC during start sequence from each side of the switch to ground. If 24 VAC is not present refer to qualified service personnel.
	6. PROBABLE CAUSES from AIRFLOW FAULT DURING IGNITION above, items 3 to 12, applies to this fault.	6. See CORRECTIVE ACTIONS from AIRFLOW FAULT DURING IGNITION above, items 3 to 12.
AIRFLOW FAULT DURING RUN	1. Blower stopped running due to thermal or current overload.	1. Check combustion blower for signs of excessive heat or high current draw that may trip thermal or current overload devices.
	2. Blocked Blower inlet or inlet ductwork.	2. Inspect the inlet to the combustion blower including any ductwork leading up to the combustion blower for signs of blockage.
	3. Blocked airflow switch.	3. Remove the airflow switch and inspect for signs of blockage, clean or replace as necessary.
	4. Defective airflow switch.	4. Measure the airflow switch for continuity with the combustion blower running. If there is an erratic resistance reading or the resistance reading is greater than zero ohms, replace the switch.
	5. Combustion oscillations.	5. Run unit to full fire. If the unit rumbles or runs rough, perform combustion calibration.
	6. PROBABLE CAUSES from AIRFLOW FAULT DURING IGNITION above, items 3 to 12, applies to this fault.	6. See CORRECTIVE ACTIONS from AIRFLOW FAULT DURING IGNITION above, items 3 to 12.
DELAYED INTERLOCK OPEN	1. Delayed Interlock Jumper not installed or removed.	1. Check for a jumper properly installed across the delayed interlock terminals in the I/O box.
	2. Device proving switch hooked to interlocks is not closed.	2. If there are 2 external wires on these terminals, check to see if an end switch for a device such as a pump, louver, etc. is tied these interlocks. Ensure that the device and or its end switch are functional. (Jumper may be temporarily installed to test interlock.)
FLAME LOSS DURING IGN	1. Burner Ground Screw not installed or loose.	1. Inspect and install/retighten Burner Ground Screw.
	2. Worn flame detector.	2. Remove and inspect the flame detector for signs of wear. Replace if necessary.

TABLE 7-1. WATER HEATER TROUBLESHOOTING		
FAULT INDICATION	**PROBABLE CAUSES**	**CORRECTIVE ACTION**
	3. No spark from Spark Plug.	3. Close the internal gas valve in the unit. Install and arc a spark igniter-injector outside the unit.
	4. Defective Ignition Transformer	4. If there is no spark, check for 120 VAC at the primary side to the ignition transformer during the ignition cycle.
	5. Defective Ignition/Stepper (IGST) Board.	5. If 120 VAC is not present, the IGST Board in the Edge Controller may be defective. Refer fault to qualified service personnel.
	6. Defective SSOV.	6. While externally arcing the spark igniter-injector, observe the open/close indicator in the Safety Shut-Off Valve to ensure it is opening. If the valve does not open, check for 120 VAC at the valves input terminals. If 120 VAC is not present, the IGST board in the Edge Controller may be defective. Refer fault to qualified service personnel.
	7. Carbon or other debris on Burner.	7. Remove the burner and inspect for any carbon or debris. Clean and reinstall.
FLAME LOSS DURING RUN	1. Worn Flame Detector or cracked ceramic.	1. Remove and inspect the Flame Detector for signs of wear or cracked ceramic. Replace if necessary.
	2. Defective Regulator.	2. Check gas pressure readings using a gauge or manometer into and out of the Air/Fuel Valve to ensure that the gas pressure into and out of the valve is correct.
	3. Poor combustion calibration.	3. Check combustion calibration. Adjust as necessary.
	4. Debris on burner.	4. Remove the burner and inspect for any carbon or debris. Clean and reinstall.
	5. Blocked condensate drain.	5. Remove blockage in condensate drain.
HEAT DEMAND FAILURE	1. The Heat Demand Relays on the Ignition/Stepper board failed to activate when commanded.	1. Press **CLEAR** button and restart the unit. If the fault persists, replace Ignition/Stepper (IGST) Board.
	2. Relay is activated when not in Demand.	2. Defective relay. Replace IGST Board.
HIGH EXHAUST TEMPERATURE	1. Poor combustion calibration.	1. Check combustion calibration using procedures in Chapter 4.
	2. Heat exchanger has scale.	2. Clean heat exchanger using procedures in Chapter 6.
	3. The gasket between the exhaust manifold and combustion chamber is not properly sealing.	3. Check the gasket between the exhaust manifold and combustion chamber.
HIGH GAS PRESSURE	1. Incorrect supply gas pressure.	1. Check to ensure that gas pressure at inlet of SSOV is ***not above*** 14" W.C. (3.49 kPa).

TABLE 7-1. WATER HEATER TROUBLESHOOTING		
FAULT INDICATION	**PROBABLE CAUSES**	**CORRECTIVE ACTION**
	2. Defective SSOV Actuator.	2. If gas supply pressure downstream of SSOV Actuator cannot be lowered to below 3.0" W.C. (747 Pa) using the gas pressure adjustment screw, see Section 4.3, Step 14, the SSOV Actuator may be defective.
	3. Defective **High Gas Pressure** switch.	3. Remove the leads from the **High Gas Pressure** switch and measure continuity across the common and normally closed terminals with the unit not firing. Replace the switch if it does not show continuity.
HIGH WATER TEMP SWITCH OPEN	1. Faulty Water temperature switch.	1. Test the temperature switch to insure it trips at its actual water temperature setting.
	2. Incorrect PID settings.	2. Check PID settings against Menu Default settings in Chapter 3. If the settings have been changed, record the current readings then reset them to the default values.
	3. Faulty shell temperature sensor.	3. Using the resistance charts in Appendix C, measure the resistance of Shell sensor and BTU sensor at a known water temperature.
	4. Unit in MANUAL mode	4. If **Manual Mode** = **Enabled**, set it to **Disabled**.
	5. Unit setpoint is greater than **Over Temperature** switch setpoint.	5. Check setpoint of unit and setpoint of Temperature switch. Ensure that the temperature switch is set higher than the unit's setpoint.
	6. System flow rate changes are occurring faster than units can respond.	6. If the system is a variable flow system, monitor system flow changes to ensure that the rate of flow change is not faster than what the units can respond to.
HIGH WATER TEMPERATURE	1. See HIGH WATER TEMPERATURE SWITCH OPEN.	1. See HIGH WATER TEMPERATURE SWITCH OPEN.
	2. Temp HI Limit setting is too low.	2. Check Temp HI Limit setting.
IGN BOARD COMM FAULT	1. Communication fault has occurred between the PMC board and Ignition/Stepper (IGST) board.	1. Press **CLEAR** button and restart unit. If fault persists, contact qualified Service Personnel.
IGN SWITCH CLOSED DURING PURGE	1. Air/Fuel Valve not rotating.	1. Start the unit. The Air/Fuel Valve should rotate to the purge (open) position. If the valve does not rotate at all or does not rotate fully open, check the Air/Fuel Valve calibration. If calibration is okay, the problem may be in the Air-Fuel Valve or the Edge Controller. Refer to qualified service personnel
	2. Defective or shorted switch	2. If the Air/Fuel Valve does rotate to purge, check the **Ignition** switch for continuity between the N.O. and COM terminals. If the switch shows continuity when not in contact with the cam replace the switch.

TABLE 7-1. WATER HEATER TROUBLESHOOTING		
FAULT INDICATION	**PROBABLE CAUSES**	**CORRECTIVE ACTION**
IGN SWITCH CLOSED DURING PURGE (continued)	3. Switch wired incorrectly.	3. Check to ensure that the switch is wired correctly (correct wire numbers on the normally open terminals). If the switch is wired correctly, replace the switch.
	4. Defective Power Supply Board or fuse.	4. Check **DS1** & **DS2** LEDs on Power Supply Board. If they are not steady ON, replace Power Supply Board.
	5. Defective IGST Board.	5. Check "Heartbeat" LED DS1 and verify it is blinking ON & OFF every second. If not, replace IGST Board.
IGN SWITCH OPEN DURING IGNITION	1. Air/Fuel Valve not rotating to ignition position.	1. Start the unit. The Air/Fuel Valve should rotate to the purge (open) position, then back to ignition position (towards closed) during the ignition cycle. If the valve does not rotate back to the ignition position, check the Air/Fuel Valve calibration. If calibration is okay, the problem may be in the Air/Fuel Valve or the Edge Controller. Refer fault to qualified service personnel.
	2. Defective **Ignition** switch.	2. If the Air/Fuel Valve does rotate to the ignition position, check the ignition position switch for continuity between the N.O. and COM terminals when in contact with the cam.
	3. Defective Power Supply Board or fuse.	3. Check **DS1** & **DS2** LEDs on Power Supply Board. If they are not steady ON, replace Power Supply Board.
	4. Defective IGST Board.	4. Check "Heartbeat" LED **DS1** and verify it is blinking ON & OFF every second. If not, replace IGST Board.
INTERLOCK OPEN	1. Interlock jumper not installed or removed.	1. Check for a jumper properly installed across the interlock terminals in the I/O box.
	2. Energy Management System does not have unit enabled.	2. If there are two external wires on these terminals check any Energy Management system to see if they have the units disabled (a jumper may be temporarily installed to see if the interlock circuit is functioning).
	3. Device proving switch hooked to interlocks is not closed.	3. Check that proving switch for any device hooked to the interlock circuit is closing and that the device is operational.
LINE VOLTAGE OUT OF PHASE	1. Line and Neutral switched in AC Power Box.	1. Check hot and neutral in AC Power Box to ensure they are not reversed.
	2. Incorrect power supply transformer wiring.	2. Check transformer wiring, in AC Power Box, against the power box transformer wiring diagram to ensure it is wired correctly.
LOW GAS PRESSURE	1. Incorrect supply gas pressure.	1. Measure gas pressure upstream of the SSOV Actuator(s) with the unit firing. For both FM and DBB gas trains, ensure it is between 4.0" W.C. (996 Pa) and 14" W.C. (3.49 kPa) (see Section 2.10.1).

TABLE 7-1. WATER HEATER TROUBLESHOOTING		
FAULT INDICATION	**PROBABLE CAUSES**	**CORRECTIVE ACTION**
	2. Defective **Low Gas Pressure** switch.	2. Measure gas pressure at the **Low Gas Pressure** switch. If it is greater than 2.6" W.C. (647 Pa), measure continuity across the switch and replace if necessary.
LOW WATER LEVEL	1. Insufficient water level in system. 2. Defective water level circuitry.	1. Check system for sufficient water level. 2. Test water level circuitry using the Edge Controller front panel LOW WATER TEST and RESET buttons. Replace water level circuitry if it does not respond.
	3. Defective water level probe.	3. Check continuity of probe end to the shell, change probe if there is no continuity.
MODBUS COMM FAULT	Unit not seeing information from Modbus network.	Check network connections. If fault persists, contact qualified Service Personnel.
PRG SWITCH CLOSED DURING IGNITION	1. A/F Valve rotated open to purge and did not rotate to ignition position.	1. Start the unit. The Air/Fuel Valve should rotate to the purge (open) position, then back to ignition position (towards closed) during the ignition cycle. If the valve does not rotate back to the ignition position, check the Air/Fuel Valve calibration. If calibration is okay, the problem may be in the Air/Fuel Valve or the Edge Controller. Refer fault to qualified service personnel.
	2. Defective or shorted switch.	2. If the Air/Fuel Valve does rotate to the ignition position, check the purge switch for continuity between the N.O. and COM terminals. If the switch shows continuity when not in contact with the cam, check to ensure that the switch is wired correctly (correct wire numbers on the normally open terminals).
PRG SWITCH CLOSED DURING IGNITION (continued)	3. Switch wired incorrectly.	3. If the switch is wired correctly, replace the switch.
	4. Defective Power Supply Board or fuse.	4. Check **DS1** & **DS2** LEDs on Power Supply Board. If they are not steady ON, replace Power Supply Board.
	5. Defective IGST Board.	5. Check "Heartbeat" LED DS1 and verify it is blinking ON & OFF every second. If not, replace IGST Board.
PRG SWITCH OPEN DURING PURGE	1. Defective purge switch.	1. If the air-fuel valve does rotate, check purge switch for continuity when closing. Replace switch if continuity does not exist.
	2. No voltage present at switch.	2. Measure for 24 VAC from each side of the switch to ground. If 24VAC is not present, refer fault to qualified service personnel.
	3. Switch wired incorrectly.	3. Check to ensure that the switch is wired correctly (correct wire numbers on the normally open terminals).
	4. Defective Power Supply Board or fuse.	4. Check **DS1** & **DS2** LEDs on Power Supply Board. If they are not steady ON, replace Power Supply Board.

TABLE 7-1. WATER HEATER TROUBLESHOOTING		
FAULT INDICATION	**PROBABLE CAUSES**	**CORRECTIVE ACTION**
	5. Defective IGST Board.	5. Check "Heartbeat" LED **DS1** and verify it is blinking ON & OFF every second. If not, replace IGST Board.
OUTDOOR TEMP SENSOR FAULT	1. Loose or broken wiring. 2. Defective Sensor. 3. Incorrect Sensor.	1. Inspect Outdoor Temperature sensor for loose or broken wiring. 2. Check resistance of sensor to ensure it is within specification. 3. Ensure that the correct sensor is installed.
RECIRC PUMP FAILURE	1. Internal recirculation pump failed.	1. Replace recirculation pump.
REMOTE SETPT SIGNAL FAULT	1. Remote setpoint signal not present: – Not yet installed. – Wrong polarity. – Signal defective at source. – Broken or loose wiring. 2. Signal is not isolated (floating) if 4 to 20 mA. 3. Edge Controller signal type selection switches not set for correct signal type (voltage or current).	1. Check I/O Box to ensure signal is hooked up. – Hook up if not installed. – If installed, check polarity. – Measure signal level. – Check continuity of wiring between source and unit. 2. Check signal at source to ensure it is isolated. 3. Check **DIP** switch on the Controller's Interface board (behind the display) to ensure it is set correctly for the type of signal being sent. Check control signal type set in **Main Menu → Advanced Setup → Unit → Application Configuration**.
RESIDUAL FLAME	1. SSOV not fully closed. 2. Defective Flame Detector.	1. Check open/close indicator window of Safety Shut-Off Valve (SSOV) and ensure that the SSOV is fully closed. If not fully closed, replace the valve and or actuator. Close the 1" Gas Shut-Off Valve downstream of SSOV (Figure 7.2-1). Install a manometer or gauge at the leak detection port between the SSOV and Gas Shut Off Valve. If a gas pressure reading is observed replace the SSOV Valve and/or Actuator. 2. Replace Flame Detector.
SSOV FAULT DURING PURGE	See SSOV SWITCH OPEN	
SSOV FAULT DURING RUN	SSOV switch closed for 15 seconds during run.	Replace or adjust micro switch in SSOV actuator. If fault persists, replace actuator.
SSOV RELAY FAILURE	1. SSOV relay failed on IGST board.	1. Press **CLEAR** button and restart unit. If fault persists, replace Ignition/Stepper (IGST) Board.

TABLE 7-1. WATER HEATER TROUBLESHOOTING		
FAULT INDICATION	**PROBABLE CAUSES**	**CORRECTIVE ACTION**
	2. Floating Neutral.	2. The Neutral and Earth Ground are not connected at the source and therefore there is a voltage measured between the two. This measurement should be near zero or no more than a few millivolts.
	3. Hot and Neutral reversed at SSOV.	3. Check SSOV power wiring.
SSOV SWITCH OPEN	1. Actuator not allowing for full closure of gas valve.	1. Observe operation of the Safety Shut-Off Valve (SSOV) through indicator on the Valve actuator and ensure that the valve is fully and not partially closing.
	2. SSOV powered when it should not be.	2. If the SSOV never closes, it may be powered continuously. Close the gas supply and remove power from the unit. Refer fault to qualified service personnel.
	3. Defective switch or Actuator.	3. Remove the electrical cover from the SSOV and check switch continuity. If the switch does not show continuity with the gas valve closed, either adjust or replace the switch or actuator.
	4. Incorrectly wired switch.	4. Ensure that the SSOV Proof of Closure switch is correctly wired.
STEPPER MOTOR FAILURE	1. Air/Fuel Valve out of calibration.	1. Perform Stepper Test per GF-112 (section 6.3.5) to ensure stepper motor rotates properly from 0% (fully closed) to 100% (fully open) positions. Verify VALVE POSITION bargraph and dial on the Air/Fuel Valve track each other to indicate proper operation. If operation is not correct, perform the Stepper Feedback Calibration (GF-112, section 6.2.1).
	2. Air/Fuel Valve unplugged.	2. Check that the Air/Fuel Valve is connected to the Edge Controller.
	3. Loose wiring connection to the	3. Inspect for loose connections between the Air/Fuel Valve
	4. stepper motor.	4. motor and the wiring harness.
	5. Defective Air/Fuel Valve stepper motor.	5. Replace stepper motor.
	6. Defective Power Supply Board or fuse.	6. Check **DS1** & **DS2** LEDs on Power Supply Board. If they are not steady ON, replace Power Supply Board.
	7. Defective IGST Board.	7. Check "Heartbeat" LED **DS1** and verify it is blinking ON & OFF every second. If not, replace IGST Board.
WARNING EXHAUST TEMP HIGH (Flashing WARNING)	1. Poor combustion calibration.	1. Check combustion calibration using procedures in Chapter 4.
	2. Heat exchanger has scale.	2. Clean heat exchanger using procedures in Chapter 6.
	3. The gasket between the exhaust manifold and combustion chamber is not properly sealing.	3. Check the gasket between the exhaust manifold and combustion chamber.

7.2 Additional Faults Without Specific Fault Messages

Refer to Table 7-2 to troubleshoot faults which may occur without a specific fault message being displayed.

TABLE 7-2. WATER HEATER TROUBLESHOOTING WITH NO FAULT MESSAGE DISPLAYED

OBSERVED INCIDENT	PROBABLE CAUSES	CORRECTIVE ACTION
Fluctuating Gas Pressure	1. Gas pressure going into unit is fluctuating.	1. Stabilize gas pressure going into unit. If necessary, troubleshoot Building Supply Regulator.

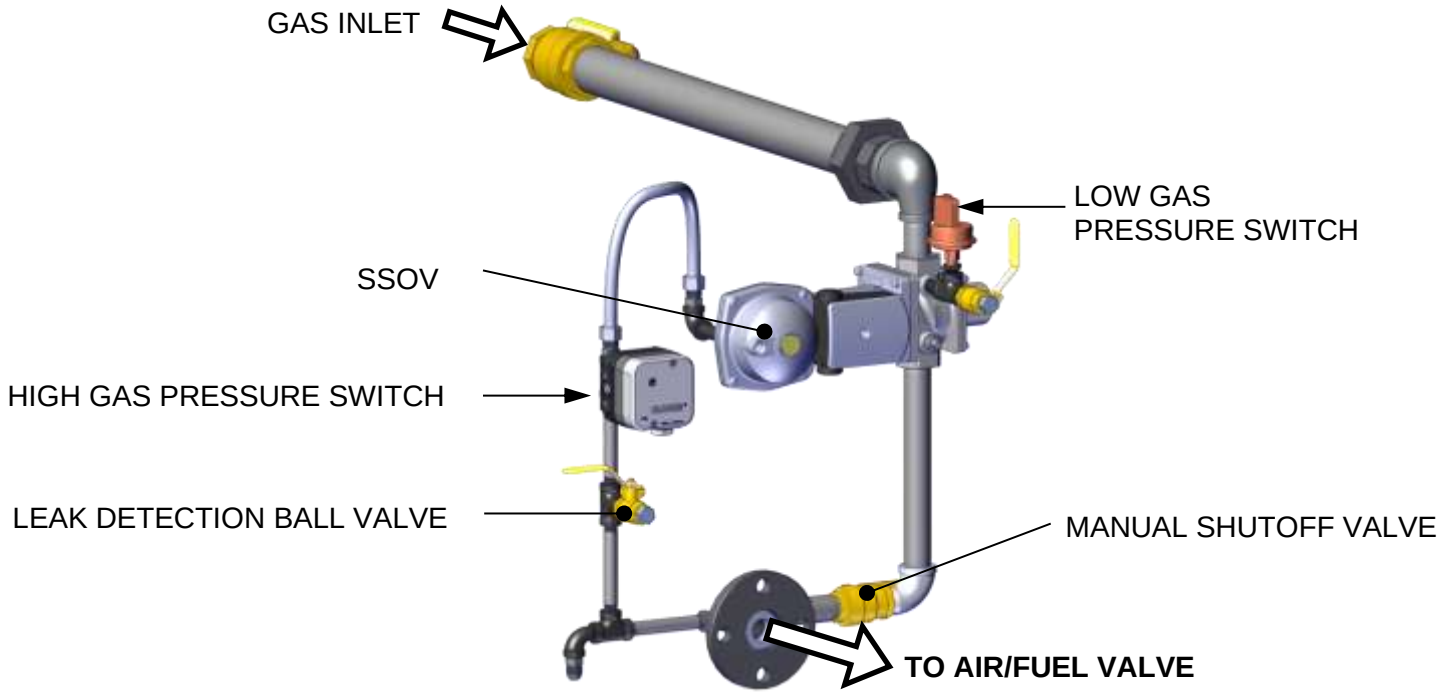


Figure 7.2-1: Innovation Gas Train Component Locations (600N & 800N P/N 22332 shown)

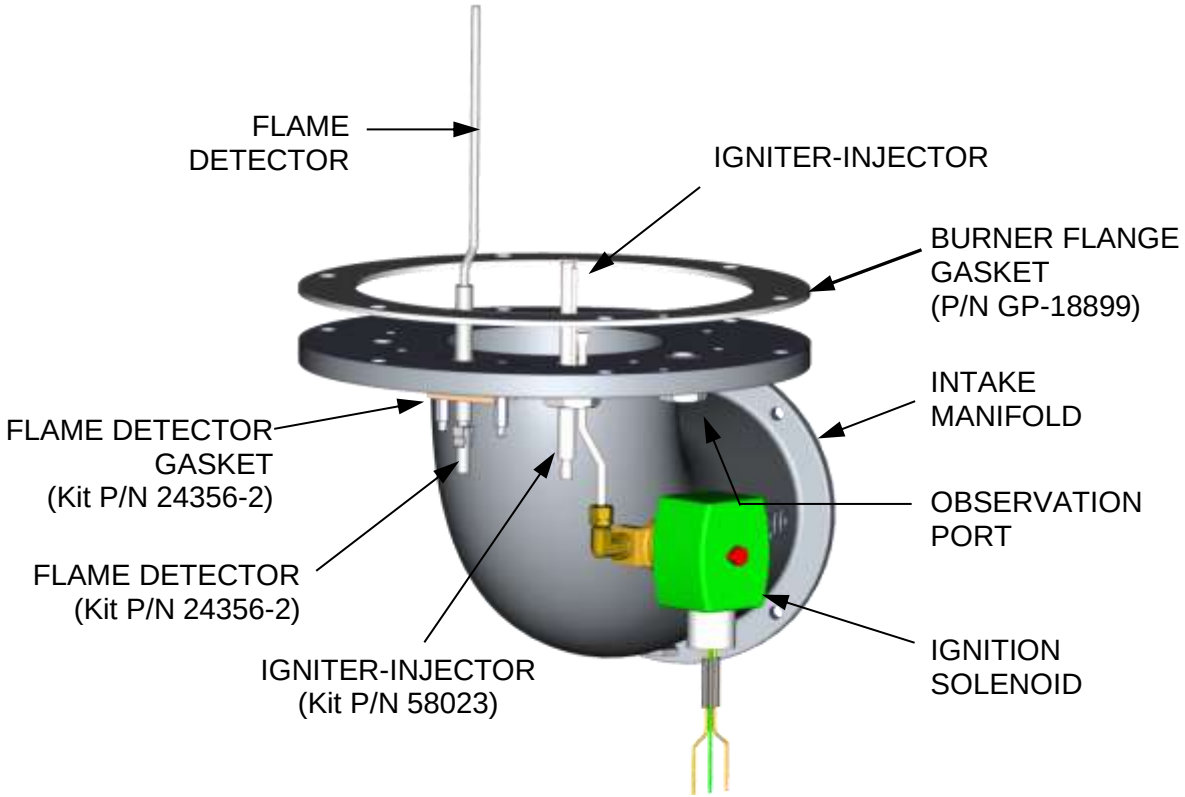


Figure 7.2-2: Intake Manifold

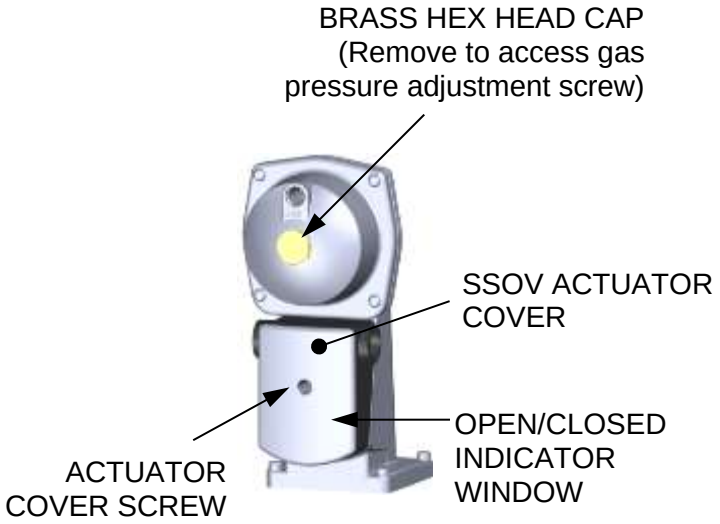


Figure 7.2-3: SSOV Actuator with Gas Pressure Adjustment

CHAPTER 8. WATER HEATER MANAGEMENT

NOTE: Some of the descriptions and procedures provided in this Chapter may duplicate information provided in previous Chapters of this manual. This is done to organize all WHM related information into a single Chapter, thus minimizing referencing back to these descriptions and procedures. It is assumed that the user is familiar with the basic Edge Controller's menu processing procedures used throughout this manual.

The On-Board-Water-Heater Management system II (WHM II) is a feature integrated in the Edge Controller, designed to stage and coordinate multiple AERCO Innovation water heaters while maximizing operational efficiency. The WHM software code resides in each Edge Controller that is part of the system. The WHMII can control up to eight (8) water heaters in parallel. Each water heater controlled by the WHM must be equipped with an Actuator-Controlled Sequencing Valve (P/N **92123**). These valves are installed on the cold-water inlet on each water heater in the WHM network (see Figure 8.1).

8.1 General Description

The Edge Controller's Water Heater Management System (WHM) is designed to ensure that all water heaters in the system operate at maximum efficiency. This is accomplished by monitoring the Air/Fuel Valve position (VP) of all water heaters that have their sequencing valves open. Units with open sequencing valves are called enabled units. Units with closed sequencing valves are called disabled units. Units which are unable to function, due to a fault or user intervention, are called offline units. When there is minimal or no demand for hot water, the sequencing valve for one unit will be open. As system load increases, the WHM will open the sequencing valves on additional heaters. A simplified block diagram of multiple water heaters connected to a WHM is shown in Figure 8.1.

