Valiant-FT® Series II

Installation and Service Manual

Gas Fired Commercial Condensing Stainless Steel Boilers
Hydronic Heating Models VA400 thru VA850

H

WARNING
If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury or death.
WHAT TO DO IF YOU SMELL GAS
• Do not try to light any appliance, • Do not touch any electrical switch; do not use any phone in your building, • Immediately call your gas supplier from a neighbour's phone. Follow the gas supplier's instructions, • If you cannot reach your gas supplier, call the fire department. **A Qualified installer, service agency or the gas supplier must perform installation and service.**
WARNING
Do not store or use gasoline or other flammable vapours and liquids in the vicinity of this or any other appliance.
TO THE INSTALLER: After installation, these instructions must be given to the end user or left on or near the appliance. **TO THE END USER:** This booklet contains important information about this appliance. Retain for future reference.

99-0419 Rev.00

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SPECIAL INSTRUCTIONS TO THE OWNER:

This manual contains information for the installation, operation, and servicing of the appliance. It is strongly recommended that this manual be reviewed completely before proceeding with an installation.

WARNING
To minimize the possibility of serious personal injury, fire or damage to your appliance, never violate the following safety rules.

DO NOT
Do not use this appliance if any part has been under water. The possible damage to a flooded appliance can be extensive and present numerous safety hazards. Immediately call a qualified service technician to inspect the boiler and to replace any part of the control system and any gas control which has been under water.

IMPORTANT
Consult and follow local Building and Fire Regulations and other Safety Codes that apply to this installation. Contact the local gas utility company to inspect and authorize all gas and flue connections.

CAUTION
It is important that all gas appliances are installed by a qualified installer/technician. It is in your own interest and that of safety to ensure that all local codes, and all the following “NOTES” and “WARNINGS” are complied with. Installing, servicing, or adjusting this appliance should be performed only by a qualified installer/technician that is trained by Camus® Hydronics. The serviceman must utilize a combustion analyzer with CO2, CO, and draft gauge, to set the appliance according to Camus® Hydronics’ recommendations, prior to commissioning.

CHECK EQUIPMENT

Check for signs of shipping damage upon receiving equipment. Pay particular attention to parts accompanying the boiler, which may show signs of being hit or otherwise being mishandled. Verify total number of pieces shown on packing slip with those actually received. In case there is damage or a shortage, immediately notify carrier.

NOTE
RETAIN THIS MANUAL FOR FUTURE REFERENCE

PART 1 GENERAL INFORMATION

1.1 INTRODUCTION

The Valiant-FT Series 2 boilers are condensing, forced draft appliances utilizing a premix power burner based on a push through design which offers several venting options. Heat output is controlled by the venturi and zero governor gas valve, which work together to provide seamless modulation. It is designed for use with a fully pumped and pressurized water system. The turndown ratio for this appliance is up to 10:1. This results in the appliance automatically modulating to provide heat outputs from 100% down to approximately 10% of rated input.

1.2 CODES

The equipment shall be installed in accordance with those installation regulations enforced in the local area where the installation is to be made. In the absence of such requirements, the installation shall conform to the latest edition of the National Fuel Gas Code, ANSI Z223.1 and/or CAN/CGAB149 Installation Code. All electrical wiring must be done in accordance with the requirements of the authority having jurisdiction or, in the absence of such requirements, with National Electrical Code, ANSI/NFPA70 and/or the Canadian Electrical Code part 1 CSA C22.1. Where required by the authority having jurisdiction, the installation must conform to the American Society of Mechanical Engineers Safety Code for Controls and Safety Devices for Automatically Fired Boiler, ASME CSD-1. All boilers conform to the latest edition of the ASME Boiler and Pressure Vessel Code, Section II & IV. Where required by the authority having jurisdiction, the installation must comply with the CSA International, CAN/CGA-B149 and/or local codes. This appliance meets the safe lighting performance criteria with the gas manifold and control assembly provided, as specified in the ANSI standards for gas fired units, ANSI Z21.13 & ANSI Z21.10.

PART 2 INSTALLATION

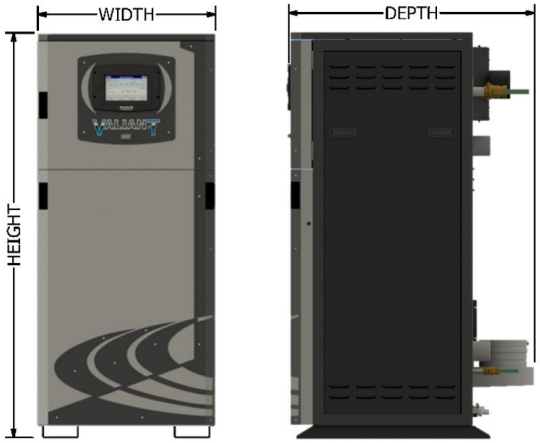
Check for signs of shipping damage upon receiving equipment. Pay particular attention to parts accompanying the boiler, which may show signs of being hit or otherwise being mishandled. Verify total number of pieces shown on packing slip with those actually received. In case there is damage or a shortage, immediately notify carrier.

2.1 UNIT LOCATION

Install this appliance in a clean, dry location.

Site preparation for the Valiant-FT should be carried out by paying attention to the dimensions of the model size and its overall clearances.

Figure 1: Floor Mounted Valiant-FT



2.1.1 Overall Dimensions

Table 1: Floor Mounted Valiant-FT Overall Dimensions

Model	Width (in)	Depth (in)	Height (in)
400	22 1/8	32 7/8	57 1/2
500	22 1/8	32 7/8	57 1/2
600	25 3/8	33 1/4	57 1/2
725	25 3/8	35	57 1/2
850	25 3/8	35	57 1/2

The clearances below must be added to your specific model's overall dimensions to calculate the total space required for the installation of your appliance.

2.1.2 Service Clearances*

Table 2: Valiant-FT Service Clearances on all sides

Model	Top	Right Side	Left Side	Back	Front
400	18"	2"	3"	1"	24"
500	18"	2"	3"	1"	24"
600	18"	2"	3"	1"	24"
725	18"	2"	3"	1"	24"
850	18"	2"	3"	1"	24"

* Minimum clearance of 10" recommended on right hand side of appliance for ease of combustion air filter replacement.

This appliance is suitable for alcove installation. Clearance to combustibles is zero on all sides.

THIS BOILER MUST NEVER BE INSTALLED ON CARPETING.

Figure 2: Valiant FT Series II appliance gas train components accessible from the top panel

The Valiant FT Series II does not necessarily require access through the sides and can be placed adjacent to each other with minimum clearances. However, it is highly recommended to allow for at least a minimum clearance of 10" on the appliance's right-hand side. This allows for easy access to maintain the combustion air filter. Access panels from the sides of the unit are also provided to make the appliance more accessible for easier maintenance. This provides larger points of access for greater ease of serviceability.

The appliance should be located close to a floor drain in an area where leakage from the appliance or connections will not result in damage to the adjacent area or to lower floors in the structure. Under no circumstances is the manufacturer to be held responsible for water damage in connection with this unit or any of its components.

Do not locate this appliance in an area where it will be subject to freezing unless precautions are taken. Due to low jacket losses from the appliance, radiant losses from the boiler are minimal and should not be relied on to keep the appliance room warm. Supplemental heat may be required in the boiler room to maintain ambient temperature at acceptable levels.

Do not locate this appliance where it may be exposed to a corrosive atmosphere.

Low Water Cut-Off requirement: If the appliance is installed above the level of the building's radiation system, a low water cut-off device must be installed in the appliance outlet at some distance above the heat exchanger inlet/outlet connections. A port for a LWCO probe is provided on the outlet piping, inside the jacket, of this appliance. Some local codes require the installation of a low water cut-off on all systems.

2.2 COMBUSTION AIR AND VENTILATION

DANGER
It is extremely important to follow these venting instructions carefully. Failure to do so can cause severe personal injury, death or substantial property damage.

A continuous supply of combustion air must be provided at all times for the safe operation of this appliance!

The Valiant-FT is a Category II and Category IV appliance. A Category IV appliance is individually vented through a dedicated vent. The Combustion air may be drawn from the room. However, in the case the boiler is direct vented, the combustion air must also be piped directly to the outdoors.

The Valiant FT boiler utilizes Category IV Venting, capable of venting up to a combined 200' equivalent length of vent (maximum 100' of exhaust and a 100' of combustion air intake vent). This appliance may only use approved venting (see table below).

For direct vent applications, the wall thickness must be between 0.5" – 12" (1.2 cm to 30 cm).

Some of the different venting configurations include:

Figure 3: Indoors Combustion Air and vertically exhausted to the outdoors

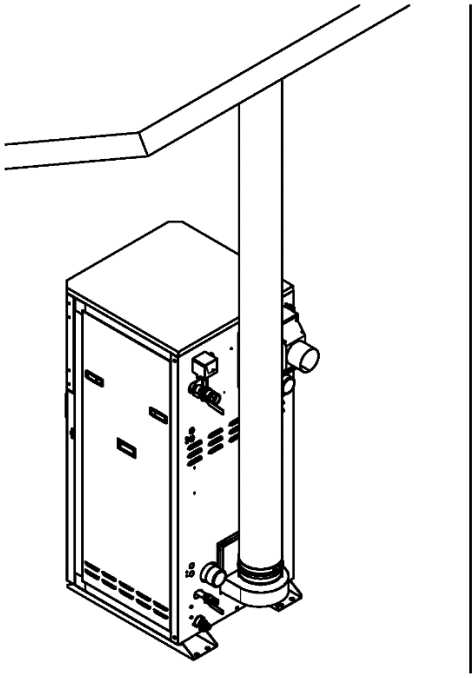


Figure 4: Combustion Air and Exhaust gasses both vertically vented to the outdoors

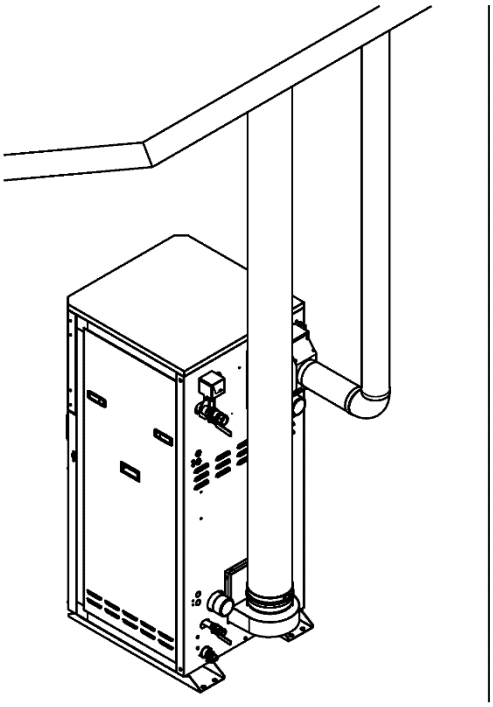


Figure 5: Indoors Combustion Air and horizontally exhausted to the outdoors

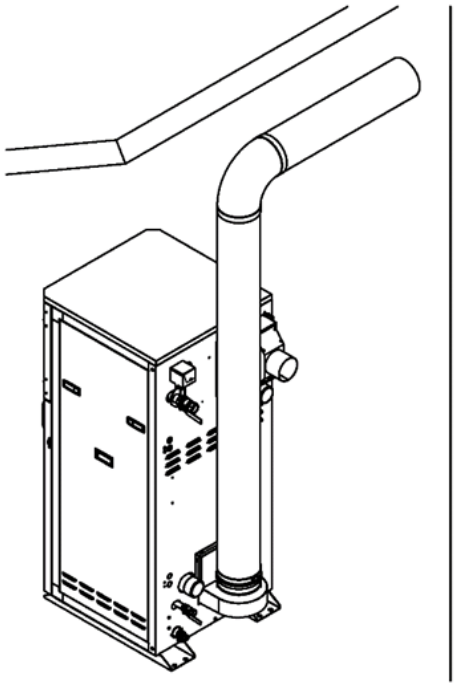
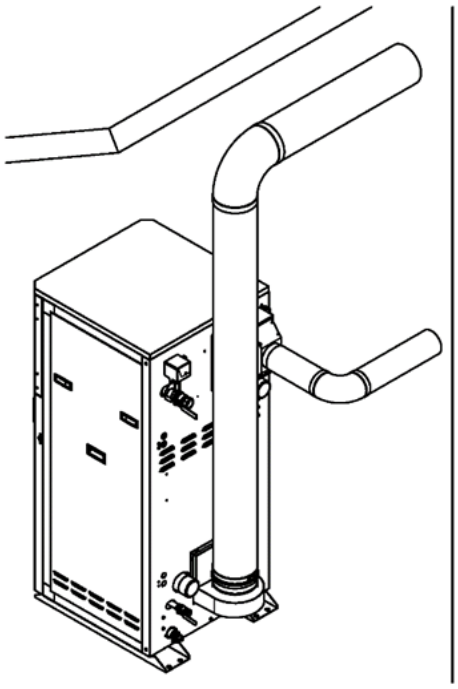


Figure 6: Combustion Air and Exhaust gasses both horizontally vented to the outdoors



2.2.1 Venting Materials

Table 3: Venting Materials for Valiant-FT Series II

Material	Maximum Flue Temp (°F)
PVC	149
CPV	194
PPE	230
AL29-4C	300+, limited only by rating of seals
316L Stainless Steel	300+, limited only by rating of seals

*Use PVC, CPVC (only ULC-S636 approved plastic material must be used in Canada) or AL29-4C gas vent pipes listed for use with Category IV appliances. All venting installations shall be in accordance with "Venting of Equipment," of the National Fuel Gas Code, ANSI Z223.1/NFPA 54, or "Venting Systems and Air Supply for Appliances," of the Natural Gas and Propane Installation Code, CAN/ CSA B149.1, or applicable provisions of the local building codes. Vent connectors serving appliances vented by natural draft shall not be connected into any portion of mechanical draft systems operating under positive pressure. Use of cellular core PVC (ASTM F891), cellular core CPVC, or Radel® (polyphenolsulfone) in venting systems is prohibited. Covering non-metallic vent pipe and fittings with thermal insulation shall be prohibited. The horizontal venting run should be sloping upwards not less than ¼ in/ft (21 mm/m) from the boiler to the vent terminal. The venting system should be installed to prevent accumulation of condensate and where necessary have the means provided for drainage of the condensate.

Failure to install an approved vent on the unit can result in severe property damage, injury or death!

In the case, the combustion air is drawn from outdoors, i.e. direct vented, there are two configurations.

1.) Vertically Direct Vented
2.) Horizontally Direct Vented

2.2.2 Vertically Direct Vented

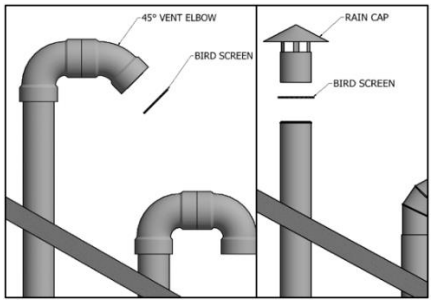
Location of Vent Termination

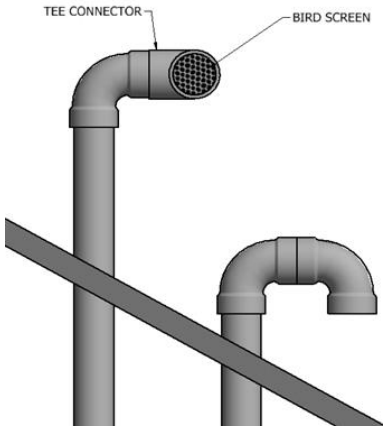
1. Total length of piping for venting must not exceed limits stated in Table 4.

Table 4: Valiant-FT Series II Vent Length Limits

Models	Air Intake	Exhaust
VA400 – VA850	Up to 120'	Up to 120'

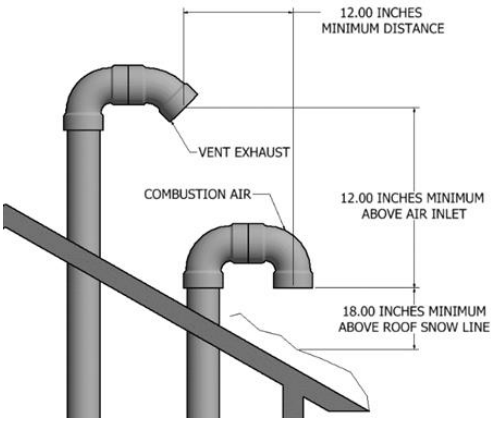
Figure 7: Vertical Vent Termination

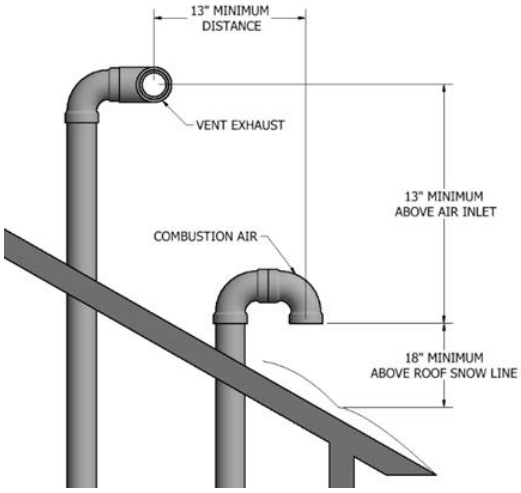




2. Vent piping must terminate in a 45° elbow if plastic piping is used or an approved vent cap if using metal venting.

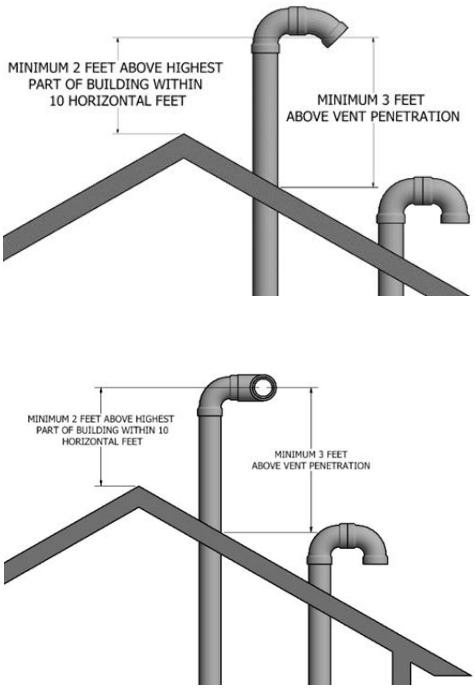
Figure 8: Vertically Direct Vented Clearances





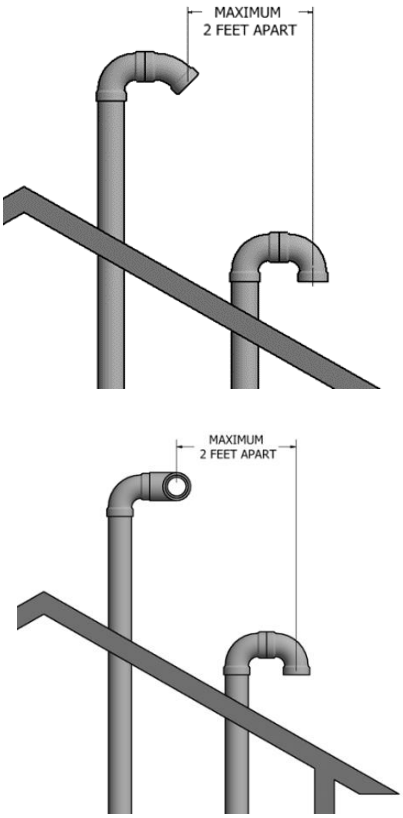
3. Vent outlet must be at least 1 foot away and 1 foot above from the air inlet opening which must terminate in a double 90° elbow facing downwards.

Figure 9: Vertical Vent Clearance above Vent Penetration



4. Vent outlet must be at least 1 foot away and 1 foot above from the air inlet opening which must terminate in a double elbow facing downwards.

Figure 10: Vertical Vent Exhaust and Air Intake Clearance



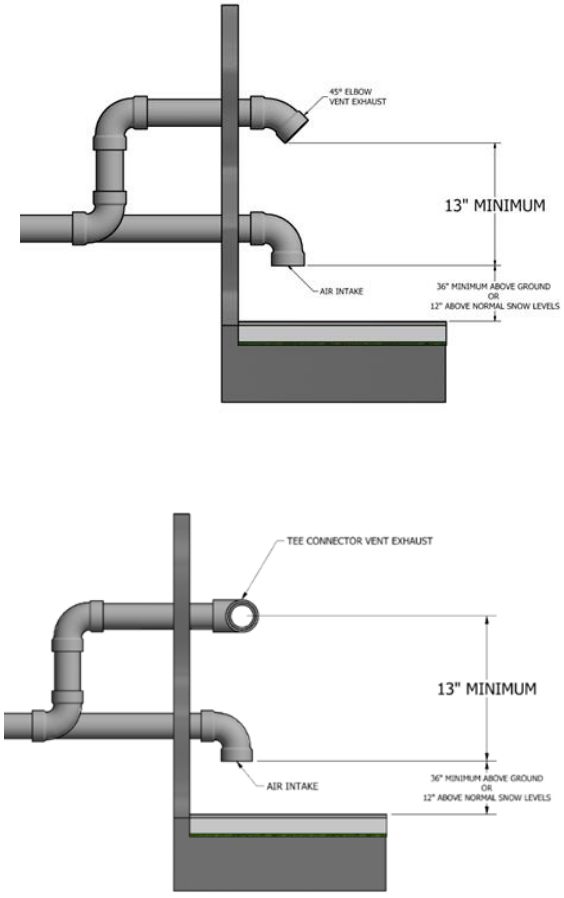
5. Vent outlet must be at least 1 foot away and 1 foot above from the air inlet opening which must terminate in a double elbow facing downwards.
6. Position the air inlet and vent terminations so they are not likely to be damaged by foreign objects, or exposed to build-up of debris.
7. DO NOT terminate closer than 4 feet (1.25m) horizontally and vertically from any electric meter, gas meter, regulator, relief valve, or other equipment. In all cases local codes take precedence.
8. Perform regularly scheduled inspections to ensure that the vent terminal is unobstructed.
9. Termination MUST NOT terminate below a forced air inlet at any distance.

2.2.3 Horizontally Direct Vented

Location of Vent Termination

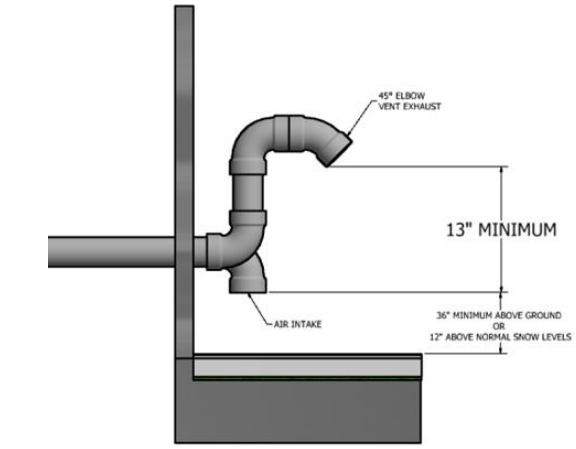
1. Total length of piping for venting must not exceed limits stated in Table 4.

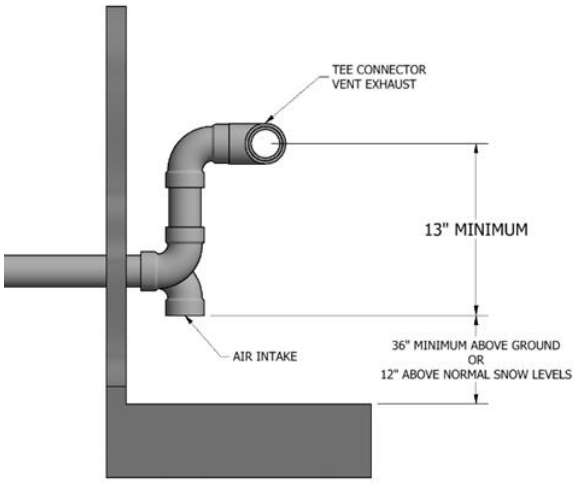
Figure 11: Horizontally Direct Vented Clearances



2. Bottom of vent terminal shall be located at least 36 inches (0.90m) above ground or 12 inches above normal snow levels. In all cases the appliance shall be installed in accordance with local codes.

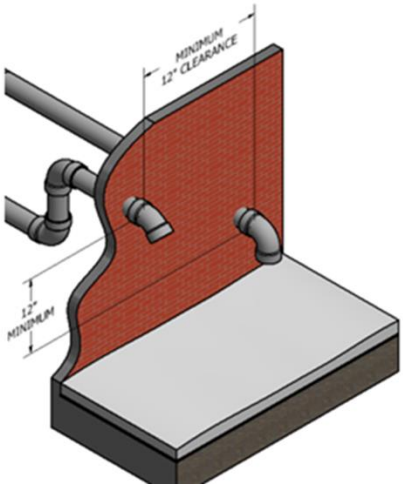
Figure 12: Horizontal Vent Exhaust and Air Intake Clearance

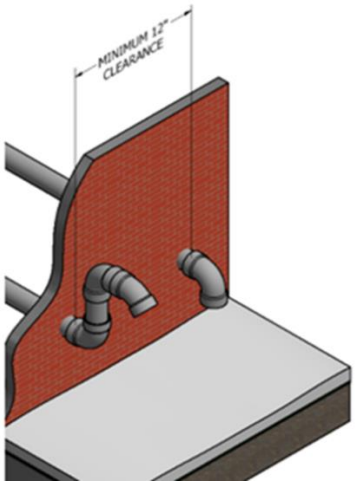


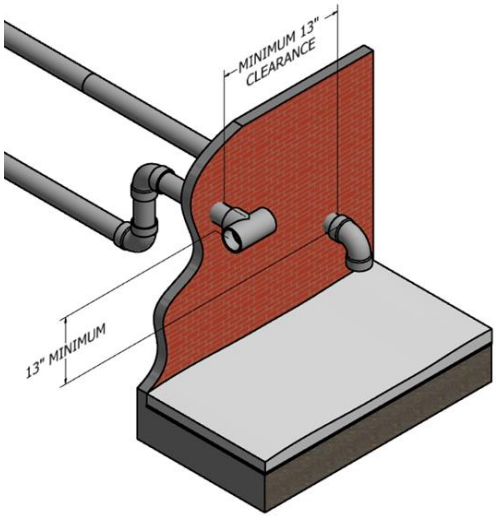


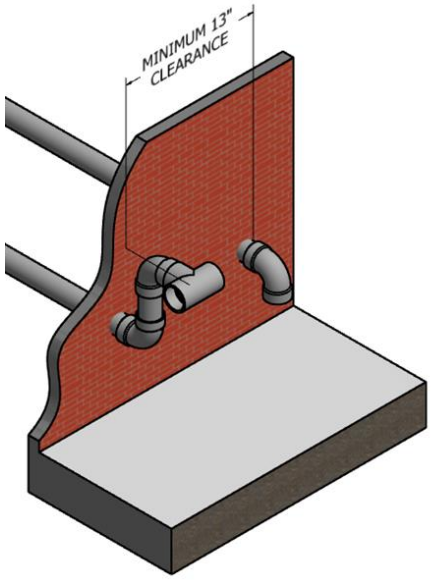
3. Valiant FT can vent up to 100 equivalent feet. Elbows can range from 3 to 5 feet in equivalent length depending on the centerline radius.

Figure 13: Horizontal Vent Exhaust and Air Intake Configurations and Clearance



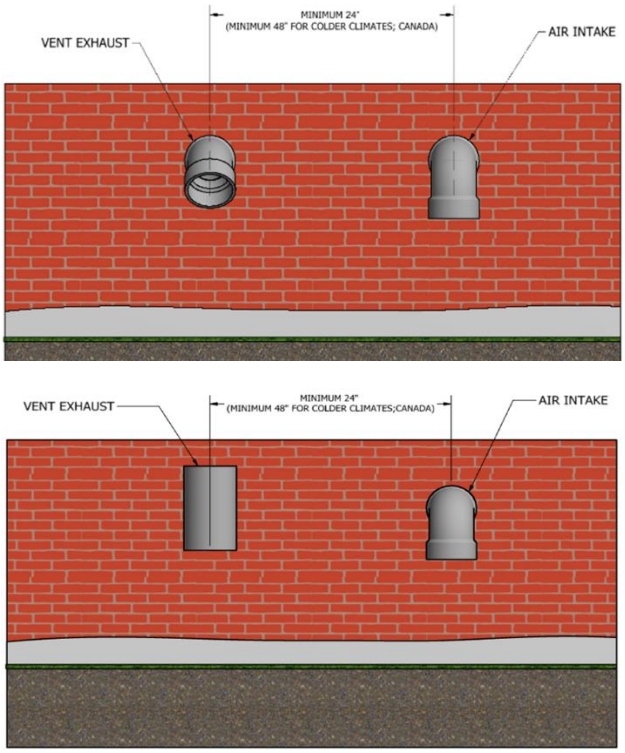






4. Vent outlet shall terminate at least 12” (0.30m) away from any forced air inlet. The combustion air intake should never terminate above the vent outlet.

Figure 14: Horizontal Vent Exhaust and Air Intake Clearance



5. If the vent exhaust and air intake are positioned on the same elevation, the minimum horizontal distance between the two must be at the least, 24" (48" in colder climates).
6. Vent outlet MUST NOT terminate below a forced air inlet at any distance.
7. Vent cannot terminate below grade. Position vent termination where vapours will not damage walls or plants or may be otherwise objectionable.
8. Vent terminal shall not be installed closer than 3 feet (1m) from an inside corner of an L-shaped structure, window well, stairwell, alcove, courtyard or other recessed area as wind eddies could affect boiler performance or cause recirculation.
9. DO NOT terminate closer than 4 feet (1.25m) horizontally and vertically from any electric meter, gas meter, regulator, relief valve, or other equipment. In all cases local codes take precedence.
10. Position terminations so they are not likely to be damaged by foreign objects, or exposed to a build-up of debris.
11. Vent piping must terminate in an elbow pointed outward or away from air inlet.
12. Flue gas condensate can freeze on exterior walls or on the vent cap. Frozen condensate on the vent cap can result in a blocked flue condition. Keep the vent cap/terminal clear of snow, ice, leaves, debris etc. Some discolouration to exterior building surfaces is to be expected. Adjacent brick or masonry surfaces should be protected with a rust resistant sheet metal plate.
13. Perform regularly scheduled inspections to ensure vent terminal is unobstructed.

CAUTION
DO NOT OPERATE APPLIANCE WITH THE TERMINAL CAP REMOVED AS THIS MAY RESULT IN THE RECIRCULATION OF FLUE PRODUCTS. WATER MAY ALSO FLOW INTO THE COMBUSTION AIR PIPE AND INTO THE BURNER ENCLOSURE.

Optional Room Air

The Valiant may also be installed utilizing room air for combustion while venting out the combustion products to the outside with a piped vent exhaust.

When utilizing room air, it is important to properly size the mechanical room openings to ensure an adequate combustion air supply to the boiler.

WARNING
Installation must conform to the latest edition of the National Fuel Gas Code, ANSI Z223.1/NFPA54, and/or Natural Gas and Propane Installation Code, CAN/CSA B149.1

IN GENERAL

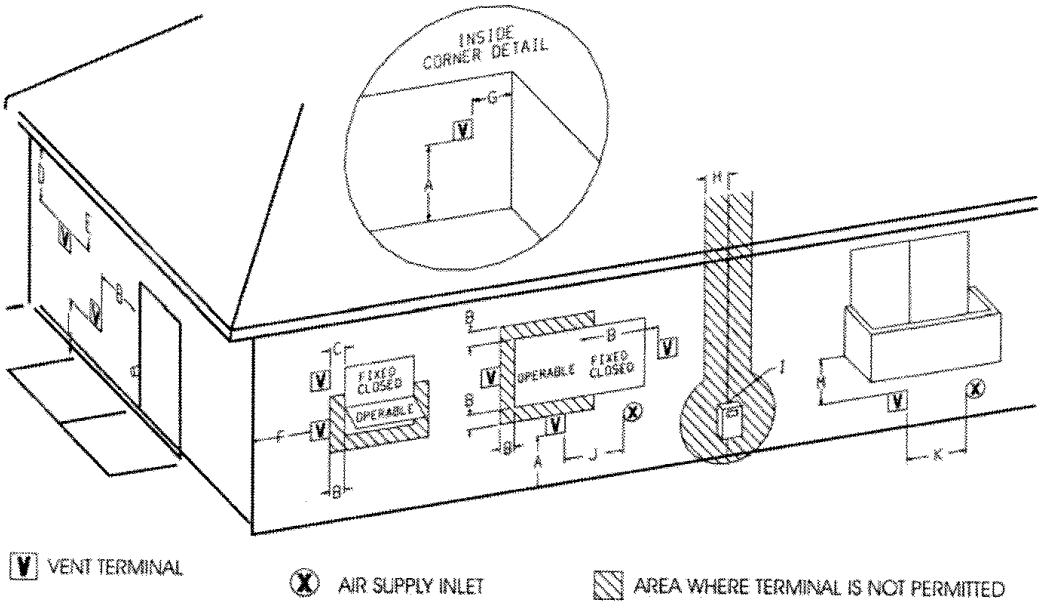
The operation of exhaust fans, compressors, air handling units etc. can rob air from the room, creating a negative pressure condition leading to reversal of the natural draft action of the venting system. Under these circumstances an engineered air supply is necessary.

If the appliance is to be installed near a corrosive or potentially corrosive air supply, the appliance must be isolated from it and outside air supplied as per code.

Potentially corrosive atmospheres will result from exposure to permanent wave solution, chlorinated waxes and cleaners, chlorine, water softening chemicals, carbon tetrachloride, halogen based refrigerants, Freon cleaning solvents, hydrochloric acid, cements and glues, masonry washing materials, antistatic fabric softeners, dry cleaning solvents, degreasing liquids, printing inks, paint removers, etc.

The equipment room MUST be provided with properly sized openings to assure adequate combustion air and proper ventilation when the unit is installed with a proper venting system.

2.2.4 Sidewall Clearance Specifications



Direct Vent Terminal Clearances		Canadian Installations[1]	US Installations[2]
A	Clearance above grade, veranda, porch, deck, or balcony	12” (30 cm)	12” (30 cm)
B	Clearance to window or door that may be opened	12” (15 cm) for appliances ≤100,000 Btuh (30kW) 36” (91cm) for appliances >100,000 Btuh (30kW)	9” (23 cm) for appliances ≤50,000 Btuh (15kW) 12” (30cm) for appliances >50,000 Btuh (15kW)
C	Clearance to window or door that may be opened	-	-
D	Clearance to permanently closed window	-	-
E	Clearance to unventilated soffit	-	-
F	Clearance to outside corner	-	-
G	Clearance to inside corner	-	-
H	Clearance to each side of center line extended above meter/regulator assembly	3’ (91 cm) within a height of 15’ (4.5 m) above the meter/ regulator assembly	-
I	Clearance to service regulator vent outlet	36” (91 cm)	-
J	Clearance to non-mechanical air supply inlet to building or the combustion air inlet to any other appliance	12” (15 cm) for appliances ≤100,000 Btuh (30kW) 36” (91cm) for appliances >100,000 Btuh (30kW)	9” (23 cm) for appliances ≤50,000 Btuh (15kW) 12” (30cm) for appliances >50,000 Btuh (15kW)
K	Clearance to a mechanical air supply inlet	6’ (1.83 m)	3’ (91 cm) above if within 10’ (3 m) horizontally
L	Clearance above paved sidewalk or paved driveway located on public property	7’ (2.13 m)[α]	-
M	Clearance under veranda, porch deck, or balcony	12” (30 cm)[β]	-

[1] In accordance with the current CSA B149.1-15 and CSA B149.2-15 Natural Gas and Propane Installation Code
[2] In accordance with ANSI Z223.1/ NFPA 54 National Fuel Gas Code
[α] A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings
[β] Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor.
* For clearances not specified in ANSI Z223.1/ NFPA 54 or CSA B149.1-15 and CSA B149.2-15. Clearance in accordance with local installation codes and the requirements of the gas supplier

2.2.5 Removal of existing appliance (if applicable)

When an existing appliance is removed from a common venting system, the common venting system is likely to be too large for proper venting of the appliances remaining connected to it. At the time of removal of an existing appliance, the following steps must be followed with each appliance remaining connected to the common venting system placed in operation, while the other appliances remaining connected to the common venting system are not in operation.

1. Seal any unused openings in the common venting system.
2. Visually inspect the venting system for proper size and horizontal pitch and determine that there is no blockage, restriction, leakage, corrosion, or other deficiency, which could cause an unsafe condition.
3. Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. If applicable turn on the clothes dryers and any appliances not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
4. Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so that appliance operates continuously.
5. If provided, test for spillage at the draft control device relief opening after 5 minutes of main burner operation. Use a cold mirror, or the flame of a match or candle.
6. After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas-burning appliance to their previous condition of use.

Any improper operation of the common venting system should be corrected so that the installation conforms to the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and/or the Natural Gas and Propane Installation Code, CSA B149.1-15 and CSA B149.2-15 Installation Codes. When resizing any portion of the common venting system, the common venting system should be resized to approach the minimum size as determined using the appropriate tables in Chapter 13 of the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and /or the Natural Gas and Propane Installation Code, CSA B149.1-15 and CSA B149.2-15 Installation Codes.

2.3 GAS CONNECTION

Verify that the appliance is supplied with the type of gas specified on the rating plate. Consult factory for installations at high altitude.

2.3.1 Gas Piping

Safe operation of the Valiant FT requires that the gas line size chosen be sufficient to handle the total installed capacity, within an acceptable range of pressure drop across the piping, and at the available pressure. Gas pipe size may be larger, but not smaller, than the appliance connection.

The gas pipe line can be sized using the Spitzglass formula;
$q = 3550 \text{ X } k \text{ X } (h/l \text{ X } SG)^{1/2}$
Where;
q = gas volume flow (cfh)
$k = [d^5 / (1 + 3.6 / d + 0.03\ d)]^{1/2}$
d = inside pipe diameter (in)
SG = specific gravity
1 CFH = 1 MBH

Table 5 below can be used for gas line sizing data (based on 0.30" W.C. pressure drop and 0.60 Specific Gravity). Please verify pipe size requirements with gas supplier.

Table 5: Recommended Gas Pipe Size for Single Appliance

Input KBtu/hr	Equivalent Length from NG Meter or LP Regulator					
	100 FT		101-200 FT		201-300 FT	
	NAT.	L.P.	NAT.	L.P.	NAT.	L.P.
400	1 ¼"	1"	1 ½"	1 ¼"	2"	1 ½"
500	1 ½"	1 ¼"	2"	1 ½"	2"	1 ½"
600	1 ½"	1 ¼"	2"	1 ½"	2"	1 ½"
725	2"	1 ½"	3"	2 ½"	3"	2 ½"
850	2"	1 ½"	3"	2 ½"	3"	2 ½"

Installation of a union at the appliance gas line connection is required for ease of service and removal of the gas train. Install a manual main gas shutoff valve, outside of the appliance as required by local codes.

Optional gas controls may require routing of bleeds and vents to the atmosphere, outside the building when required by local codes. Larger models of this appliance may be supplied with a gas pressure relief valve. This valve is designed to relieve lockup pressure in excess of the high gas pressure switch setting. It must be piped to discharge excess gas pressure through the valve to a safe location in accordance with local codes.

All gas connections must be made with pipe joint compound resistant to the action of liquefied petroleum and natural gas. All piping must comply with local codes and ordinances. Use new, properly threaded black iron pipe free from burrs. Avoid flexible gas connections. Internal diameter of flexible gas lines may not provide appliance with proper volume of gas. A trap (drip leg) must be provided in the inlet gas connection to the appliance.

2.3.2 Gas Supply Pressure

Gas supply pressure must be maintained within the specified range in Table 6. Before operating the appliance, the complete gas train and all connections must be purged of air and tested using soap solution. The appliance and its individual gas shut-off valve must be disconnected from the supply piping when pressure testing the gas supply piping at pressures above ½ PSI.

Table 6: Gas Supply Pressure Range

Pressure Range	Propane	Natural Gas*
Minimum (inches WC)	8	4**
Maximum (inches WC)	14	14

*** 7" WC recommended regulator setting**
**** 5" WC minimum pressure for VA0500**

2.3.3 Gas Regulators and Lockup Pressure

A stable gas supply pressure is important to achieve stable operation on gas fired appliances using a 1:1 ratio control valve for gas pressure regulation.

Lockup pressure (i.e. the pressure upstream of the gas valve after closing) must not be in excess of 14" WC. It is paramount that maximum lockup pressure be confirmed before any attempt is made to start up the appliance. A suitable lockup regulator with internal or external relief will not exceed running pressure by more than 20%. An external relief valve may be required. Operating the Valiant FT at lockup pressures exceeding the recommended levels can lead to delayed ignitions and damage to the appliance.

NOTE: In facilities where the incoming gas pressure is significantly higher than the pressure required, it may be necessary for several regulators to work together to stage the gas pressure down in a stable fashion. Check with the gas supplier for more information.

The final stage gas regulator is to be located a minimum of 10 linear feet (do not factor in equivalent lengths for elbows) from the appliance. Even regulators classified as fast reaction type require appropriately dimensioned volumes of gas between the regulator and appliance, to absorb the pressure swings caused by fast flow rate variations and avoid high lockup pressure.

2.3.4 Connecting the Gas Supply Piping

When connecting the gas pipeline to the Valiant FT, it is essential to install a manual shutoff valve (supplied with the appliance) outside the boiler jacket. It is also recommended to install sediment trap/ drip leg (field supplied), a ground joint union for servicing and a manual shutoff valve.

Figure 15: Valiant-FT Gas Connection

The gas pipe connection to the Valiant FT can be found at the rear of the unit (Figure 15).

Whenever tightening or loosening the gas piping at the boiler, it is essential to use two wrenches to avoid putting stress on the appliance's gas train components.

The gas line must be supported by hangers and not by any part of the appliance.

WARNING

DO NOT support the weight of the gas piping on the boiler! Failure to comply could result in severe damage, personal injury or death!

2.4 WATER CONNECTION

This appliance is designed to withstand 160 PSIG working pressure. Minimum static water pressure in the appliance must be maintained at 12 PSIG.

Check all applicable local heating, plumbing and building safety codes before proceeding. If the appliance is installed above radiation level it must be provided with a low water cut-off device at the time of appliance installation (available from Camus®). Some local codes require the installation of a low water cut-off on all systems.

This appliance is supplied with a temperature and pressure relief valve sized in accordance with ASME Boiler and Pressure Vessel Code, Section IV. The relief valve is installed at the top of the appliance on the external outlet water pipe. To prevent water damage, the discharge from the relief valve shall be piped to a suitable floor drain for disposal when relief occurs. No reducing couplings or other restrictions shall be installed in the discharge line. The discharge line shall allow complete drainage of the valve and line. Relief valves should be manually operated at least once a year. If a 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.**

Be sure to provide unions and gate valves at the inlet and outlet of the appliance so that it can be easily isolated for service. Strainers are recommended to be installed into the system to prevent foreign objects from entering the heat exchanger. Use suitable pipe hangers or floor stands to support the weight of all water and gas piping.

The Valiant FT must be installed so that the gas ignition system components are protected from water (dripping, spraying, rain, etc.) during appliance operation and service.

2.4.1 Freeze Protection

Appliance installations are not recommended in areas where danger of freezing exists unless precautions are taken. An inhibited propylene glycol mixture may be used as freeze protection, providing it is specially formulated for hydronic systems. An uninhibited glycol solution may attack gaskets and seals in the system, therefore extra care is required when selecting the correct solution.

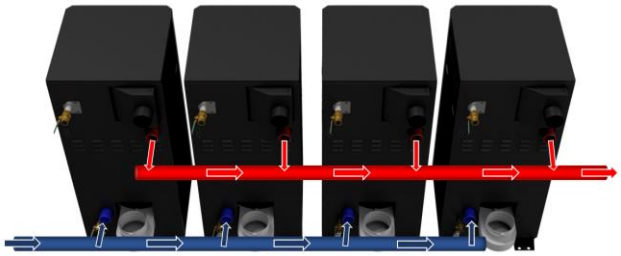
Inlet water temperatures must not drop below 40°F to prevent freezing.

2.4.2 Connecting to the Valiant FT

Figure 16: Valiant-FT Piping Connection

For ease of service, install unions on the inlet and outlet of the appliance. The cold water return must be connected to the connection labelled “Inlet”. The hot water supply to the building must be connected to the connection labelled “Outlet”.

Figure 17: Valiant-FT Reverse-Return Piping Configuration (Flow illustration)



If multiple units are installed together, piping to the units must be arranged such that each unit has the same length of pipe connected to it, in order to balance the flow. The recommended configuration would be “Reverse-Return”, where the unit closest to the incoming supply connection is the furthest from the system supply connection. (Figure 17).

2.4.3 Low Water Cut-off (LWCO)

If this boiler is installed above radiation level, a low water cut-off device must be installed at the time of boiler installation. Some local codes require the installation of a low water cut-off on all systems. Low water cut-off probes are available as a factory supplied option on all models. Low water cut-offs should be tested every six months.

2.4.4 High Limit

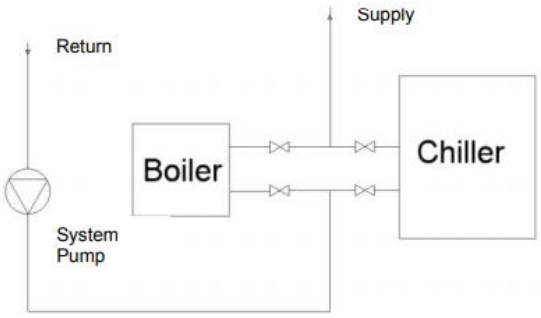
The high limit on the Valiant FT Series II is incorporated with the outlet sensor. This limits maximum discharge water temperature. A manual reset high limit needs to be reset on the touchscreen, or the rest button on the control board, which must be pushed whenever water temperature has exceeded the set point of the high limit.

WARNING REGARDING CHILLED WATER AND HEATING COIL SYSTEMS

When an appliance is connected to a refrigeration system where the same water is used for heating and cooling, the chiller must be piped in parallel with the appliance. Appropriate isolation valves; manual or motorized must be provided to prevent the chilled water from entering the appliance.

The appliance piping system of a hot water boiler connected to heating coils located in air handling units where they may be exposed to refrigerated air circulation must be equipped with flow control valves or other automatic means to prevent gravity circulation of the boiler water during the cooling cycle.

Figure 18: Chilled Water System



2.4.5 Minimum Pipe Size Requirements

The equivalent number of straight feet of pipe for each valve and fitting in the connecting piping must be considered to properly arrive at the total equivalent feet of straight pipe in the field installed piping to the appliance. For water connection sizing, see the table below:

Table 7: Valiant-FT Pipe Sizes

Model	Water Connection
400	2”
500	2”
600	2”
725	2-1/2”
850	2-1/2”

HEAT EXCHANGER

The heat exchanger is of fully welded construction and is cylindrical in appearance. The heat exchanger is a vertical,

single-pass, counter-flow, fire-tube design. Models 400 MBH throughout 850 MBH are designed to withstand 160 PSIG of operating pressure.

ΔT HEAT EXCHANGER ALGORITHM

The Valiant FT Series 2 is constantly monitoring the inlet and outlet water temperatures. When the ΔT approaches 60°F the burner will modulate down to prevent tripping of the high limit and to protect the heat exchanger against thermal shock. This setting may be changed in the Valiant FT Series 2 control.

LOW WATER TEMPERATURE SYSTEMS

In applications where the heating system requires supply water temperatures below 110°F, connections may be made directly to the Valiant FT Series II. At incoming temperatures of 120°F or lower this appliance achieves maximum efficiency. Inlet temperatures must not drop below 40°F to prevent freezing.

2.4.6 Flow and pressure drop at a given ΔT

Table 8: Valiant-FT Series II Flow and Pressure Drops vs ΔT

Input KBtu/hr	Flow and Pressure Drop at given ΔT					
	20°F		30°F		40°F	
	GPM	ΔP	GPM	ΔP	GPM	ΔP
400	39.6	4.2	26.4	2.8	19.8	3.0
500	49.5	4.3	33	3.9	24.7	3.9
600	59.4	5.7	39.6	4.5	29.7	3.0
725	71.7	5.8	47.8	3.6	35.9	4.7
850	84.1	6.1	56.1	3.9	42	3.8

Table 9: Valiant-FT Series II Minimum Flow

Model	400	500	600	725	850
US GPM	13.2	16.5	19.8	23.9	28.0

2.5 ELECTRICAL CONNECTIONS

2.5.1 Minimum Power Requirements

Table 10: Minimum Power Requirements

Model	Voltage Requirement	Full Load Amps [Amperes]	Maximum Over Protection [Amperes]
400	115VAC, 60Hz, Single Phase	7	15
500		7	15
600		7	15
725		7	15
850		7	15

The appliance, when installed, must be electrically grounded in accordance with the requirements of the authority having jurisdiction or in the absence of such requirements, with the latest edition of the National Electrical Code ANSI/NFPA No. 70. When the unit is installed in Canada, it must conform to the Canadian Electrical Code, C22.1, Part 1 and/or local Electrical Codes. All wiring between the appliance and field installed devices shall be made with wire having minimum 220ºF (105ºC) rating. Line voltage wire external to the appliance must be enclosed in approved conduit or approved metal clad cable. To avoid serious damage, **DO NOT ENERGIZE** the appliance until the system is full of water. Ensure that all air is removed from the pump housing and piping before beginning initial operation. Provide the appliance with proper overload protection.

WARNING
This product must be properly grounded before any electric current is applied to the blower or controls.

BLOWER MOTOR

The Valiant FT uses a 120V/1PH electrical supply to power the blower motor. On ignition, after safety checks are complete, the blower is provided with a signal to operate at soft start level for burner ignition. After main burner ignition is established, the motor receives a modulating signal from the control corresponding to the rate of modulation necessary.

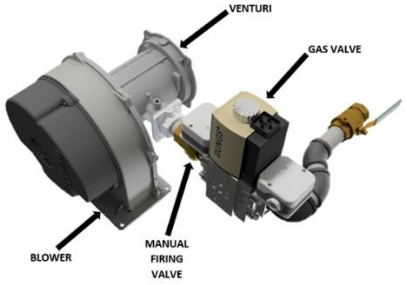
AIR PRESSURE SWITCH, BLOCKED FLUE & CONDENSATE SWITCH

The air proving switch and blocked venting switch are wired in series. When the error on the control shows “Air Switch Open”, it could be a result of these switches. A minimum pressure across the differential air switch proves the combustion air fan. A failure of this switch to close could be due to several factors such as, sensing line broken or loose fitting, blocked vent, steady high wind condition or an incorrectly set switch.

The Blocked Flue & Condensate switch is mainly due to a blocked air intake or vent condition. When the blocked flue switch has tripped, check the venting and/or air intake piping for obstructions before placing the unit into operation. Power must be shut off to the boiler and gas supply to the appliance must be closed before attempting to investigate reason for blocked flue condition.

PART 3 COMBUSTION COMPONENTS

Figure 19: Combustion Components Assembly (VA600-850 gas train displayed)



3.1 AIR/ GAS RATIO CONTROL VALVE

Operation of the gas valve in combination with the combustion air fan allows the burner input rate to vary from

10% to 100%. These utilize a 1:1 ratio dual seat negative pressure gas valve. The gas valve adjusts fuel supply according to negative pressure generated by the combustion fan. The valve is dual seat and serves as a safety shut-off. The inlet gas supply pressure must be maintained within the specified minimum and maximum pressures (a reduction of up to 30% is permitted in the inlet gas pressure between light-off and full fire conditions).

Figure 20: Zero Governor Gas Valve (VA0400)

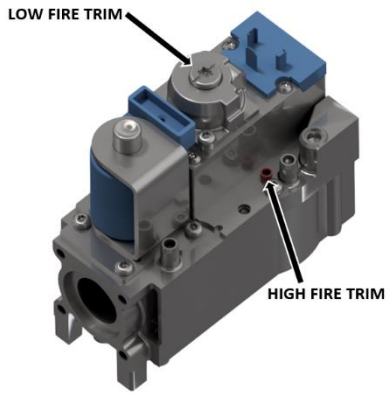
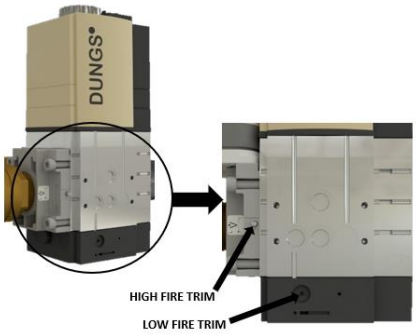


Figure 21: Zero Governor Gas Valve (VA0500)

Figure 22: Zero Governor Gas Valve (VA0600-VA0850)



3.2 GAS PRESSURE SWITCHES (Optional)

Gas pressure switches prevent the burner from being activated if pressure is outside certain ranges. Each switch is a physical manual reset device, requiring physical depression of the reset button if it is not closed prior to burner start or during burner operation.

3.2.1 Low Gas Pressure

A low gas pressure switch is standard equipment and monitors the minimum incoming gas supply pressure supplied to the gas train. If gas pressure upstream of the valve(s) falls below the minimum setting of the pressure switch, the switch will open and the appliance will shut down. An open gas pressure switch alarm will be shown on the display.