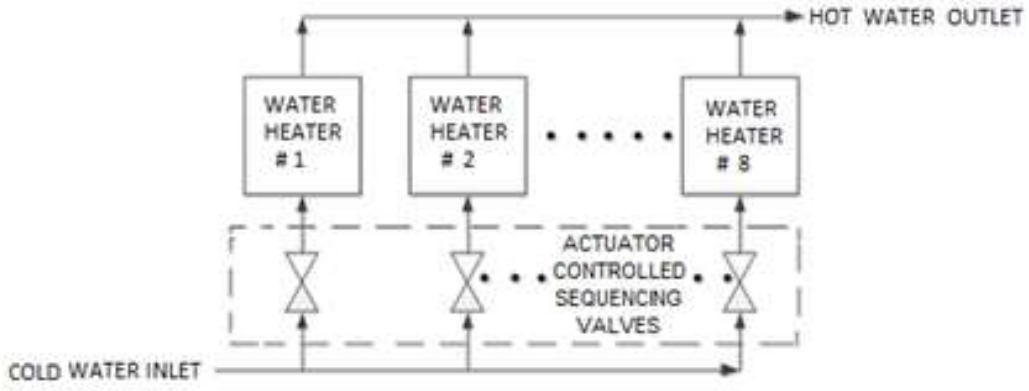


Figure 8.1: Simplified Block Diagram - Water Heater Management (WHM)

8.2 WHM Principles of Operation

The WHM system communicates with the plant water heaters via a RS485 network utilizing Modbus RTU protocol (8-bit, 9600 baud, no parity). All Modbus networks are implemented using a "Manager" / "Client" scenario where only one device, the Manager, can initiate a communication sequence. All other Edge Controller equipped units on the network are called Clients. However, since the WHM software code resides in each Edge Controller that is part of the system, any one of the Edge Controllers can be selected to control the system.

The WHM Manager monitors the Air/Fuel Valve position (VP) of all enabled units. When this valve position (% open) exceeds a user-selectable limit (**Next On Valve Pos**), the WHM will open the sequencing valve of another water heater in the system. Conversely, when the valve positions of all enabled units have dropped below a different user-selectable limit (**Next Off Valve Pos**) threshold, the WHM Manager will close the sequencing valve on a unit. The philosophy behind this approach is to maintain the fire rates (Air/Fuel Valve % open) at a level that maximizes heater efficiency.

In addition to collecting Air/Fuel Valve position data, the controlling Manager also monitors the total accumulated operating time for each unit on the system and attempts to balance the system so that all units operate for approximately the same number of hours.

8.3 New AERCO WHM Features

The following sections describe new Water heater Management features.

8.3.1 Valve Feedback

The Valve Feedback feature is designed to confirm that the Neptronic Valve has successfully executed either a Valve-Open or Valve-Close command from the Edge Controller.

The Valve Feedback signal from the Neptronic Valve is connected to the Edge Controller via the I/O box. When the Edge Controller issues either a Valve-Open or Valve-Close command to the valve, the Valve Feedback signal is monitored to confirm that the Neptronic Valve has successfully opened or closed. If there is a mismatch between the Valve Feedback signal and the Valve-Open or Valve-Close command for a period of time exceeding the value entered in "Valve Fdbk timer" a fault is invoked.

This feature can be enabled or disabled in the **Valve Feedback** parameter (see **Main Menu → Advanced Setup → WHM Cascade → Operating Controls → Valve Configuration**).

8.3.2 Valve Supervisor

This feature periodically monitors the Neptronic valve status (On or Off) and compares it to the Valve command. If there is a mismatch, a fault is displayed and the unit will react as follows:

1. If the Valve is Stuck Open, it displays the ***VALVE STUCK OPEN*** fault message but continue with the unit operation (do not shut the unit down).
2. If the Valve is Stuck Closed, it shuts down the unit and displays the ***VALVE STUCK CLOSED*** fault message.

8.3.3 Valve Control

The Valve Control logic has been redesigned to assure proper valve operation. Critical valve positioning (On or Off) is assured by the development of two independent valve control functions, with one function monitoring the results of the other.

8.3.4 Temperature Sensor Calibration

The Temperature Sensors screens allows you calibrate the unit's temperature sensors to achieve optimal performance. Complete the following to calibrate the temperature sensors.

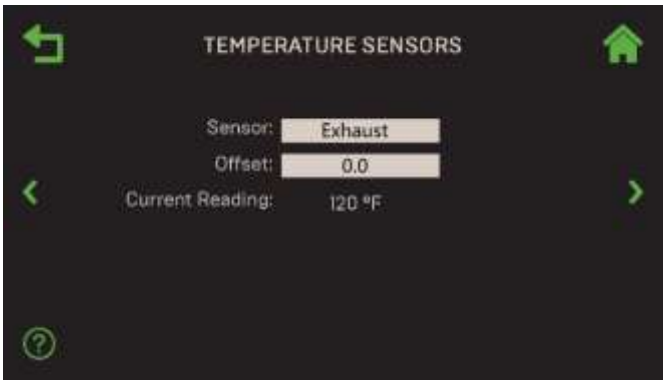


Figure 8.3.4: Temperature Sensors Screen

Temperature Sensor Calibration Instructions

1. Go to: **Main Menu → Calibration → Input/Output → Temperature Sensors**.
2. Press the **Sensor** parameter and select the temperature sensor you want to calibrate. The following sensors are available for calibration:
   - Feed Forward
   - Outside Temp
   - Lower Inlet
   - Exhaust
   - Air Inlet
   - Outlet
3. The selected sensor's current reading appears in the **Current Reading** field.
4. If there is an independent way to measure the temperature, and it differs from the **Current Reading**, enter an appropriate value in the **Offset** parameter.

8.3.5 Manual Mode Password Required

To prevent unauthorized or inadvertently setting the unit in Manual Mode of operation, entering a valid password is required to set the Edge in Manual Mode. Any level password will enable Manual Mode.

8.3.6 Auto-Manager Transfer

The Auto-Manager Transfer feature, once enabled, automatically transfers WHM Manager functionality to a new unit if the current WHM Manager fails or loses power.

To use this feature (default = Disabled), go to: **Main Menu → Advanced Setup → WHM Cascade → Cascade Configuration** on the unite designated as the WHM Manager and set **Auto-Manager Transfer** to **Enabled**, then choose address of the backup unit in the **Backup Manager Addr** parameter. You can also specify a delay before transferring manager functionality in the **Auto-Manager Timer** parameter.

8.3.7 Run Hours and Run Cycles

Run hours and run cycles are monitored to select the Lead unit and Lag unit (next on unit) in a WHM Cascade. In the event an Edge or PMC board is exchanged in the field, this feature will allow the user to increase but not decrease the run hours or run cycles. Once a user hits enter, the changes made will be permanent and this feature will not allow changing to the previous value.

Only AERCO personnel are permitted to change this menu item. To increase the **Run Hours** or **Run Cycles**, go to **Main Menu → Advanced Setup → Unit → Unit Settings**.

8.3.8 High Temperature Governor

The High Temperature Governor is a feature that aggressively prevents the outlet temperature from exceeding the "Temperature High Limit". The High Temperature Governor is independent of the system PID and Feed-Forward control methodology and independently modulates the Valve Position (Fire Rate) if the outlet temperature dangerously approaches the **Temperature Hi Limit** parameter.

This feature has 5 separate temperature bands for more precise control.

This feature is enabled by the **TEMP GOV** parameter in **Main Menu → Advanced Setup → Performance → Temperature Control → FFWD Settings**. Once enabled, the 5 "governor" items, **GOV Limit-5** to **GOV Limit-15** are available. When the Outlet Temperature exceeds the value of the **Temperature Hi Limit** parameter (in **Main Menu → Advanced Setup → Performance → Temperature Control → Temperature Conformance**) the effective Fire Rate will be reduced by the value entered in **GOV Limit-5** through **GOV Limit-15**.

8.4 WHM Status Displays

The following WHM status information will be displayed to inform the user of critical WHM real-time operating conditions:

Once a unit is defined as the WHM Manager, the green Manager light appears on the Controller's front face. In addition, the flowing status information appears on the WHM Cascade Status screen:

MANAGER-DISABLED – *The Manager has been disabled and is not available*
MANAGER-STANDBY – *The Manager is "Cycled Off" and is available to be lit off*
MANAGER-IGNITED – *The Manager is ignited*

On unit's defined as WHM Clients, the flowing status information will be displayed on the Unit Status screen:

CLIENT-DISABLED – *The Client has been disabled and is not available*
CLIENT-STANDBY – *The Client is "Cycled Off" and is available to be lit off*
CLIENT-IGNITED – *The Client is ignited*

8.5 Manager Alternating Status Displays

Manager Status Displays:

On both WHM Manager units, the following status information will alternate, and be displayed on the WHM Cascade Status screen:

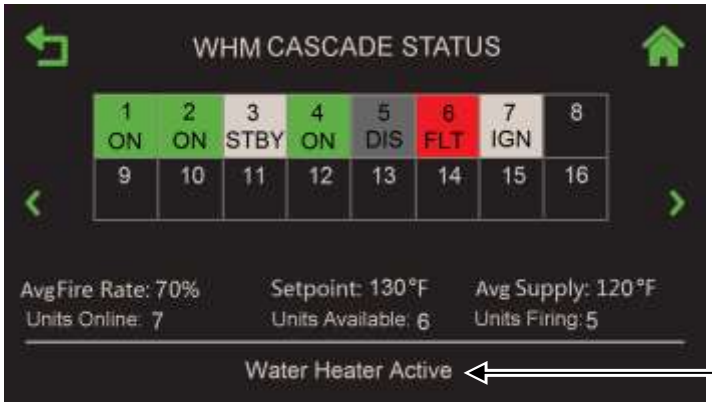


Figure 8.5: WHM Cascade Status Screen

The following messages can appear on this screen:

FAILSAFE ACTIVE – *The Client Failsafe Mode has been activated*
All Heaters On – *All available heaters are ignited*
All Heaters Off – *All available heaters are off*
Enabling First – *The first heater is allowed to ignite and its valve is opened*
Enabling Next – *The next heater is allowed to ignite and its valve is opened*
Wtr Htr Inactive – *This Client unit is inactive; its valve is closed and can't ignite*
Wtr Heatr Active – *This Client unit is active; its valve is opened and it can ignite*
REMOTE SIG FAULT – *Remote signal fault*
WHMS FAILSAFE – *WHMS is in Failsafe Mode*

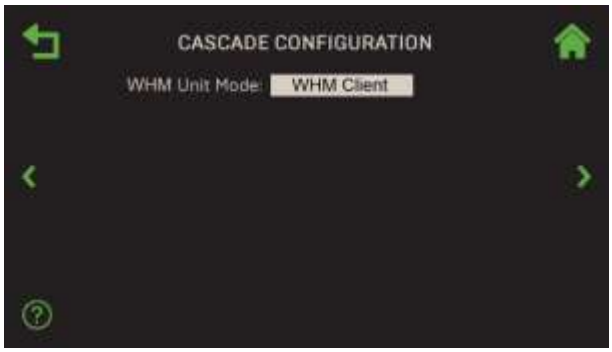
8.6 WHM Parameters

The WHM parameters are all in the various screens under **Main Menu → Advanced Setup → WHM Cascade**. However, these parameters can only be viewed if the ***Unit Type*** option in the **Main Menu → Advanced Setup → Unit → Unit Settings** screen is set to **Innovation WH**. Many of the options in this menu are preset at the factory and cannot be altered by the user.

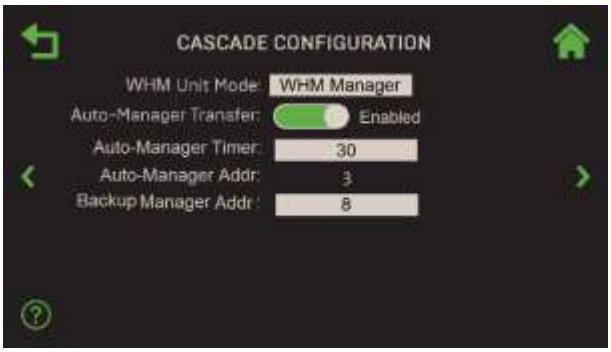
NOTE: Some of the WHM parameters appear only if they are enabled, either in the WHM Cascade screens or by a specific menu item.

TABLE 8-6a: WHM Cascade → Cascade Configuration Parameters

Menu Item Display	Available Choices or Limits		Default
	Minimum	Maximum	
WHM Unit Mode	**Off, WHM Client, WHM Manager**		**Off**
This menu option enables/disables the WHM mode and sets the unit to function as a WHM Client or WHM Manager. Set the **WHM Unit Mode** option to **WHM Manager** for the unit designated as the WHM Manager and to **WHM Client** for all other units on the network.			
Auto-Manager Transfer	**Enable, Disable**		**Disable**
This item enables (Password Level 2 required) an Automatic WHM Manager Switch-Over function. When enabled, the WHM will automatically select a new Manager if the current Manager fails or loses power. This option is used with the Auto-Manager Timer option, described in the following section.			
Auto-Manager Timer	**10 sec.**	**120 sec.**	**30 sec.**
When **Auto-Manager Transfer** is Enabled, this parameter allows the user to select the elapsed time interval between failure of the WHM Manager and switch-over to a new WHM Manager.			
Auto-Manager Addr	**1 – 16**		**Read Only**
The address of the WHM Manger.			
Backup Manager Addr	**1**	**16**	**0**
The address of the WHM Backup Manger.			



WHM Unit Mode = WHM Client

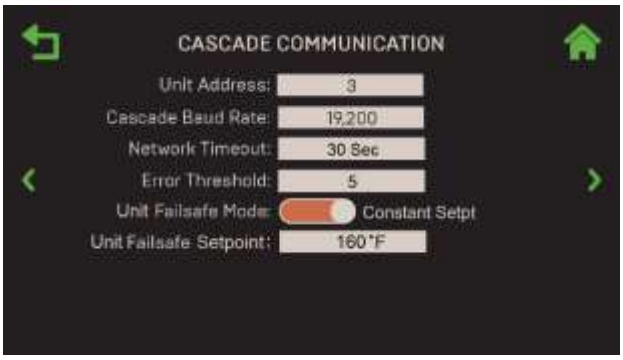


WHM Unit Mode = WHM Manager

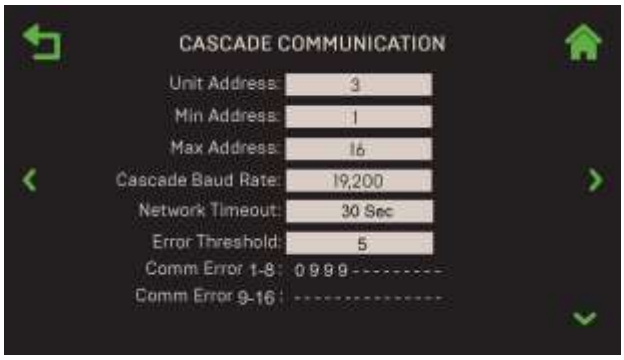
Figure 8.6-1: Cascade Configuration Screens

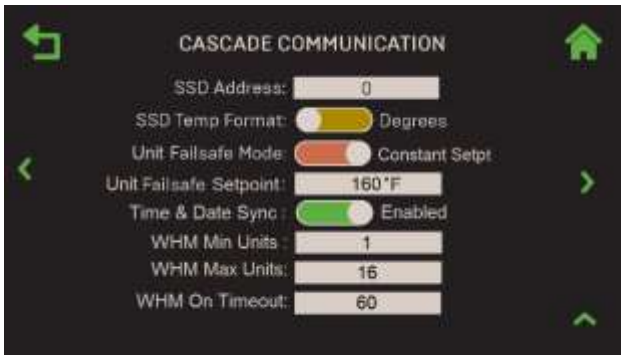
TABLE 8-6b: WHM Cascade → Cascade Communication Parameters			
Menu Item Display	**Available Choices or Limits**		**Default**
	Minimum	**Maximum**	
Unit Address	**1**	**16**	**1**
The address in the WHM Cascade of the current unit.			
Min Address	**1**	**16**	**1**
WHM Manager only – The minimum address in the WHM cascade			
Max Address	**1**	**16**	**16**
WHM Manager only – The maximum address in the WHM cascade			
Cascade Baud Rate	**9600, 19200, 38400, 57600**		**9600**
The rate at which information is transferred in a communication channel.			
Network Timeout	**5**	**999**	**30 sec.**
The timeout value before a Modbus Fault is declared due to no response from the WHM Manager unit or (if a Manager) from the BAS			
Error Threshold	**1**	**9**	**5**
The number of Modbus Comm errors allowed before invoking a Modbus Comm Fault.			
Comm Error 1- 8	**0**	**9**	**0**
WHM Manager only – Displays the number of comm errors on Clients 1 – 8			
Comm Error 9- 16	**0**	**9**	**0**
WHM Manager only – Displays the number of comm errors on Clients 9 – 16			
SSD Address	**0**	**250**	**0**
WHM Manager only – The Client/Client Device address (for backwards compatibility).			
SSD Temp Format	**Degrees or Points**		**Degrees**
WHM Manager only – Choose **Degrees** or **Points**			
Unit Failsafe Mode	**Constant Setpt or Shutdown**		**Constant Setpt**
Specifies the plant's operating mode if there is a loss of communication with BAS			
Unit Failsafe Setpoint	**60**	**150**	**140**
Specifies the plant's setpoint if there is a loss of communication.			
Time & Date Sync	**Enabled/Disabled**		**Enabled**
WHM Manager only – If Enabled, all WHM Client units will synchronize time and date with the WHM Manager.			
WHM Min Units	**1**	**16**	**1**
WHM Manager only – The minimum number of units in the WHM cascade (it can differ from **Min Address**)			
WHM Max Units	**1**	**16**	**1**
WHM Manager only – The maximum number of units in the WHM cascade (it can differ from **Max Address**)			

TABLE 8-6b: WHM Cascade → Cascade Communication Parameters			
WHM On Timeout	**15 Sec**	**300 Sec**	**60 Sec**
WHM Manager only – Specifies the time the WHM Manager must wait for a Client unit to turn on.			



WHM CLIENT SCREEN





WHM MANAGER SCREEN

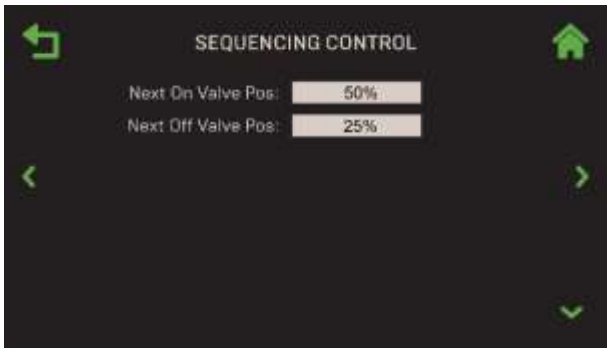
Figure 8.6-2: Cascade Communication Screens

TABLE 8-6c: WHM Cascade → Application Configuration Parameters			
Menu Item Display	**Available Choices or Limits**		**Default**
	Minimum	**Maximum**	
Application	**Read Only**		**DHW**
Specifies the application for the entire WHM Cascade.			
Operating Mode	**Read Only**		**Constant Setpoint**
Specifies the operating mode for the entire WHM Cascade.			
WHM Setpoint	**60°F**	**150°F**	**120°F**
Specifies the Setpoint for the entire WHM Cascade.			

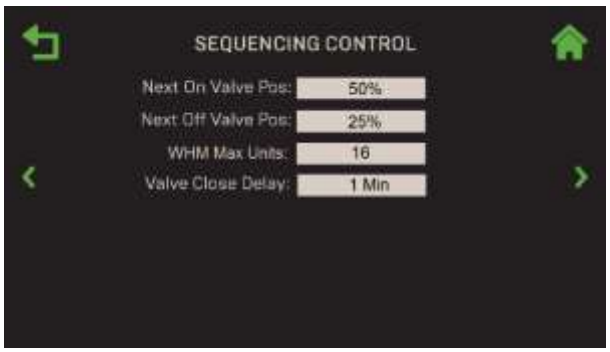
Figure 8.6-3: Application Configuration Screen

The remaining WHM parameters are in **Main Menu → Advanced Setup → WHM Cascade → Operating Controls**.

TABLE 8-6d: Operating Controls → Sequencing Control Parameters			
Menu Item Display	**Available Choices or Limits**		**Default**
	Minimum	**Maximum**	
Next On Valve Pos	**16%**	**100%**	**50%**
The valve position that triggers the next unit to come on line.			
Next Off Valve Pos	**16%**	**100%**	**25%**
The valve position that triggers the next unit to come off line.			
WHM Max Units	**1**	**16**	**16**
WHM Manager only – The maximum number of units that will fire. For example: if there are 5 units, but this setting is set to 3, the plant will not fire more than 3 units.			
Valve Close Delay	**0**	**15**	**1 min.**
WHM Manager only – The time an open Isolation Valve will remain open once a unit has cycled off. When an ignited unit is cycled off, its Isolation Valve will remain open for the specified time to dissipate residual heat.			



WHM Client screen



WHM Manager screen

Figure 8.6-4: Operating Controls: Sequencing Controls Screens

TABLE 8-6e: Operating Controls → Anti-Cycling Parameters			
Menu Item Display	**Available Choices or Limits**		**Default**
	Minimum	**Maximum**	
On Delay	**30**	**300**	**30**
The minimum length of time a unit must stay off after shutting down or going into standby.			
WHM Off Delay	**30**	**300**	**30 sec.**
The amount of time the low fire position will be delayed.			
Shutoff Delay Temp	**0**	**25**	**5**
The temperature above setpoint the unit may rise to during delay shutdown.			

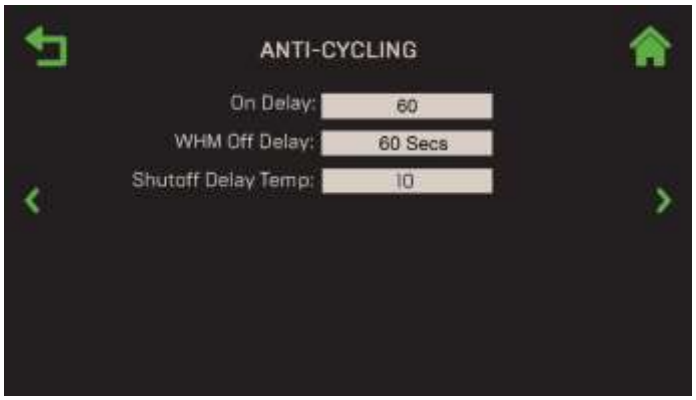


Figure 8.6-5: Operating Controls: Anti-Cycling Control Screen

TABLE 8-6f: Operating Controls → Valve Configuration Parameters			
Menu Item Display	**Available Choices or Limits**		**Default**
	Minimum	**Maximum**	
Select Output	**Standard Setup**		**Read Only**
Select the output you want to configure.			
Output Signal Type	**Current** or **Voltage**		**Voltage**
Select the output signal type of the selected output.			
Control Mode	**On/Off**		**Read Only**
Select the Control Mode for the selected output (Standard Setup)			
Valve Feedback	**Enabled/Disabled**		**Disabled**
Allows Valve Feedback functionality to be enabled; **Valve Feedback Status** appears.			
Valve Feedback Timer	**30 Sec.**	**240 Sec.**	**60 Sec.**
The amount of time for the valve to open before returning an error.			
Valve Feedback Status	**Open, Close**		**Read Only**
Displays the status of the selected valve.			

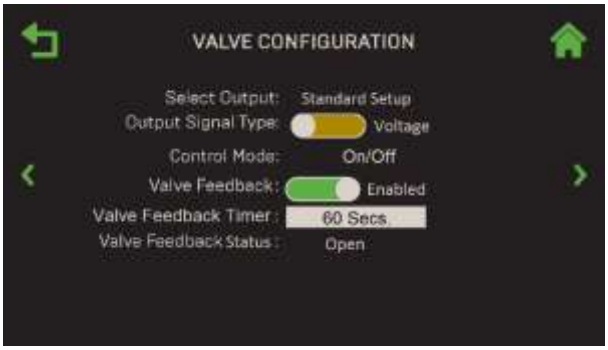


Figure 8.6-6: Operating Controls: Valve Configuration Screen

TABLE 8-6g: Operating Controls → Lead/Lag Control Parameters			
Menu Item Display	**Available Choices or Limits**		**Default**
	Minimum	**Maximum**	
Lead/Lag Setting	**Run Hours, Unit Size, Select Lead/Lag**		**Run Hours**
Specify how the Lead and Lag units will be selected.			
Run Hours	**25**	**225**	**72**
Specify the number of hours after which the Lead unit is rotated.			
Lead Unit	**0**	**16**	**0**
Specify the address of the Lead unit.			
Lag Unit	**0**	**16**	**16**
Specify the address of the Lag unit.			

Figure 8.6-7: Operating Controls: Lead/Lag Control Screen

8.7 WHM Hardware Installation & Set-Up Instructions

The following sections provide the basic installation and set-up instructions for implementing a Water Heater Management System (WHM) to control up to 16 AERCO Innovation Water Heaters. Some of the descriptions and procedures included in Chapter 2 are repeated here to avoid unnecessary referencing.

8.7.1 Installation Notes

AERCO requires a WHM sequencing valve in multi-unit Innovation configurations. When WHM is employed, Modbus communication with BAS is available via Modbus TCP (go to **Main Menu → Advanced Setup → Comm & Network → BAS**).

If you are installing a WHM system that also includes a ProtoNode SSD, you ***must*** adhere to the procedure listed below. Failure to complete these steps can result in the failure of the WHM system.

a) Do ***NOT*** install the ProtoNode Device at the outset of the installation. If the ProtoNode Device is already installed, you must physically disconnect it from the Modbus network in I/O board.

b) Make sure that the Modbus load and bias resistors are properly configured for the system to operate without the ProtoNode installed.

c) Temporarily set the WHM system for Constant Setpoint mode of operation (see below).

d) Turn on and completely test the installation to verify that it is operating proper.

e) Once the installation is working properly as a WHM system, install the ProtoNode Device.

f) Make sure that the Modbus load and bias resistors are properly configured for the system to operate with the ProtoNode installed.

g) Set the WHM system for desired mode of operation (Setpoint mode).

h) Test the system completely with the ProtoNode installed.

8.7.2 Hardware Installation

All Innovation Water Heaters which will be controlled by a WHM Manager must be equipped with an actuator-controlled sequencing valve (P/N **92123**). If this valve is not already installed on the cold-water inlet, proceed as follows:

WHM Hardware Installation

1. Remove the sequencing valve from its stowed location.
2. Refer to Figure 8.7 and attach the valve to the cold-water inlet of the unit using the pipe union and nipple provided.
3. Ensure the valve is positioned with the actuator enclosure position as shown in Figure 8.7.
4. AERCO recommends that another pipe nipple and union be attached to the valve inlet prior to connecting the cold-water supply piping.
5. Tighten all pipe connections after the sequencing valve is properly positioned.
6. Connect the 4-pin Molex connector on the sequencing valve to the mating connector on the Innovation harness at the rear of the unit.
7. This completes the sequencing valve installation.