3.2.2 High Gas Pressure

High gas pressure switches may be ordered to comply with CSD-1 code. These will either be integrated into the gas train. If gas pressure downstream of the gas valve(s) exceeds the maximum setting of the pressure switch, the switch will open, and the appliance will shut down.

3.3 AIR PRESSURE SWITCHES

3.3.1 Blocked Flue Switch

All models use a normally closed blocked flue switch to shut down the appliance under conditions of blockage of the air intake or the flue outlet.

3.3.2 Low Air Switch

The low air switch is closed by operation of the combustion air blower, to confirm that there is air flow present. This switch is adjustable but typically does not need to be altered from factory settings. Once this switch is closed the unit initiates the pre-purge counter. If this switch opens during operation the unit will lock-out.

3.4 COMBUSTION AIR BLOWER

Figure 23: Valiant FT Series II Combustion Air Fan

The Valiant FT Series II uses a modulating air fan to provide combustible air/gas mix to the burner and push the products of combustion through the heat exchanger and venting system. The fan assembly consists of a sealed housing and fan wheel constructed from spark resistant cast aluminum. The fan is operated by a fully enclosed 120 VAC, Single-Phase EC/DC electric motor. The fan housing and motor assembly is fully sealed and SHOULD NOT be field serviced.

3.5 BURNER

Figure 24: Valiant FT Series II Burner

This appliance uses a single cylindrical burner installed vertically into the combustion chamber at the top of the heat exchanger. The burner consists of a round mounting flange welded to a mixing tube. The flange provides the transition from the combustion air fan into the burner. The mixing tube is covered with a knitted alloy material that forms the burner port surface. The burner port surface can sustain operation from a blue flame down to infrared conditions as the burner input varies.

There is a unique burner for each model. Burners may not be interchanged between different input models.

3.6 SPARK IGNITER

Figure 25: Spark Igniter

The ceramic igniter is inserted directly through the fan flange and held in place by two screws. A sealing gasket above and below the igniter assures a good seal. The igniter provides the spark which ignites the main burner flame during start-up.

3.7 FLAME SENSOR

The flame sensor is inserted directly through the fan flange and is screwed into the fan flange. Care must be taken when installing the flame sensor to align it perpendicular to the fan flange and parallel to the burner tube and not to over tighten. Always remove the flame sensor prior to removing the fan assembly for inspection of the burner and heat exchanger.

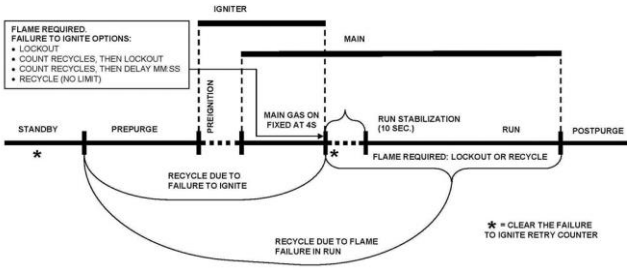
Figure 26: Flame Sensor

The ignition module relies on the flame sensor to provide a flame rectification signal. Oxide deposits, improper placement or damaged ceramic insulator will result in insufficient signal leading to ignition module lock out. For proper operation minimum 0.8 VDC must be fed back to the module. Oxide deposit on the sensor rod must be removed with steel-wool. Do not use sand-paper since this will contaminate the surface.

PART 4 OPERATION & START UP

4.1 SEQUENCE OF OPERATION

Figure 27: Valiant-FT Series II Ignition Cycle



1. Supply power connection as per 2.5.1 *'Minimum Power Requirements'*.
2. Place power switch in the "ON" position.
3. 120 VAC power is supplied to the control transformer.
4. 24 VAC is supplied to the ignition module and low voltage controls.
5. The Valiant FT Series II controller receives a call for heat via the remote operator contacts and the Demand parameter reads Central Heating, DHW, or Lead Lag Slave.
6. The Valiant FT Series II controller closes the pump contacts to start the pump, which then causes the Flow Switch to close once minimum flow is reached. If all limit controls are made including temperature and water flow, the controller closes the blower contacts to ramp up the frequency of the Combustion Fan using the modulating signal provided by the on-board modulating control. If the Low Air Switch contacts are made within the 60 seconds, the blower will run at Pre-Purge speed until the Pre-Purge timer is satisfied.
7. After the appliance water pump starts, flow is proven by the Flow Switch. The Flow Switch is mounted at the outlet of the appliance. If installing a Flow Switch, it is required to properly trim the Flow Switch Paddles in order not to jam the switch in the tee.
8. Once the Pre-Purge Timer is satisfied, the Valiant FT Series II controller will target the ignition fan speed.
9. The Valiant FT Series II controller will activate the Spark Ignitor for a few seconds before energizing the gas valve. A signal of 0.8 Vdc minimum must be recognized by the controller at the Flame Sensing rod (*or at the UV Scanner if equipped*)

to keep the Gas valve in the open position. The fan is kept at ignition speed until the flame is stabilized. As demand increases the modulation signal causes the Gas valve to draw more gas.

10. The fan speed will slowly decrease as the temperature nears the target. The modulation rate is controlled via a PWM signal. If the heat demand is sustained without change, the boiler firing rate will reach a point of steady-state and the fan will rotate at constant speed.
11. When the heat demand is satisfied or the remote enable is removed, the burner will shut off and the fan speed will ramp up to the preset Post-Purge speed until the Post-Purge timer is satisfied.
12. The pump continues to circulate until the Post-Purge time is satisfied.
13. The boiler will then go into Standby as it waits for the next heat demand or remote enable.

NOTE:

1. If a flame signal is detected at the end of the Pre-Purge period, an error will occur.
2. If at the end of the safety period (4 sec) no flame is detected, the control will go to Post-Purge to remove the unburned gas. After this, a re-ignition attempt is started following the same cycle. The number of re-ignition attempts is limited to 2 after which a lockout occurs.
3. The burner can only be ON continuously for a period of 24 hours. After this, the burner is switched OFF and a restart sequence follows.
4. The Hot Surface Igniter is de-energized at the end of the ignition period to allow for ionization detection.

HEAT TRANSFER PROCESS

1. Burner input rate continues to increase until water temperature reaches the set point temperature.
2. Burner input rate may stabilize at a fixed rate when demand equals input.
3. Burner input rate will decrease when water temperate approaches temperature set point.

4.2 FIELD START-UP PROCEDURE

Setting the correct combustion is essential to get the best performance out of the appliance.

1. Toggle the main power button to the “ON” position.
2. Make sure the boiler is in “Standby” condition by setting the LOCAL/REMOTE switch to REMOTE and disabling all external demand to the boiler.
3. Unlock the SOLA control by pressing the lock button on the top right and entering the password “SOLA”.
4. Open the Diagnostics menu, select manual run and enter the RPM corresponding with the Ps pressure written on the label behind the front door of the Valiant FT Series II.
5. Insert Combustion Analyzer into the Exhaust port and record the combustion readings. If the readings do not match table 11 below, the combustion values will need to be changed.
6. Re-enter the RPM corresponding with the low fire Ps pressure and record the Combustion values using the Combustion Analyzer.
7. If the CO2 values need to be changed, find the low fire trim on the gas valve, and rotate it clockwise to increase CO2 and counterclockwise to decrease CO2. Make sure the values are in the range of table 11.

Figure 28: Low Fire Trim (VA0400)

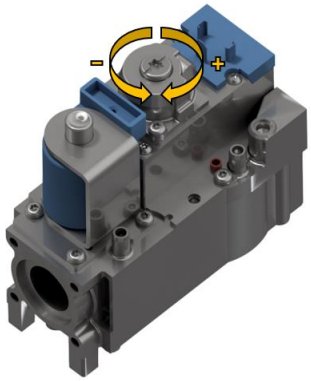
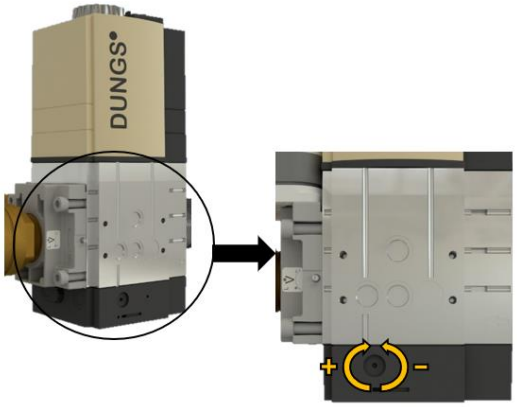


Figure 29: Low Fire Trim (VA0500)

Figure 30: Low Fire Trim (VA0600, VA0725, VA0850)



8. Next, on the test screen menu, press the UP or DOWN buttons to select “High Power” and wait for the boiler to ramp up to High Fire.
9. Once the boiler ramps up to High Fire, the readings on the Combustion Analyzer should match the High Fire values in table 11 (table 12 for LP Gas). If the values match, skip to the next step.
10. Find the High Fire trim on the gas valve and rotate it counterclockwise to increase CO2 and clockwise to decrease CO2 until the values match those in the range of table 11 (table 12 for LP Gas).

Figure 31: High Fire Trim

11. Once the Low Fire and High Fire values are within range of table 11, exit out of the menu and place boiler into operation by switching the LOCAL/REMOTE switch into LOCAL and running with a local demand or keep it in REMOTE and re-enabling any external demand if required.

4.3 NATURAL GAS COMBUSTION VALUES

The appliance combustion values for **Natural Gas** should be as below:

Table 11: Valiant FT Natural Gas Combustion Values

HIGH FIRE			
Model	CO2 % Range	Target CO2%	CO (ppm)
400	8.5% – 10.0%	9.6%	<150
500			
600			
725			
850			
LOW FIRE			
Model	CO2 % Range	Target CO2%	CO (ppm)
400	8.0% – 9.5%	8.5%	<50
500			
600			
725			
850			

4.4 LP GAS COMBUSTION VALUES

The appliance combustion values for **LP Gas** should be as below:

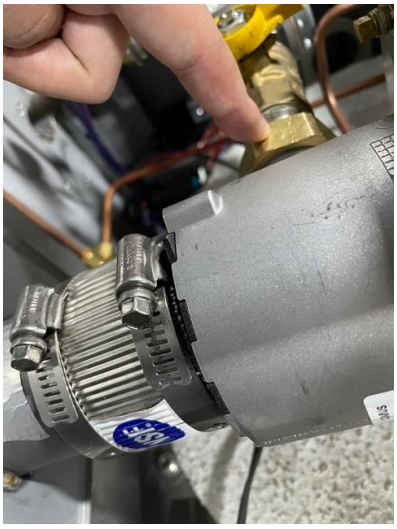
Table 12: Valiant FT LP Gas Combustion Values

HIGH FIRE			
Model	CO2 % Range	Target CO2%	CO (ppm)
400	9.6% – 11.0%	10.5%	<150
500			
600			
725			
850			
LOW FIRE			
Model	CO2 % Range	Target CO2%	CO (ppm)
400	9.6% – 11.0%	10.0%	<100
500			
600			
725			
850			

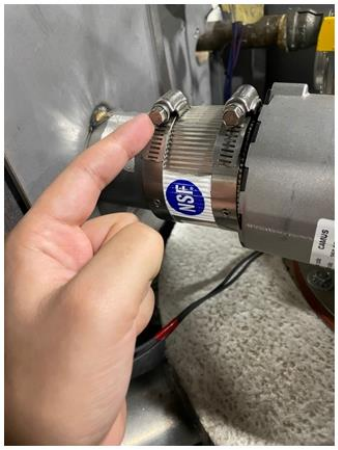
4.5 CONVERSION PROCEDURE FOR NG TO LP GAS

To carry out a field conversion of a NG Valiant FT Series II appliance to an LP gas unit, follow the conversion procedure below.

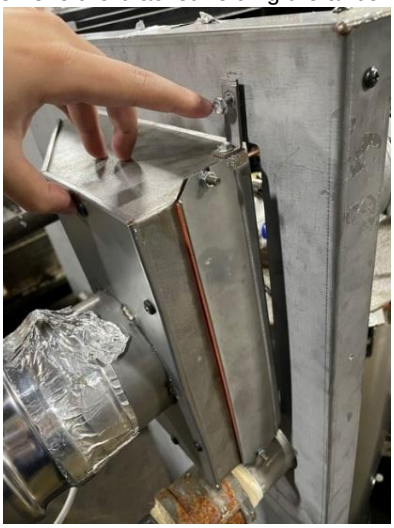
1. Open adaptor connection connecting the gas valve to the venturi.



2. Loosen the two screws on the air intake coupling below.



3. Remove the bracket holding the airbox.



4. Remove the air intake elbow from the venturi.

5. Using a torx driver, remove the screws attaching the venturi to the blower.

6. Replace this Venturi with the LP Venturi.

7. Follow steps 5 to 1 in reverse order to reattach all the components.
8. Adjust high fire and low fire CO2 values using the high fire and low fire trims on the gas valve and match with table 12.

4.6 HIGH ALTITUDE

For US: The input ratings of the appliance operating at elevations above 2000ft shall be reduced at the rate of 4% for each 1000ft above sea level.
For Canada: The de-rated input rating above 2000ft is as stated on the rating plate of the appliance. For operation above 4500ft, consult the local authorities for de-rating capacities.

AIR SWITCH PROCEDURE

1. Connect a manometer to the two air pressure ports and check the differential pressure between them.

2. Compare the pressures from the air switch to the *Valiant-FT Factory Test Data Sheet.*
3. Match or come close to the required pressure by changing the RPM on the digital display

PART 5 CONTROLS

5.1 VALIANT FT CONTROL

The Valiant FT Series 2 utilizes the SOLA control. This control includes the main board mounted inside the control panel and an HMI touchscreen mounted at the front.

5.1.1 Levels of Access

The control has an access code which restricts critical parameters from being restricted to ensure safe and efficient operation of the boiler.

- **User –** Access to general parameters, display settings and adjustments to the setpoint. No code is required for this level.
- **Installer –** Access to additional parameters to allow for ease of startup and serviceability. This level is unlocked by entering the correct code into the control.

CAUTION
Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation.

Figure 32: Valiant FT Series II Controller

5.1.2 Control Board Connections

Table 13: Valiant FT Series II Control Board Connections

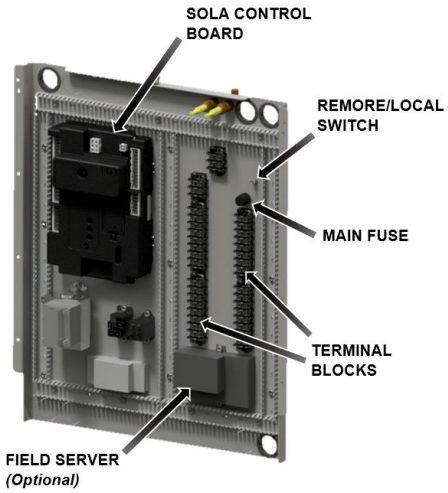
Connector	Connector Description
J1	Flame Sensor, Ground
J3	Display, Lead Lag, Modbus Comm.
J4	24VAC Power, Pump, VFD
J5	Gas Valve, Interlock
J6	Safety Annunciation, Alarm, LCI
J8	24VAC Power, Inlet, Outlet Sensor
J9	DHW, Stack Sensor

5.2 HMI TOUCHSCREEN INTERFACE

Figure 33: Valiant FT Series II Touchscreen

The HMI Touchscreen Interface is a 7 inch graphical touch screen. This display provides the ability to change setpoints over various modes of operation (Central Heating, DHW, Outdoor Curve Reset, etc.). The modes themselves can also be changed. This interface also provides visual graphs illustrating the various temperature points over a certain period of time. This interface allows for overall appliance monitoring, including all sensors, cycle count, burner run time, firing rate, fan speed, flame signal, alarm reporting, and manual firing rate control during product commissioning.

Figure 34: Valiant FT Series II Control Panel



Control Panel Terminal Blocks

The control panel has terminal blocks for sensors and output terminals for additional components.

REMOTE/LOCAL SWITCH

The local remote switch mounted inside the control box is designed to deliver an enable signal either relying on an external contact closure (Remote) or enabling the boiler locally (Local). When Remote is selected via the DPDT switch, the Remote Operator contacts must close to deliver an enable signal. When Local is selected via the DPDT switch, a constant enable signal is present. When troubleshooting the Valiant FT Series II, it is recommended to switch to Local mode.

IGNITION MODULE LOCKOUT FUNCTIONS

The Valiant FT Controller may lockout in either a manual reset condition requiring pushing the reset button to recycle the control for a CSD1 requirement or an automatic reset condition. Pushing the “OK” with the control in a hard lockout condition is the only way to reset the Valiant FT Controller. Turning the main power “OFF” and then “ON” or cycling the thermostat will not reset a hard lockout condition. Wait until the display has synchronized before pushing the “OK” button to clear a manual reset condition. The Valiant FT controller may proceed into a soft lockout condition. The boiler will stay in the automatic reset state

until the fault is corrected and will automatically return to normal operating state.

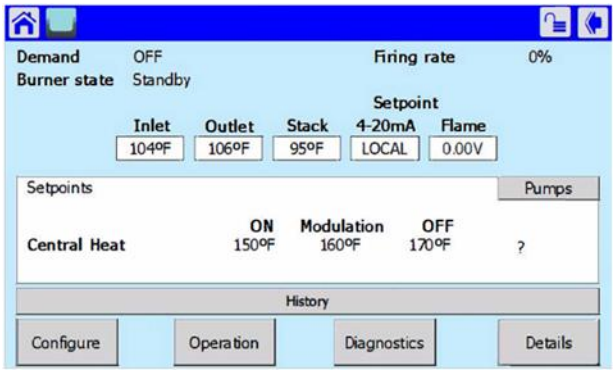
SERVICE PARTS

The Valiant FT Series II Control is not field repairable. Any modification or repairs will invalidate the warranty and may create hazardous conditions that result in property damage, personal injury, fire, explosion and/or toxic gases. A faulty direct spark igniter MUST be replaced with a new factory part. DO NOT use general purpose field replacement parts. Each appliance has one control board, one direct spark igniter and one flame sensor. A list of recommended spare parts is illustrated in parts breakdown in this manual.

VALIANT FT SERIES II BOILER CONTROLS

The appliance is provided with an end-user HMI touchscreen at the front and an operator interface digital display inside. The HMI touchscreen provides access to general boiler and display adjustments to the central heating, domestic hot water, and lead lag setpoints. The operator interface inside the boiler allows for changes to additional boiler parameters for ease of startup and serviceability.

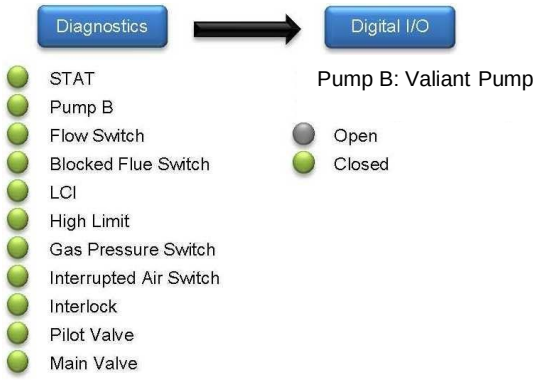
PART 6 CONTROL SETTINGS



Parameter	Description
Demand	Central Heating (ARH)
	Domestic Hot Water (ARW)
	Lead Lag
Burner State	Current Status of Valiant FT Series II
Firing Rate	Target Firing Rate
Inlet	Inlet Water Temperature [°F]
Outlet	Outlet Water Temperature [°F]
Stack	Stack Temperature [°F]
DHW	DHW Temperature [°F], if equipped
Header	Header Temperature [°F], if equipped
Outdoor	Outdoor Temperature [°F], if equipped

Button	Description
Configure	Access Valiant Series II parameters (CH Parameters, DHW Parameters, Outdoor Reset, Pump Configuration etc.)
Operation	Details of Boiler Operation (Set point, Firing Rate, Pump Status, Safety Circuit)
Diagnostics	Manual Firing Rate, Analog/Digital Status
Details	History, Pump Status, Outlet Temperature

Sequence of Operation



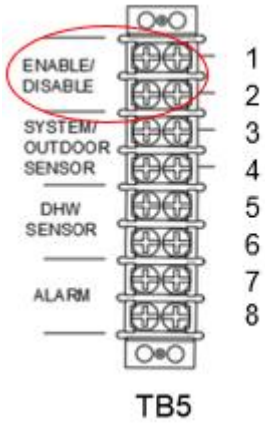
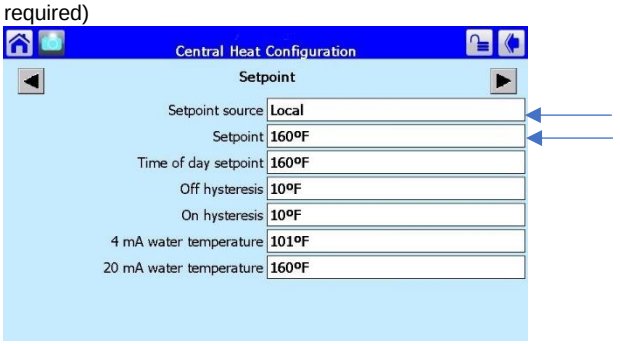
Flow Switch: Flow Switch, Water Pressure Switch (12 PSIG), Low Water Cut Off (if equipped)

Gas Pressure Switch: Low Gas Pressure Switch (4.5”-5.5” w.c., N/O), High Gas Pressure Switch (14” w.c, N/C)

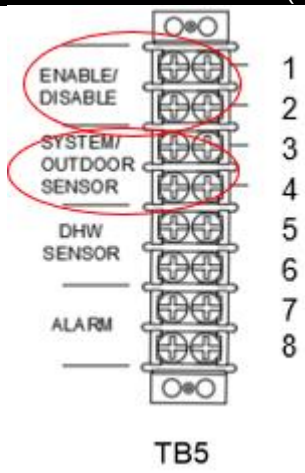
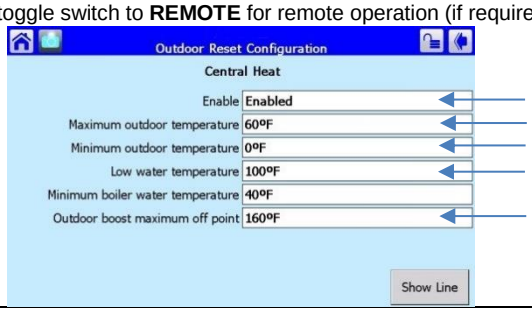
Interrupted Air Switch: Air Proving Switch (N/O)

Hydronic Heating

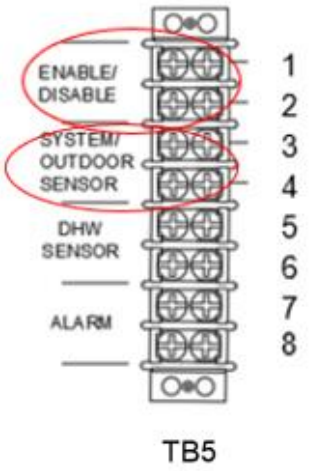
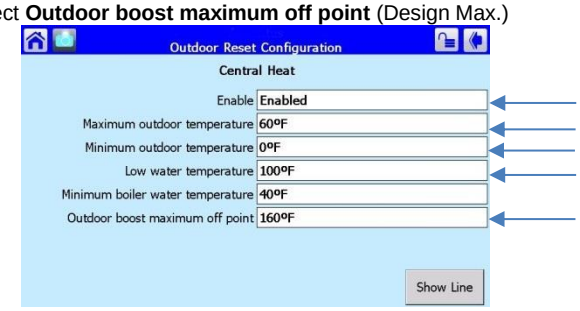
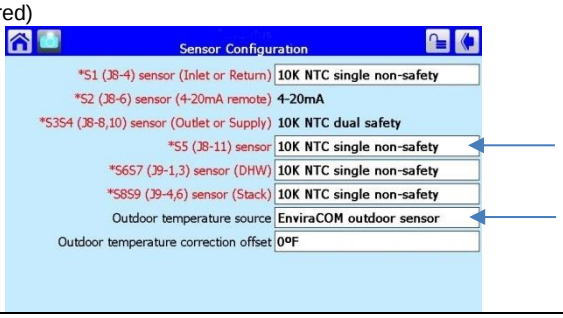
Modulation: Boiler Outlet, Boiler Fixed Setpoint Operation (Standalone)

Description	Electrical Connection(s)	Programming Instructions
• Boiler operates at a fixed CH setpoint • Modulates on boiler outlet sensor (default) • Heat demand is generated when outlet temperature drops below setpoint minus on hysteresis • If set to local enable constant pumping is required • For remote enable intermittent pumping is allowed.		1) Place toggle switch to **LOCAL** 2) Press Configure and Login 3) Press **[CH – Central Heat Configuration]** 4) Press the ➡ to arrive at **Setpoint** 5) Select **Setpoint source: Local** 6) Enter desired **Setpoint** 7) Place toggle switch to **REMOTE** for remote enable operation (if required) 

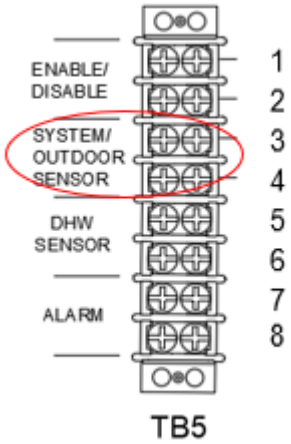
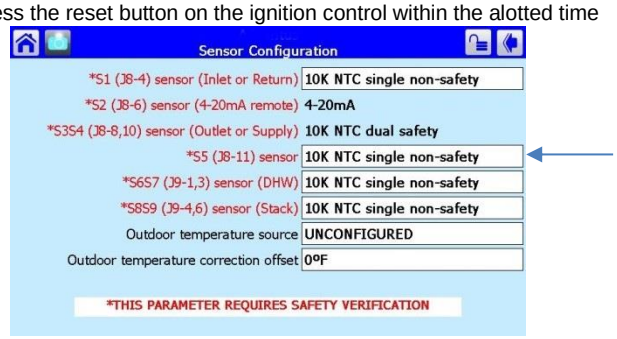
Modulation: Boiler Outlet, Outdoor Reset Operation (Standalone)

Description	Electrical Connection(s)	Programming Instructions
• Boiler operates with variable setpoint determined by outdoor reset curve • Modulates on outlet sensor (default) • Heat demand is generated when outlet temperature drops below setpoint minus on hysteresis		1) Connect outdoor sensor to System/Outdoor contacts 2) Place toggle switch to **LOCAL** 3) Press Configure and Login 4) Press **Outdoor Reset Configuration** 5) Select **Enable: Enable** 6) Select **Maximum outdoor temperature** (WWSD) 7) Select **Minimum outdoor temperature** (Outdoor Design) 8) Select **Low Water Temperature** (Min. Water Temp.) 9) Select **Outdoor boost maximum off point** (Design Max.) 10) Press **[CH – Central Heat Configuration]** 11) Select **Outdoor Reset = Enabled** 12) Set **CH Setpoint = Outdoor boost maximum off point** 13) Press **Sensor Configuration** 14) Select **Outdoor temperature source = S5 (J8-11) sensor** 15) Place toggle switch to **REMOTE** for remote operation (if required) 