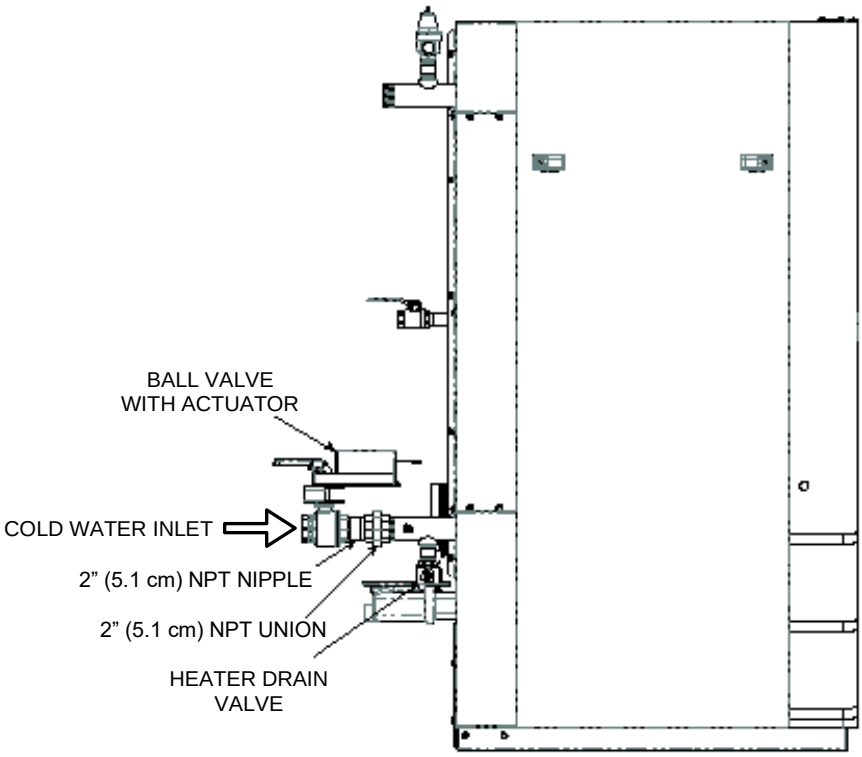


Figure 8.7.2: Innovation Water Heater Equipped with Sequencing Valve

8.7.3 WHM Modbus Network Wiring

As previously mentioned, all units being controlled by the WHM will be connected to a RS485 Modbus Network. All Modbus networks are wired in a daisy-chain configuration using a Manager/Client scenario as shown in Figure 8.7.3.

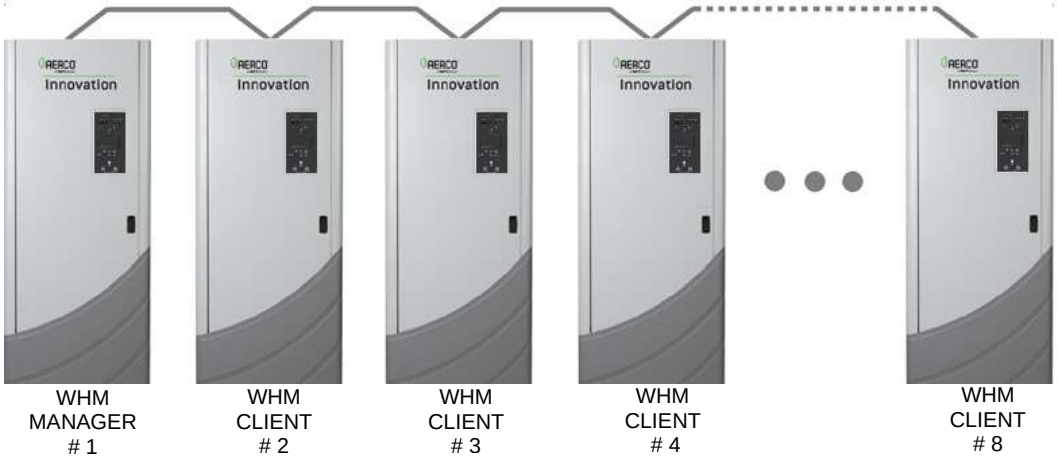


Figure 8.7.3: Typical Daisy-Chain Modbus/RS485 Network

NOTE: The WHMS Manager does not need to be on either end of the Daisy-Chain loop.

Any one of the Edge WHM units included in the Modbus network can be the Manager. However, it is recommended that you decide which unit will be the Manager and which will be the last unit on the daisy-chain prior to performing the wiring connections. This will simplify wiring connections and Modbus address assignments.

Modbus network wiring connections must be made using shielded twisted-pair wiring, (18 – 24 AWG) such as Belden #9841, #3105A, #8760, or equivalent. The Modbus wiring connections are made at the RS485 COMM terminals on the I/O board included with each Edge Controller.

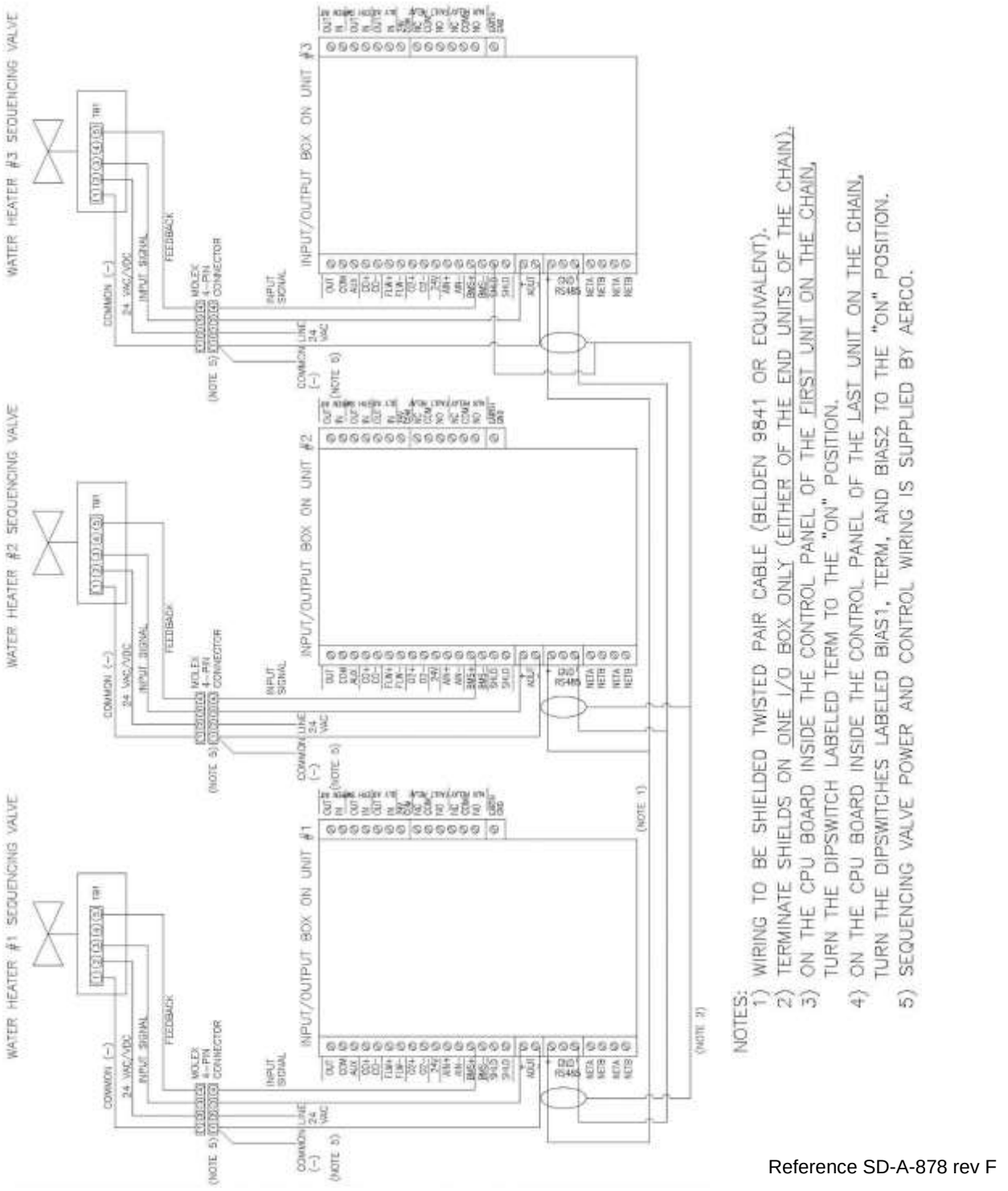
Connect the Modbus wiring as follows:

Modbus Network Wiring

1. Starting at the first unit, connect the twisted, shielded pair cable to the RS485 Comm plus (+) and minus (-) terminals on the left side I/O board as shown in Figure 8.7.4.
2. At the I/O board of the first unit in the daisy chain (not necessarily Manager), activate the **DIP** switch labeled “MODBUS TERM” by placing it in the up position. This will connect a termination resistor across the terminals at the source end.
3. Refer to Figure 8.7.4 and run the shielded cable to the next unit in the daisy-chain and connect the + and – wire leads (+ to +, - to -). DO NOT terminate the shield of the RS485 Comm leads to the SHIELD terminal at the Client. Instead, connect the shields of the incoming and outgoing RS485 leads together.
4. Continue connecting the + and - wire leads and shields for the remaining units as described in step 3 for the remaining Client units in the chain.
5. At the end unit in the chain, activate the **DIP** switch labeled “MODBUS TERM” by placing it in the up position. This will ensure that the termination resistors are activated at both ends of the loop.

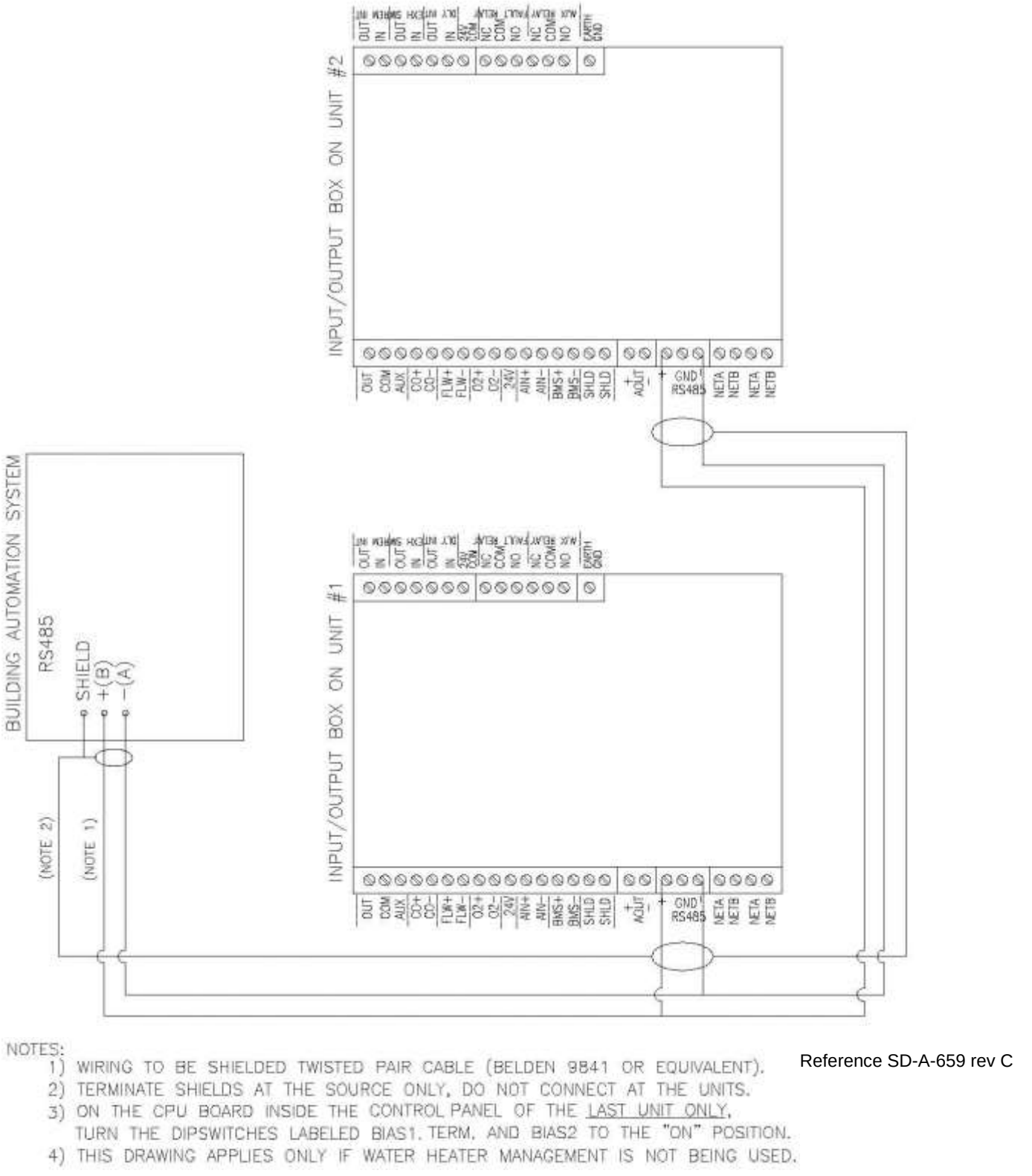
8.7.4 Control and Power Wiring

Control and power wiring connections to the sequencing valves associated with each Edge WHM unit is accomplished by simply ensuring that the 4-pin Molex connectors on the units are connected to the corresponding connectors on the valves.



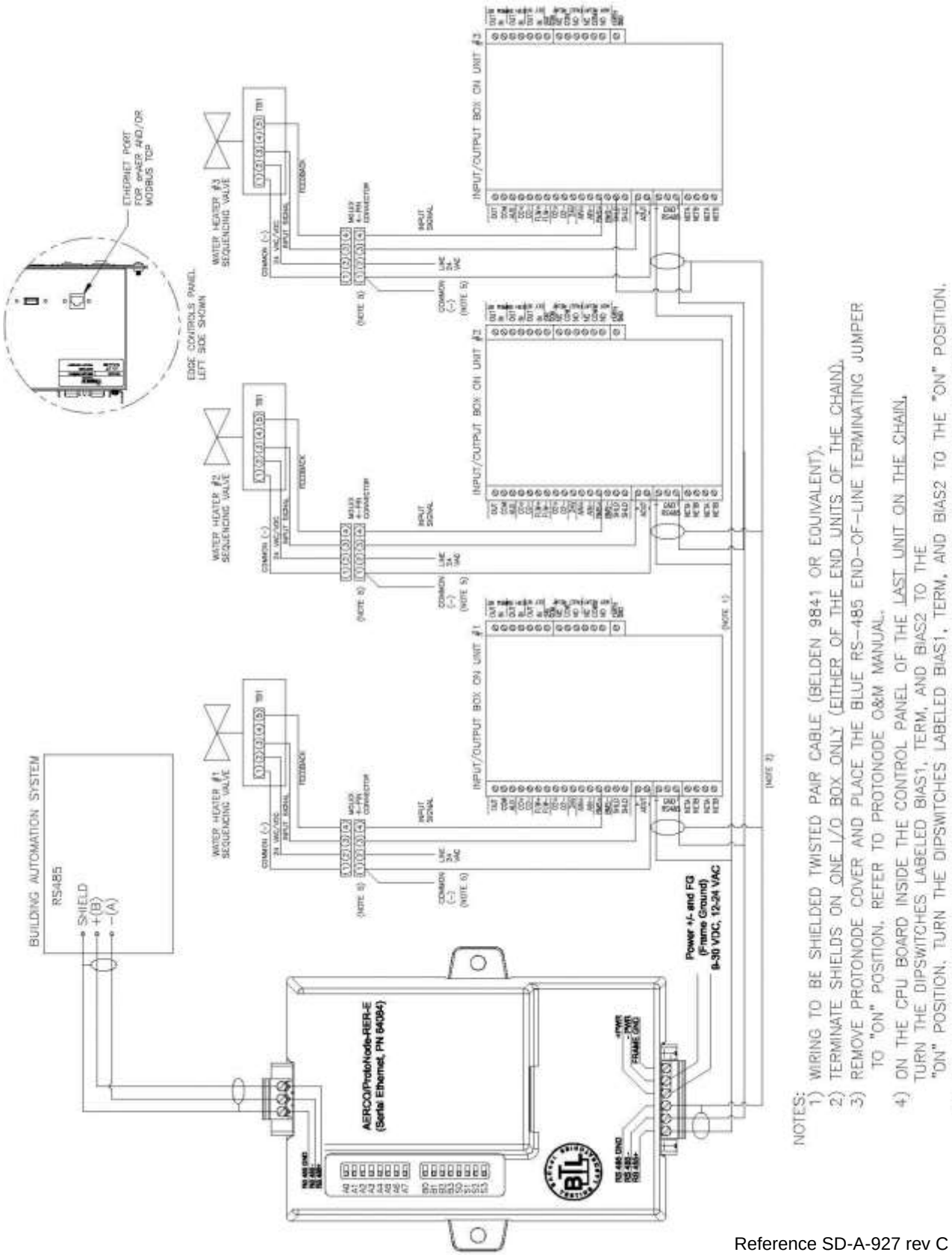
Reference SD-A-878 rev F

Figure 8.7.4-1: WHM Network Wiring Diagram



Reference SD-A-659 rev C

Figure 8.7.4-2: WHM Network Wiring Diagram



Reference SD-A-927 rev C

Figure 8.7.4-3: WHM Network Wiring Diagram

8.8 WHM Programming & Start-Up

All required hardware installation and network wiring must be completed *before* configuring the WHM parameters into the WHM Manager and Client units. In addition, the required menu entries must be determined based on the descriptions in the previous sections.

AERCO recommends that the WHM Manager be set up first. By doing so, the Manager will "push" most of the operating parameters to each WHM Client when they are brought on-line. For clarity, the instructions below assume that the WHM Manager and Clients will be consecutively numbered, starting at 1 (WHM Manager), although that's not required.

Complete the instructions below **on the unit designated as the WHM Manager**:

WHM Manager Programming & Start-Up Procedure

1. Go to: **Main Menu → Advanced Setup → WHM Cascade → Cascade Configuration**, then configure the following parameters:
   a. Set the WHM Unit Mode to **WHM Manager**.
   b. You have the option of designating one of the units in the WHM Cascade as a Backup Manager. If the WHM Manager fails, manager functionality will automatically transfer to the designated Backup Manager. To use this functionality, enable the **Auto-Manager Transfer** parameter, then specify the address of the Backup Manager in the **Backup Manager Addr** parameter. You can also enter a delay before transferring manager functionality in the **Auto-Manager Timer** parameter.
2. Go to: **Main Menu → Advanced Setup → WHM Cascade → Application Configuration**.
3. Set the **WHM Setpoint** parameter to the desired temperature.
4. Go to: **Main Menu → Advanced Setup → WHM Cascade → Cascade Comm** and configure the following parameters:

Figure 8.8: WHM Manager Cascade Communication Screens

   a. Specify the address of the WHM Manager in the **Unit Address** parameter.
   b. Specify the minimum and maximum address in the Cascade in the **Min Address** and **Max Address** parameters (typically 1 to the maximum number of units in the cascade).
   c. Set the communication parameters in the **Cascade Baud Rate**, **Network Timeout** and **Error Threshold** parameters.
   d. Specify the **Plant Failsafe Mode**, which determines what the entire plant does if the WHM Manager loses communication with the WHM Client units.

WHM Manager Programming & Start-Up Procedure

e. Check that the **Manager** LED is lit on the Controller's front face.

5. Go to: **Main Menu → Advanced Setup → WHM Cascade → Operating Controls → Sequencing Control**. The **Next On Valve Pos** parameter specifies the valve position that will trigger the next unit to come on line, and the **Next Off Valve Pos** parameter specifies the valve position that will trigger the next unit go off-line.
6. The Controller includes a *Setback* option, which can be used to adjust the setpoint temperature, start and end time, for operation during periods of low demand. To specify the setback time and temperature, go to: **Main Menu → Advanced Setup → Performance → Temperature Control → Setpoint Range** and configure the following parameters:
   a. Set the **Setpoint Limiting** parameter to **Enabled**.
   b. Configure the **Setpt Low Limit** and **Setpt High Limit** parameters, which together determine the temperature range within which the setpoint can vary. You can also configure the **Setpoint Limit Band** parameter, which allows you to set the number of degrees *below* **Setpoint High Limit** the unit's outlet temperature must fall before the unit restarts.
   c. Configure the **Setback Start Time** and **Setback End Time**, which together define when the Setback period will be in effect.
7. If you want to change the **Lead/Lag Hours**, go to: **Main Menu → Advanced Setup → WHM Cascade → Operating Controls → Lead/Lag**, set **Lead/Lag Settings** to **Select Lead/Lag**, then select the Lead and Lag units in the **Lead Unit** and **Lag Unit** fields.

Complete the instructions below **on each unit designated as a WHM Client:**

WHM Client Programming & Start-Up Procedure

1. Go to: **Main Menu → Advanced Setup → WHM Cascade → Cascade Configuration** and set the **WHM Unit Mode** to **WHM Client**.
2. Go to: **Main Menu → Advanced Setup → WHM Cascade → Cascade Comm**.
   a. Enter the Client unit's address in the **Unit Address** parameter,
   b. Set the communication parameters in the **Cascade Baud Rate**, **Network Timeout** and **Error Threshold** parameters.
   c. Specify the **Unit Failsafe Mode**, which determines what happens if a WHM Client units loses communication with the WHM Manager.
3. If you want to change the Lead/Lag Hours, go to: **Main Menu → Advanced Setup → WHM Cascade → Operating Controls → Lead/Lag**, set **Lead/Lag Settings** to **Select Lead/Lag**, then select the Lead and Lag units in **the Lead Unit** and **Lag Unit** fields.

8.9 Troubleshooting

Faults which may occur during WHM operation include the items listed in Table 8-9.

TABLE 8-9: WHM Troubleshooting

FAULT INDICATION	PROBABLE CAUSE	CORRECTIVE ACTION
Manager LEDs are flashing on 2 Controllers	1. Two Edge Controllers have their WHM Mode menu option set to WHM Manager.	1. Check the WHM Mode entries in the units which have their displays flashing. Change one of the WHM Mode settings to WHM Client.
MANAGER LED on one or more WHM units is **Off**.	1. Improperly connected or faulty RS485 Modbus wiring. 2. Improper Comm address. 3. Unit Comm address is not unique.	1. Check the polarity of the RS485 Comm connections on the I/O board of the affected unit. Also, ensure that all Modbus wiring connections to the unit are secure. 2. Verify that the address of the affected unit is within the allowable range (1 thru 16). 3. Check to ensure that none of the units have the same Comm address.
Actuator-controlled sequencing valve does not open	1. Control cable not connected to valve actuator. 2. 24 VAC power not being supplied to valve actuator. 3. Defective valve actuator.	1. Ensure that the control cable from the unit's I/O Box is connected to the valve actuator. 2. Remove the enclosure cover from the valve actuator and verify that 24 VAC is present at Terminal 2 of the actuator. 3. Replace valve actuator. Following replacement, the actuator stroke will have to be calibrated to ensure it fully opening and closing.

8.10 Sequencing Valve Description & Operation

Brief descriptions of Actuator-Controlled Sequencing Valve (P/N **92123**) and its operating characteristics are provided below in Sections 8.11.1 and 8.11.2, respectively. The installation of the valve itself is described in Chapter 2, Section 2.5.1.

8.10.1 Sequencing Valve Description

The Actuator-Controlled Sequencing Valve shown in Figure 8.10.1-1 is comprised of the following main components:

- 2" Brass Ball Valve
- Actuator Linkage
- Actuator Housing
- Valve Shaft Handle

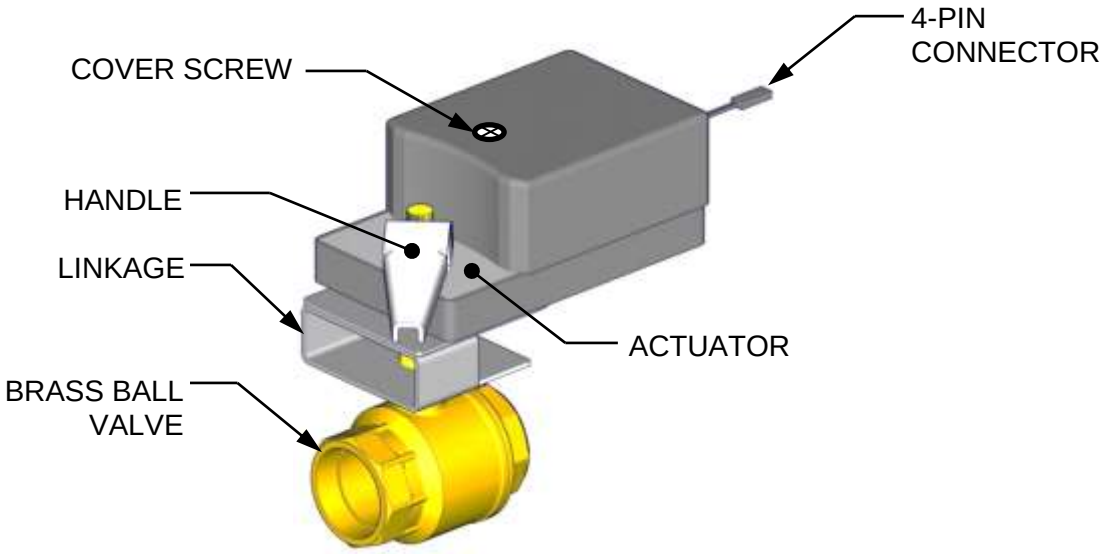
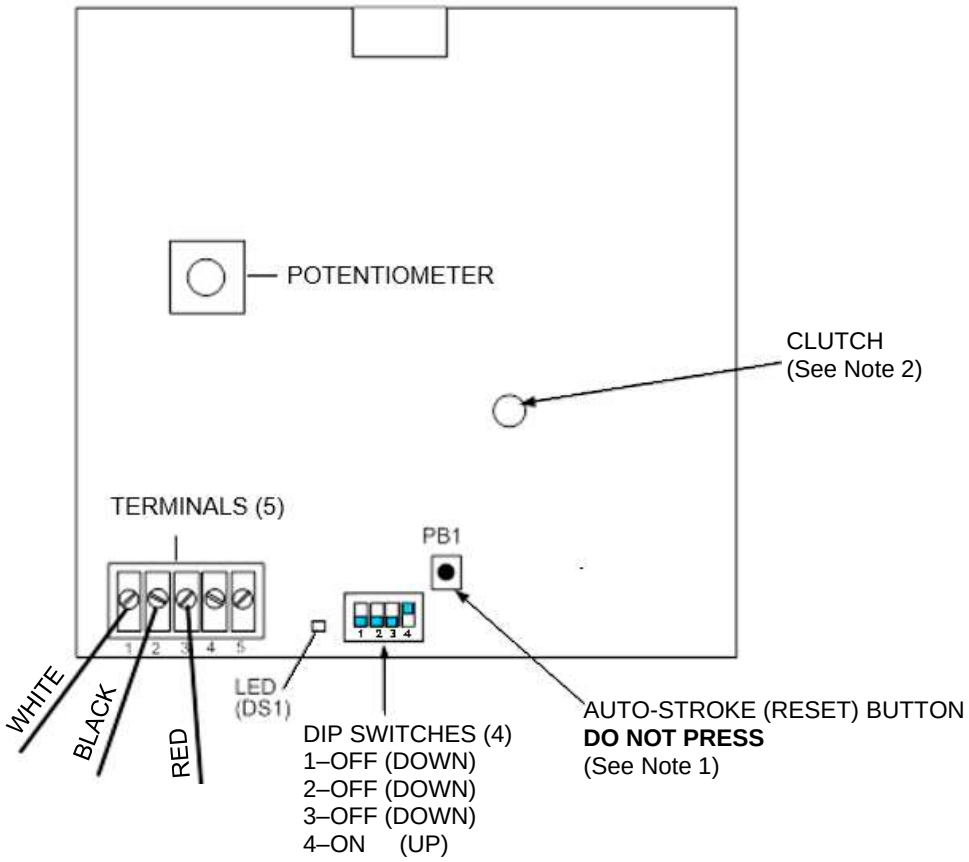


Figure 8-10.1-1: Actuator-Controlled Sequencing Valve (P/N 92123)

The Actuator Housing contains a cover which is removed by simply loosening a single captive screw. Removing the cover provides access to a PC Board containing wiring connections and control circuitry components as shown in Figure 8.10.1-2.

The components on the PC board include **DIP** switches which are preset at the factory and should not be changed unless instructed to do so.



NOTES:
1. **DO NOT press Auto-Stroke (Reset) button**. Doing so may alter actuator calibration.
2. Depress and hold brass clutch button to manually rotate valve.

Figure 8.10.1-2: Actuator PC Board Components

CAUTION!

Power must be removed from the Actuator prior to attempting to disengage the clutch. Failure to observe this precaution may damage the Actuator.

The PC board also contains a brass button which is used to disengage the clutch and permit the ball valve to be manually rotated. To disengage the clutch, proceed as follows:

Actuator Clutch Disengagement Instructions

1. Disconnect the 4-pin connector on the Actuator to ensure that 24 VAC power is not being supplied
2. Press and hold the brass **CLUTCH** button shown in Figure 8.10.1-2.
3. With the **CLUTCH** button depressed, the ball valve can be manually rotated from the fully open (90°) to the fully closed (0°) position.

8.10.2 Sequencing Valve Operating Characteristics

The Sequencing Valve is powered by 24 VAC which is supplied from a step-down transformer located in the Power Box of the Innovation Water Heater. The 24 VAC power output and a 2 to

10 VDC control signal from the I/O Box of the Water Heater are routed to the Sequencing Valve via a 4-pin Molex connector.

During normal Water Heater Management (WHM), a control signal of less than (<) – 2 VDC will rotate the valve to the fully open (90°) position. Conversely, a control signal above 8 VDC will rotate the valve to the fully closed (0°) position. The sequencing valve will send a status of the Valve (open/close) as a feedback signal (2 – 10 VDC) to the Edge Controller.

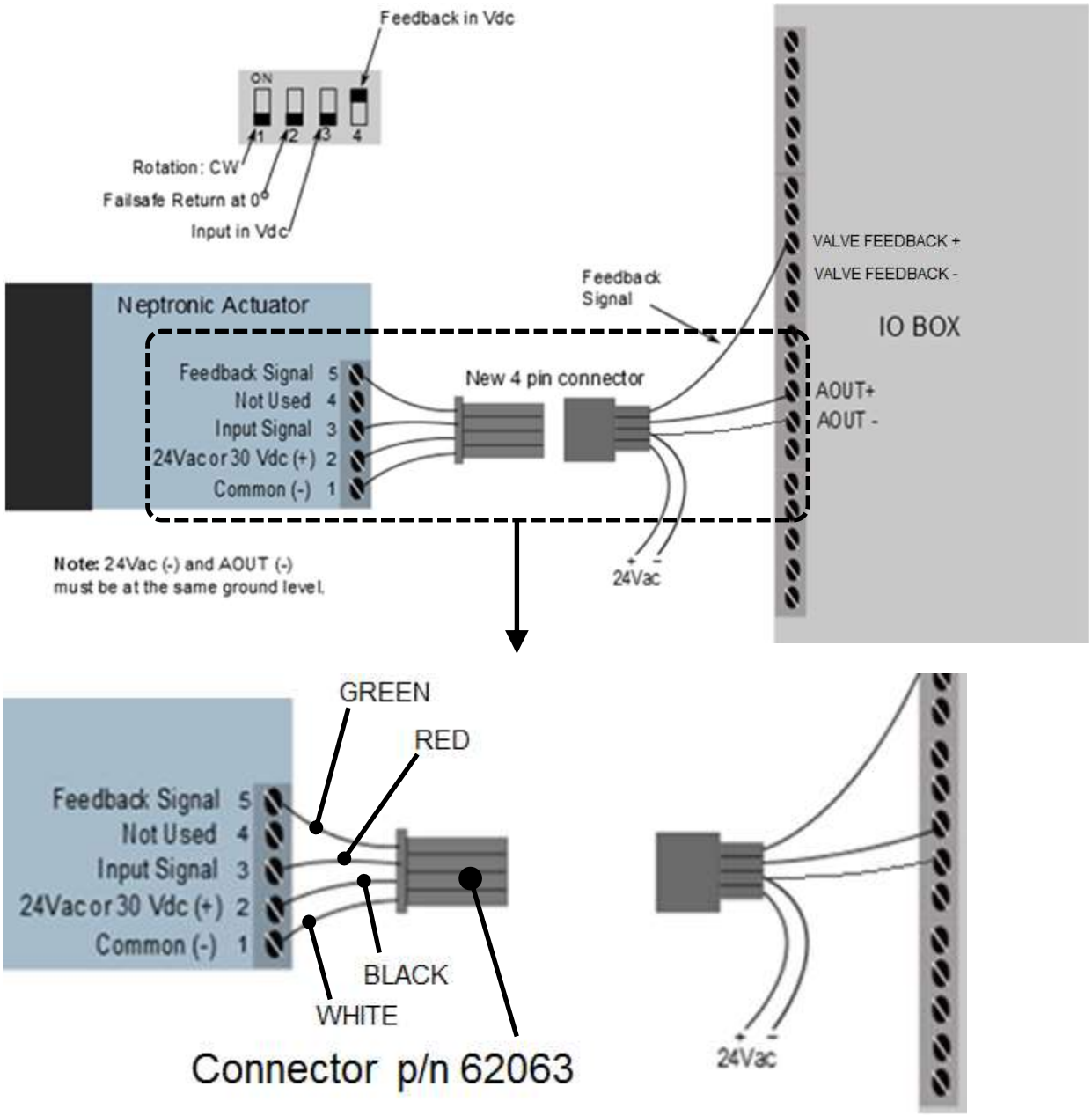


Figure 8.10.2: Sequencing Valve Wiring

APPENDIX A – Startup, Status and Fault Messages

All Startup, Status and Fault messages are included in Section 8 of the *Edge [i] Controller Manual for Benchmark Boilers and Innovation Water Heaters*, OMM-0141, GF-213.

APPENDIX B – Temperature Sensor Resistance/Voltage Chart

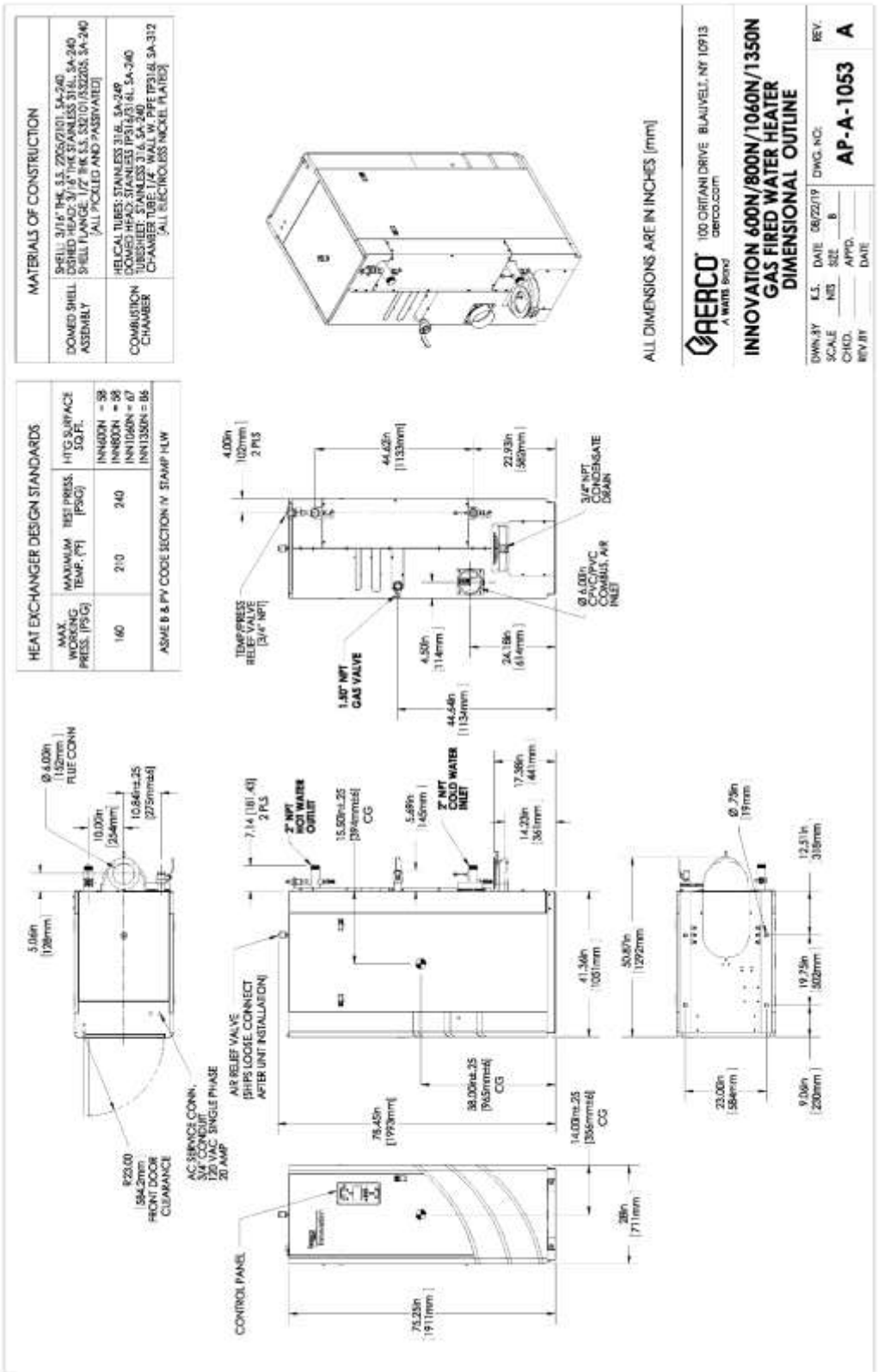
TEMPERATURE SENSOR RESISTANCE/VOLTAGE CHART

(BALCO)

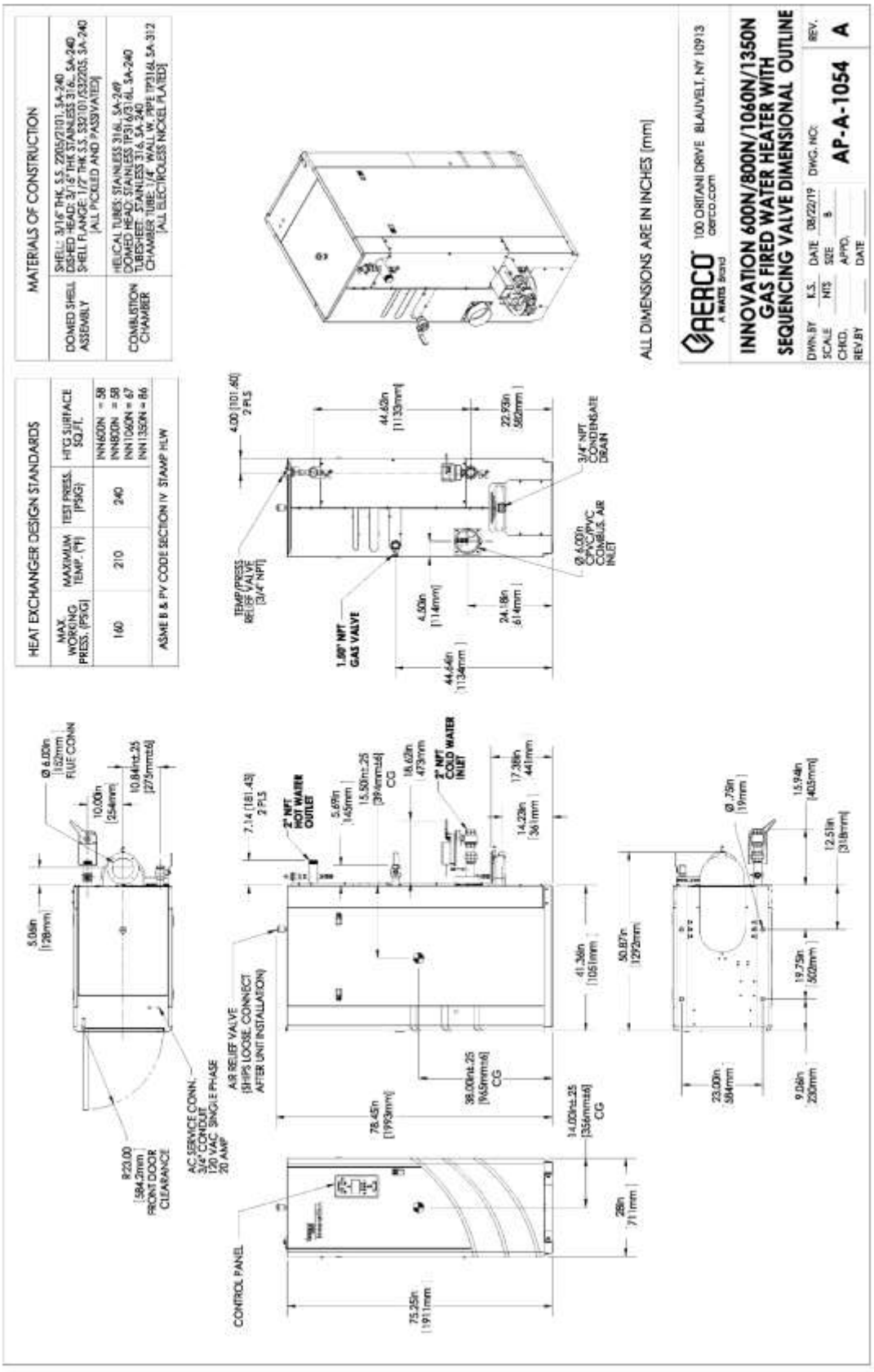
TEMPERATURE			
°F	**°C**	**RES (OHMS)**	**VOLTS***
-40	-40	779.0	1.93
-30	-34.4	797.5	1.96
-20	-28.9	816.3	1.99
-10	-23.3	835.4	2.02
0	-17.2	854.8	2.05
10	-12.2	874.6	2.07
20	-6.7	894.7	2.10
30	-1.1	915.1	2.12
40	4.4	935.9	2.15
50	10	956.9	2.17
60	15.5	978.3	2.20
70	21.1	1000.0	2.23
80	26.7	1022.0	2.25
90	32.2	1044.4	2.27
100	37.8	1067.0	2.30
110	43.3	1090.0	2.32
120	48.9	1113.3	2.34
130	54.4	1137.0	2.36
140	60	1160.9	2.39
150	65.6	1185.2	2.41
160	71.1	1209.5	2.43
170	76.7	1234.7	2.45
180	82.2	1260.0	2.47
190	87.8	1285.6	2.50
200	93.3	1311.4	2.52
210	98.9	1337.7	2.54
220	104.4	1364.2	2.56
230	110	1391.0	2.58
240	115.6	1418.2	
250	121.1	1445.7	

*Voltage at AUX & Common terminals in the I/O Box

APPENDIX D – Dimensional Drawings



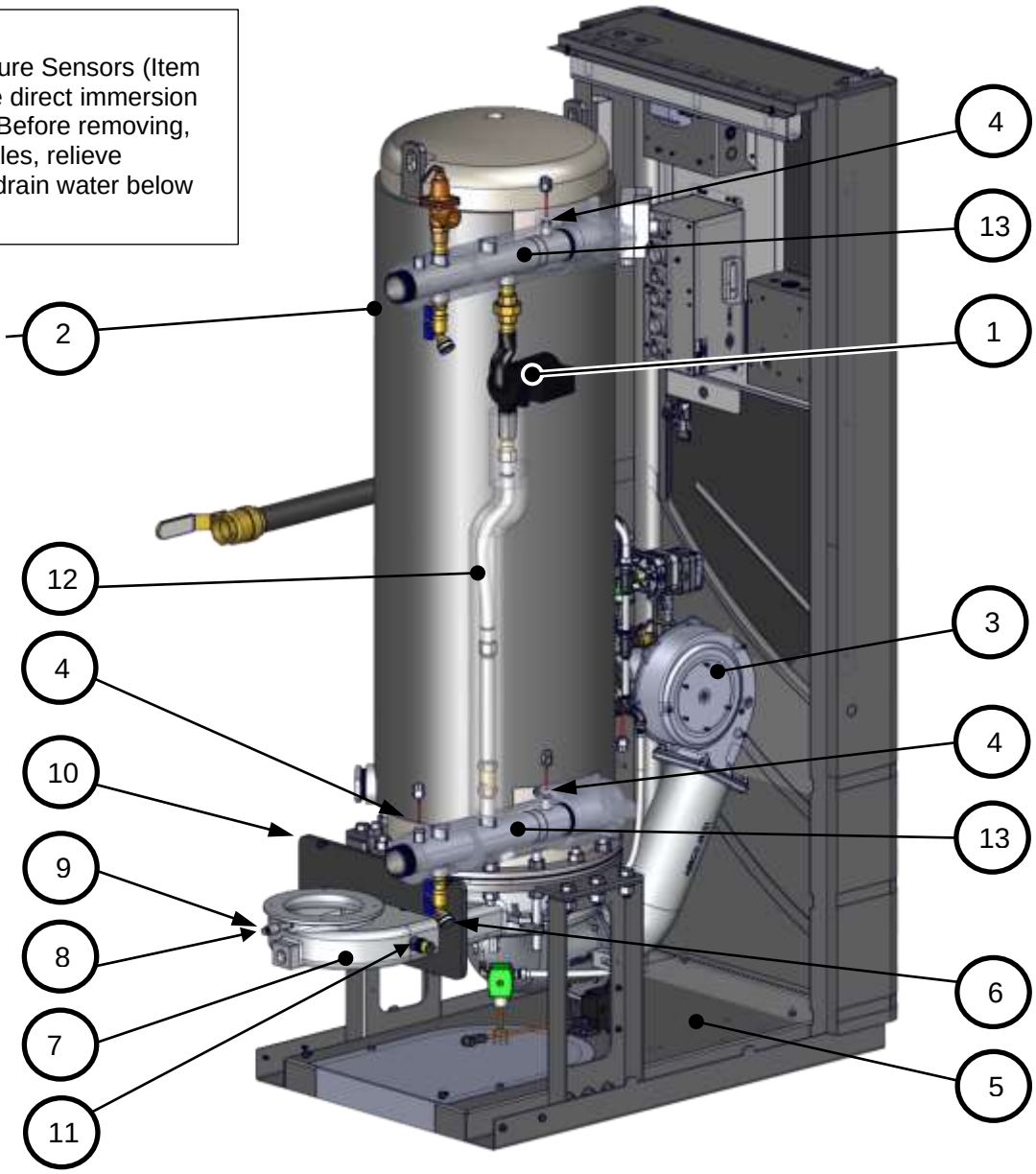
Drawing Number: AP-A-1053 rev A



Drawing Number: AP-A-1054 rev A

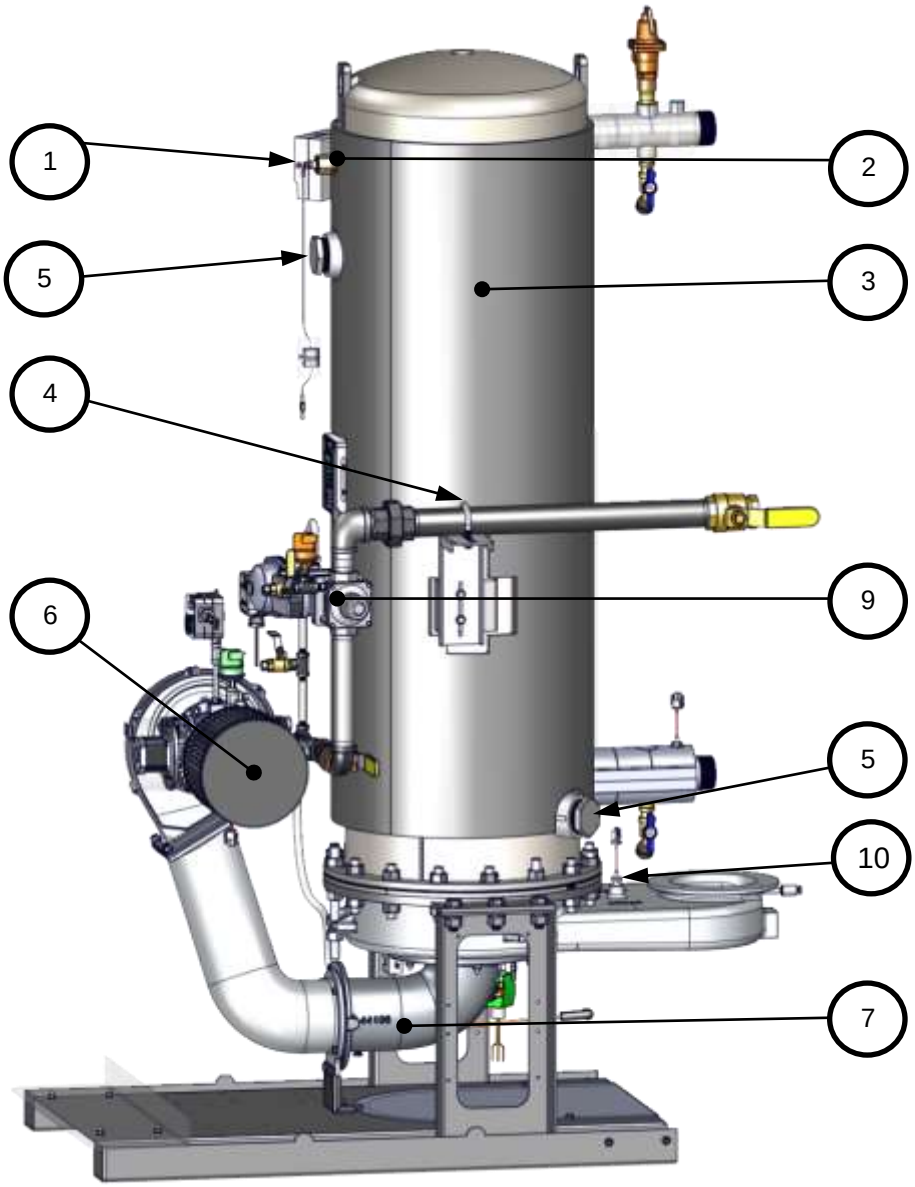
APPENDIX E – Parts List Drawings

*** NOTE:**
The Temperature Sensors (Item 4, 123449) are direct immersion type sensors. Before removing, close water vales, relieve pressure and drain water below sensor level.

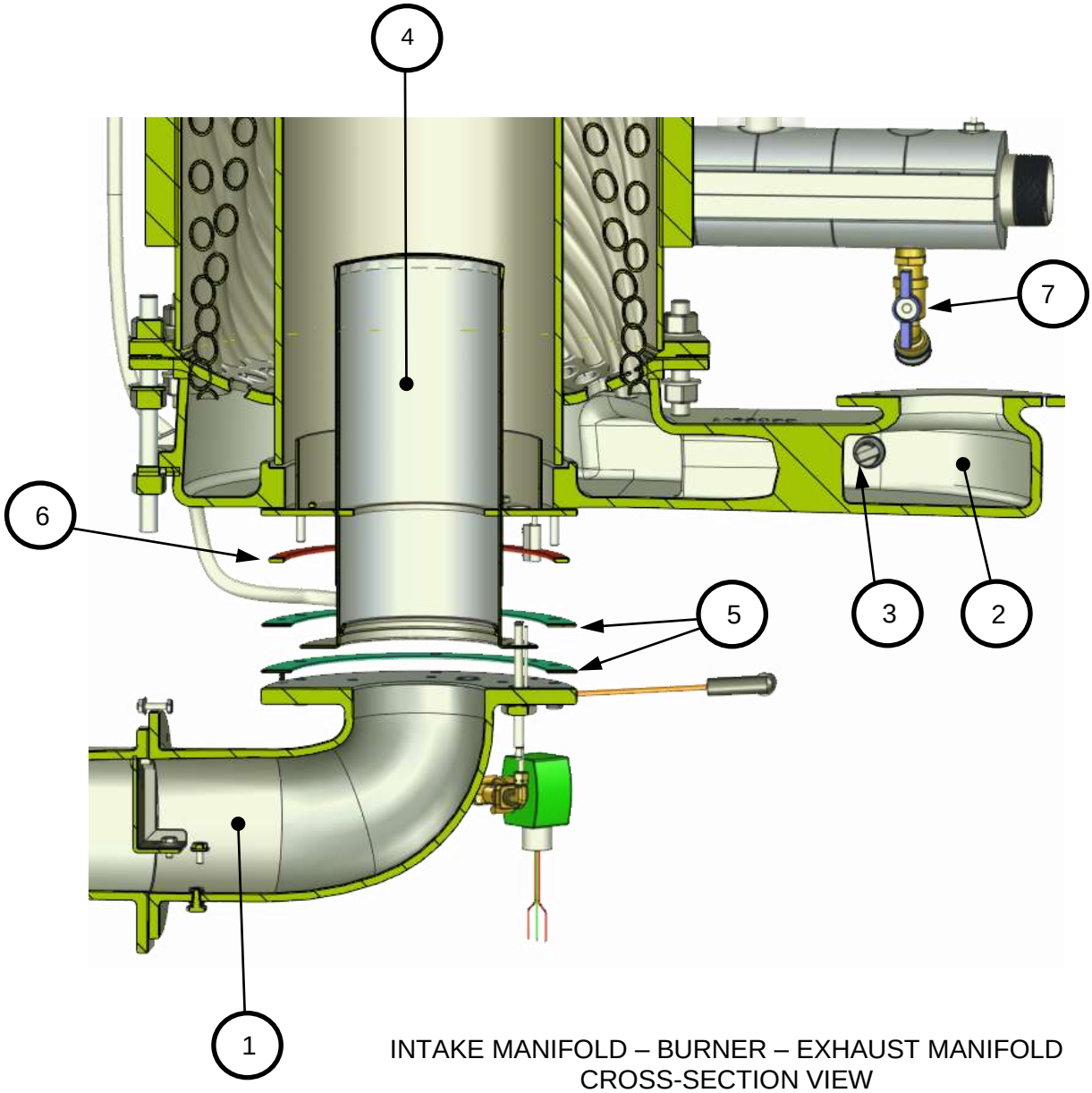


Innovation Parts List – 28735-TAB rev D – Page 1

Item	Qty.	Part #	Description		Item	Qty.	Part #	Description
1	1	22246	DYNAMIC LOAD ANTICIPATOR ASSY		5	1	34061	BASE FORMED 26 X 40
2	1	80106	INNOVATION SHELL INSULATION - Ø16.00		6	1	92060	VALVE, 3/4" DRAIN
3	1	24648-1	AIR-FUEL DELIVERY COMPONENTS	INN 600N/800N P	7	1	44085-3	6" EXHAUST MANIFOLD - INNOVATION
		24648-2		INN 800N	8	1	93410	COUPLING, 1/8 NPT 304 SST 150 PSI
		24648-3		INN 1060N	9	1	93357	PLUG, 1/8 NPT HEX PIPE 304 STAINLESS
		24648-4		INN 1350N/1400N K	10	1	80088	EXHAUST MANIFOLD SEAL
		24648-5		INN 600N P	11	1	61073	ULTRASONIC CONDENSATE LEVEL SWITCH
		24648-6		INN 1060N P/1350N P/1400NK P	12	1	80119	PIPING INSULATION (shown transparent)
4 *	3	123449	SENSOR, TEMPERATURE		13	2	80107	ELBOW INSULATION (shown transparent)