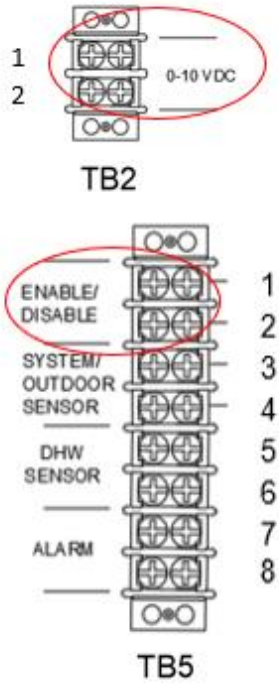
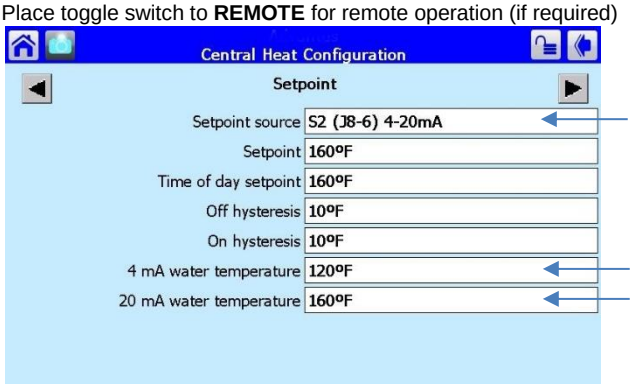
<u>Modulation: System Sensor, Outdoor Reset Operation (Standalone)</u> NOTE: Outdoor Reset Module required (PN: W8735S1000)

Description	Electrical Connection(s)	Programming Instructions
• Boiler operates with variable setpoint determined by outdoor reset curve • Modulates on system sensor • Heat demand is generated when system temperature drops below setpoint minus on hysteresis		1) Connect Remote Operator 2) Connect System sensor to System/Outdoor contacts 3) Connect Outdoor Sensor to J3 ECOM connector 4) Place toggle switch in **LOCAL** 5) Press Configure and Login 6) Press **Outdoor Reset Configuration** 7) Select **Enable: Enable** 8) Select **Maximum outdoor temperature** (WWSD) 9) Select **Minimum outdoor temperature** (Outdoor Design) 10) Select **Low Water Temperature** (Min. Water Temp.) 11) Select **Outdoor boost maximum off point** (Design Max.)  12) Press **[Show Line]** to confirm reset curve 13) Press **Sensor Configuration** 14) Selet **S5 (J8-11) sensor: 10K NTC single non-safety** 15) Select **Outdoor temperature source = EnviraCOM outdoor sensor** 16) Place toggle switch to **REMOTE** for remote enable operation (if required) 

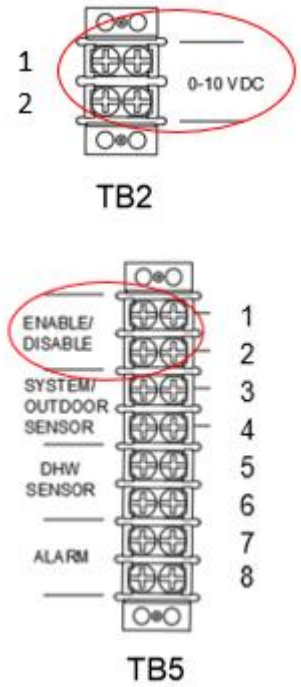
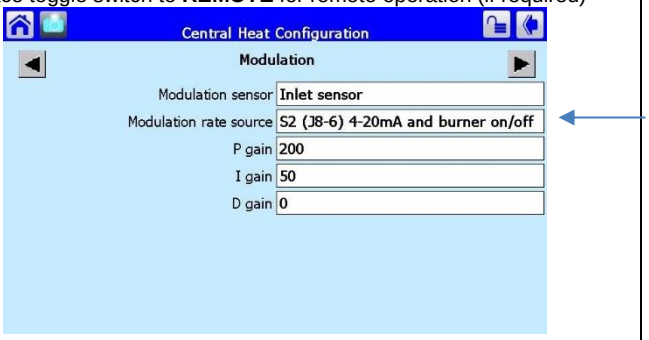
System Sensor Enable (Standalone)

Description	Electrical Connection(s)	Programming Instructions
• Method to enable system sensor for Standalone applications		1) Press Configure and Login 2) Press **[Sensor Configuration]** 3) Select **S5 (J8-11) Sensor**: **10K NTC Single Non-Safety** 4) The control will proceed into a Lockout 2 condition 5) Press **[Verify]** > **[Begin]** > **[Yes]** 6) Press the reset button on the ignition control within the alotted time 

4-20mA/ 0-10Vdc Setpoint Operation (Standalone)

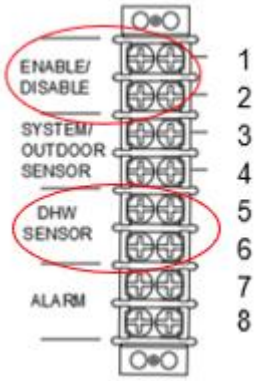
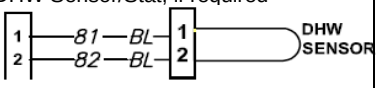
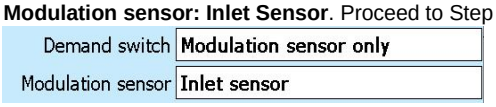
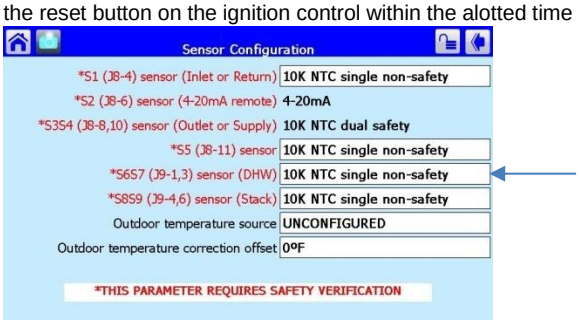
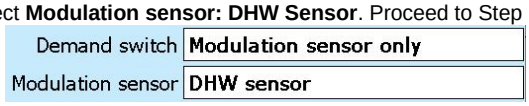
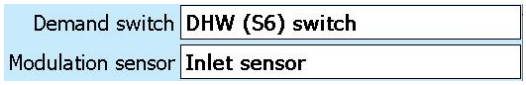
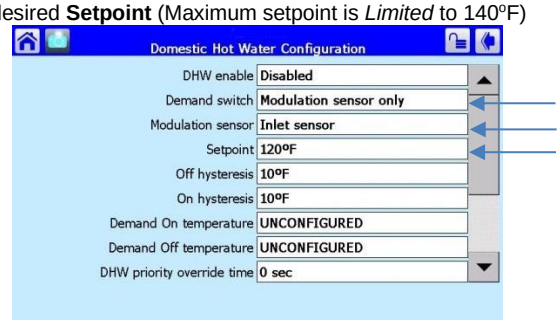
Description	Electrical Connection(s)	Programming Instructions
• Boiler operates with variable setpoint determined by 4-20mA incoming signal • Modulates on boiler outlet sensor (default) • Heat demand is generated when inlet temperature drops below setpoint minus on hysteresis and 4-20mA or 0-10Vdc signal is present. • If set to local enable constant pumping is required • For remote enable intermittent pumping is allowed.		1) Place toggle switch to **LOCAL** 2) Press Configure and Login 3) Press **[CH – Central Heat Configuration]** 4) Press the ▶ to arrive at **Setpoint** 5) Select **Setpoint Source = S2 (J8-6) 4-20mA** 6) Select **4mA water temperature** 7) Select **20mA water temperature** 8) Place toggle switch to **REMOTE** for remote operation (if required) 

4-20mA/ 0-10Vdc Firing Rate Operation (Standalone)

Description	Electrical Connection(s)	Programming Instructions
• Boiler operates with variable firing rate determined by 4-20mA incoming signal • Modulates on boiler inlet sensor (default) • Heat demand is generated when inlet temperature drops below setpoint minus on hysteresis and 4-20mA or 0-10Vdc signal is present. • If set to local enable constant pumping is required • For remote enable intermittent pumping is allowed.		1) Place toggle switch to **LOCAL** 2) Press Configure and Login 3) Press **[CH – Central Heat Configuration]** 4) Press the ▶ to arrive at **Modulation** 5) Select **Modulation Rate Source = S2 (J8-6) 4-20mA and burner on/off** 6) Place toggle switch to **REMOTE** for remote operation (if required) 

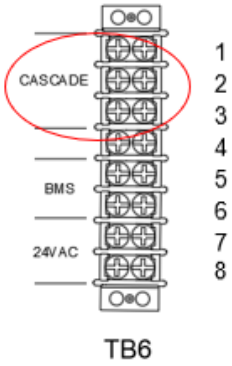
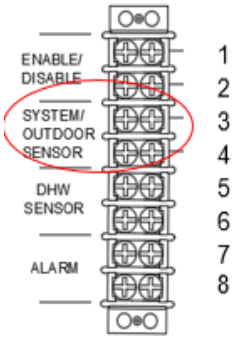
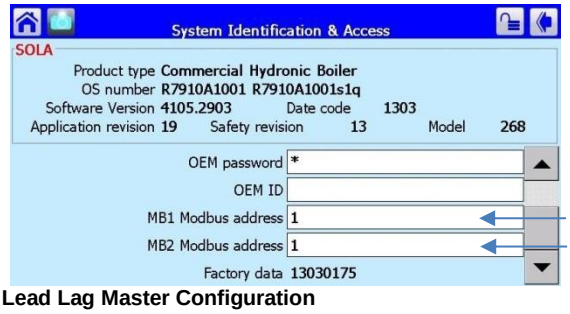
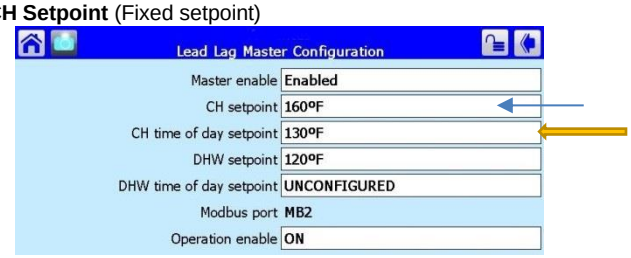
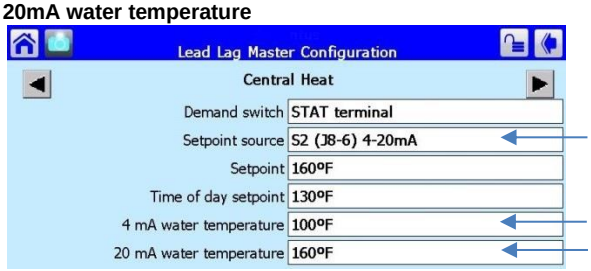
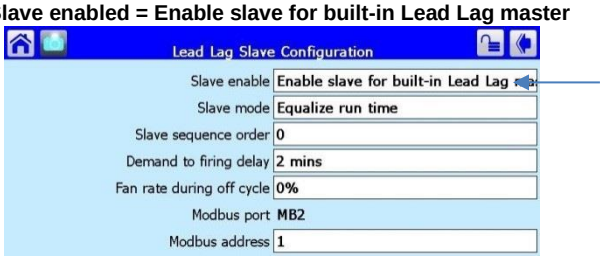
DHW (Domestic Hot Water)

Modulation: Boiler Inlet or DHW Sensor, Fixed Setpoint Operation (Standalone)

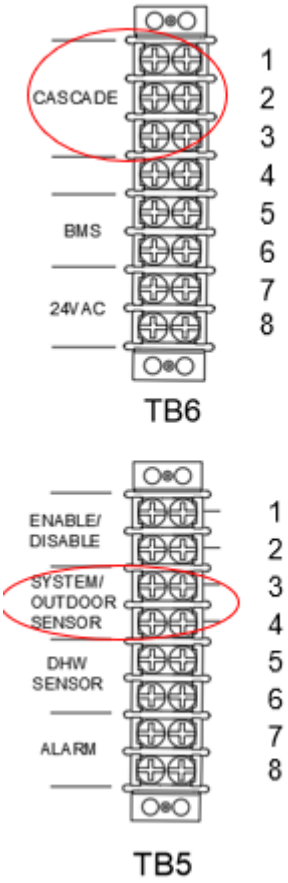
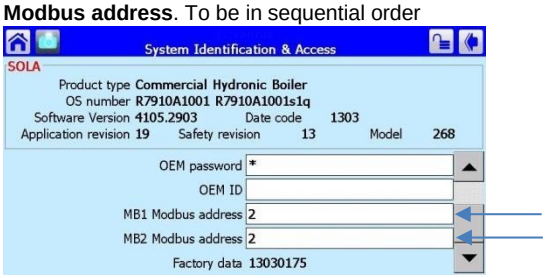
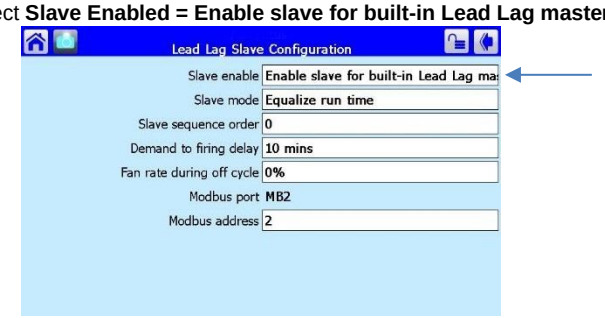
Description	Electrical Connection(s)	Programming Instructions
• Boiler operates at a fixed DHW setpoint • Modulates on boiler DHW sensor (default) • Heat demand is generated when inlet temperature drops below setpoint minus on hysteresis. • For DHW sensor/Aquastat operation intermittent pumping is allowed • For inlet sensor operation constant pumping is required	 DHW Sensor/Stat, if required 	1) Place toggle switch to **LOCAL** ***2)*** Press Configure and Login ***Inlet Sensor operation*** 3) Press **[DHW – Domestic Hot Water Configuration]** 4) Select **Demand Switch: Modulation sensor only** 5) Select **Modulation sensor: Inlet Sensor**. Proceed to Step 17  ***DHW Sensor/Stat operation*** 6) Press **[Sensor Configuration]** 7) Select **S6S7 (J9-1,3) Sensor (DHW)**: **10K NTC Single Non-Safety** 8) The control will proceed into a Lockout 2 condition 9) Press **[Verify]** > **[Begin]** > **[Yes]** 10) Press the reset button on the ignition control within the alotted time  ***DHW Sensor operation*** 11) Press **[DHW – Domestic Hot Water Configuration]** 12) Select **Demand Switch: Modulation sensor only** 13) Select **Modulation sensor: DHW Sensor**. Proceed to Step 17  ***DHW Stat operation*** 14) Press **[DHW – Domestic Hot Water Configuration]** 15) Select **Demand Switch: DHW (S6) switch** 16) Select **Modulation sensor: Inlet sensor**  17) Enter desired **Setpoint** (Maximum setpoint is *Limited* to 140°F) 

VA(H,W) Lead lag Operation

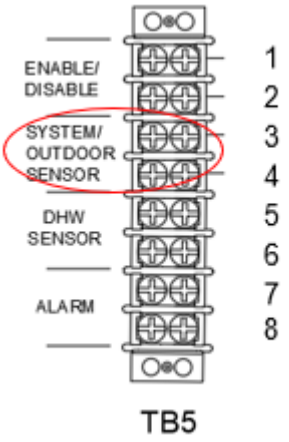
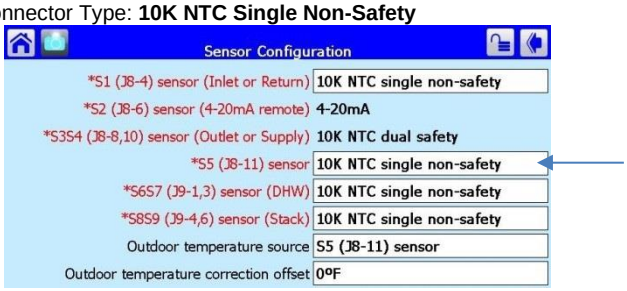
Master Boiler

Description	Electrical Connection(s)	Programming Instructions
• Master boiler lead lag setup • Modulates on system sensor connected to master boiler • System temperature sensor must be connected to boiler #1. • Outdoor temperature sensor must be connected to boiler #2.	 TB6  TB5	1) Place toggle switch to **LOCAL** 2) Press Configure and Login 3) Select **System Identification & Access** 4) Verify **MB1 Modbus address = 1** 5) Verify **MB2 Modbus address = 1**  6) Select **Lead Lag Master Configuration** 7) Select **Master Enabled = Enabled** <u>Fixed Setpoint operation</u> 8) Enter **CH Setpoint** (Fixed setpoint)  <u>4-20mA/ 0-10Vdc setpoint operation</u> 9) Select **[Advanced Settings >]** 10) Press the ▶ to arrive at **Central Heat** 11) Select **Setpoint Source = S2 (J8-6) 4-20mA** 12) Select **4mA water temperature** 13) Select **20mA water temperature**  14) Select **Lead Lag Slave Configuration** 15) Select **Slave enabled = Enable slave for built-in Lead Lag master** 

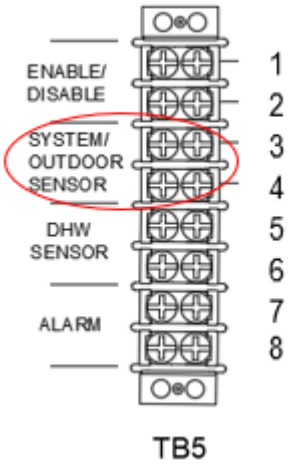
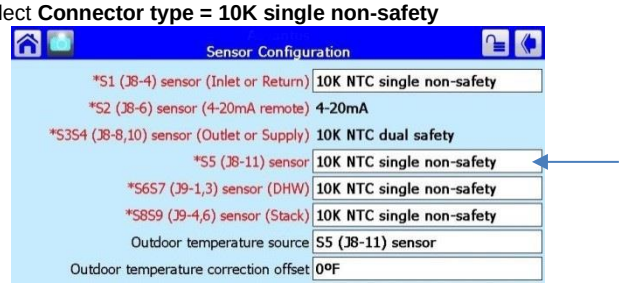
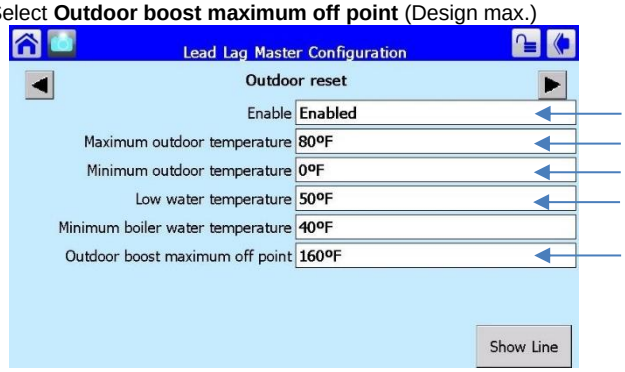
Slave Boiler

Description	Electrical Connection(s)	Programming Instructions
• Slave boiler lead lag setup • System temperature sensor must be connected to boiler #1. • Outdoor temperature sensor must be connected to boiler #2.		1) Place toggle switch to **LOCAL** 2) Press Configure and Login 3) Select **System Identification & Access** 4) Verify **Modbus address**. To be in sequential order  5) Select **Lead Lag Slave Configuration** 6) Select **Slave Enabled = Enable slave for built-in Lead Lag master**  ***The following steps are performed at the factory and verifying on site will be sufficient:*** 7) Select **Pump Configuration** 8) Press **[Advanced Options >>]** 9) Press the ▶ to arrive at **Central Heat Pump** or **DHW Pump** 10) On Options: ☑ Local burner demand 11) On Options: Local Lead Lag ☑ Service Active 12) Force On: ☑ Outlet high limit

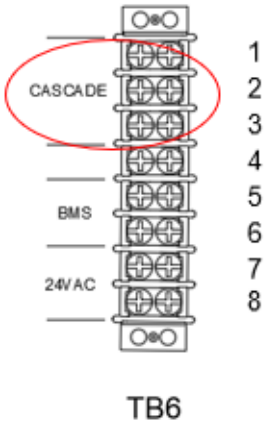
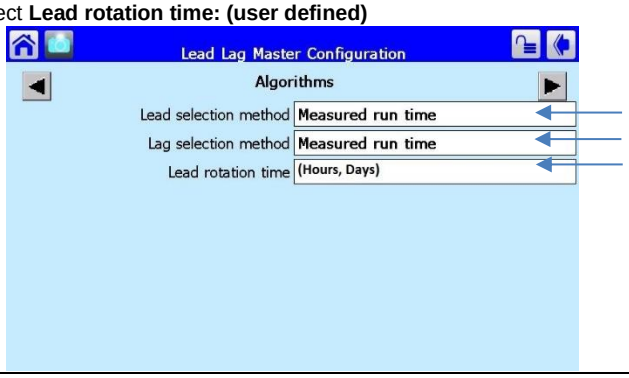
Master Boiler, System Sensor (Connected to Master Boiler #1)

Description	Electrical Connection(s)	Programming Instructions
• Master boiler system sensor configuration • System temperature sensor must be connected to boiler #1. • Outdoor temperature sensor must be connected to boiler #2.		1) Press Configure and Login 2) Press **[Sensor Configuration]** 3) Select **S5 (J8-11) Sensor** 4) Connector Type: **10K NTC Single Non-Safety**  5) The control will proceed into a Lockout 2 condition 6) Press **[Verify]** > **[Begin]** > **[Yes]** 7) Press the reset button on the ignition control within the alotted time

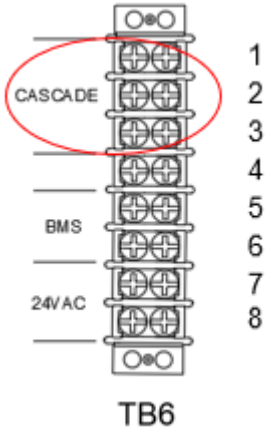
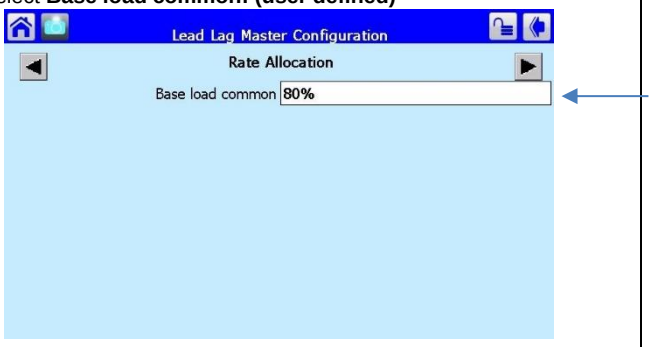
Outdoor Sensor Connected to Slave Boiler 2

Description	Electrical Connection(s)	Programming Instructions
• Slave boiler outdoor sensor configuration • Outdoor temperature sensor must be connected to boiler #2. • When done correctly, the outdoor temperature will be shown on the Master boiler		***Slave Boiler*** 1) Press Configure and Login 2) Press **Sensor Configuration** 3) Select **S5 (J8-11) Sensor** 4) Select **Connector type = 10K single non-safety**  5) The control will proceed into a Lockout 2 condition 6) Press **[Verify]** > **[Begin]** > **[Yes]** 7) Press the reset button on the ignition control within the alotted time ***Master Boiler*** 8) Press Configure and Login 9) Press **[Lead Lag Master Configuration]** 10) Press **[Advanced Settings >]** 11) Press the ▶ to arrive at **Outdoor Reset** 12) Select **Enable: Enabled** 13) Select **Maximum outdoor temperature** (WWSD) 14) Select **Minimum outdoor temperature** (Outdoor design) 15) Select **Low Water Temperature** (Min. water temp) 16) Select **Outdoor boost maximum off point** (Design max.)  17) Press **[Show Line]** to confirm reset curve 18) Press the ▶ to arrive at **Warm Weather Shutdown** 19) Select **Enable = Shutdown after demand ends** 

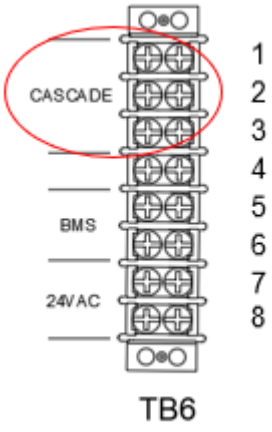
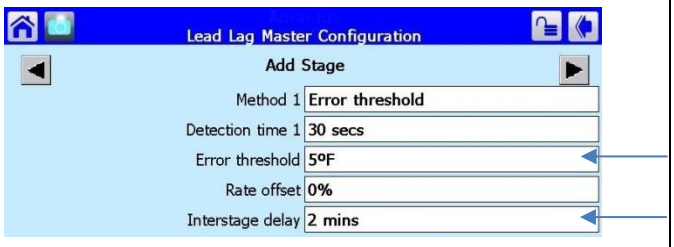
Rotation Schedule Adjustment

Description	Electrical Connection(s)	Programming Instructions
• Standard rotation schedule is based on equalizing run time on a 1-hour schedule • To vary the rotation to a fixed schedule based on (hours, days)		1) Press Configure and Login 2) Press **[Lead Lag Master Configuration]** 3) Press **[Advanced Settings >]** 4) Press the ▶ to arrive at **Algorithms** 5) Select **Lead selection method: Sequence order** 6) Select **Lag selection method: Sequence order** 7) Select **Lead rotation time: (user defined)** 

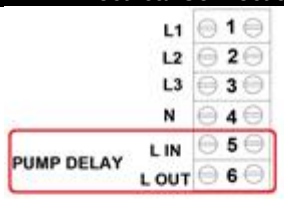
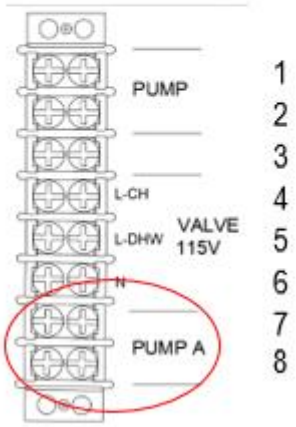
Base Load Rate Adjustment