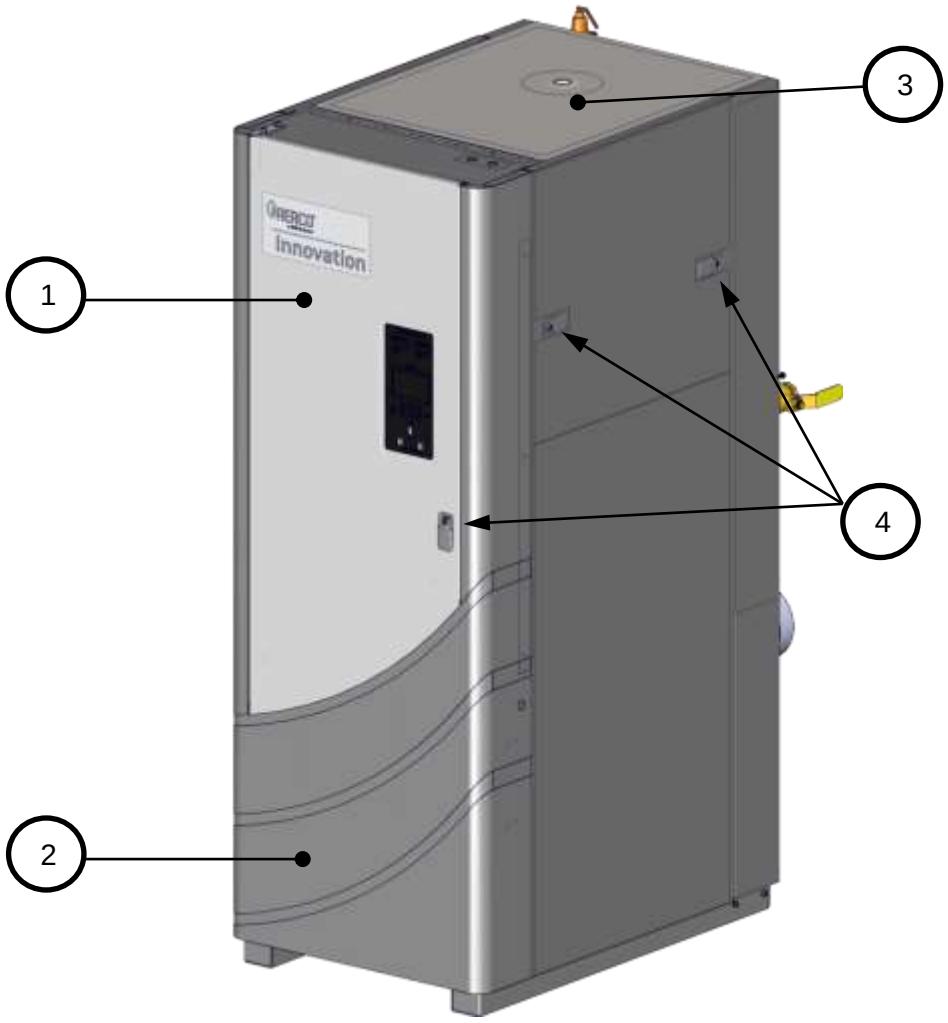


Innovation Parts List – 28735-TAB rev D – Page 2							
Item	**Qty.**	**Part #**	**Description**	**Item**	**Qty.**	**Part #**	**Description**
1	1	65175	THERMOSTAT, JUMO	9	1	22332	GAS TRAIN, 3/4" SSOV, INN 600N/800N FM
2	1	122843	LOW WATER, CUTOFF			22353	GAS TRAIN, 1" SSOV, INN 1060N FM
3	1	80106	INSULATION WRAP, 16" DIAMETER SHELL			22363	GAS TRAIN, 1" SSOV, INN 1350N FM
4	1	55033	U-BOLT 1-1/2"			22387	GAS TRAIN, INN 600N P, 800N P PROPANE
5	2	93322	PLUG, 2" NPT			22386	GAS TRAIN, INN 1060N P, 1350N P PROPANE
6	1	59138	FILTER, AIR 6"	10	1	123449	SENSOR, TEMPERATURE
7	1	24234	6" EXHAUST MANIFOLD – INNOVATION				

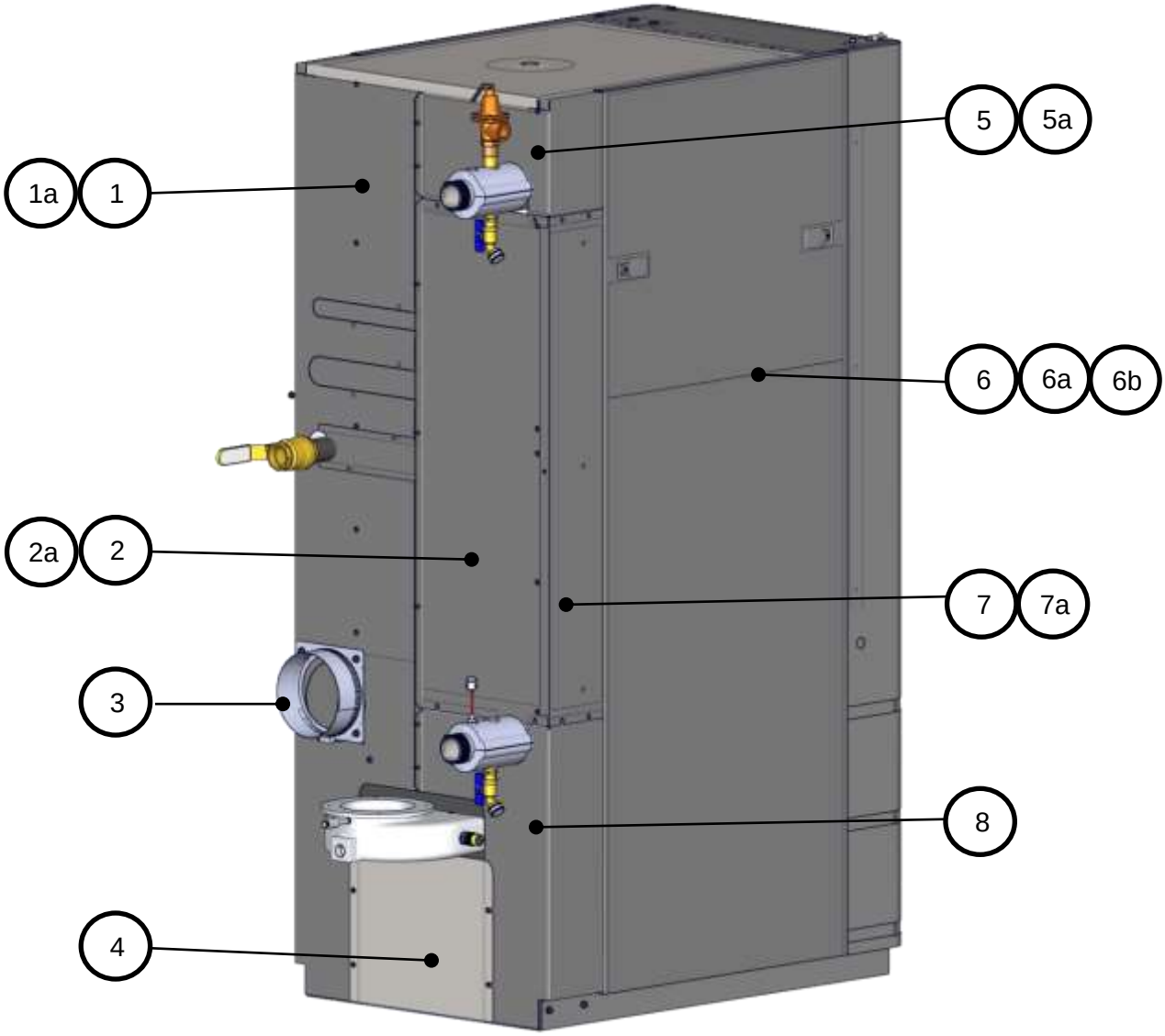


INTAKE MANIFOLD – BURNER – EXHAUST MANIFOLD
CROSS-SECTION VIEW

Innovation Parts List – 28735-TAB rev D – Page 3							
Item	**Qty.**	**Part #**	**Description**	**Item**	**Qty.**	**Part #**	**Description**
1	1	44106	INTAKE MANIFOLD	5	2	GP-18899	BURNER FLANGE GASKET
2	1	44085-3	EXHAUST MANIFOLD	6	1	122537	EXHAUST MANIFOLD TO COMBUSTION CHAMBER GASKET
3	1	61073	CONDENSATE LEVEL SWITCH	7	2	92060	DRAIN VALVE, 3/4"
4	1	24233-2	BURNER ASSEMBLY				

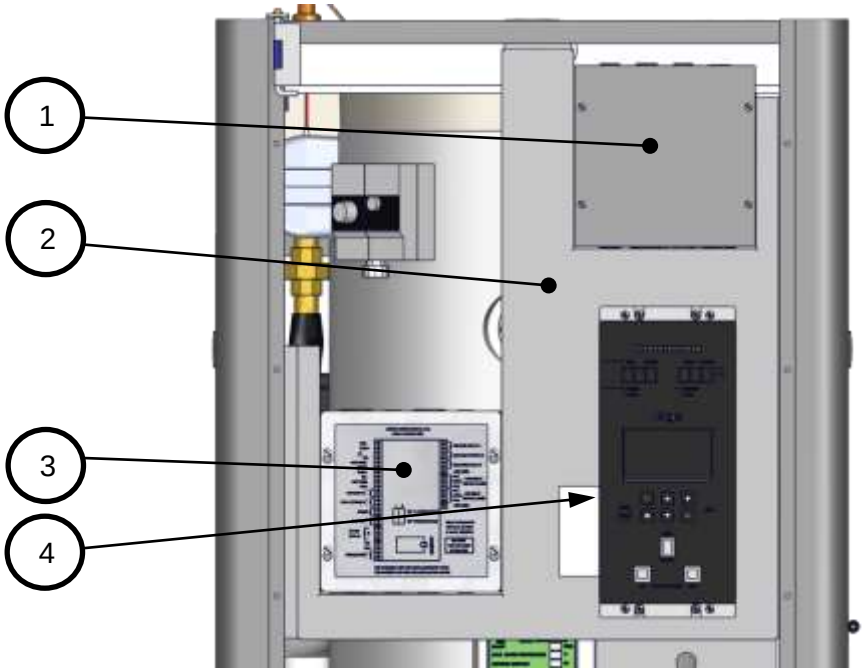


Innovation Parts List – 28735-TAB rev D – Page 4							
Item	**Qty.**	**Part #**	**Description**	**Item**	**Qty.**	**Part #**	**Description**
1	1	37185	FRONT DOOR ASSY. w/ LATCHES	3	1	37098	TOP PANEL
2	1	37094	FRONT PANEL ASSEMBLY	4	5	59133	LATCH, COMPRESSION



Innovation Parts List – 28735-TAB rev D – Page 5							
Item	**Qty.**	**Part #**	**Description**	**Item**	**Qty.**	**Part #**	**Description**
1	1	37097	LEFT-REAR PANEL	7	2	37184	SIDE DOOR ASSY.
1a *	1	80111	LEFT-REAR PANEL, INSULATION	6a*	2	80115	SIDE DOOR ASSY., LOWER INSULATION
2	1	37102	ACCESS PANEL, RIGHT-REAR	6b*	2	80116	SIDE DOOR ASSY., UPPER INSULATION
2a *	1	80113	ACCESS PANEL, INSULATION	7	1	37104	RIGHT-SIDE ZERO CLEARANCE PANEL
3	1	39125	ADAPTER, AIR INLET 6" PVC	7a*	1	80110	RIGHT-SIDE ZERO PANEL, INSULATION
4	1	37063	REAR PANEL	8	1	37103	LOWER PANEL, RIGHT-REAR
5	1	37101	REAR PANEL, UPPER-RIGHT				
5a*		80114	REAR PANEL, UPPER-RIGHT, INSULATION				

* Insulation is behind enclosure panels, not shown.



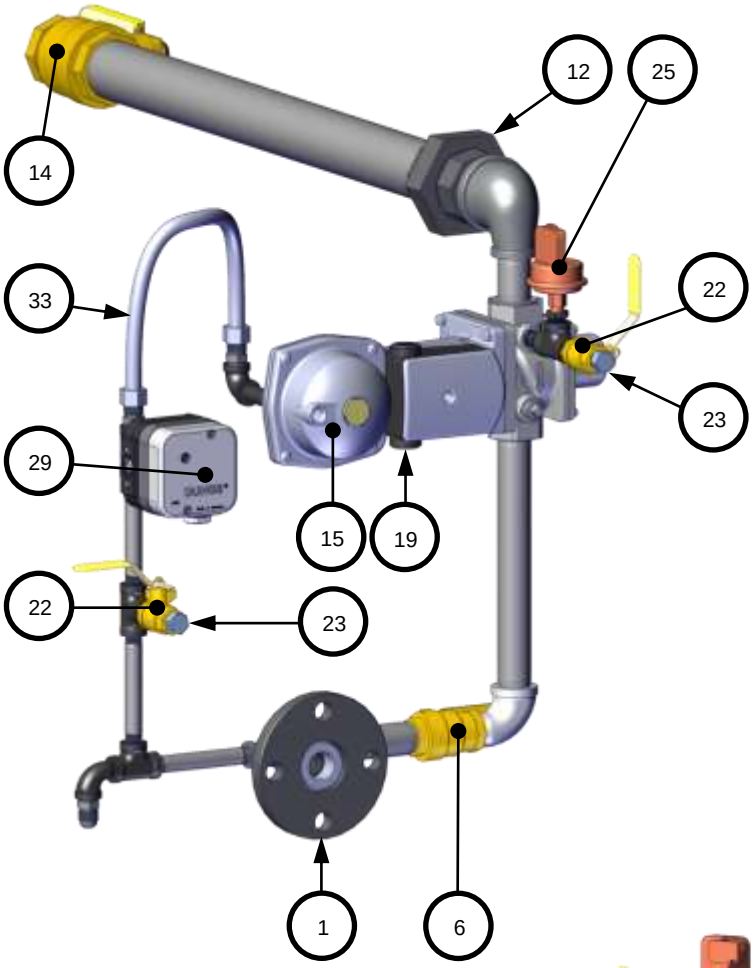
* Older version I/O Boxes (P/N **69151**) are compatible with Innovation units with Edge [i] Controller and the current I/O Box (P/N **69245**).

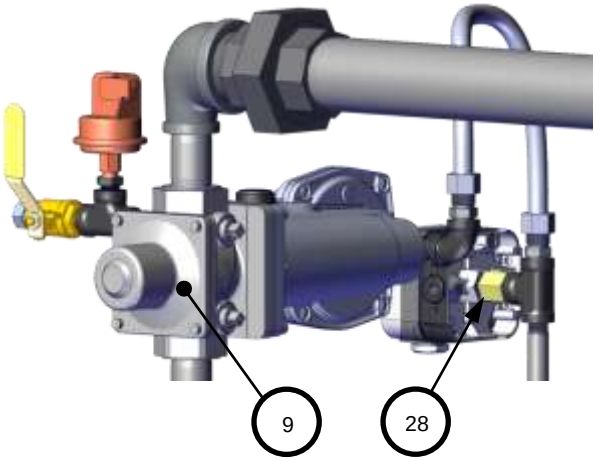
Innovation Parts List – 28735-TAB rev D – Page 6							
Item	**Qty.**	**Part #**	**Description**	**Item**	**Qty.**	**Part #**	**Description**
1	1	64163	POWER BOX 120/220 VAC	3	1	69245 *	I/O BOX WITH Nexa & SEQ VALVE CABLES
2	1	30190	PANEL, ELECTRICAL	4	1	69344-4	EDGE [I] CONTROLLER

Accessories			
92123	**2" DOMESTIC WATER MOTORIZED SEQUENCING BALL VALVE**		
	1	93100	UNION: 2" NPT 304 STAINLESS
	1	90046-3	NIPPLE: 2" NPT 304 SS
69126	**LWCO/CAPACITOR ASSEMBLY KIT**		
	1	122843	LOW WATER CUT-OFF
	1	63070	47 MCF CAPACITOR ASSY
	1	122690	NUT, ACORN NYLON #8-32

Innovation 600N, 800N 3/4" NATURAL GAS Gas Train – P/N 22332 rev E, 3/20/2021							
Item	**Qty**	**Part #**	**Description**	**Item**	**Qty**	**Part #**	**Description**
1	1	95026	1.25" NPT 125#: THREADED FLANGE	22	2	92077	1/4" NPT MXF BRASS BALL VALVE (CLOSED)
6	1	92006-4	VALVE: FULL PORT BAL 3/4" NPT	23	2	9-22	PIPE PLUG: 1/4" NPT: STEEL
9	1	92101	VALVE: SSOV ¾" NPT	25	1	61002-1	PRESSURE SWITCH: 2.6" W.C. FALL N.O.
12	1	5018	1-1/2" NPT MALE/FEMALE UNION	28	1	99017	SNUBBER: PRESSURE: 1/4"
14	1	92006-7	VALVE: BALL BRASS 1-1/2" NPT	29	1	60032-1	GAS PRESSURE SWITCH: 1-20" W.C.
15	1	64048 ❶	ACTUATOR: SSOV w/ REGULATOR	33	1	97087-12	TUBE: FLEXIBLE 12"
19	2	12951-2	BUSHING: CONTROL BOX				

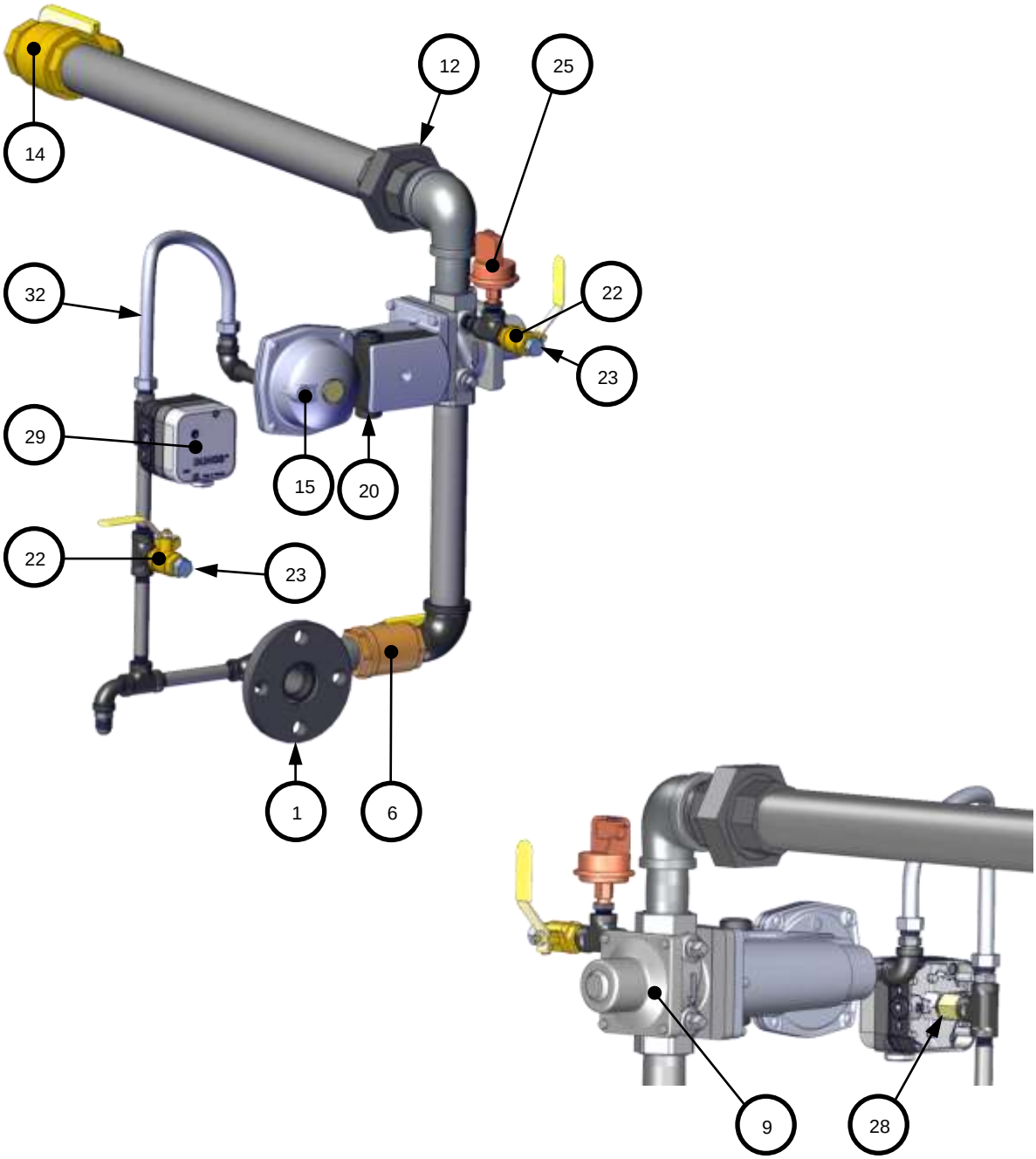
❶ Part number of Kit





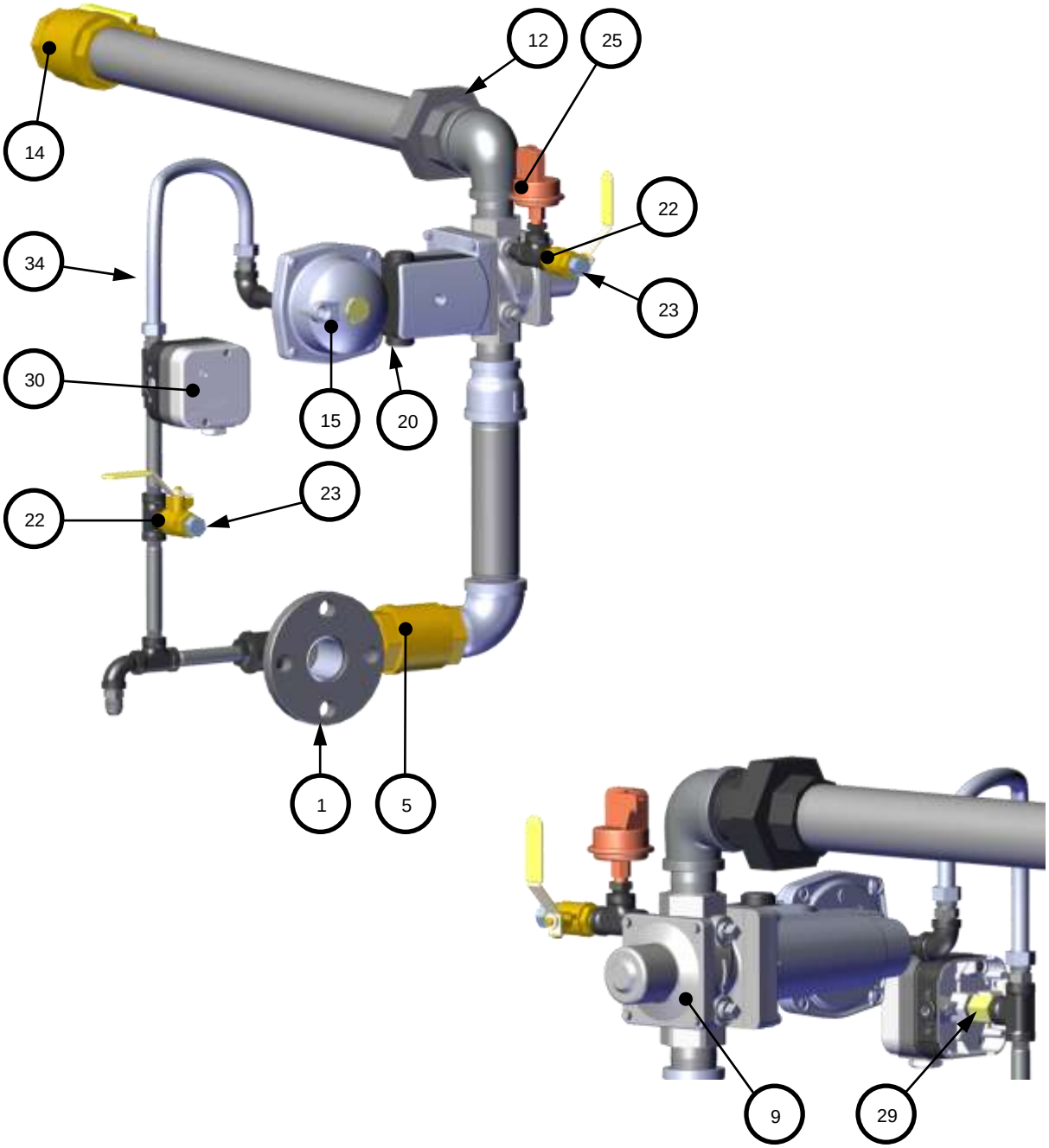
Innovation 1060N NATURAL GAS Gas Train – P/N 22353 rev E, 3/15/2021							
Item	**Qty**	**Part #**	**Description**	**Item**	**Qty**	**Part #**	**Description**
1	1	95026	1.25" NPT 125#: THREADED FLANGE	22	2	92077	1/4" NPT MXF BRASS BALL VALVE (CLOSED)
6	1	92006-5	VALVE: BALL 1" NPT	23	2	9-22	PIPE PLUG: 1/4" NPT: STEEL
9	1	92036	VALVE: SSOV 1" NPT	25	1	61002-1	PRESSURE SWITCH: 2.6" W.C. FALL N.O.
12	1	5018	1-1/2" NPT MALE/FEMALE UNION	28	1	99017	SNUBBER: PRESSURE: 1/4"
14	1	92006-7	VALVE: BALL BRASS 1-1/2" NPT	29	1	60032-1	PRESSURE SWITCH ASSY 1-20" W.C.
15	1	64048 ❶	ACTUATOR: SSOV w/ REGULATOR	32	1	97087-12	FLEXIBLE TUBE, 12"
20	2	12951-2	BUSHING: CONTROL BOX				