Description	Electrical Connection(s)	Programming Instructions
• Upon a call for heat the lead boiler will fire up to the specified base load rate (80%). If the temperature is not within Error threshold (5ºF) of setpoint after Interstage delay (2 minutes) a lag boiler will be brought online and will also fire up to the base load rate specified. • Modulation of boilers will only occur after all boilers in the Lead Lag system are firing up to the specified base load rate (80%).		1) Press Configure and Login 2) Press **[Lead Lag Master Configuration]** 3) Press **[Advanced Settings >]** 4) Press the ▶ to arrive at **Rate Allocation** 5) Select **Base load common: (user defined)** 

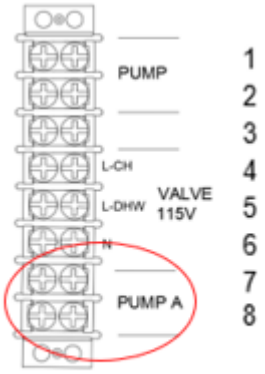
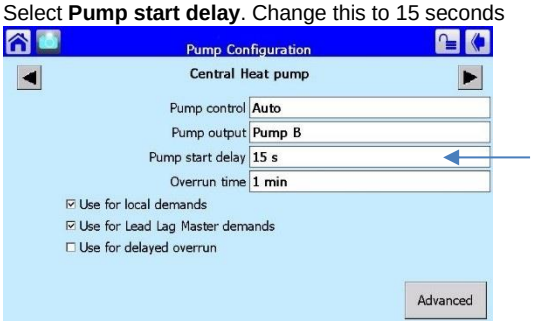
Adjust Staging of Boilers

Description	Electrical Connection(s)	Programming Instructions
• Upon a call for heat the lead boiler will fire up to the specified base load rate (80%). If the temperature is not within Error threshold (5ºF) of setpoint after Interstage delay (2 minutes) a lag boiler will be brought online and will also fire up to the base load rate specified. • This method will then be repeated for the next lag boiler, if available.		1) Press Configure and Login 2) Press **[Lead Lag Master Configuration]** 3) Press **[Advanced Settings >]** 4) Press the ▶ to arrive at **Add Stage** 5) Select **Error threshold** 6) Select **Interstage delay** 

Boiler Pump Operation (ALL Boilers)

Description	Electrical Connection(s)	Programming Instructions
• To activate the boiler pump on a call for heat. This function also includes a post pump feature.	  TB4	1) Select **Pump Configuration** 2) Press **[Advanced Options >>]** 3) Press the ▶ to arrive at **Central Heat Pump** or **DHW Pump** 4) On Options: ☑ Local burner demand 5) On Options: Local Lead Lag ☑ Service Active 6) Force On: ☑ Outlet high limit

Isolation Valve Operation (ALL Boilers)

Description	Electrical Connection(s)	Programming Instructions
• Building pump varies flow through boiler based on demand Sequence of operation where two or more boilers or programmed to operate in lead lag 1. Lead isolation valve is opened using Pump B (Central Heat Pump) contacts 2. Remote Operator closes to initiate call for heat 3. Prepurge, Honeywell SOLA checks that all boiler safeties are closed before ignition attempt 4. Lead boiler fires up to base load rate (Default: 80%) for a period of time (Add Stage: Interstage delay) 5. An additional boiler is needed when: Lead lag temp < (Lead lag setpoint – Add stage Error threshold) AND (Interstage delay timer has expired) 6. Lag boiler is called to start 7. 15-second delay exists between a call for heat and closure of Pump B contacts 8. Lag boiler performs prepurge, Honeywell SOLA checks that all boiler safeties are closed before ignition attempt	 TB4	1) Press Configure and Login 2) Select **Pump Configuration** 3) Scroll to **Central Heat Pump** 4) Select **Pump start delay**. Change this to 15 seconds  a. If the Pump start delay parameter does not appear on screen, use the following steps: b. Go to the Home Screen c. Press Setup d. Press Control Setup e. Press Modbus Configuration f. Enter Register Address: **292** g. Press Get h. Enter Register Value: **15** i. Press Set

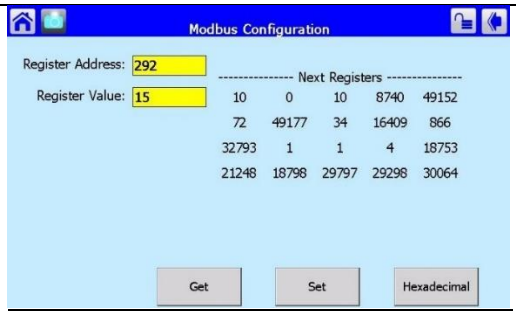
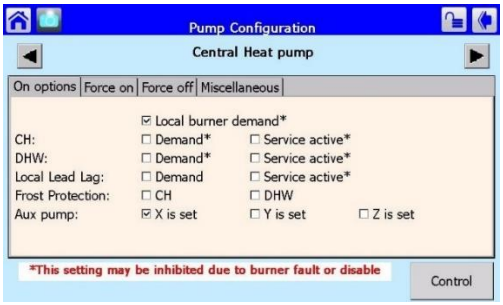
9. Lead boiler fires up to base load rate and both boilers modulate in unison up to 100% or as low as 4% based on heating demand 10. Lag boiler shuts down first when: Lead lag temp > (Lead lag setpoint + Drop stage Error threshold) 11. Lag boiler isolation valve remains open for overrun time (Default: 1 minute) 12. All boilers off: Lead lag temp > (Lead lag setpoint + off hysteresis) 13. Lead boiler isolation valve remains open for overrun time (Default: 1 minute). Lag boiler isolation valve also opens for overrun time to remove any residual heat that may have accumulated inside boiler. 14. Lag boiler electronic isolation valve is closed, and lead boiler electronic isolation valve remains open		 5) Select Advanced 6) Uncheck ☐ CH: Demand* 7) Uncheck ☐ CH: Service Active* 8) Uncheck ☐ Local Lead Lag: Service Active* 9) ☑ Aux pump: X is set 

Figure 35: Configure Menu

6.1.1 System Identification & Access

Menu Group Selection	Parameter	Description
System Identification & Access	Product Type	Commercial Hydronic Boiler
	OS number	Part Number of SOLA Controller
	Software Version	Software Version
	Date Code:	Release Date of Software
	Boiler Name	Valiant Model Number

6.1.2 Pump Configuration

Pump Configuration	Central Heat Pump	Pump Control	Auto	Assigns the method for SOLA to control a Central Heating pump (Default: Auto, Pump is activated whenever a call for heat is present)
			ON	ON: Pump is constantly powered
		Pump Output	Pump B	Specify pump contact
		Over run time	1..5 min	Post pump time (Default: 1 min)
		Use for local (Stand-alone) demands	P	

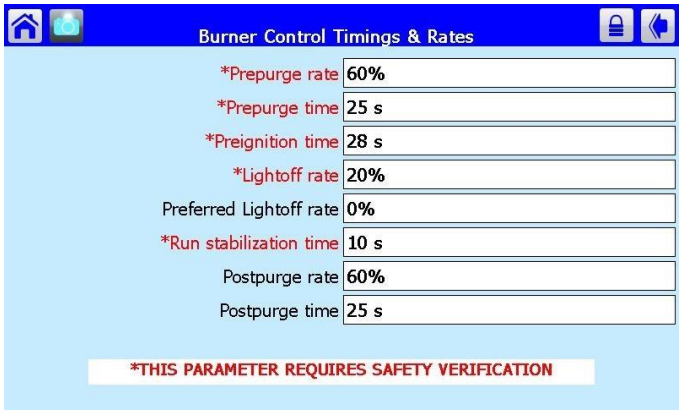
		Use for Lead Lag Master demands	P	
	Boiler Pump	Pump Control	Auto	Refer to above (Default)
			ON	Refer to above
		Pump Output	Pump A	Specify pump contact
		Over run time	1..5 min	Post pump time (Default: 1 min)
		Use for local (Stand-alone) demands	P	
		Use for Lead Lag Master demands	P	
Pump Configuration	DHW Pump	Pump Control	Auto	Refer to above (Default)
			ON	ON: Pump is constantly powered
		Pump Output	Pump B	Specify pump contact
		Over run time	1..5 min	Post pump time (Default: 1 min)

6.1.3 Statistics Configuration

Menu Group Selection	Sub-Menu Group Selection	Parameter	Selection	Description
Statistics Configuration		Boiler pump cycles		Displays the number of cycles the boiler pump has been activated
		Burner cycles		Displays the number of cycles the burner has been activated
		Burner run time		Displays burner run time in hours
		CH pump cycles		Displays the number of cycles the CH pump has been activated
		DHW pump cycles		Displays the number of cycles the DHW pump has been activated

6.1.4 Burner Control Timing and Rates

Figure 36: Burner Control Timing and Rates



Menu Group Selection	Sub-Menu Group Selection	Parameter	Selection	Description
Burner Control Timing and Rates		Prepurge rate	3000 RPM	Prepurge fan speed
		Prepurge time	25 sec..5 mins	Prepurge time (Default: 25 sec)
		Run Stabilization Time	10 sec	Main flame establishing period
		Postpurge rate	3000 RPM	Postpurge fan speed
		Postpurge time	25 sec..5 mins	Postpurge time (Default 25 sec)

6.1.5 Sensor Configuration

Menu Group Selection	Sub-Menu Group Selection	Parameter	Selection	Description
Sensor Configuration		S1 (J8-4, 5) sensor	10K NTC single non-safety	Inlet Sensor
		S2 (J8-6, 7) sensor	4-20mA	4-20mA Input Signal
		S3S4 (J8-8, 9) sensor	10K NTC dual safety	Outlet Sensor
		S5 (J8-11, 12) sensor	10K NTC single non-safety	Outdoor Sensor: Standalone boiler or Slave boiler Header sensor: Master boiler
		S6S7 (J9-1, 2) sensor	10K NTC single non-safety	DHW Sensor (ARW Only)
		S8S9 (J9-4, 5) sensor	10K NTC single non-safety	Stack Sensor

6.2 Lead Lag Setup

All SOLA controllers are programmed with a default adress of 1. The address of the slave controllers in the system must have a unique address (1..8).

Sequence of Operation:

When a boiler is set as Lead Lag Master = Enabled and Modbus address =1, the controller of this boiler will drive the lead lag operation.

The outdoor temperature sensor connected to the slave boiler 2 (ie. B-2) will be the outdoor sensor for the lead lag system.

- The system temperature sensor connected to boiler 1 (the master) in terminals labeled “Outdr/Sys” in the junction box will be the control sensor for lead lag operaiton.
- The start/stop signal connected to boiler 1 (the master) at terminals labeled “Remote Operator” will be the enable signal for lead lag operation.

When the enable signal is present and there is a heat demand, the lead boiler will start and uses the lead lag parameters for boiler modulation. After a period of “Interstage delay” the master boiler compares the lead lag temperature with the lead lag set point and will check if:

1. **An additional boiler is needed**: Lead lag temperature < Lead lag setpoint – Add stage Error Threshold
2. **Number of boilers remain the same**: Lead lag temperature > Lead lag setpoint – Add Stage Error Threshold **AND** Lead lag < Lead lag setpoint + Drop Stage Error Threshold
3. **A boiler should stop**: Lead lag temperature > Lead lag setpoint + Drop Stage Error Threshold
4. **All boilers off**: Lead lag temperautre > Lead lag setpoint + Off Hysteresis

If the lead lag master system is interrupted, the remaining boilers will operate as standalone boilers based on the Central Heat or DHW parameters when set to “Enabled”.

Rotation

Rotation time is configurable based on equalized run time (default) or a fixed rotation schedule.

Interstage Delay

The length of time to wait between requesting a slave SOLA to fire. (Default: 2 minutes)

Base Load Rate

When a call for heat is initiated the lead boiler runs up to the desired base load rate (default: 80%) and continues to operate in this fashion based on the above 4 scenarios. If the lead lag temperature is not satisfied a second boiler is fired and they would both operate up to 80% fire rate.

Slave State

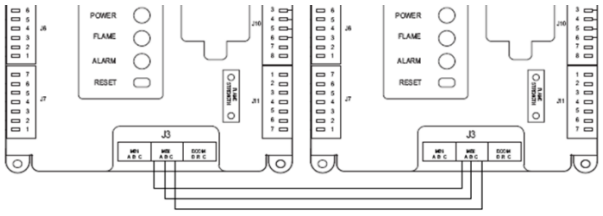
Slave Status Manager	
Unknown	Table entry is unused or empty
Available	Slave is operational and ready to use
Add Stage	Stage is getting ready to fire
Suspend Stage	Stage was getting ready but is not needed
Disabled	Slave is locked out or disabled
Recovering	Slave is in time delay to verify that it is operational before considered to be available

Wiring the Lead Lag Setup

Use Cascade terminals in the juntion box to wire lead lag appliances.

	Master	Slave 2	..	Slave 7
J3, MB2	A	A	..	A
	B	B	..	B
	C	C	..	C

Figure 37: Lead Lag Wiring Setup (Left: Master, Right: Slave)



NOTE
Recycle power on all boilers after programming is complete if lag boilers are not discovered automatically

NOTE
CH Setpoint or DHW Setpoint must match Setpoint located in Lead Lag Master Configuration, for the system to operate correctly.

NOTE
The Local/Remote switch must be set in the “Local” position on ALL lag boilers.

6.3 SAFETY AND SYSTEM FUNCTIONS

6.3.1 On-board Physical Lockout Reset

The Valiant FT control board is equipped with a push button and a 2 color (red/green) LED.

The green LED will be ON when the control is operational.

The red LED will be ON when the control has a lockout error.

The control can be reset with the push button when control has a lockout error.

6.3.2 Flame Detection

When the Valiant FT is running but the flame is not detected anymore, the gas valve will be closed and the control will perform a post-purge, after which a restart will take place. When the flame disappears 3 times within one heat demand the control will lockout.

The presence of a flame is measured using the flame rod which points into the flame. When a flame is present, the free electrons in the flame flow from the flame rod to ground.

This flow of electrons is the flame current. The flame current is measured by the control as ionization in uA.

When the flame current is above *1.5uA*, the Valiant FT will register a flame.

When the flame current is below *1,0uA*, the flame will be registered as extinguished.

PART 7 ERROR TABLE

There are three different type of error-groups:

Locking Errors (Manually reset via the reset button)
Blocking Errors (Automatically reset when the error is resolved)
Warnings (will disappear when the warning is resolved; not stored in history)

Table 14: Lockout Codes

#	Description
1	Unconfigured safety data
2	Waiting for safety data verification
3-46, 58-60, 97-99, 143-148, 172-178	Internal Fault. Replace SOLA Controller
47	Flame rod to ground leakage
48	Static Flame
49	24VAC low/high
50	Modulation Fault
64	Fan speed not proved, ignition failure
67	Interlock Off, safety circuit is open
79	Heater Outlet high limit tripped
82	Stack limit tripped (PVC: 149˚F, CPVC: 194˚F, 250˚F)
105	Flame detected out of sequence
106	Flame lost if Main Flame Establishing Period (MFEP)
107	Flame lost early in run
108	Flame lost in run
109, 110	Ignition failed
112	Pilot test flame timeout
113	Flame circuit timeout
137	Interlock failed to close; safety circuit is open
149	Flame detected

Figure 38: Lockout Condition (Home screen)

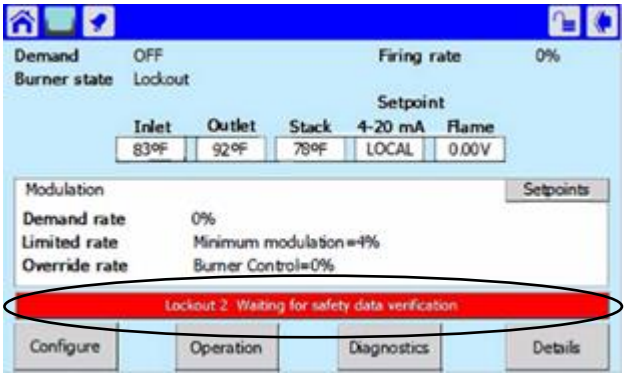


Figure 39: Lockout Condition (lockout screen)

To eliminate the lockout error,

1. Press the red bar, as circled above
2. Press the [Lockouts] button
3. Press [Clear Lockout]

Table 15: Alert Codes

#	Description
29	Burner switch turned OFF
30	Burner switch turned ON
61	Anti-short Cycle
62	Fan speed not proved
63	LCI off, safety circuit is open
68	Setpoint was overridden due to sensor fault
69	Modulation was overridden due to sensor fault
81	Delta-T limit exceeded (70˚F)
110	Ignition failure occurred
123	Modulation rate was limited due to outlet limit
124	Modulation rate was limited due to Delta-T limit
215	No Lead Lag slaves available to service demand
219	Using backup Lead Lag header sensor due to sensor failure
229	Lead lag slave communication timeout.
275-281	LCI off, safety circuit is open
283	Demand off during measured purge time
291	Abnormal Recycle: Flame was not on at end of Ignition period
292	Abnormal Recycle: Flame was lost during Main Flame Establishing Period
293	Abnormal Recycle: Flame was lost early in Run
294	Abnormal Recycle: Flame was lost during Run
303-310⁺	Interlock Off, safety circuit is open
324, 374-379	Hardware flame bias. Flame sensor wire needs to be re-routed.
352⁺	Stack sensor fault
355⁺	Outlet sensor fault
357⁺	DHW sensor fault
359⁺	Inlet sensor fault
460	LCI lost in run
550	Delta T inlet/outlet limit was exceeded
614	Lead boiler was rotated due to measured run time

* If an internal hardware fault is detected, contact Camus Technical Support for troubleshooting procedure.
⁺ The alarm LED and alarm contacts closed and remain closed until the 'RESET' button is pressed.

PART 8 MAINTENANCE

CAUTION

It is important that all gas appliances be serviced by qualified technicians. It is in your own interest and that of safety to ensure that all local codes, and all the "NOTES" and "WARNINGS" in this manual are complied with. The serviceman must utilize a combustion analyzer with CO_2 and CO to set the appliance according to Camus® Hydronics recommendations.

CAUTION

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation.

Listed below are items that must be checked to ensure safe reliable operations. Verify proper operation after servicing.

8.1 EXAMINE THE VENTING SYSTEM

Examine the venting system at least once a year. Check more often in the first year to determine inspection interval. Check all joints and pipe connections for tightness, corrosion or deterioration. Flush the condensate drain with water to clean. Have the entire system, including the venting system, periodically inspected by a qualified service agency.

WARNING

THE HEAT EXCHANGER UTILIZES A CERAMIC FIBER MATERIAL REFRACTORY WHICH, AT HIGH TEMPERATURES ABOVE 1750°F, CAN CONVERT INTO CRISTOBALITE. THE INTERNATIONAL AGENCY FOR RESEARCH ON CANCER (IARC) HAS CONCLUDED, "CRYSTALLINE SILICA INHALED IN THE FORM OF QUARTZ OR CRISTOBALITE FROM OCCUPATIONAL SOURCES IS CARCINOGENIC TO HUMANS (GROUP 1)."

AVOID BREATHING DUST AND CONTACT WITH SKIN AND EYES.

Follow the Precautions Below:

• Use a NIOSH certified dust respirator (N95). This type of respirator is based on the OSHA requirements for Cristobalite at the time this document was written. Other types of respirators may be needed depending on job site conditions. Current NIOSH recommendations can be found on the NIOSH website: http://www.cdc.gov/niosh/homepage.html. NIOSH approved respirators, manufacturers, and phone numbers are also listed on this website.
• Wear long-sleeved, loose fitting clothing, gloves, and eye protection.
• Apply enough water to the combustion chamber lining to prevent dust.
• Wash potentially contaminated clothes separately from other clothing. Rinse washer thoroughly.
NIOSH stated First Aid.
• Eye: Irrigate immediately.
• Breathing: Fresh air.

8.2 CLEANING BOILER HEAT EXCHANGER

1. Shut down boiler:
   a.) Turn the main power off to the boiler.
   b.) Shut off gas supply at the main manual valve.
   c.) DO NOT drain the boiler unless it will be exposed to freezing temperatures. If using antifreeze fluid in the heat exchanger, DO NOT drain!
2. Allow time for the boiler to cool to room temperature if it has been firing.
3. Remove igniter and flame sensor electrodes. If necessary, clean with steel wool. DO NOT use sandpaper.
4. Remove the fan/ venturi assembly from the heat exchanger.
5. Remove burner.
6. Examine burner and clean if required.
7. Examine heat exchanger surfaces to determine if cleaning is required. If cleaning is required remove the nuts fastening the heat exchanger plate from the heat exchanger.
8. Remove all the gaskets and refractory from the Heat exchanger combustion chamber.
9. Disconnect the condensate fitting from the heat exchanger and connect a hose (field supplied) directly to the bottom of the heat exchanger to drain.
10. Use a vacuum cleaner or shop-vac to remove any debris that has collected on the heat exchanger surfaces. DO NOT use any type of solvent
11. Brush the heat exchanger with a nylon bristle brush. DO NOT use a metal brush. Re-vacuum the heat exchanger.
12. Finish cleaning by wiping down the boiler heating surfaces with a clean, damp cloth.
13. Rinse out any additional debris with a low-pressure water supply.
14. Re-install the heat exchanger top plate and fasten the top plate nuts to heat exchanger.
15. Re-connect the fan assembly to the boiler mixing tube, burner, igniter, flame sensor, and fan/ mixing tube assembly. Fasten the nuts back to the heat exchanger assembly.
16. Re-connect the condensate hose to the heat exchanger.

NOTE

All gaskets on disassembled components must be replaced with new gaskets/sealant on re-assembly, if required. Gasket kits are available from the factory.

CAUTION

When the vent system is disconnected for any reason it must be reassembled and resealed according to vent manufacturer's instruction.

8.3 CONDENSATE TREATMENT

Condensate occurs when the products of combustion are cooled below their dew point in the heat transfer process. The liquid condensate formed from this high efficiency heat transfer process is mildly acidic.

The condensate will typically have a pH ranging from 4.0 to 5.0 as it is discharged from the condensate drain of the appliance.

The condensate collection box inside each Valiant FT Series II boiler where the condensate is collected is constructed of a non-corrosive material.

All materials external to the appliance in contact with the condensate must be corrosion resistant.

Condensate must be able to flow freely from the appliance. All condensate flow is accomplished by gravity requiring a minimum downward slope of 1/4" per foot (21mm/m) to ensure proper flow to a suitable drain.

All condensate piping and connections must be easily accessible for routine maintenance and inspection.
Use solid piping when running condensate line across the floor.

Check neutralized pH level regularly or as required by local jurisdiction. Replace neutralizer medium as required.
There are several factors affecting amount of condensation created by the appliance, however for rough approximation use.

Condensation Volume, US Gallon/Hr = Input, MBH/1000 x 5.0

Many jurisdictions will require the acidic condensate to be neutralized before it can be placed in a drain system.

8.4 IGNITER AND FLAME SENSOR ELECTRODES

The direct spark igniter is to be checked at every service interval. Clean the direct spark igniter as required to maintain peak ignition efficiency.

1. Turn off main electrical power to the appliance.
2. Turn off main manual gas shutoff to the appliance.
3. Locate the direct spark igniter and flame sensor.
4. Disconnect the power lead to the direct spark igniter and flame sensor
5. Loosen and remove the two (2) torx screws that hold the igniter and flame sensor to the heat exchanger flange.
6. Pull the igniter horizontally out of the heat exchanger flange. Use care, do not hit or break the igniter leads.
7. Remove any debris that has accumulated on the electrodes using steel wool. If the electrodes cannot be cleaned to their original appearance, replacements are needed. Do not use sandpaper since this will contaminate the surface.
8. Check that the igniter and flame sensor gaskets are still in good condition (no tears or seams). If the gaskets are in good condition the electrodes can be re-installed back to the heat exchanger flange.
9. Check that the igniter gap is 13/64".
10. Re-install and tighten the mounting screws.

CHECK IGNITER GROUND WIRING

1. Inspect boiler ground wire from the heat exchanger flange to ground on boiler. Check boiler ground wire continuity.
2. Verify that all wiring is in good condition and is securely anchored

8.5 BURNER MAINTENANCE

The burner should be removed for inspection and cleaning on an annual basis. An appliance installed in a dust or dirt contaminated environment will require inspection and cleaning on a more frequent schedule. The fan assisted combustion process may force airborne dust and dirt contaminants, contained in the combustion air, into the burner. With sustained operation, non-combustible contaminants may reduce burner port area, reduce burner input or cause non-warrantable damage to the burner. Never operate this appliance during construction.

Airborne contaminants such as dust, dirt, concrete dust or dry wall dust can be drawn into the burner with the combustion air and block the burner port area.

8.5.1 Burner Removal and Cleaning

Access to the burner will require the following steps:

1. Turn off main electrical power to the appliance.
2. Turn off main manual gas shutoff to the appliance
3. Disconnect the gas train to the fan inlet.
4. Disconnect the fan motor power wires at the harness.
5. Remove the screws from the burner flange and then remove the burner flange to gain access to the burner.
6. The burner can now be pulled vertically out of the heat exchanger.
7. Use care to prevent damage to the knitted metal fiber of the burner surface.
8. Wash the burner with water, such as a garden hose. Never wipe or brush the surface of the burner.
9. For optimal results immerse the burner port area in a solution of dishwashing detergent and hot water. DO NOT use chlorine-based solvents or cleaning agents on the burner. Allow the burner to remain in the solution for a short period of time to remove, dust, dirt and oil or grease laden contaminants.
10. Rinse the burner thoroughly with clean water to remove any residue from the detergent cleaner.
11. The burner should be air dried after removal from the cleaning solution and rinsing.
12. Check all gaskets and replace as necessary. Gaskets affected by heat will not reseal properly and must be replaced.
13. Replace the burner in the reverse order that it was removed.

NOTE

When the combustion air fan is removed for any reason, the inlet to the burner must be covered to prevent foreign objects from falling into the burner. Always look inside the burner to check for dents. Do not place a burner back

into operation if the inner distribution screen has been dented during the service operation, call the factory for recommendations. Use care when removing and handling the burner, Sharp objects or impact may damage or tear the metal fiber surface rendering the burner unfit for service.

8.6 COMBUSTION AND VENTILATION AIR

Check frequently to be sure that the flow of combustion air to the appliance is not obstructed. Unless air is piped directly to the heater combustion air must be provided to the mechanical room with openings sized per the requirements of the current B149 or National Fuel Gas Code. The Valiant FT is setup to allow outdoor combustion air to be connected directly to the appliance. It is highly recommended that combustion air be connected directly to the appliance. For installations in a common boiler room with atmospheric appliances or if there is the possibility of negative pressure in the boiler room, the air inlet must be piped directly to the Valiant FT.

COMBUSTIBLE MATERIALS

CAUTION

Keep appliance clear from combustible materials; do not store GASOLINE and other flammable vapors and liquids in the proximity of the appliance.

8.7 FREEZE PROTECTION FOR INDOOR & OUTDOOR INSTALLATIONS

Installations are not recommended in areas where the danger of freezing exists. Proper freeze protection must be provided for appliances installed outdoors, in unheated mechanical rooms or where temperatures may drop to the freezing point or lower. If freeze protection is not provided for the system, a low ambient temperature alarm is recommended for the mechanical room. Damage to the appliance by freezing is non-warrantable.