❶ Part number of Kit



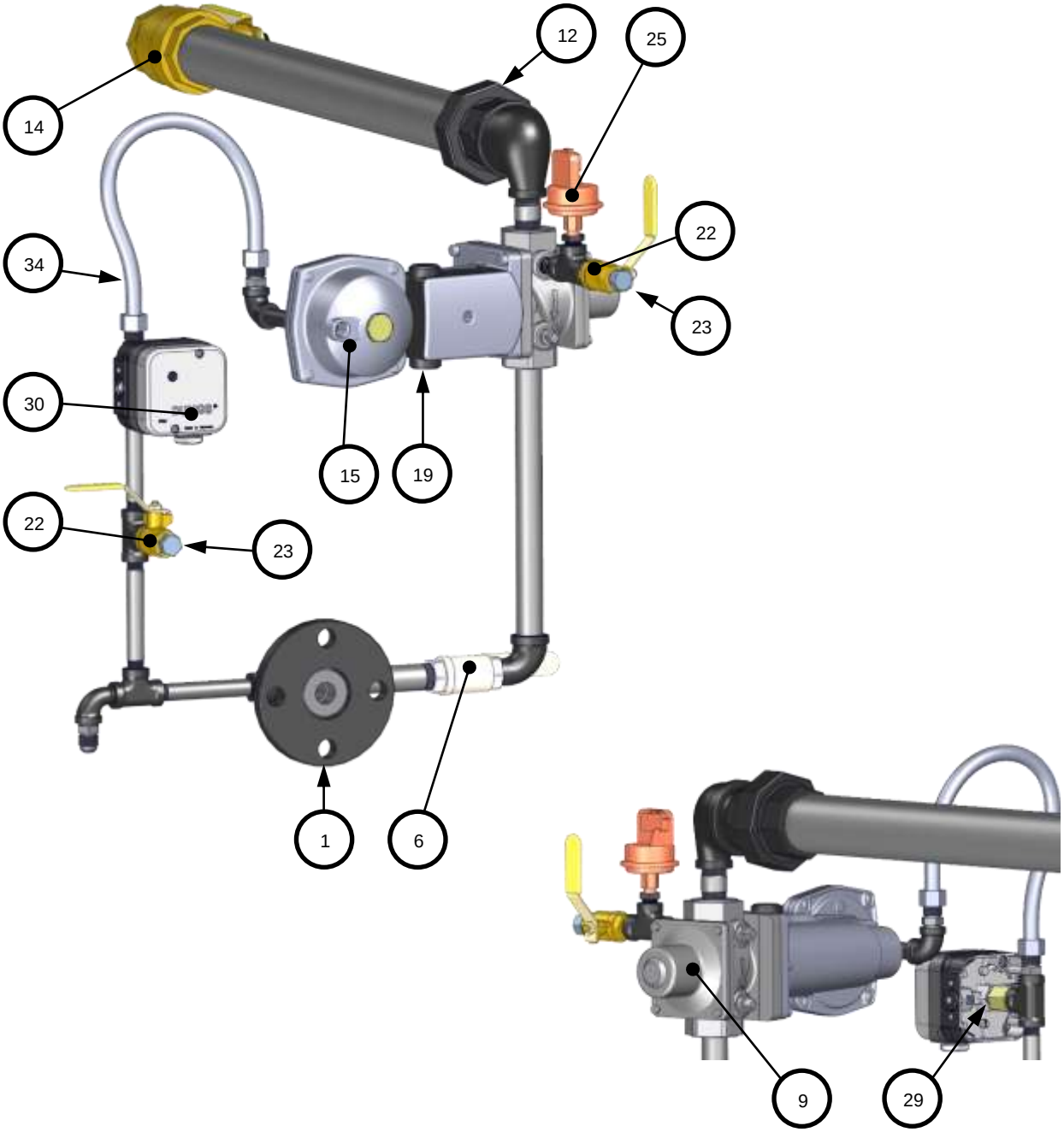
Innovation 1350N NATURAL GAS Gas Train – P/N 22363 rev E, 3/15/2021							
Item	**Qty**	**Part #**	**Description**	**Item**	**Qty**	**Part #**	**Description**
1	1	95026	1.25" NPT 125#: THREADED FLANGE	22	2	92077	1/4" NPT MXF BRASS BALL VALVE (CLOSED)
5	1	92006-6	VALVE: BALL BRASS 1-1/4" NPT	23	2	9-22	PIPE PLUG: 1/4" NPT: STEEL
9	1	92036	VALVE: SSOV 1" NPT	25	1	61002-1	PRESSURE SWITCH: 2.6" W.C. FALL N.O.
12	1	5018	1-1/2" NPT MALE/FEMALE UNION	29	1	99017	SNUBBER: PRESSURE: 1/4"
14	1	92006-7	VALVE: BALL BRASS 1-1/2" NPT	30	1	60032-1	GAS PRESSURE SWITCH: 1-20" W.C.
15	1	64048 ❶	ACTUATOR: SSOV w/ REGULATOR	34	1	97087-12	Flex Tube 12"
20	2	12951-2	BUSHING: CONTROL BOX				

❶ Part number of Kit



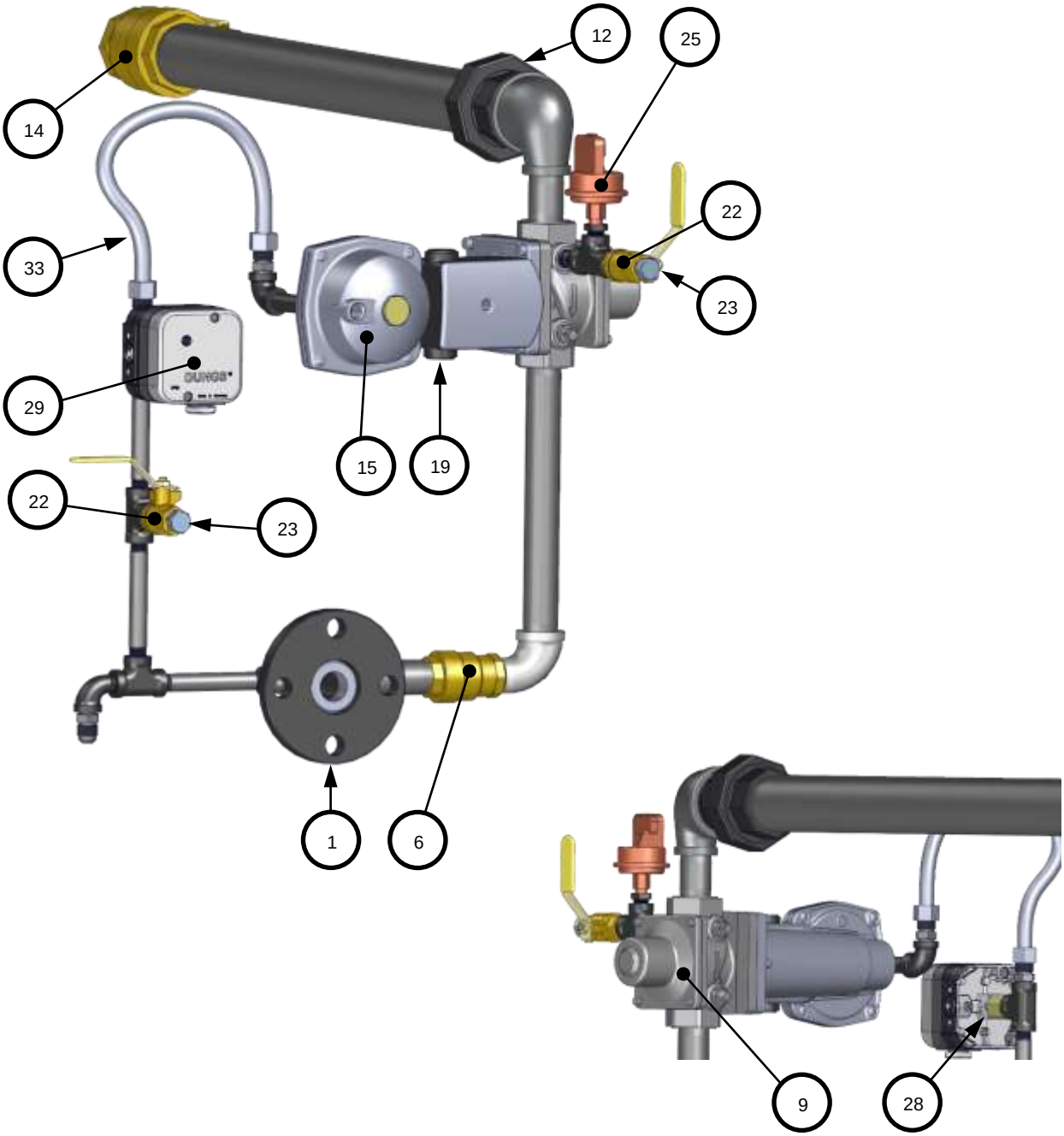
Innovation 600N P, 800N P, PROPANE Gas Train – P/N 22387 rev B, 3/16/2021							
Item	**Qty**	**Part #**	**Description**	**Item**	**Qty**	**Part #**	**Description**
1	1	95026	1.25" NPT 125#: THREADED FLANGE	22	2	92077	1/4" NPT MXF BRASS BALL VALVE
6	1	92006-3	VALVE: BALL 1/2" NPT	23	2	9-22	PIPE PLUG: 1/4" NPT: STEEL
9	1	92103	VALVE: SSOV 1/2" NPT	25	1	61002-21	LOW PRESSURE SWITCH: 7.5”
12	1	5018	1-1/2" NPT MALE/FEMALE UNION	29	1	99017	SNUBBER: PRESSURE: 1/4"
14	1	92006-7	VALVE: BALL BRASS 1-1/2" NPT	30	1	60032-1	PRESSURE SWITCH ASSY 1-20" W.C.
15	1	64048 ❶	ACTUATOR: SSOV w/ REGULATOR	34	1	97087-12	FLEXIBLE TUBE, 12"
19	2	12951-2	BUSHING: CONTROL BOX				

❶ Part number of Kit



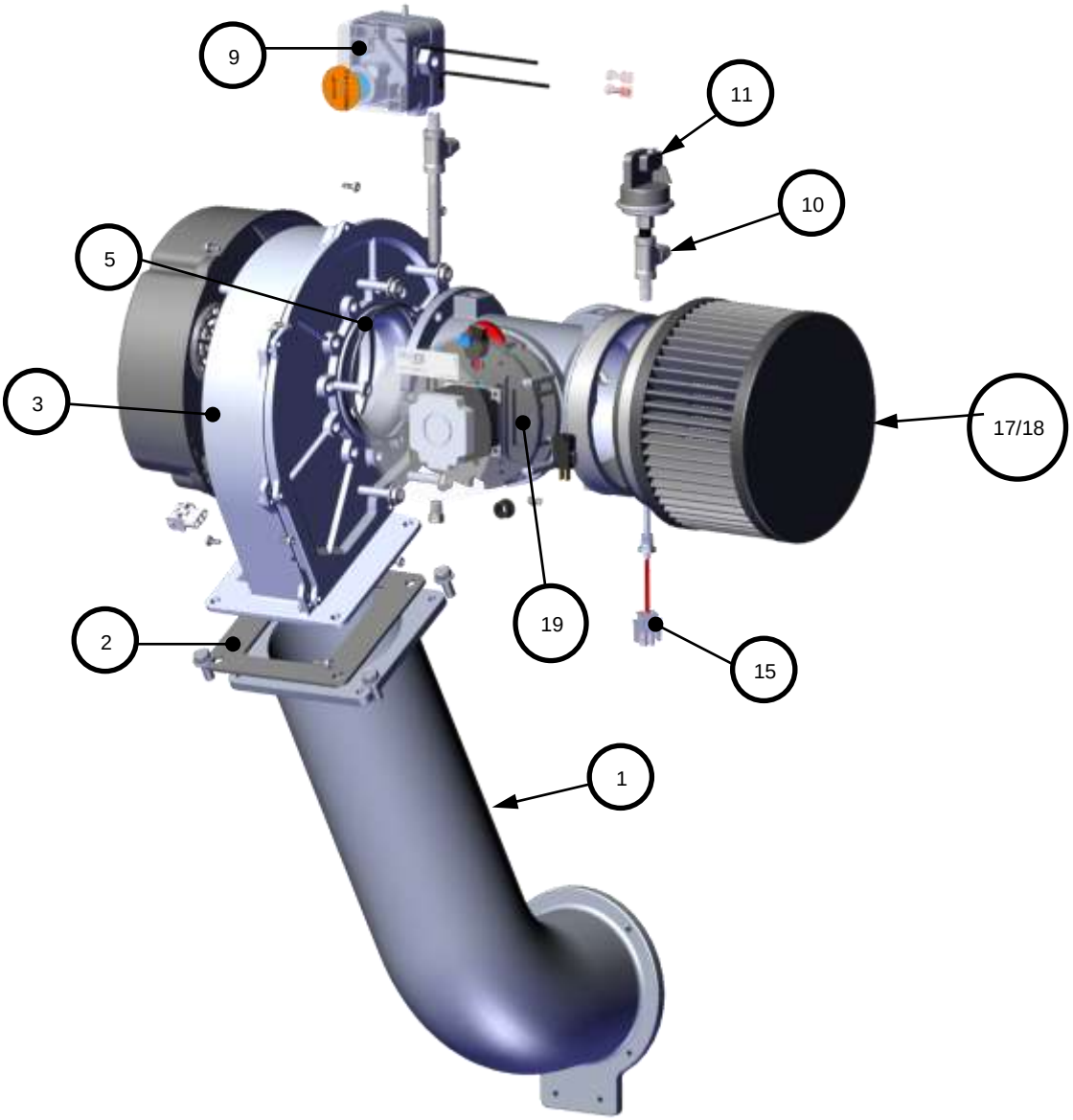
Innovation 1060N P, 1060N B BAH, 1350N P PROPANE Gas Train – P/N 22386 rev C, 3/16/2021							
Item	**Qty**	**Part #**	**Description**	**Item**	**Qty**	**Part #**	**Description**
1	1	95026	1.25" NPT 125#: THREADED FLANGE	22	2	92077	1/4" NPT MXF BRASS BALL VALVE
6	1	92006-4	VALVE: BALL 3/4" NPT	23	2	9-22	PIPE PLUG: 1/4" NPT: STEEL
9	1	92101	VALVE: SSOV 3/4" NPT	25	1	61002-21	LOW PRESSURE SWITCH: 7.5”
12	1	5018	1-1/2" NPT MALE/FEMALE UNION	28	1	99017	SNUBBER: PRESSURE: 1/4"
14	1	92006-7	VALVE: BALL BRASS 1-1/2" NPT	29	1	60032-1	PRESSURE SWITCH ASSY 1-20" W.C.
15	1	64048 ❶	ACTUATOR: SSOV w/ REGULATOR	33	1	97087-12	FLEXIBLE TUBE, 12"
19	2	12951-2	BUSHING: CONTROL BOX				

❶ Part number of Kit



Innovation 600N, 800N, 1060N, 1060N B BAH, 1350N, 1400NK Air Fuel Delivery System – P/N 24648 rev D, 2/4/2020							
Item	**Qty**	**Part #**	**Description**	**Item**	**Qty**	**Part #**	**Description**
1	1	43101	BLOWER INTAKE MANIFOLD	16	1	124149-1	WIRE ASSY, JUMPER O.T. SWITCHES
2	1	81160	GASKET, 8.9" BLOWER	17	1	59138	FILTER, AIR 6", INN 1060N, 1350N, 1400NK (Natural Gas and Propane)
3	1	58193❶	FASCO BLOWER GPM 7.0	18	1	59139	FILTER, AIR 6" X 4.5 LG, INN 600N, 800N (Natural Gas and Propane)
5	1	88004	O-RING #2-244 BUNA-N	19	1	24298-4	A/F VALVE ASSY INN 600N, plus 800N 1350N and 1400NK PROPANE units
9	1	60011-4	SWITCH ASSY, BLOWER PROOF			24298-5	A/F VALVE ASSY INN 800N
10	1	9-21	PLUG, HEX HD 1/8 NPT			24298-6	A/F VALVE ASSY INN 1060N
11	1	61002-5	VACUUM PRESSURE SWITCH 4.5"			24298-7	A/F VALVE ASSY INN 1350N/1400NK
15	1	61024-1	AIR INLET TEMPERATURE SENSOR, 1/8" NPT			24298-8	A/F VALVE ASSY INN 600N PROPANE ONLY
						24298-10	AFV INN1060N B BAHRAIN

❶ Part number of Kit

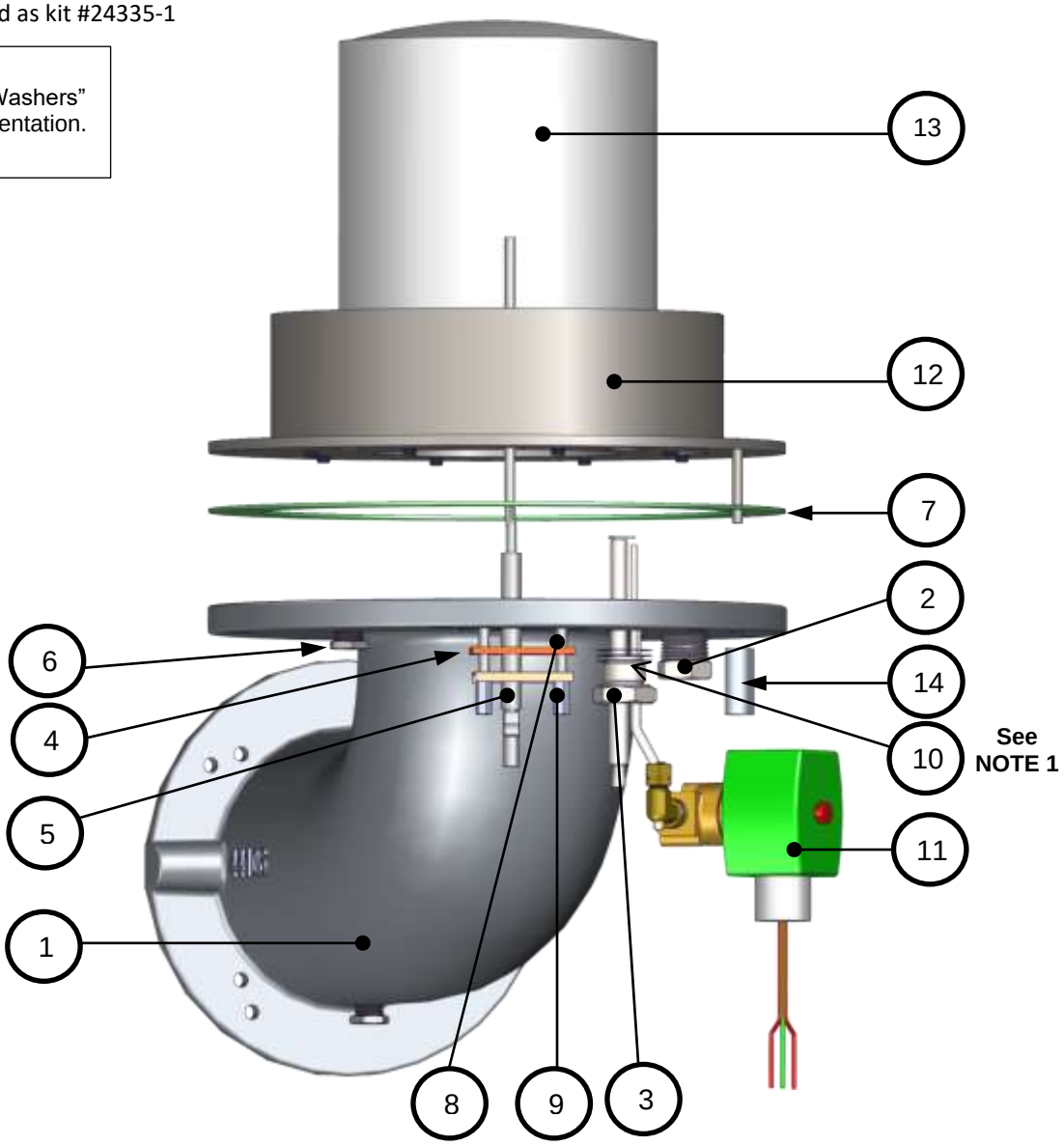


Intake Manifold Assembly P/N 24234 rev E			
Item	**Qty**	**Part #**	**Description**
1	1	44106	INTAKE MANIFOLD
2	1	59104	OBSERVATION PORT
3 ❷	1	66026	IGNITER-INJECTOR
4 ❶	1	81048	FLAME DETECTOR GASKET
5 ❶	1	66037	FLAME DETECTOR
6	2	93358	PLUG 1/4 NPT HEX HD PIPE
7 ❸	1	GP-18899	BURNER FLANGE GASKET
8	2	52037	STUD #10-32
9	2	59027	STANDOFF, THREADED #10-32
10 ❷	3	53033	WASHER: CLOCKING
11	1	24247	STAGED IGNITION ASSY

Innovation Burner Assembly P/N 24233-2 rev H			
Item	**Qty**	**Part #**	**Description**
12	1	44179	BURNER PLATE
13	1	46062	BURNER ASSEMBLY
14	1	122977	TWO-WAY CONNECTOR

❶ 81048 & 66037 are supplied as kit # 24356-2
❷ 66026 & 53033 are supplied as kit #58023
❸ GP-18899 is supplied as kit #24335-1

NOTE 1:
Use 0 to 4 “Clocking Washers” to establish correct orientation.



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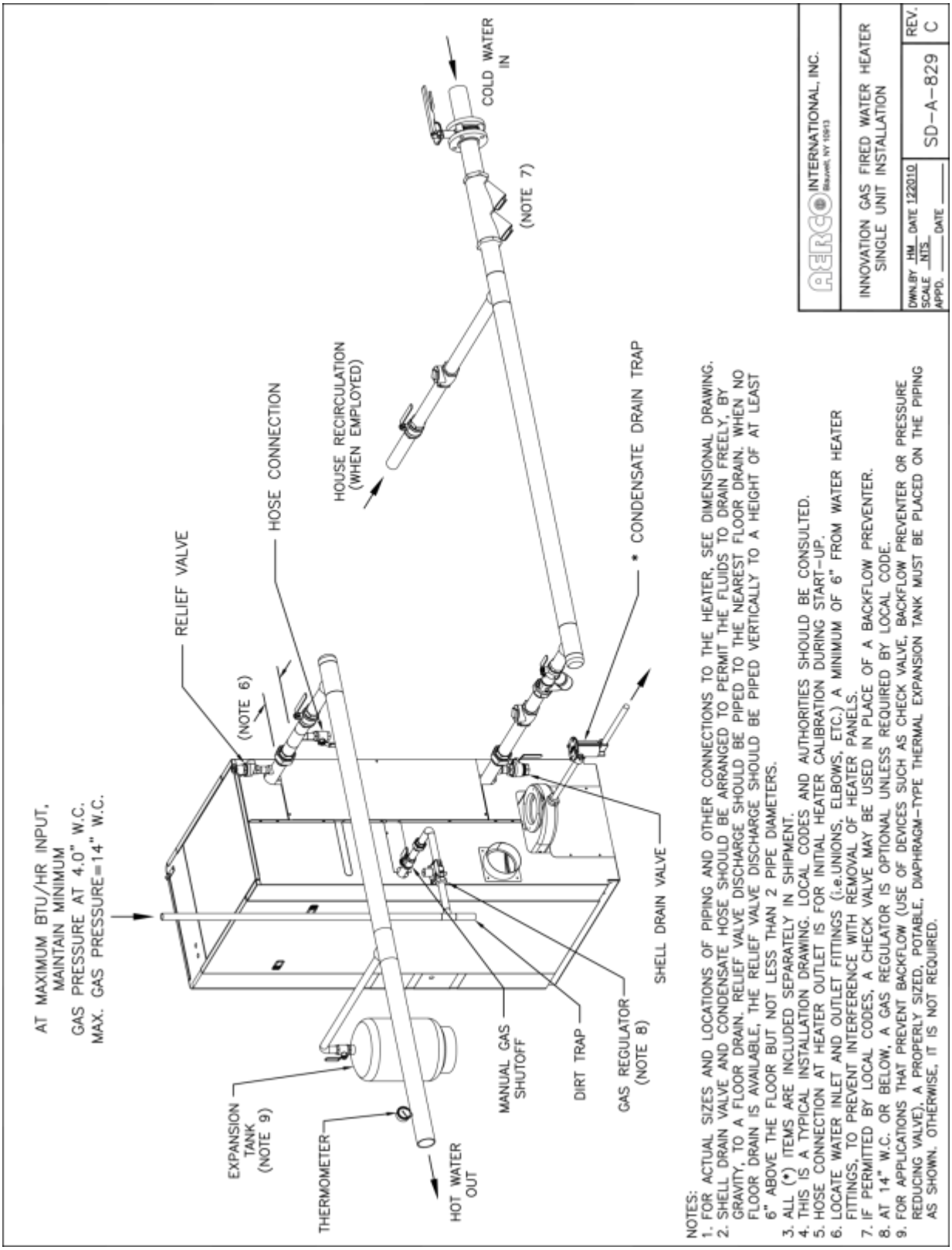
APPENDIX F – Piping Drawings