Location - Heating boilers, hot water supply boilers or water heaters must be located in a room having a temperature of at least 40ºF (5ºC).

A mechanical room operating under a negative pressure may experience a downdraft in the flue of an appliance that is not firing. The cold outside air may be pulled down the flue and causing a frozen heat exchanger. This condition must be corrected to provide adequate freeze protection.

CAUTION

Verify proper operation after servicing!

PART 9 PIPING DIAGRAMS

Figure 40: Single Boiler Hydronic Heating Zoned Piping

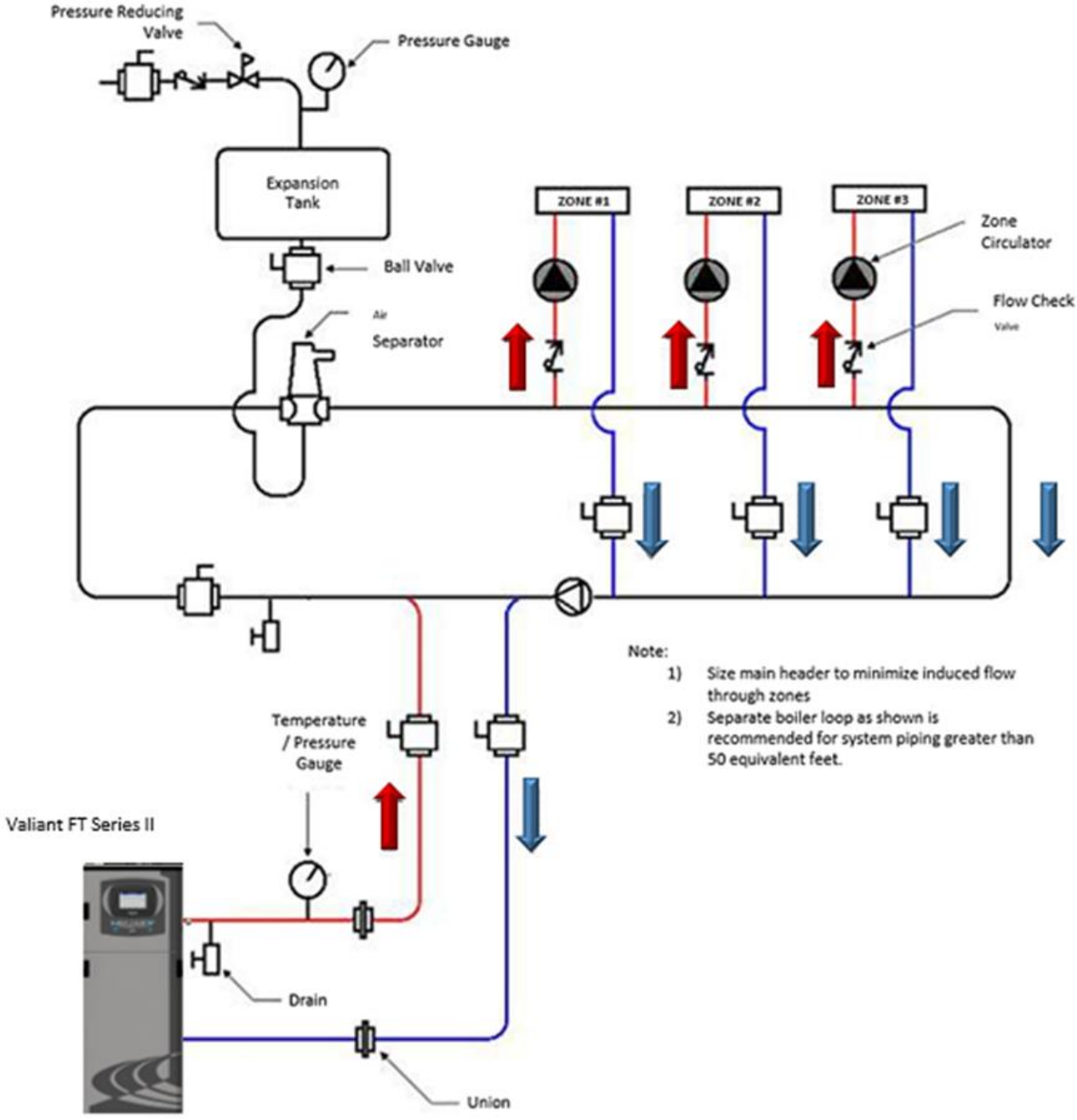


Figure 41: Multiple Boiler Hydronic Heating Zoned Piping

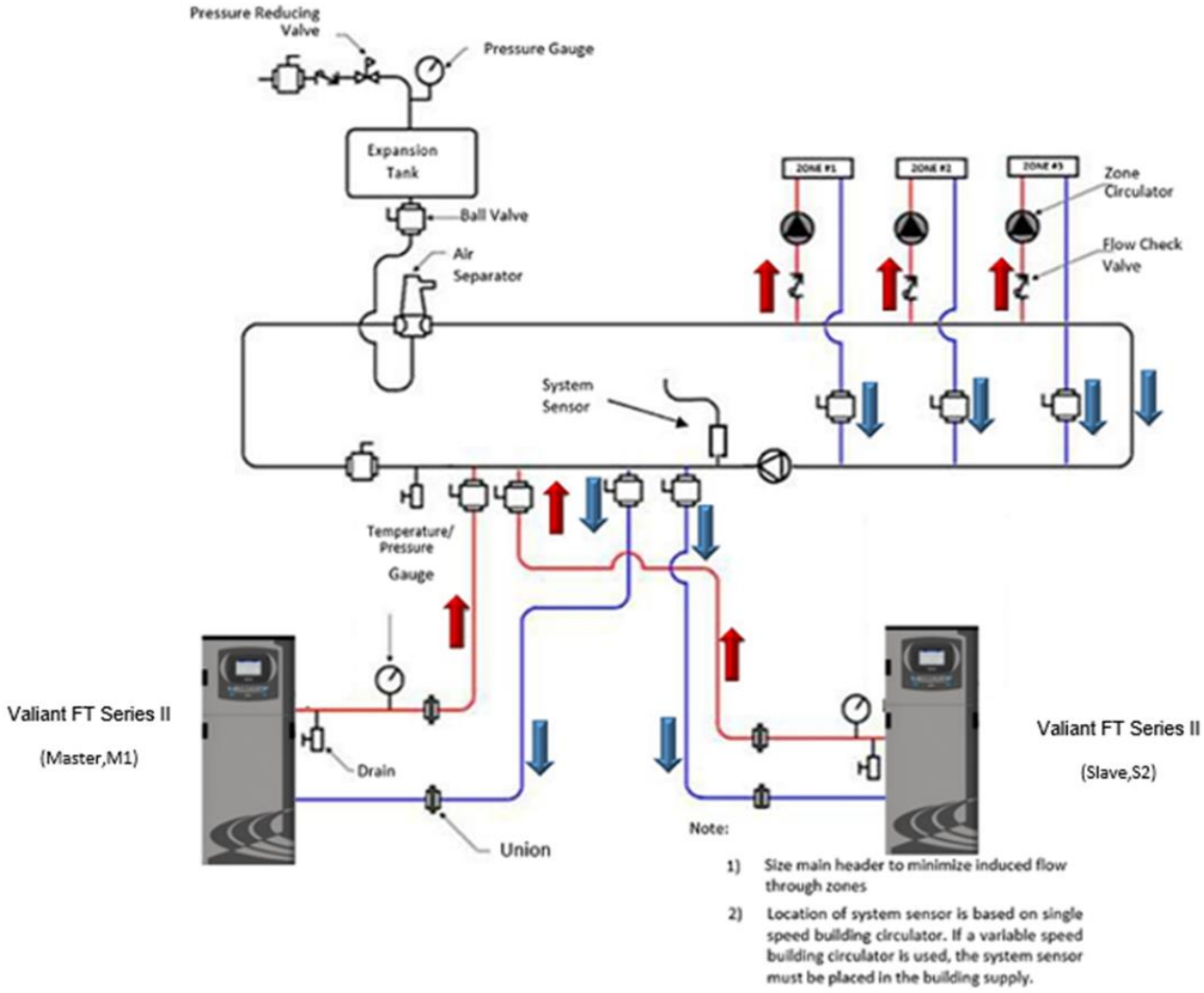
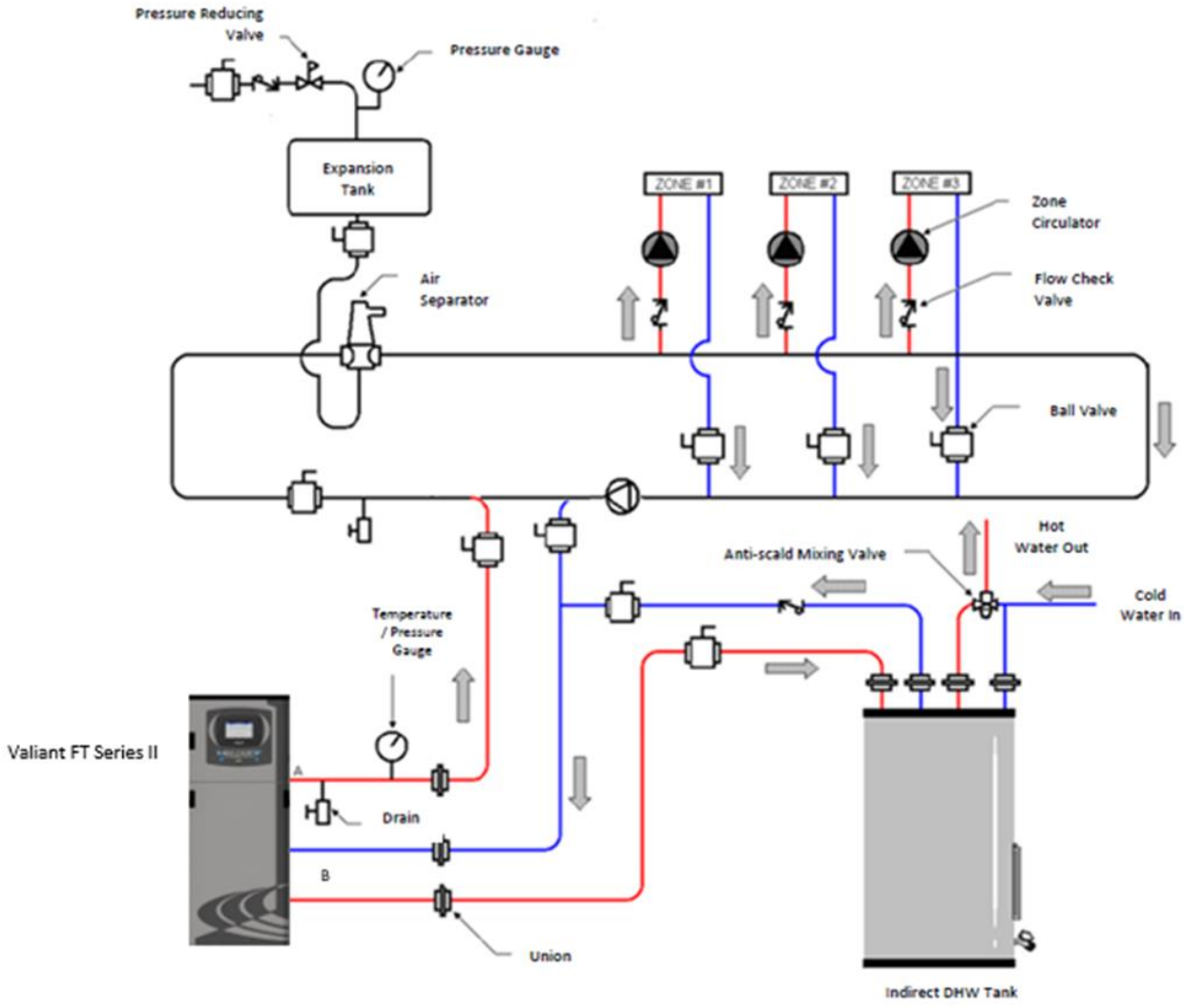


Figure 42: Single Boiler with DHW Tank Hydronic Heating Zoned Piping

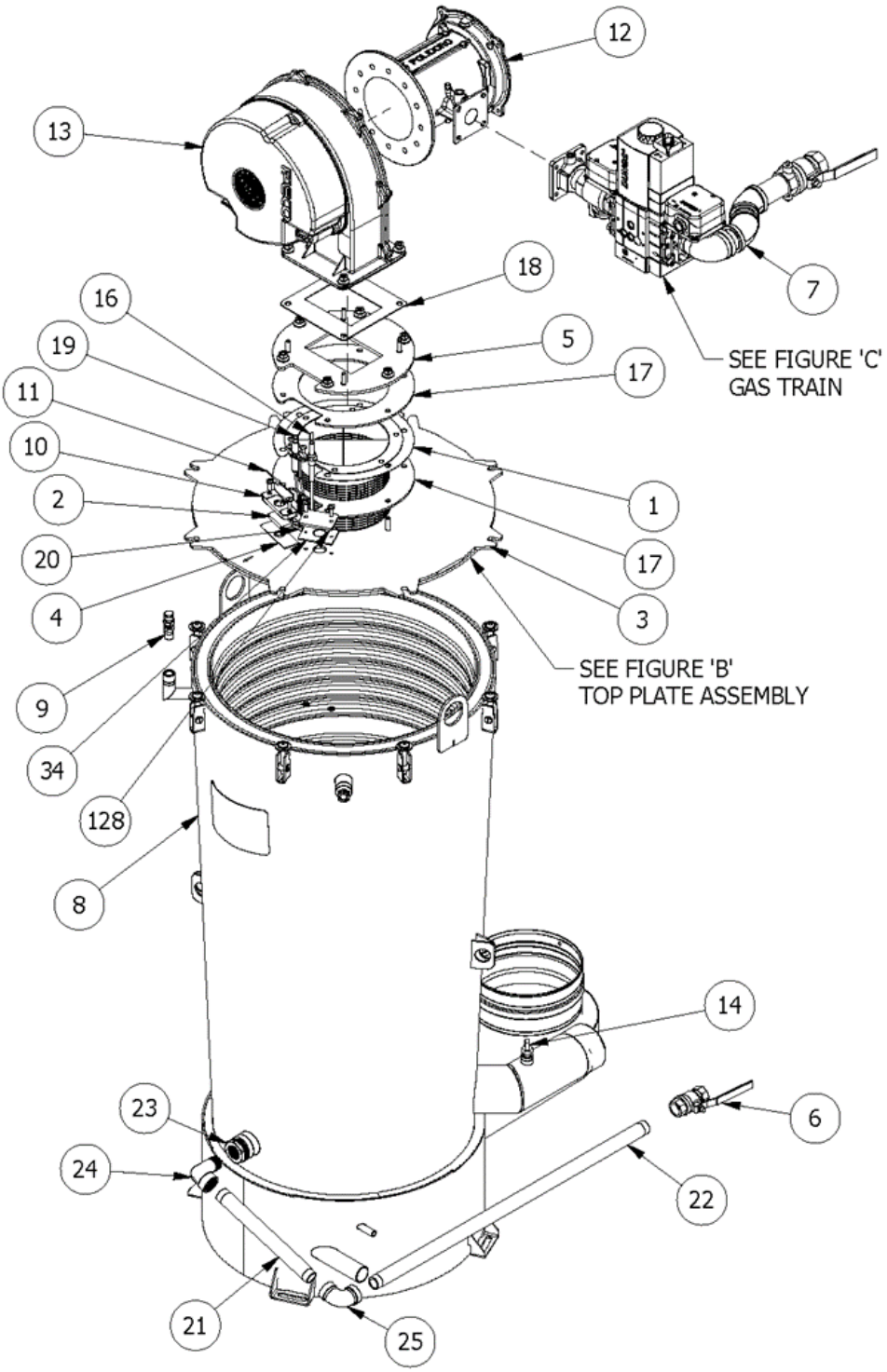


Note:

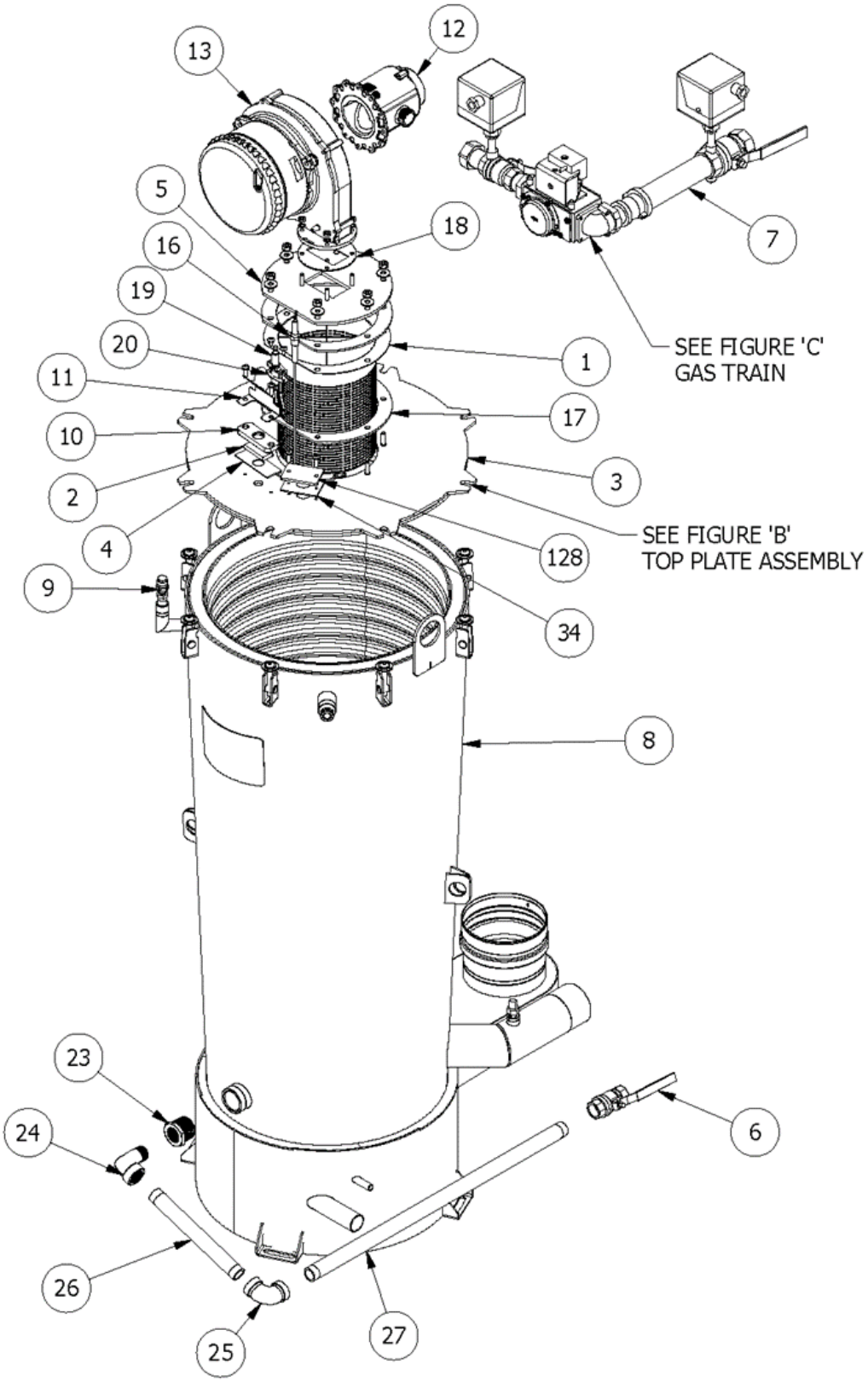
1) Size main header to minimize induced flow through zones
2) Separate boiler loop as shown is recommended for system piping greater than 50 equivalent feet.

PART 10 PARTS LIST

FIGURE 'A'
VALIANT SERIES II 850-600



VALIANT SERIES II 500



VALIANT SERIES II 400

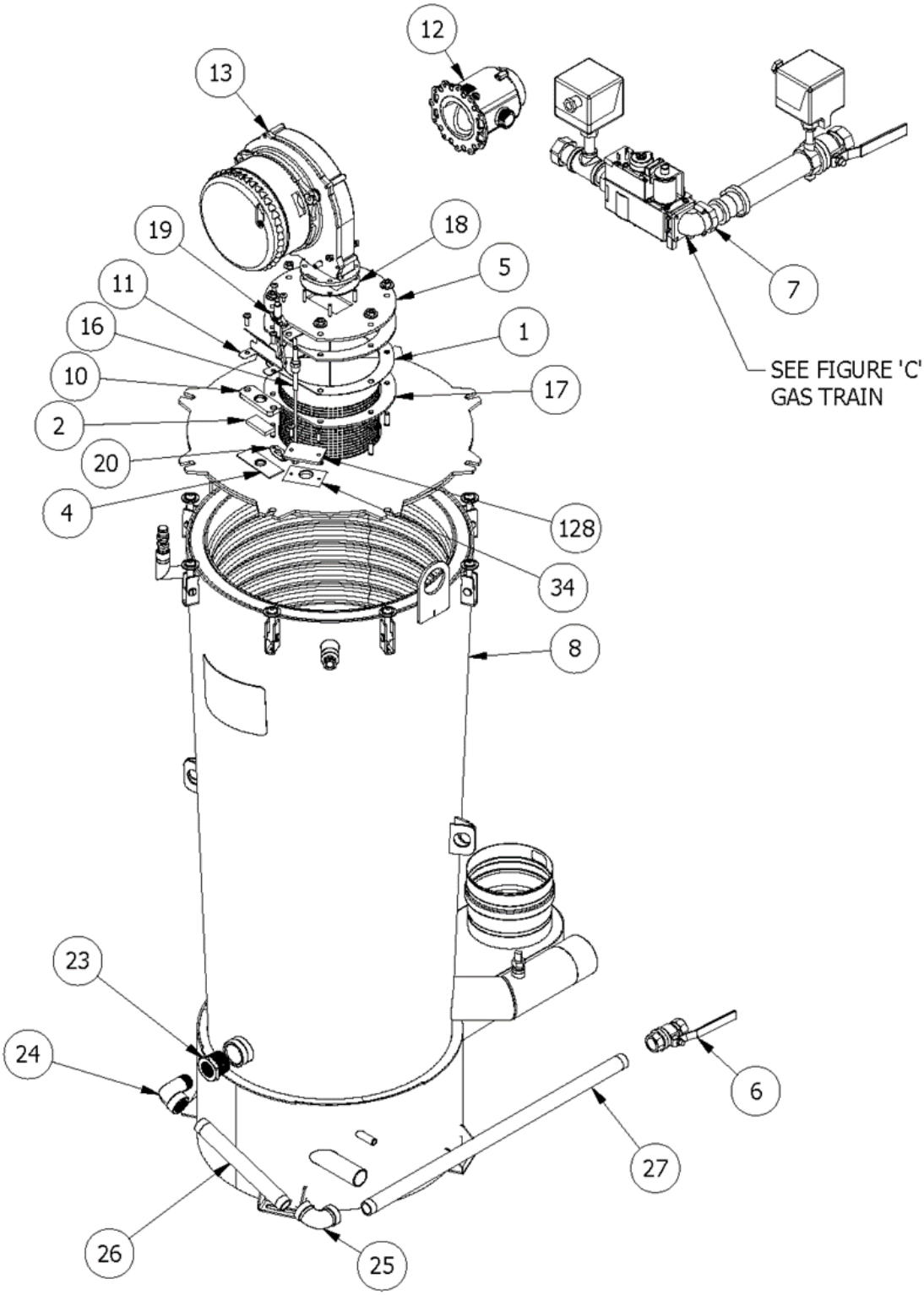
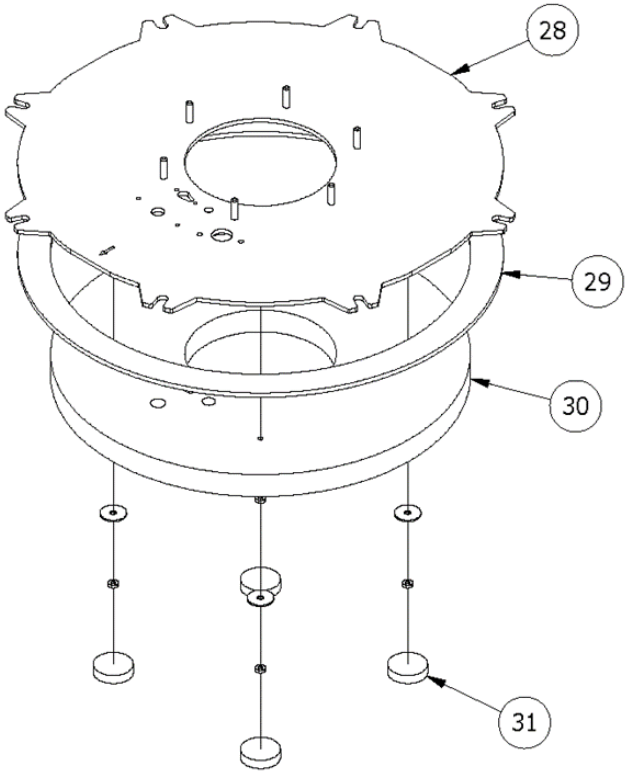