Drawing Number: SD-A-829 rev C

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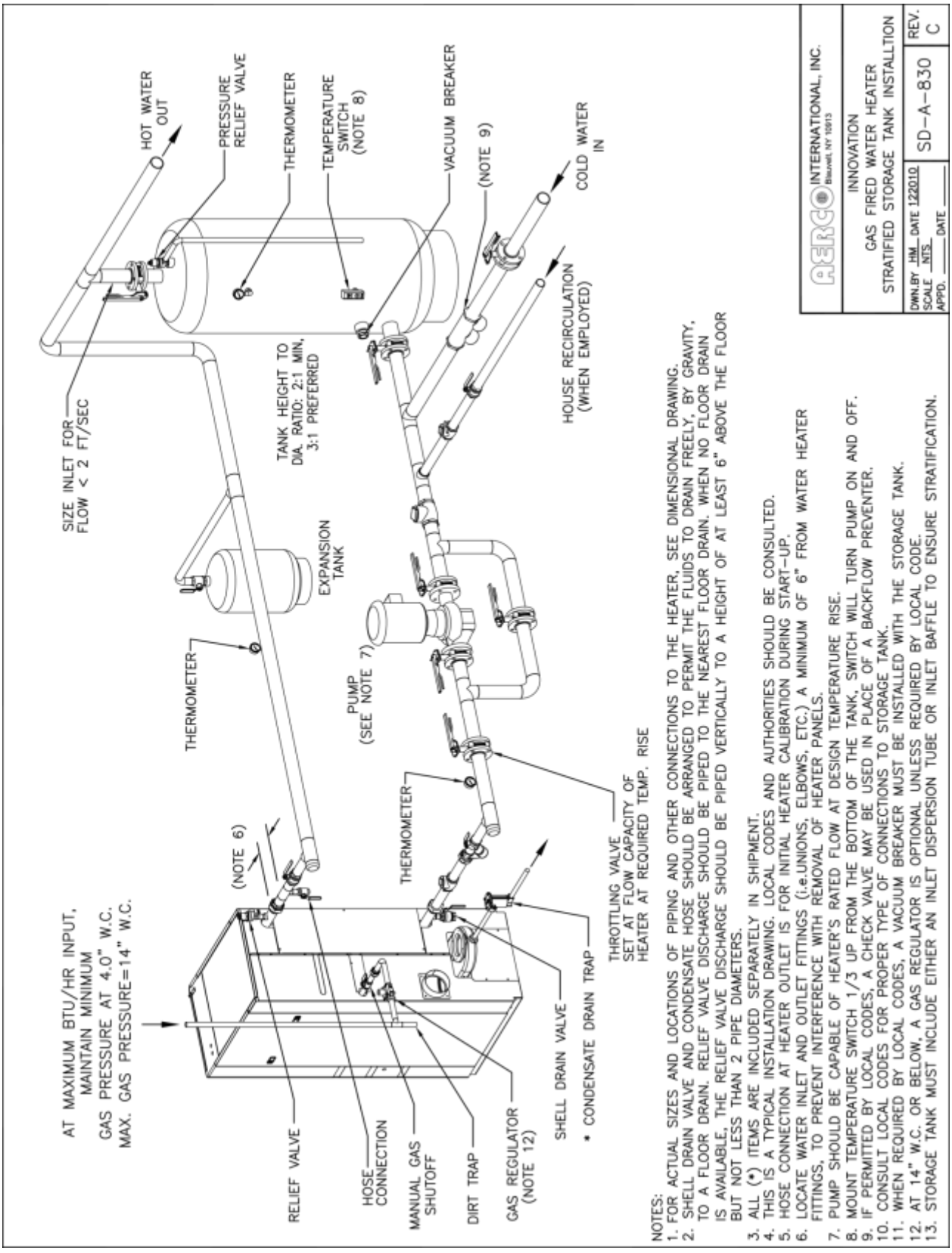
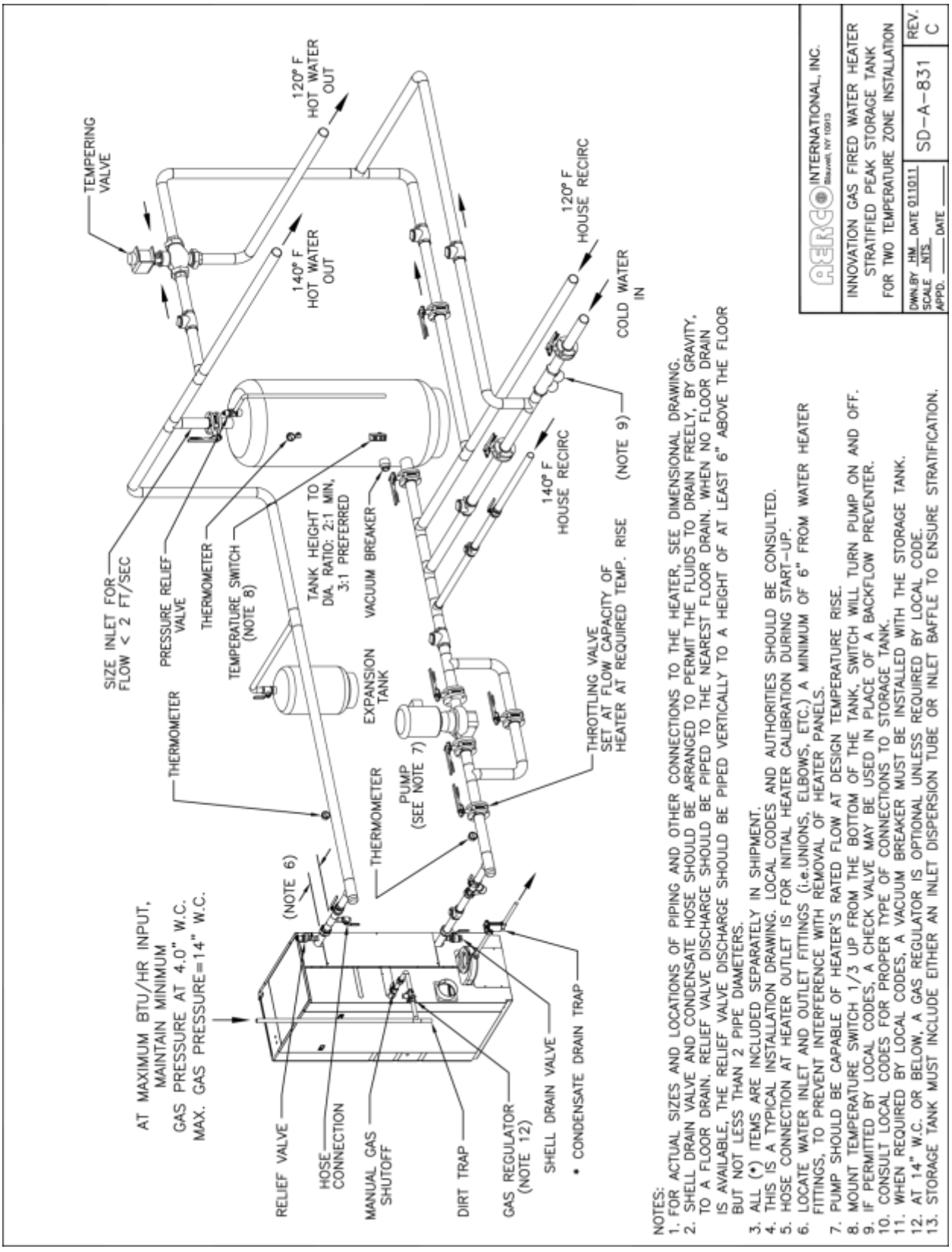


NOTES:
1. FOR ACTUAL SIZES AND LOCATIONS OF PIPING AND OTHER CONNECTIONS TO THE HEATER, SEE DIMENSIONAL DRAWING.
2. SHELL DRAIN VALVE AND CONDENSATE HOSE SHOULD BE ARRANGED TO PERMIT THE FLUIDS TO DRAIN FREELY, BY GRAVITY, TO A FLOOR DRAIN. RELIEF VALVE DISCHARGE SHOULD BE PIPED TO THE NEAREST FLOOR DRAIN. WHEN NO FLOOR DRAIN IS AVAILABLE, THE RELIEF VALVE DISCHARGE SHOULD BE PIPED VERTICALLY TO A HEIGHT OF AT LEAST 6" ABOVE THE FLOOR BUT NOT LESS THAN 2 PIPE DIAMETERS.
3. ALL (•) ITEMS ARE INCLUDED SEPARATELY IN SHIPMENT.
4. THIS IS A TYPICAL INSTALLATION DRAWING. LOCAL CODES AND AUTHORITIES SHOULD BE CONSULTED.
5. HOSE CONNECTION AT HEATER OUTLET IS FOR INITIAL HEATER CALIBRATION DURING START-UP.
6. LOCATE WATER INLET AND OUTLET FITTINGS (i.e.UNIONS, ELBOWS, ETC.) A MINIMUM OF 6" FROM WATER HEATER FITTINGS, TO PREVENT INTERFERENCE WITH REMOVAL OF HEATER PANELS.
7. PUMP SHOULD BE CAPABLE OF HEATER'S RATED FLOW AT DESIGN TEMPERATURE RISE.
8. MOUNT TEMPERATURE SWITCH 1/3 UP FROM THE BOTTOM OF THE TANK, SWITCH WILL TURN PUMP ON AND OFF.
9. IF PERMITTED BY LOCAL CODES, A CHECK VALVE MAY BE USED IN PLACE OF A BACKFLOW PREVENTER.
10. CONSULT LOCAL CODES FOR PROPER TYPE OF CONNECTIONS TO STORAGE TANK.
11. WHEN REQUIRED BY LOCAL CODES, A VACUUM BREAKER MUST BE INSTALLED WITH THE STORAGE TANK.
12. AT 14" W.C. OR BELOW, A GAS REGULATOR IS OPTIONAL UNLESS REQUIRED BY LOCAL CODE.
13. STORAGE TANK MUST INCLUDE EITHER AN INLET DISPERSION TUBE OR INLET BAFFLE TO ENSURE STRATIFICATION.

Drawing Number: SD-A-830 rev C



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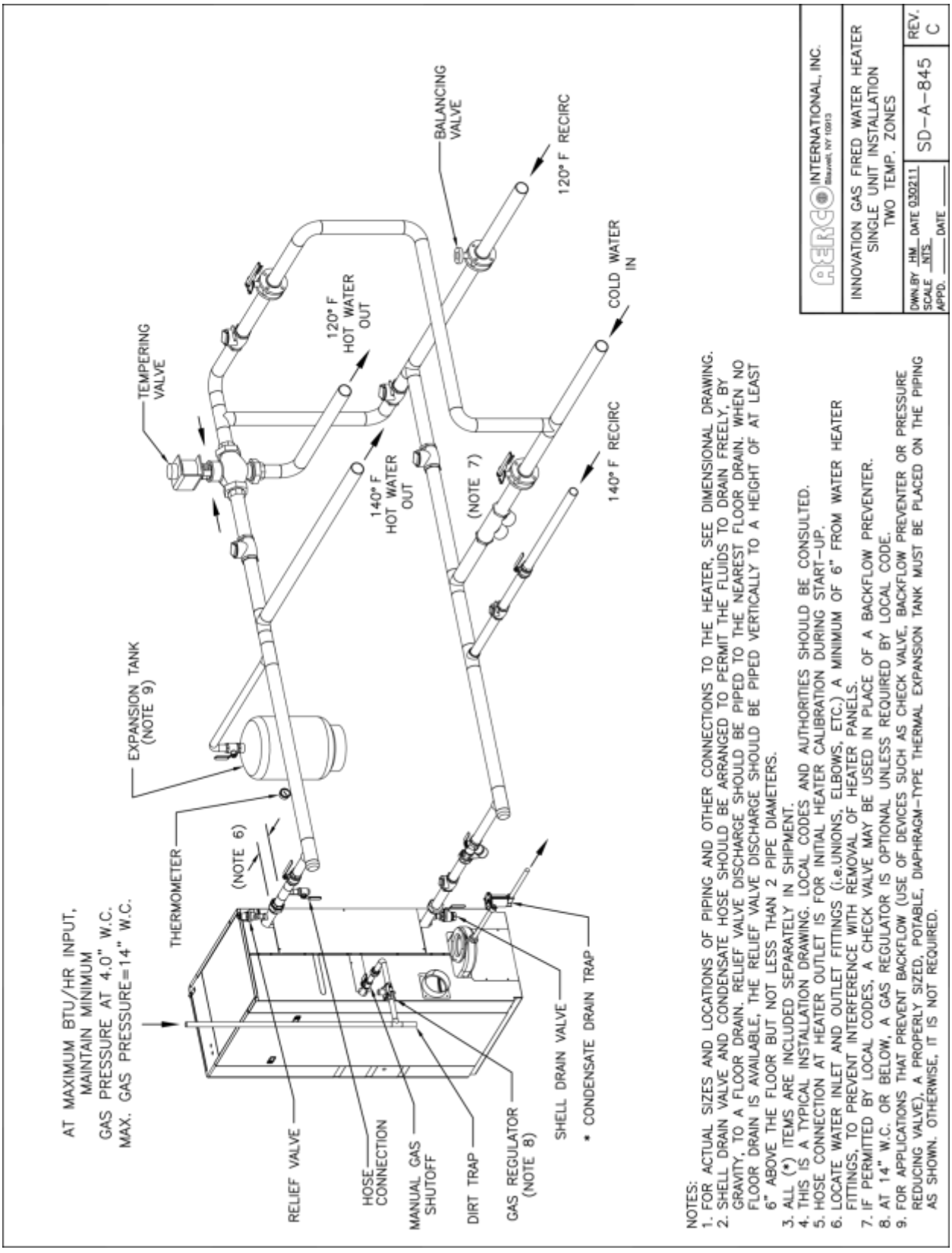

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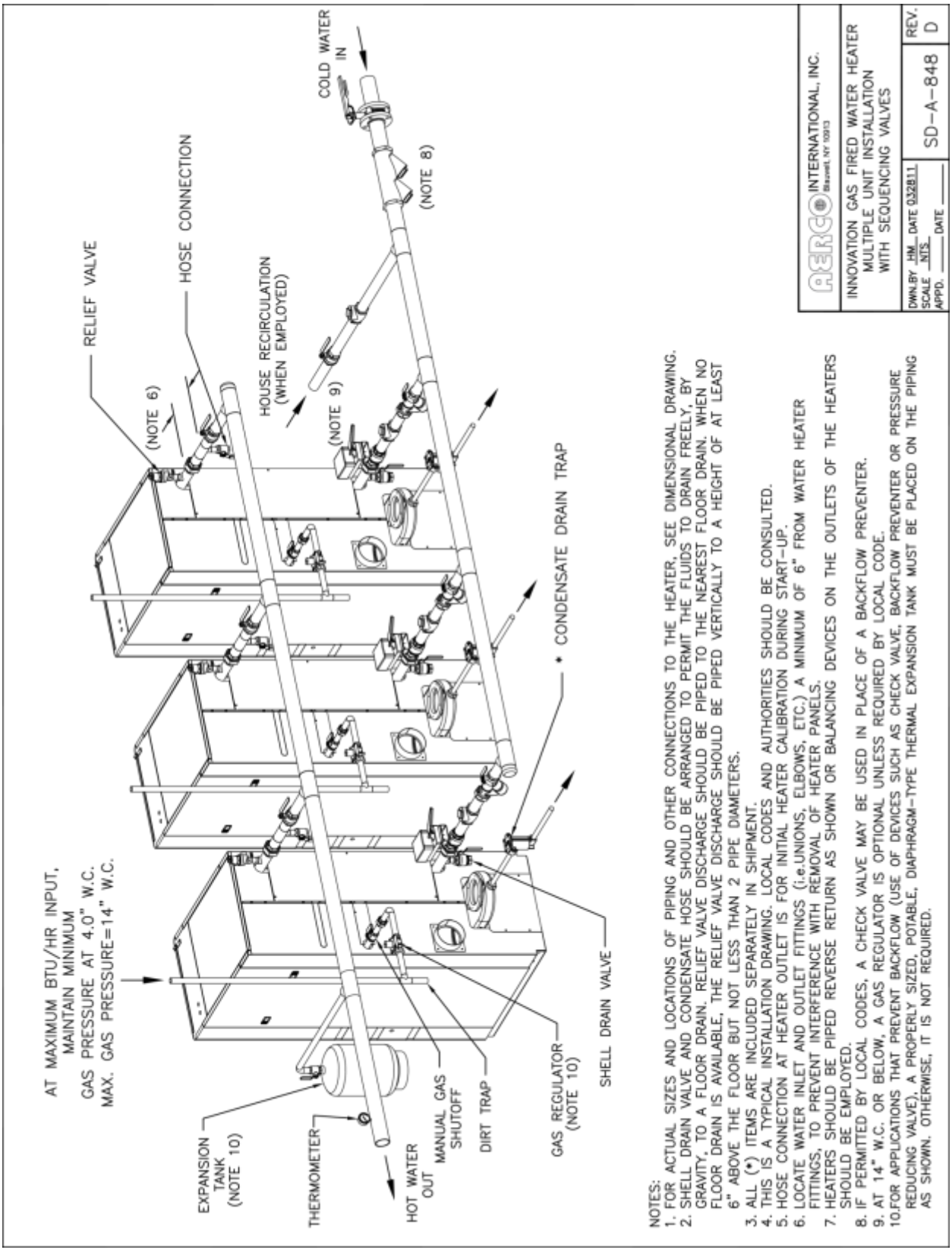

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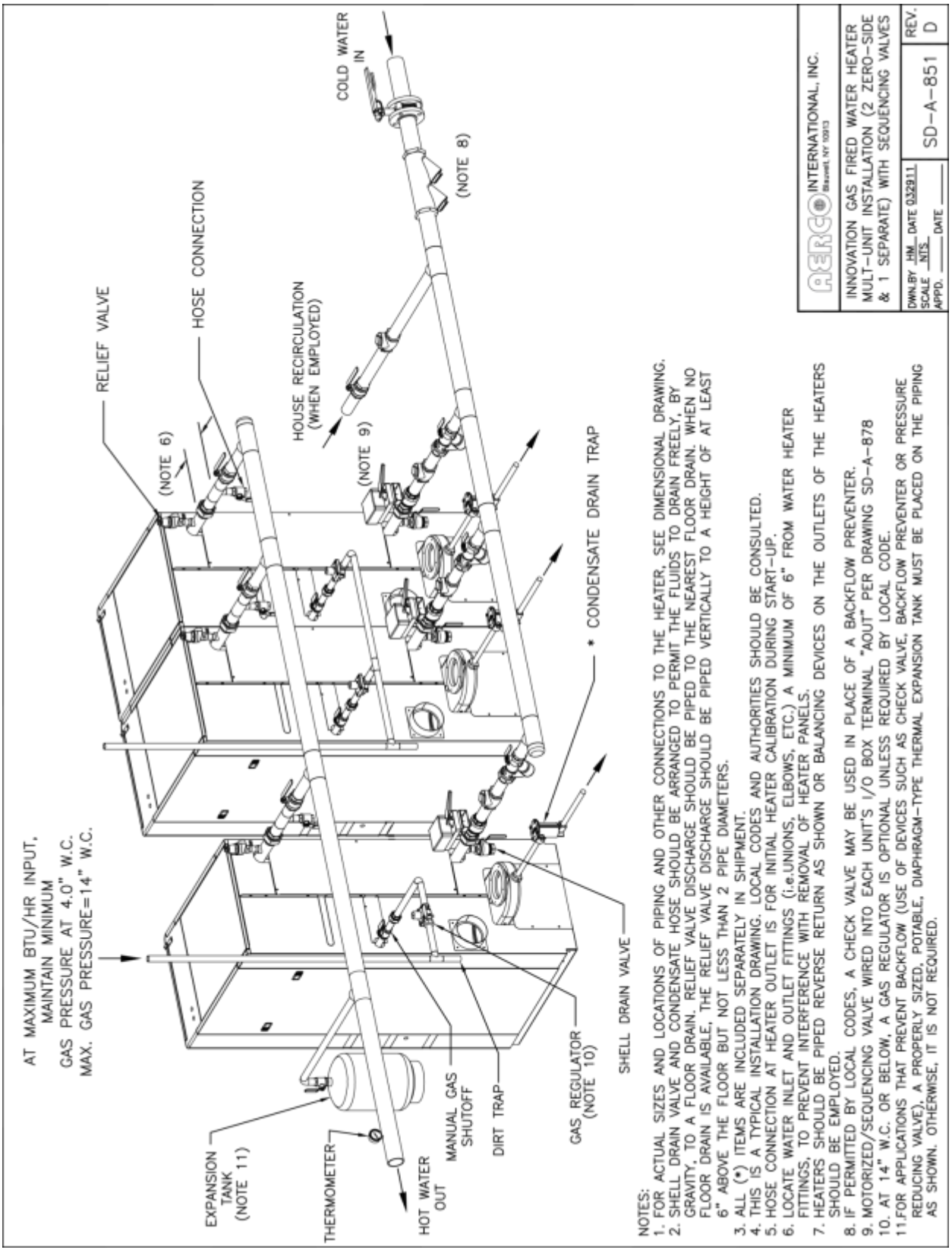

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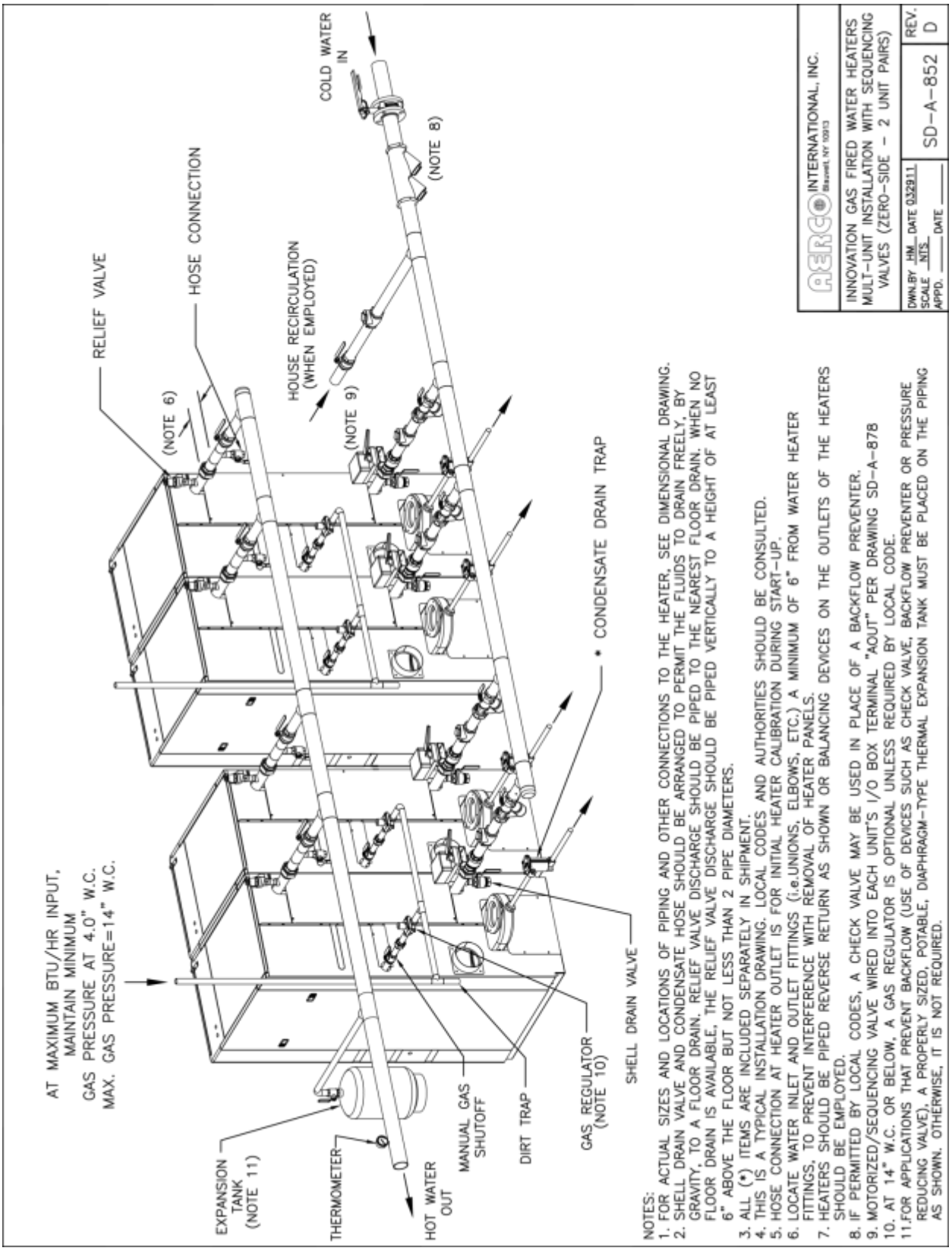

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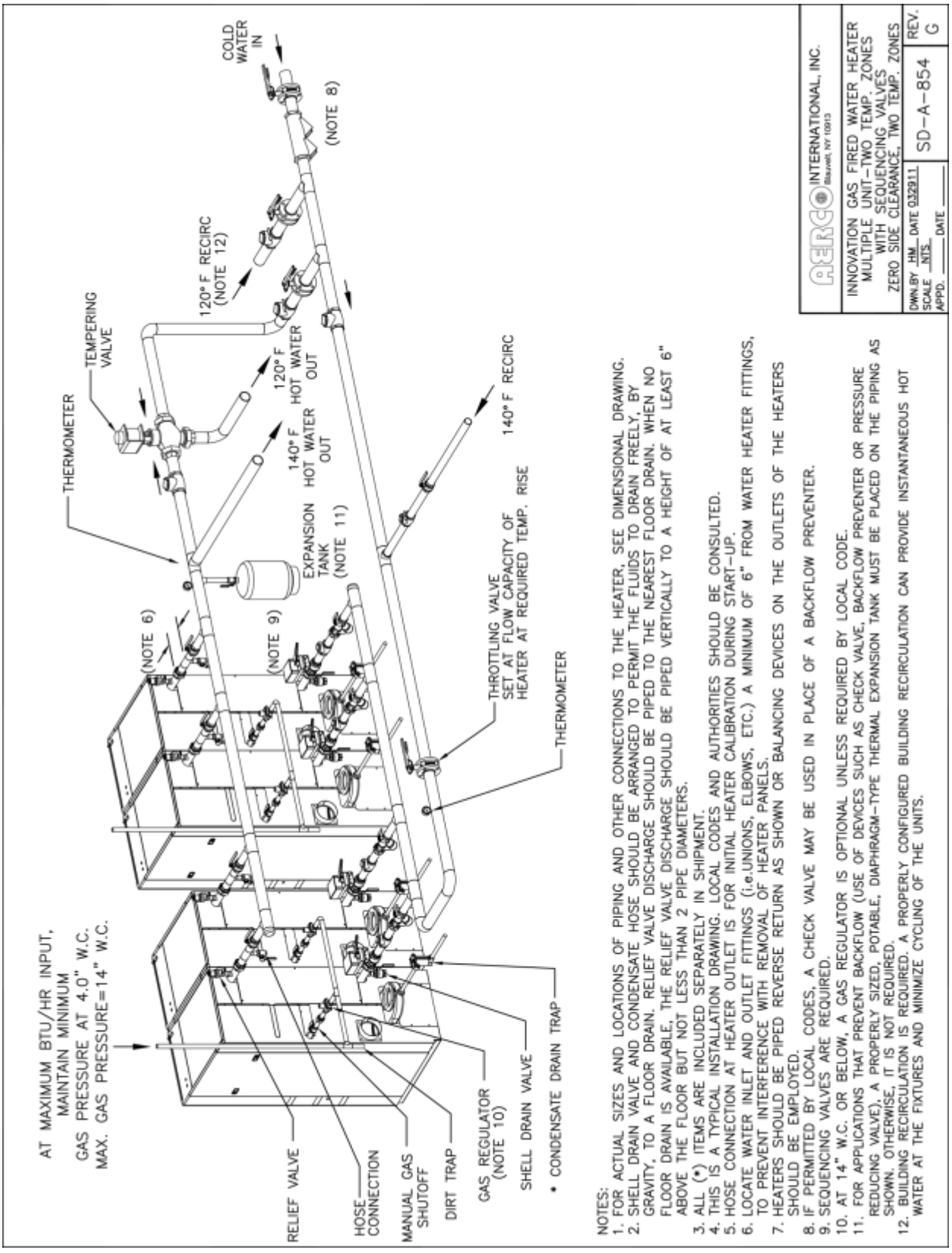
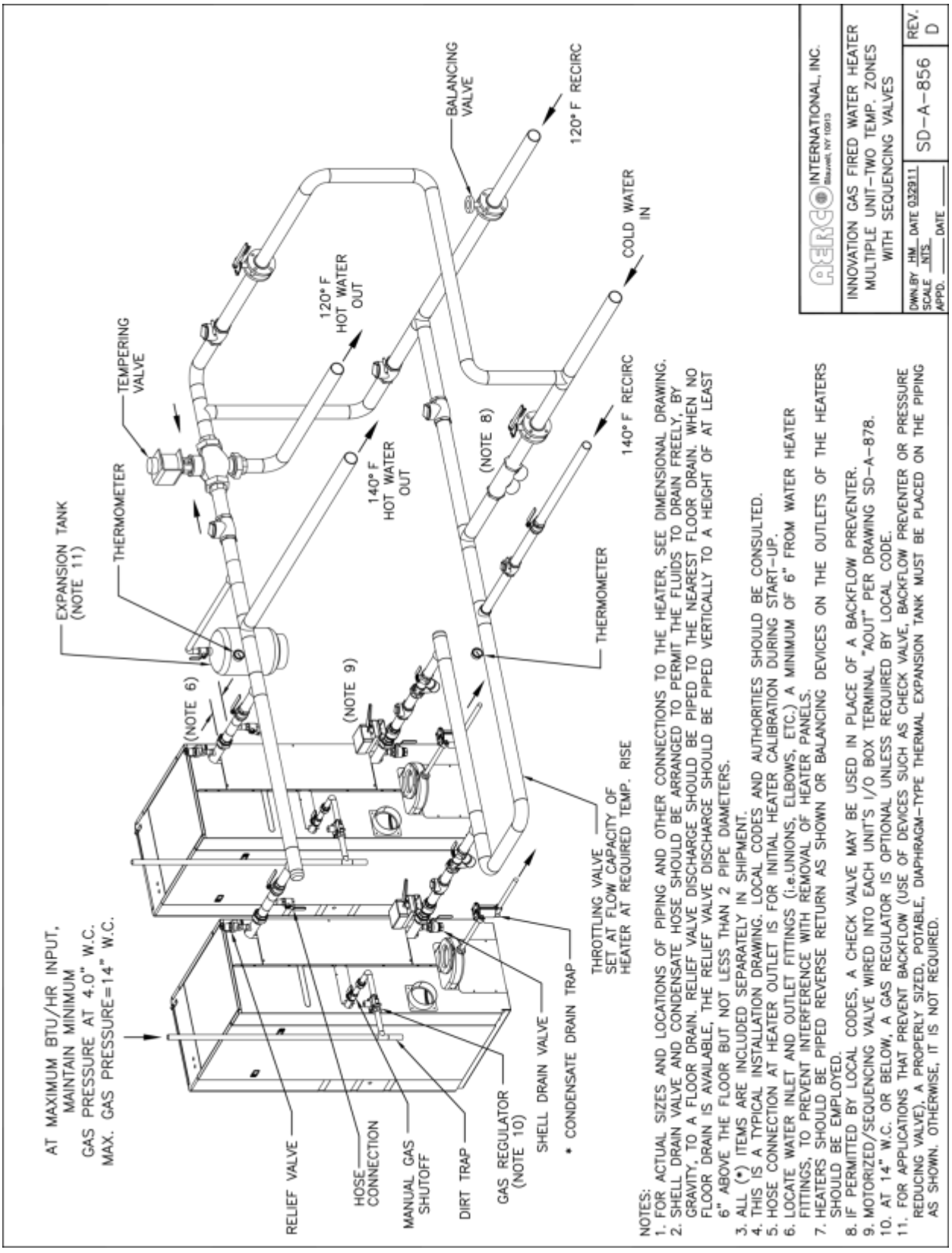