FIGURE 'B'
VALIANT TOP ASSEMBLIES

VALIANT SERIES II HEX TOP ASSEMBLY 850-725



VALIANT SERIES II HEX TOP ASSEMBLY 600-400

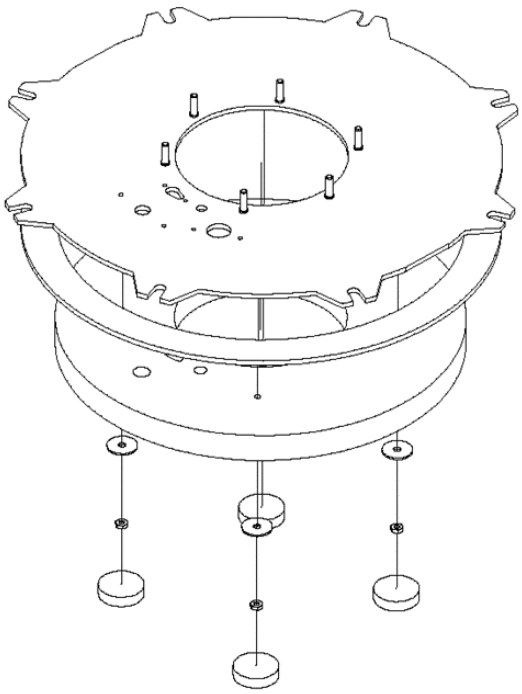
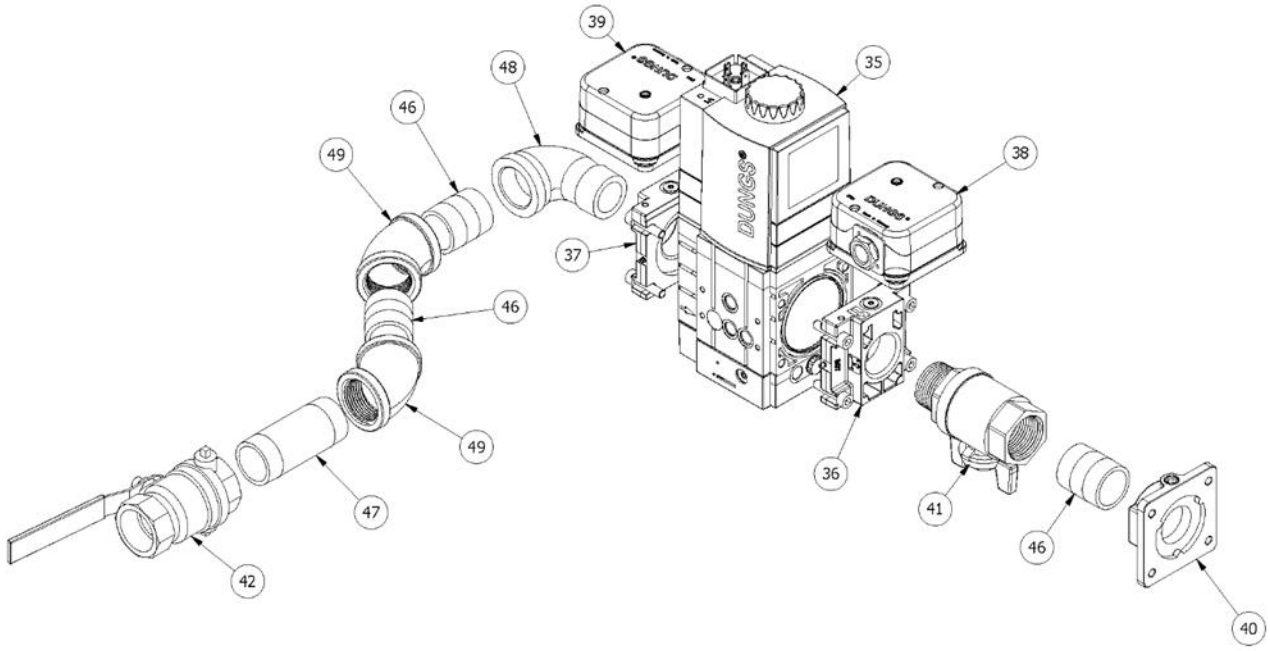
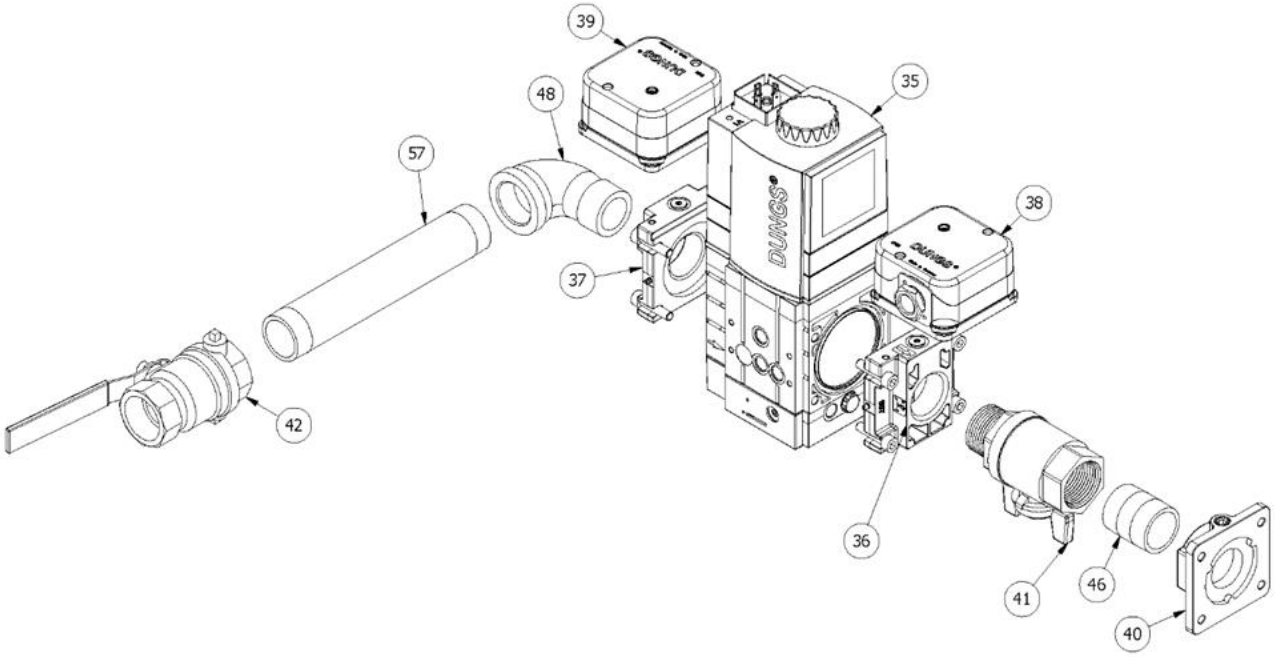


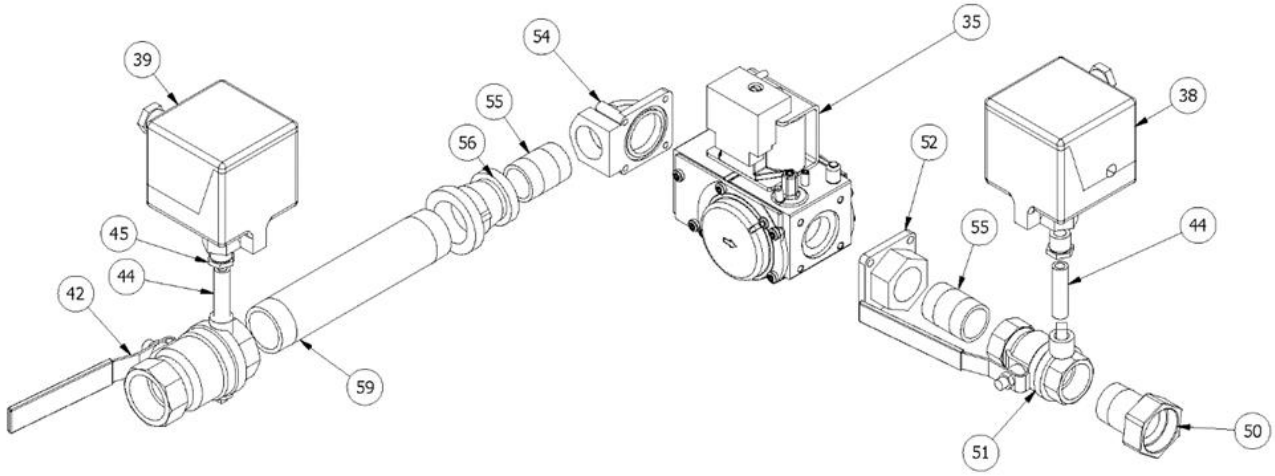
FIGURE 'C'
Valiant Series II 850-725 Gas Train