Drawing Number: SD-A-854 rev G



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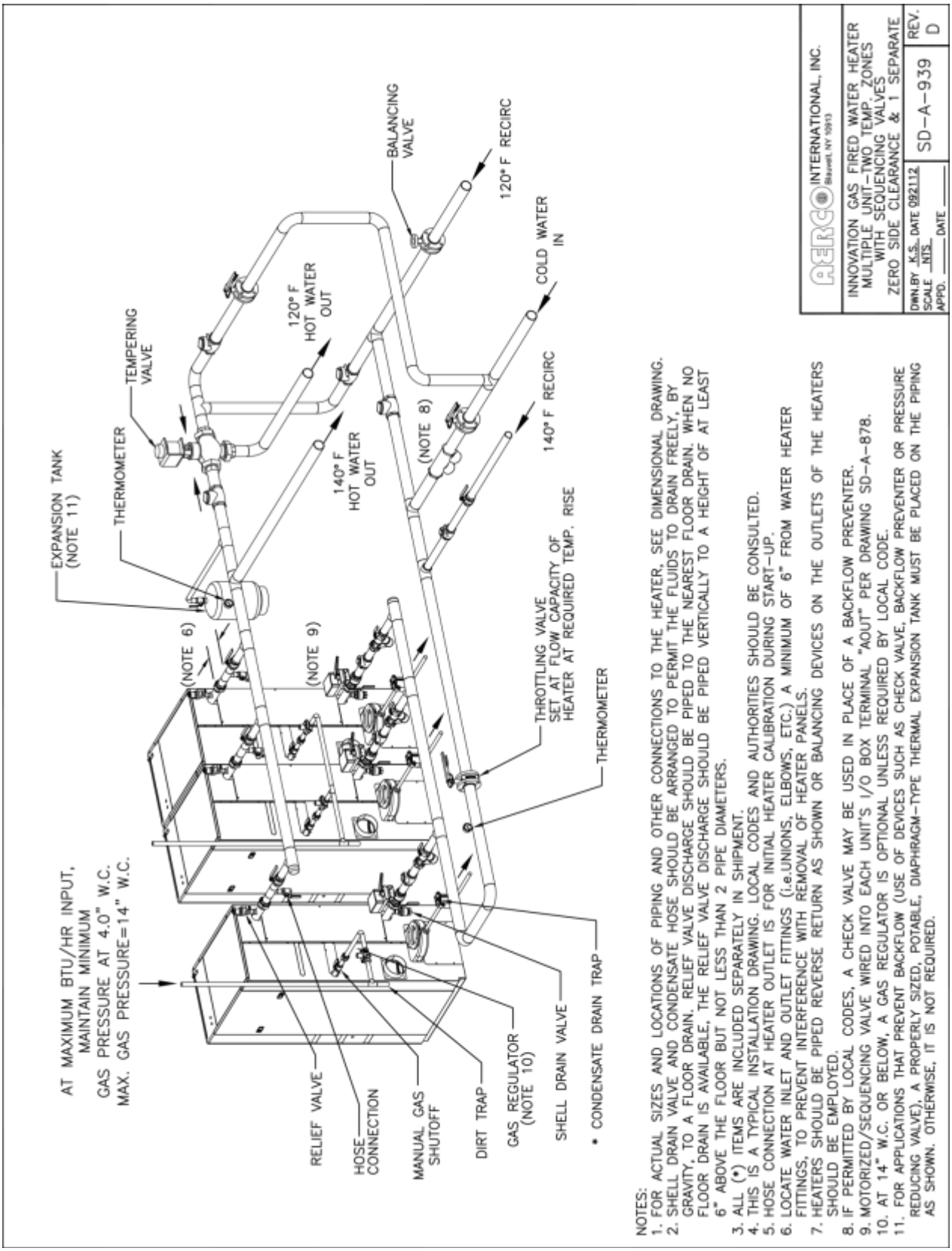
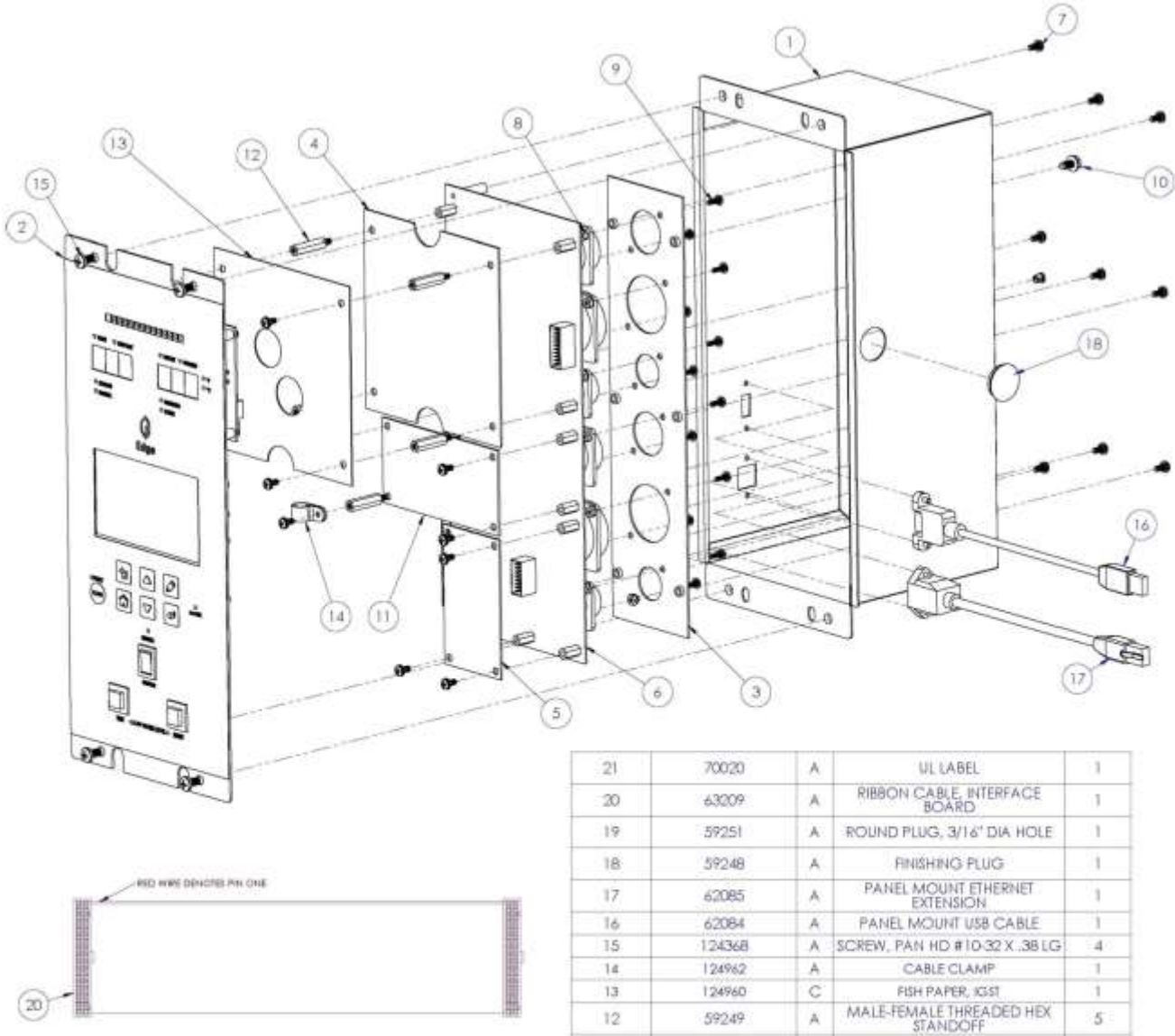


NOTES:
1. FOR ACTUAL SIZES AND LOCATIONS OF PIPING AND OTHER CONNECTIONS TO THE HEATER, SEE DIMENSIONAL DRAWING.
2. SHELL DRAIN VALVE AND CONDENSATE HOSE SHOULD BE ARRANGED TO PERMIT THE FLUIDS TO DRAIN FREELY, BY GRAVITY, TO A FLOOR DRAIN. RELIEF VALVE DISCHARGE SHOULD BE PIPED TO THE NEAREST FLOOR DRAIN. WHEN NO FLOOR DRAIN IS AVAILABLE, THE RELIEF VALVE DISCHARGE SHOULD BE PIPED VERTICALLY TO A HEIGHT OF AT LEAST 6" ABOVE THE FLOOR BUT NOT LESS THAN 2 PIPE DIAMETERS.
3. ALL (*) ITEMS ARE INCLUDED SEPARATELY IN SHIPMENT.
4. THIS IS A TYPICAL INSTALLATION DRAWING. LOCAL CODES AND AUTHORITIES SHOULD BE CONSULTED.
5. HOSE CONNECTION AT HEATER OUTLET IS FOR INITIAL HEATER CALIBRATION DURING START–UP.
6. LOCATE WATER INLET AND OUTLET FITTINGS (i.e.UNIONS, ELBOWS, ETC.) A MINIMUM OF 6" FROM WATER HEATER FITTINGS, TO PREVENT INTERFERENCE WITH REMOVAL OF HEATER PANELS.
7. HEATERS SHOULD BE PIPED REVERSE RETURN AS SHOWN OR BALANCING DEVICES ON THE OUTLETS OF THE HEATERS SHOULD BE EMPLOYED.
8. IF PERMITTED BY LOCAL CODES, A CHECK VALVE MAY BE USED IN PLACE OF A BACKFLOW PREVENTER.
9. MOTORIZED/SEQUENCING VALVE WIRED INTO EACH UNIT'S I/O BOX TERMINAL "AOUT" PER DRAWING SD–A–878.
10. AT 14" W.C. OR BELOW, A GAS REGULATOR IS OPTIONAL UNLESS REQUIRED BY LOCAL CODE.
11. FOR APPLICATIONS THAT PREVENT BACKFLOW (USE OF DEVICES SUCH AS CHECK VALVE, BACKFLOW PREVENTER OR PRESSURE REDUCING VALVE), A PROPERLY SIZED, POTABLE, DIAPHRAGM–TYPE THERMAL EXPANSION TANK MUST BE PLACED ON THE PIPING AS SHOWN. OTHERWISE, IT IS NOT REQUIRED.

Drawing Number: SD-A-939 rev B

APPENDIX G – Edge [i] Controller Views



ITEM NO.	PART NUMBER	REV	DESCRIPTION	Default/ QTY.
21	70020	A	UL LABEL	1
20	63209	A	RIBBON CABLE, INTERFACE BOARD	1
19	59251	A	ROUND PLUG, 3/16" DIA HOLE	1
18	59248	A	FINISHING PLUG	1
17	62085	A	PANEL MOUNT ETHERNET EXTENSION	1
16	62084	A	PANEL MOUNT USB CABLE	1
15	124368	A	SCREW, PAN HD #10-32 X .38 LG	4
14	124962	A	CABLE CLAMP	1
13	124960	C	FISH PAPER, IGST	1
12	59249	A	MALE-FEMALE THREADED HEX STANDOFF	5
11	124362	B	POWER SUPPLY	1
10	54119	A	GROUND SCREW, 10-32 X 3/8	1
9	54141	A	SCREW, 4-40, 3/8	12
8	54142	A	NUT W/ STAR WASHER, 4-40	12
7	54145	A	SCREW, PAN HEAD, #6-32 X 5/16	20
6	124366	B	CONNECTOR BOARD	1
5	124363	A	LOW WATER CUT OFF BOARD	1
4	124361	M	IGST BOARD	1
3	38043	A	CONNECTOR PLATE	1
2	69294	B	CONTROL PANEL, FRONT ASSY	1
1	37142	C	CONTROL BOX ENCLOSURE	1

Figure G-1 – Edge Controller (P/N 64134) - Exploded View

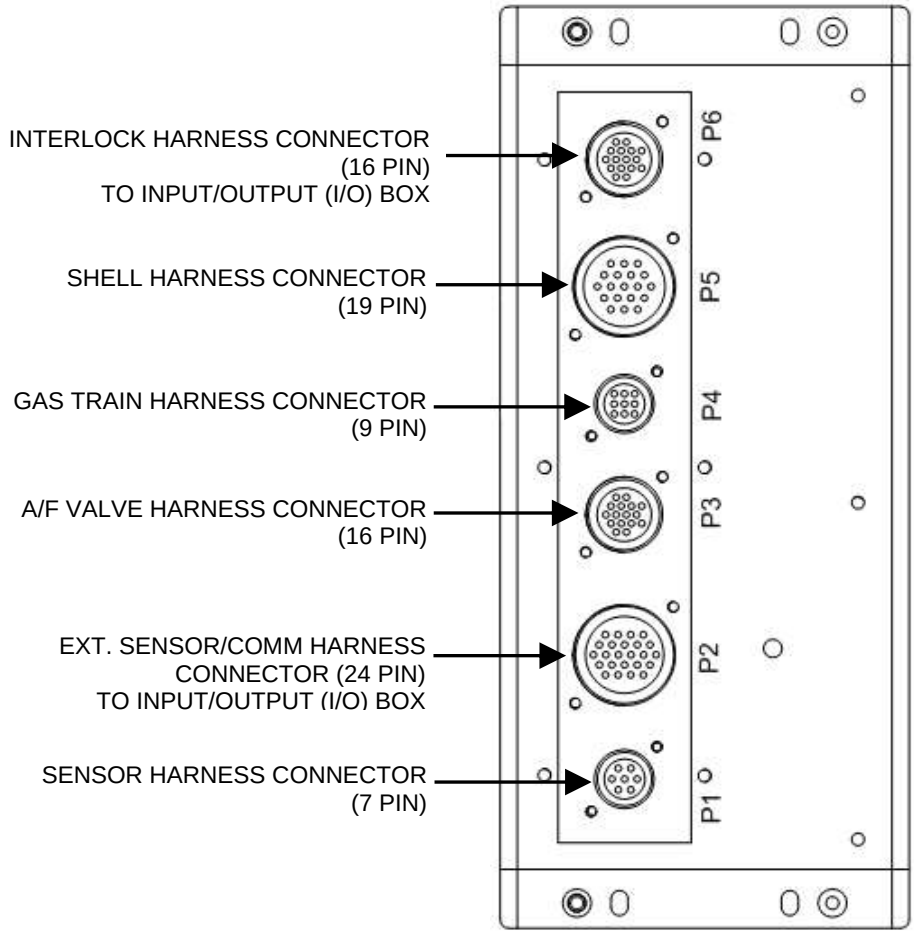


Figure G-2: Edge [i] Controller Rear View

DIP Switch Function & Default	
SW2	**SW1**
1 Bias + – OFF	1 CO Sensor – mA
2 Termination – OFF	2 Flow Sensor – V
3 Bias - – OFF	3 O_2 Sensor – V
4 Not Used	4 Analog In – mA
5 Not Used	
6 Not Used	

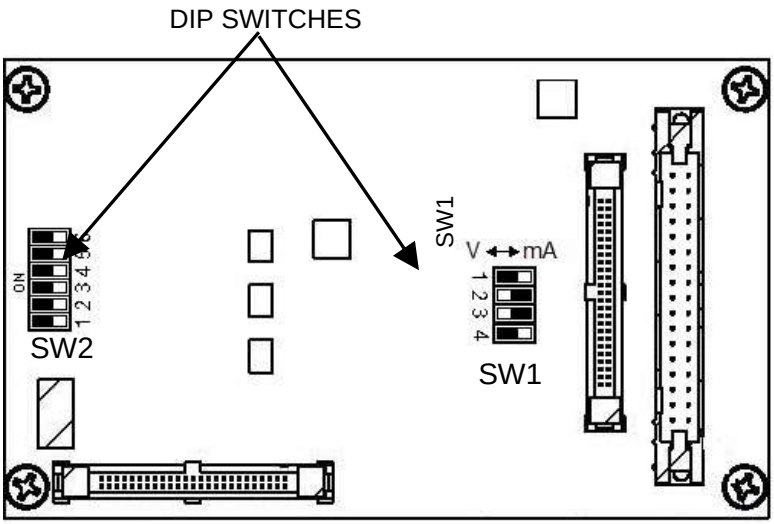
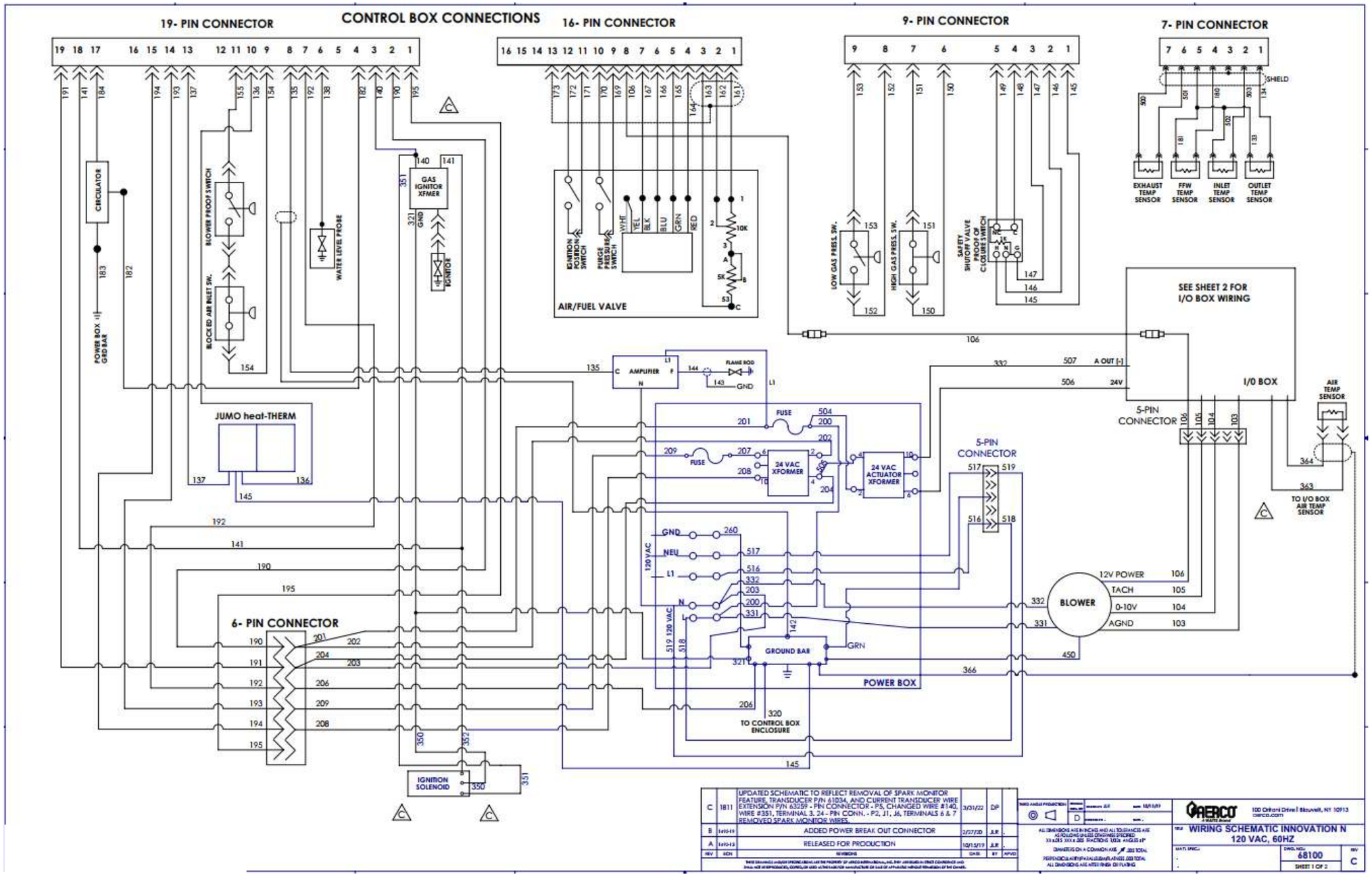
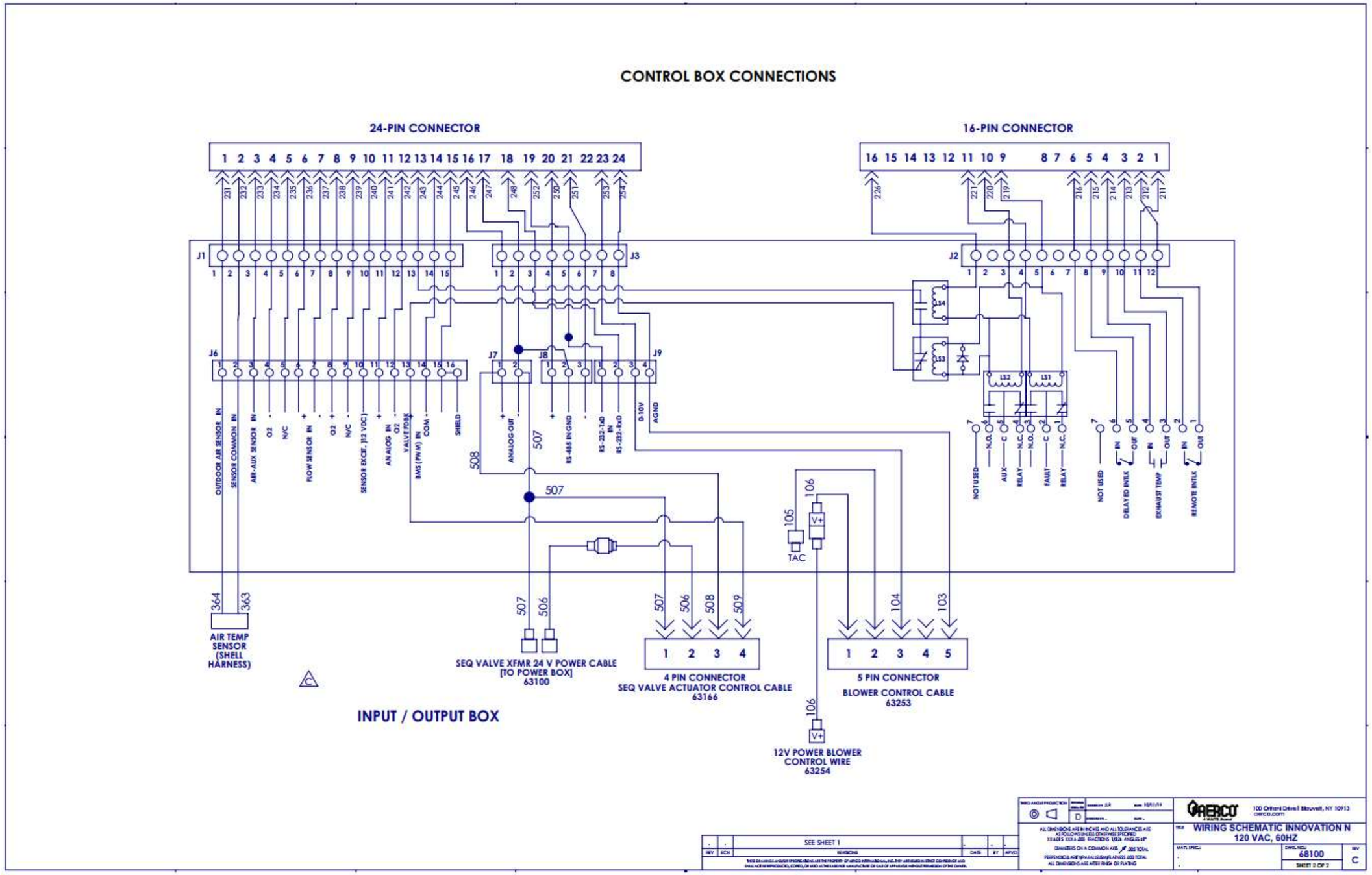


Figure G-3: Edge [i] Controller Interface Board (Behind Front Face)

APPENDIX H – Wiring Diagrams



Drawing Number: 68100 rev C Sheet 1 of 2



Drawing Number: 68100 rev C Sheet 2 of 2

APPENDIX I – Recommended Spares

For the locations of the recommended and optional spare parts listed below, refer to the Parts List illustrations in Appendix E.

TABLE I-1. Recommended Emergency Spare Parts

DESCRIPTION	PART NO.	QUANTITY
120 VAC/Single-Phase Blower	58039	One per three units
SSOV Actuator/Regulator Combo - Used on: • ALL FM gas train models • **Downstream** SSOV on DBB (IRI) gas train models	64048	One per three units
SSOV Actuator Without Proof of Closure switch: • Used **ONLY** on **Upstream** SSOV on models with a DBB (IRI) gas train	27086-1	One per three units
Temperature Sensor (Water & Exhaust)	123449	Three per unit
Flame Detector Kit	24356-2	One kit per unit
Igniter-Injector Kit	58023	One kit per unit
Low Gas Pressure Switch: • Natural Gas: INN600N to INN1350N • Propane: INN600N, 800N	61002-1 61002-21	One per three units
High Gas Pressure Switch: • INN600N to INN1350N (Natural Gas, Propane and Butane)	60032-1	One per three units

TABLE I-2. 12 and 24 Month Maintenance Kits

DESCRIPTION	PART NO.	QUANTITY
12-Month Maintenance Kit	58196-12	One kit per unit
24-month Waterside/Fireside Inspection Kits:	58196-24	One kit per unit

TABLE I-3. Additional Kits Available

DESCRIPTION	PART NO.
Innovation Shell Replacement Kit	58189
Innovation Heat Exchanger Replacement Kit	24684-TAB
Innovation Hydro Replacement Kit	58191-TAB
FASCO GPM 7.0H Blower Replacement Kit	58193
Innovation Burner Replacement Kit	58192
Innovation A/F Valve Replacement Kit	58194

Edge [i] Controller	69344-5

TABLE I-4. Optional Spare Parts

DESCRIPTION	PART NO.	QUANTITY
Circulator Pump, for Dynamic Load Anticipator:	69197	One per site
Burner	24233-2	Stock one if site has difficulty getting parts
Air Inlet Temperature Sensor	61024	One per site
Low Gas Pressure Switch, Natural Gas	61002-1	One per three units
High Gas Pressure Switch, Natural Gas	60032-1	One per three units