Valiant Series II 600 Gas Train



VALIANT SERIES II 500 GAS TRAIN



Valiant Series II 400 Gas Train

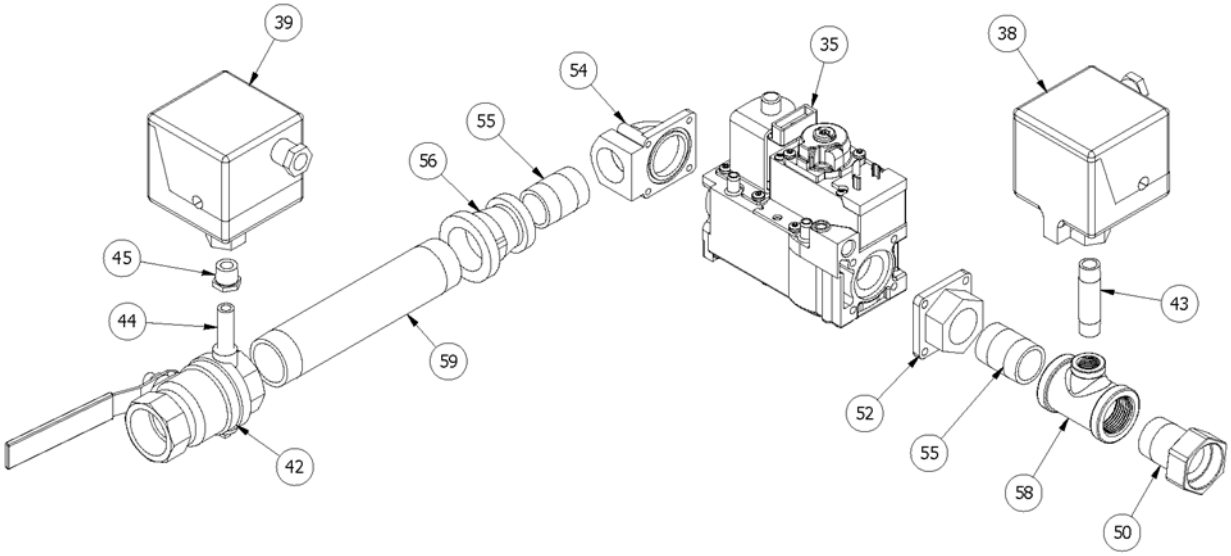


FIGURE 'D'
VALIANT SERIES II 850-400 ELECTRICAL PANEL

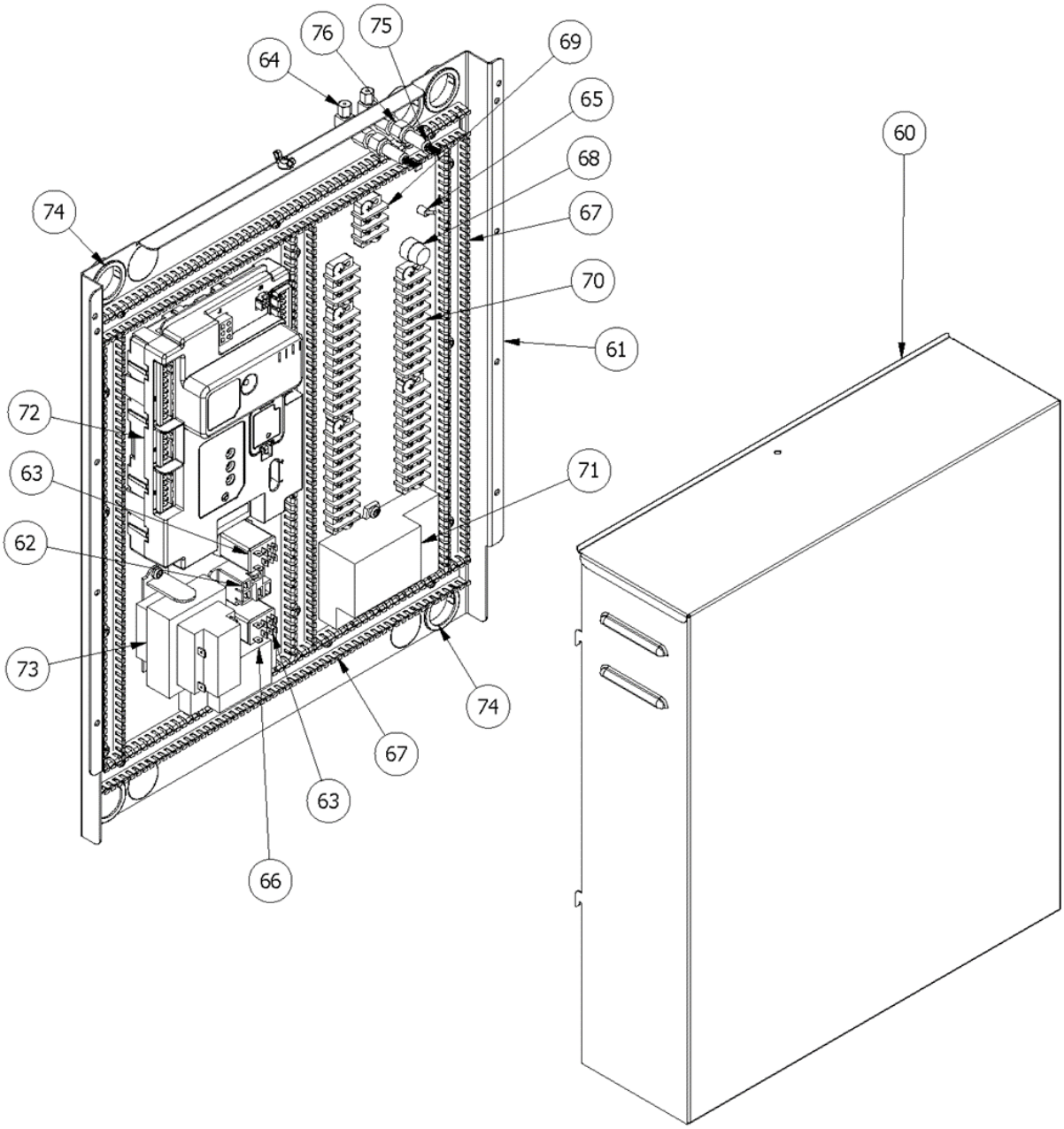


FIGURE 'E'
VALIANT SERIES II JACKET ASSEMBLY

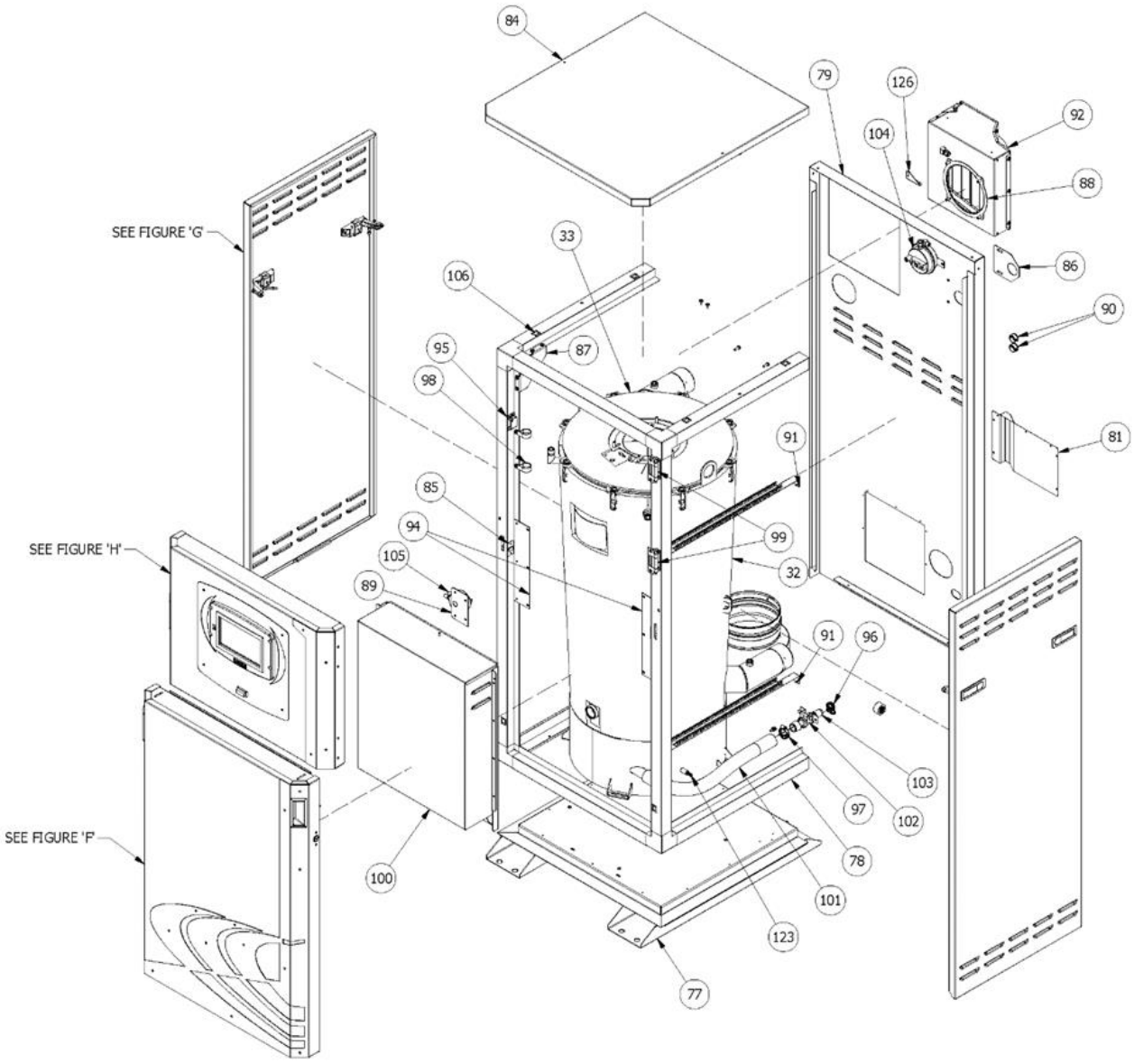


FIGURE 'F'
VALIANT SERIES II BOTTOM FRONT PANEL

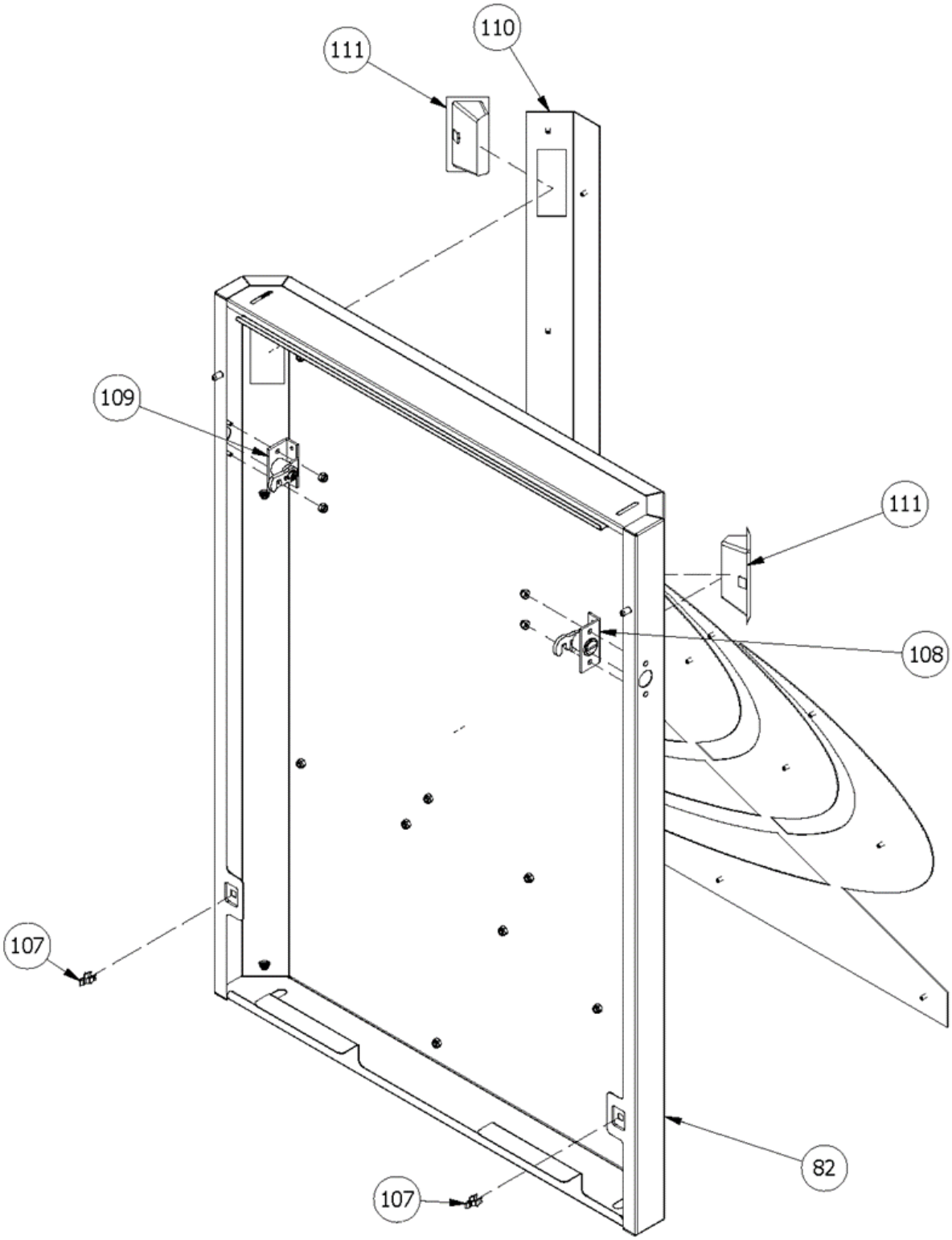


FIGURE 'G'
VALIANT SERIES II SIDE PANEL

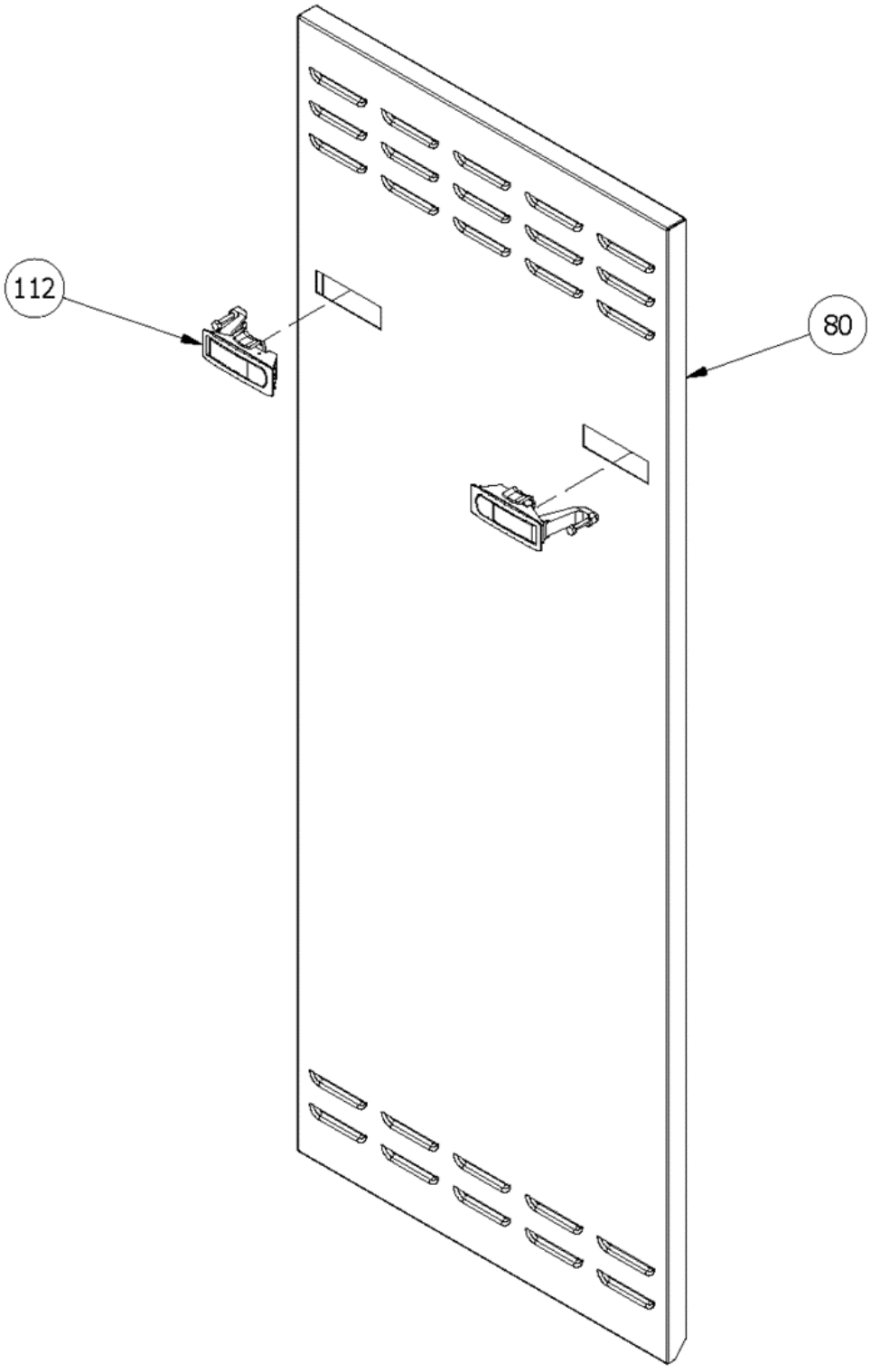


FIGURE 'H'
VALIANT SERIES II FRONT DOOR

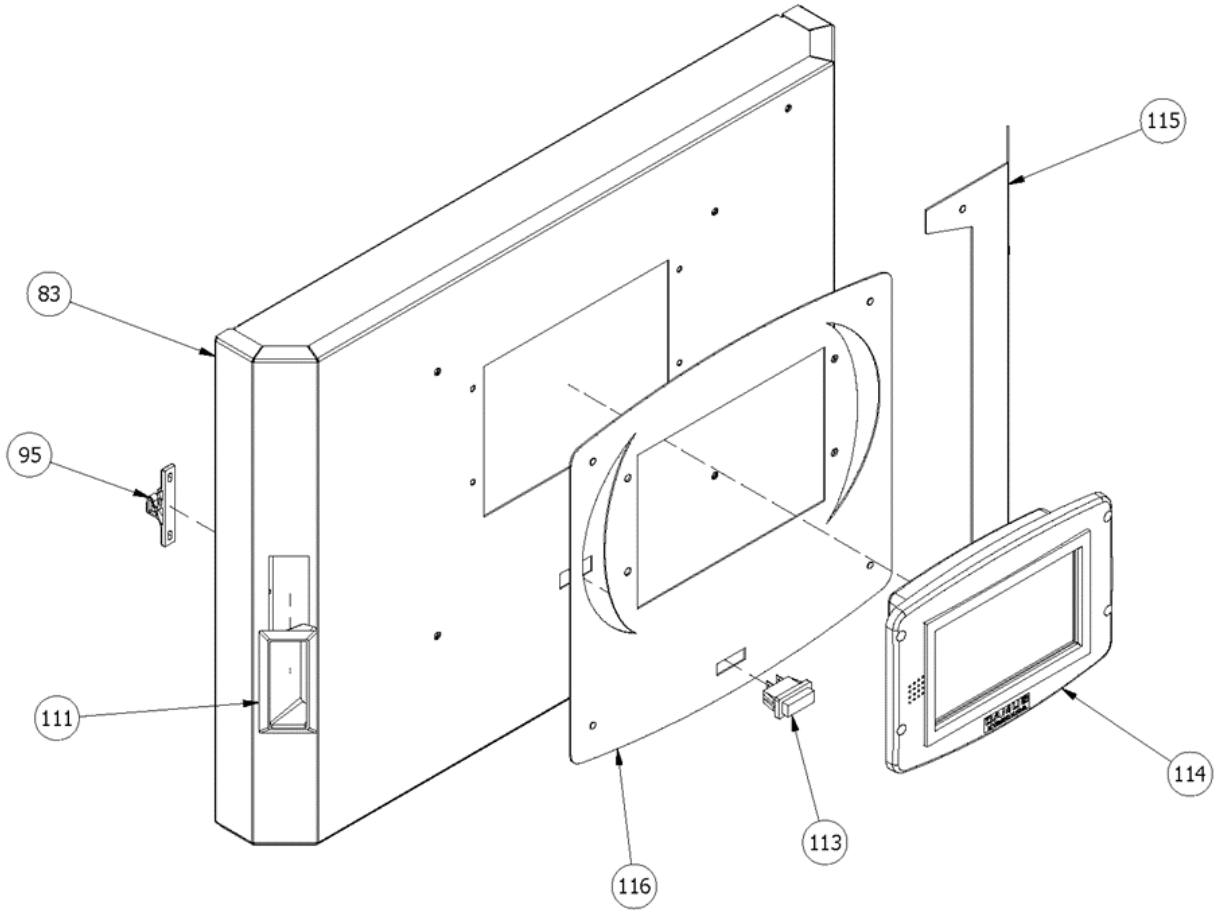
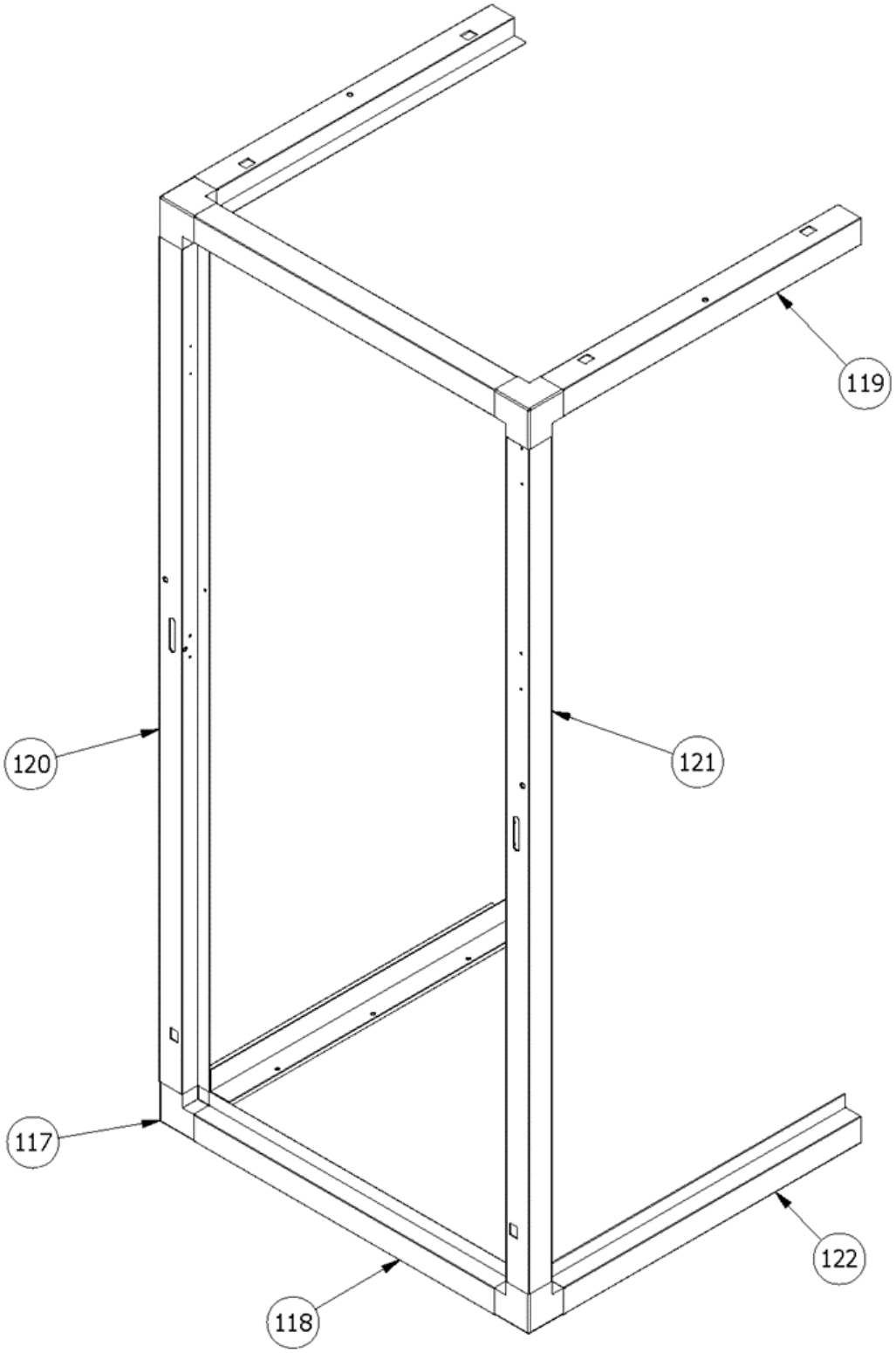


FIGURE 'I'
VALIANT SERIES II FRAME



Item #	Figure	Part Description	Part Number	Valiant-FT Series II Models					
				All	850	725	600	500	400
1	A	Burner	829-01779-100		x	x			
			829-01780-100				x		
			829-01780-000					x	x
2	A	Burner Sight Glass	851-06444-000	x					
3	A	Heat Exchanger Top Assembly	019-02752-000		x	x			
			019-02769-000				x	x	x
4	A	Sight Glass Gasket	032-24592-000	x					
5	A	Blower Connection Plate	059-00147-000		x	x	x		
			059-00147-002					x	x
6	A	1/2" Ball Valve	223-01366-000	x					
7	A	Gas Train Assembly	059-00147-000		x	x			
			257-01123-000				x		
			257-01124-000					x	x
8	A	Heat Exchanger	651-00114-000		x				
			651-00113-000			x			
			651-00112-000				x	x	
			651-00117-000						x
9	A	Purge Valve	957-05311-000	x					
10	A	Sight Glass Holder	285-03645-000	x					
11	A	Sight Glass Mirror	789-02428-000	x					
12	A	High Modulation Venturi	813-00006-055		x				
			813-00006-050			x			
			813-00006-150				x		
			813-00004-044					x	
			813-00004-135						x
13	A	Blower	813-02804-000		x	x	x		
			813-02796-000					x	x
14	A	Hot Water Sensor	817-11135-000	x					
15	A	Burner Plate	829-00030-000		x	x			
			059-00151-000						x
16	A	PSE-CH13 Flame Sensor	834-02000-000	x					
17	A	Burner Gasket	853-02552-000		x	x			
			853-02152-000				x	x	
			853-00010-000						x
18	A	Blower Gasket	853-02555-000		x	x			
			853-02153-000				x		
			032-00104-000					x	x
19	A	DM Series Electrode Ignitor	873-01018-001	x					
20	A	Ignitor Gasket	853-09579-000	x					
21	A	1/2" x 8" Black Pipe Nipple	857-17214-000		x	x			
22	A	1/2" x 23" Black Pipe Nipple	857-17216-000		x	x			

23	A	1" to 1/2" Black Pipe Bushing	057-30409-000	x					
24	A	1/2" Black Pipe Street Elbow	859-01553-000	x					
25	A	1/2" Black Pipe Elbow	859-01554-000	x					
26	A	1/2" x 7" Black Pipe Nipple	857-17213-000				x	x	x
27	A	1/2" x 20" Black Pipe Nipple	857-17215-000				x	x	x
28	B	Combustion Chamber Cover Plate	059-00146-000		x	x			
			059-00148-000				x	x	
			059-00150-000						x
29	B	Combustion Chamber Seal	853-02553-000		x	x			
			853-02151-000				x	x	x
30	B	Combustion Chamber Insulation	872-01838-000		x	x			
			872-01834-000				x	x	
			872-01864-000						x
31	B	Insulation Plug	872-01838-001	x					
32	E	Foil Fiberglass Blanket	904-00204-000		x	x			
			904-00208-000				x	x	x
33	E	Ceramic Paper Top	904-00203-000		x	x			
			904-00207-000				x		
			904-00205-000					x	x
34	A	UV Block Paper Gasket	872-01838-006	x					
35	C	Solenoid Gas Valve	235-00821-000		x	x	x		
			235-00723-000					x	
			833-25180-000						x
36	C	High Trim Flange	285-00414-000		x	x	x		
37	C	Flange to 1" NPT	285-00413-000						
38	C	High Gas Switch	817-00068-000		x	x	x		
			817-00079-000					x	x
39	C	Low Gas Switch	817-00069-000		x	x	x		
			817-02416-000					x	x
40	C	1" NPT Adaptor Kit	800-00092-000		x	x	x		
41	C	1" Male-Female Ball Valve, T-Handle	223-00137-000		x	x	x		
42	C	1" Dual Port Ball Valve	223-01371-000	x					
43	C	Black Nipple - 1/4"x2"	857-17013-000						x
44	C	Black Nipple - 1/8"x1-1/2"	057-30480-000					x	x
45	C	1/4" to 1/8" Black Bushing	057-30479-000					x	x
46	C	1" Nipple Close	857-17028-000		x	x	x		
47	C	1" x 3" Nipple	857-17030-000		x	x			
48	C	1" Street Elbow	859-01477-000		x	x	x		
49	C	1" 45 Elbow	057-30430-000		x	x			
50	C	3/4" NPT Fitting to BSPP Nut 1"	157-02906-000					x	x
51	C	3/4" Ported ball valve	223-01377-000					x	x
52	C	3/4" NPT Flange Kit	285-03723-000					x	x
53	C	Gas Valve Wire Harness	826-06152-000					x	x

54	C	3/4" 90 deg elbow flange kit	285-03731-000					x	x
55	C	3/4" Nipple Close	857-17021-000					x	x
56	C	1" x 3/4" reducing coupling	221-00427-000					x	x
57	C	1" x 7" Black Nipple	857-17035-000				x		
58	C	3/4"x3/4"x1/4" NPT Black Tee	214-00271-000						x
59	C	1" x 6" Black Nipple	857-17034-000					x	x
60	D	Low Profile Electrical Box Cover	019-02635-000	x					
61	D	Low Profile Electrical back panel	136-04361-000	x					
62	D	Relay 115 VAC Omron	175-00358-000	x					
63	D	Omron LY1F 110-120VAC	175-00360-000	x					
64	D	Elbow 90 Tube to Male Pipe	216-00417-000	x					
65	D	Local Remote Switch	826-06099-000	x					
66	D	ETISO-V Analog Signal Isolation Module	832-18249-000	x					
67	D	1.5" x 1" - Wiring Duct	832-18265-000	x					
68	D	Fuseholder - 6.3 x 32mm	832-18285-000	x					
69	D	Terminal Strip Block 2 x 2	832-18287-000	x					
70	D	Terminal Strip Block 8 x 2	832-18290-000	x					
71	D	ProtoNode FPC-N34 (Optional)	833-25160-000	x					
72	D	SOLA Modulating Hydronic Control System	833-25167-000	x					
73	D	120/24V 75VA Transformer	834-03852-000	x					
74	D	1-3/8" black nylon snap bushing	848-12115-000	x					
75	D	Push-on Cap 6-7mm	158-00007-000	x					
76	D	Connector Tube to Female Pipe	001-01889-000	x					
77	E	Base	003-00252-000		x	x			
			003-00254-000				x		
			003-00253-000					x	x
78	E	Frame	446-01818-000		x	x			
			446-01934-000				x		
			446-01882-000					x	x
79	E	Rear Panel	136-04384-000		x	x			
			136-04425-000				x		
			136-04406-000					x	x
80	G	Side Panel Assembly	136-04381-000		x	x			
			136-04405-000				x	x	x
81	E	Rear cover Panel	136-04384-001		x	x			
			136-04406-001				x	x	x
82	F	Bottom Front Assembly	136-04380-000		x	x	x		
			136-04402-000					x	x
83	E	Top Front Assembly	136-04383-000		x	x	x		
			136-04403-000					x	x
84	E	Top Cover Assembly	136-04382-000		x	x			
			136-04426-000				x		
			136-04404-000					x	x

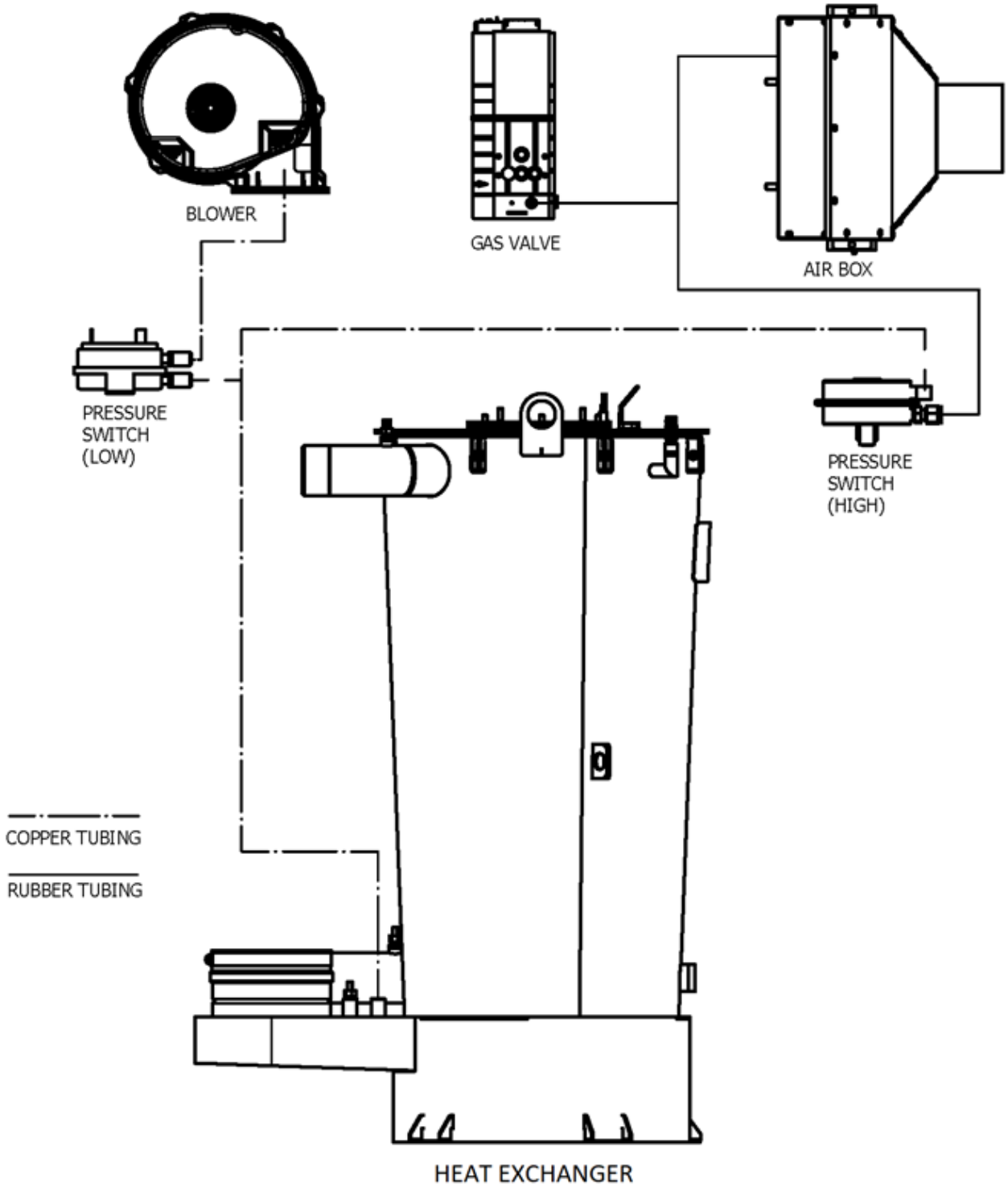
85	E	Side Latch With Pin	043-00063-000	x					
86	E	VA2 Gas Train Support	530-01097-000	x					
87	E	Corner Reinforcement	140-00880-000	x					
88	E	Air Box Gasket	853-02554-000	x					
89	E	Low Air Switch Bracket	008-06854-000	x					
90	E	7/8 Hole Bushing	847-09272-000	x					
91	E	Wiring Support Bracket	008-06855-000		x	x			
			008-06860-000				x	x	x
92	E	Filter Air Box	426-04007-000		x	x		x	x
			426-04007-100				x		
93		Air box Connector	426-04007-040					x	x
94	E	Electrical Panel Support Bracket	008-06859-000		x	x			
95	E	Door Catch 10lbs	043-00005-020	x					
96	E	Hose Clamp #8	015-00241-000	x					
97	E	Hose Clamp	015-00289-000	x					
98	E	Nylon Clamp 1"	015-00243-000	x					
99	E	Door Hinge	462-00382-000	x					
100	E	Electrical Box	848-02826-000	x					
101	E	1" ID Drain Hose	861-00368-000	x					
102	E	Drain Clamp	008-06828-000	x					
103	E	Barbed Drain Reducer	221-00474-000	x					
104	E	Air Differential Switch	817-11046-000	x					
105	E	Low Air Switch	817-11073-000	x					
106	E	Plastic Strike	037-00607-000	x					
107	F	Metal Latch	037-00606-000	x					
108	F	1057-U1 Hook Insert RH	043-00061-000	x					
109	F	1057-U2 Hook Insert LH	043-00062-000	x					
110	F	Lower Cosmetic Panel	136-04416-000		x	x	x		
			136-04422-000					x	x
111	G,H	Lid Handle	037-00608-000	x					
112	G	compression latch	043-00029-000	x					
113	H	Power Switch	817-11058-000	x					
114	H	Honeywell Touch Screen	833-25171-000	x					
115	H	Upper Cosmetic Panel	136-04417-000	x					
116	H	Cosmetic Center Panel	136-04423-000	x					
117	I	Black Nylon Corner	008-00113-000	x					
118	I	Horizontal Front and Rear Member	446-01818-006		x	x	x		
			446-01882-003					x	x
119	I	LH and RH Top Side Member	446-01818-005		x	x			
			446-01882-002				x	x	x
120	I	Front Left Vertical Member	446-01818-001	x					
121	I	Front Right Vertical Member	446-01818-002	x					
122	I	LH and RH Bottom Side Member	446-01818-004		x	x			

			446-01882-001				x	x	x
123	E	Push-on Cap 9-10MM	158-00008-000	x					
124		Flue Temp. Sensor	817-11087-000	x					
125	A	UV Sensor Plate	059-12416-000	x					
126	E	Air Box Support	530-01106-000	x					

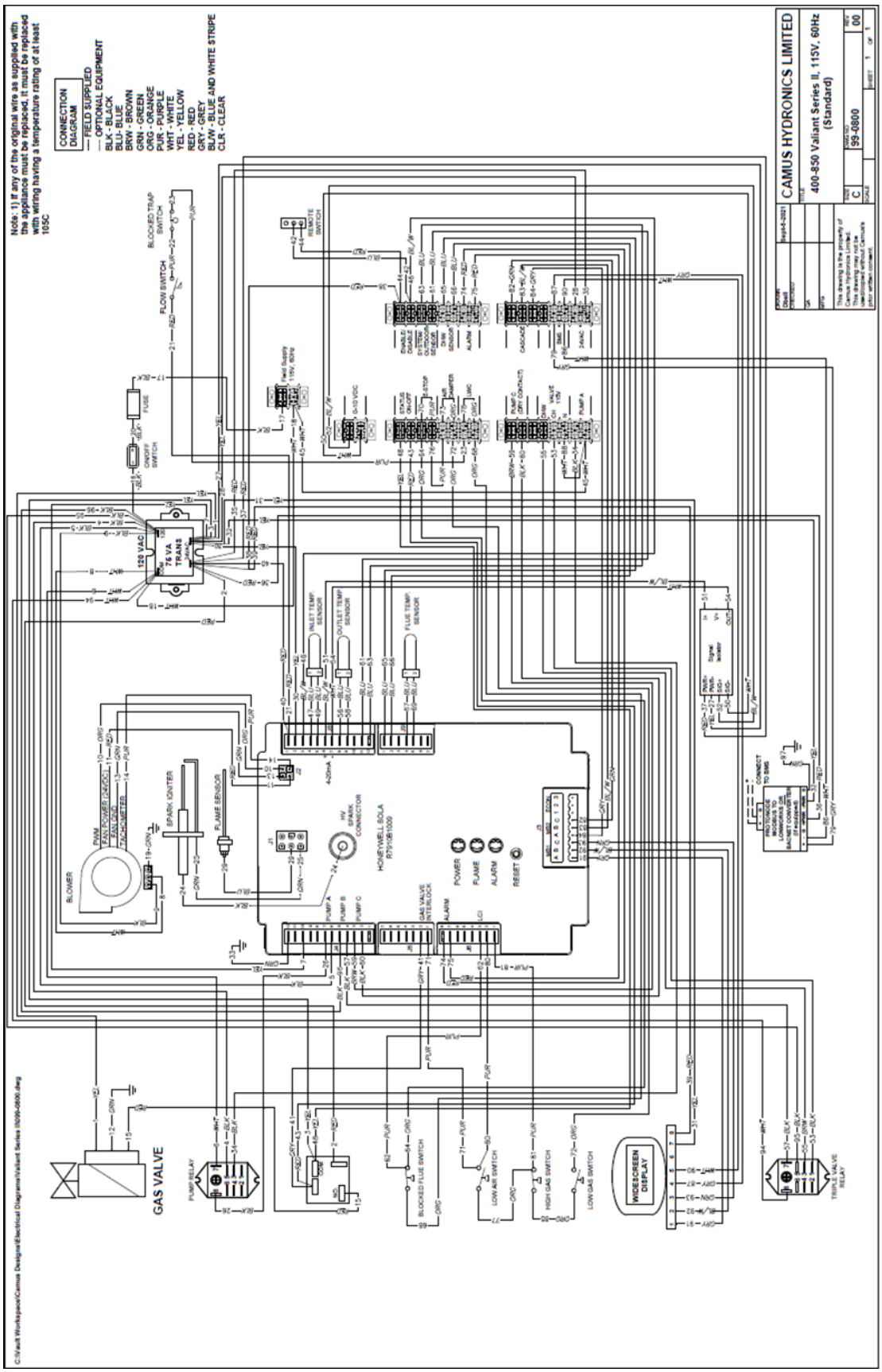
Optional & Propane Parts

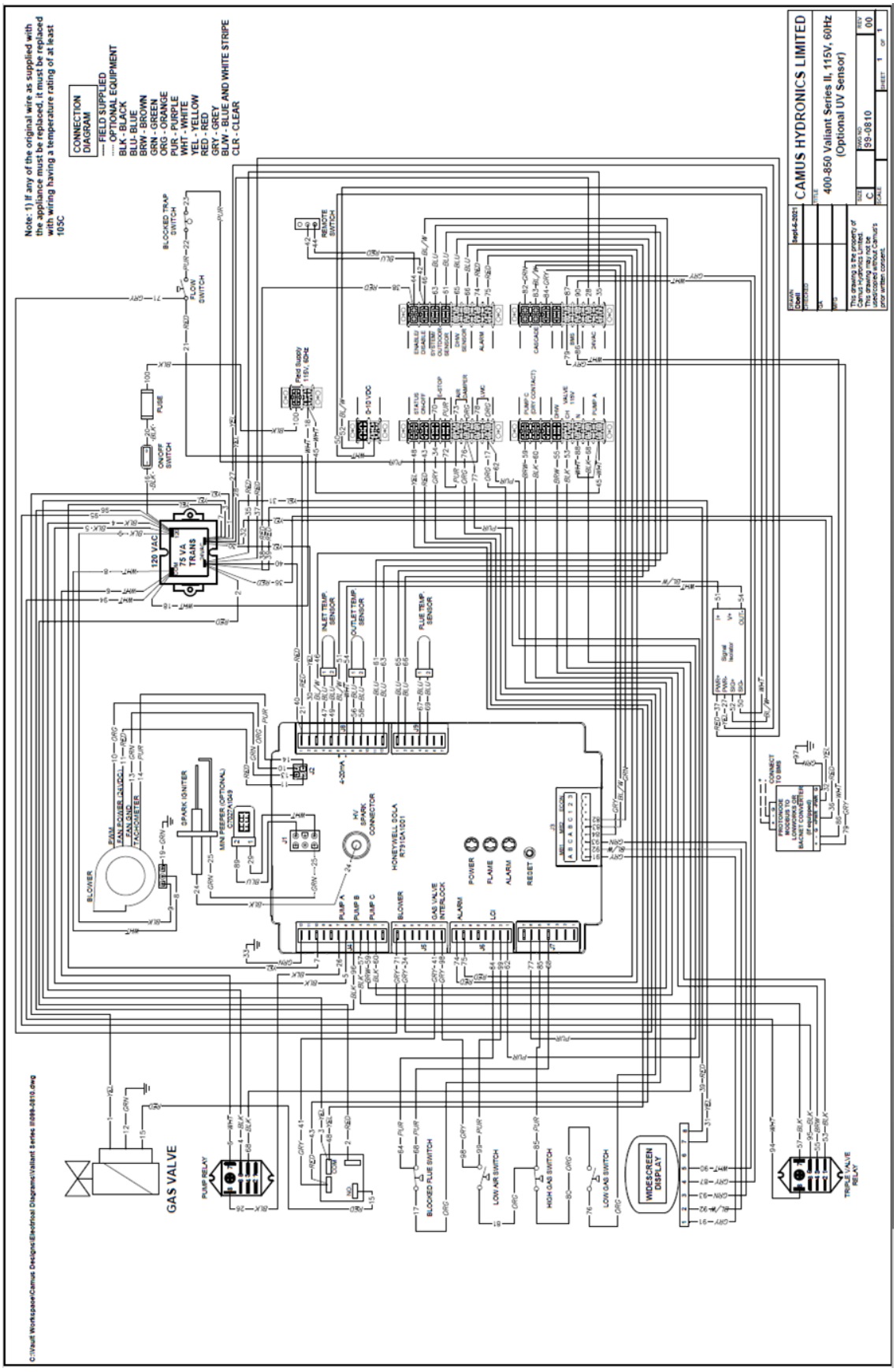
Figure		Part Description	Part Number	Valiant-FT Series II Models					
				All	850	725	600	500	400
129		Venturi (Propane)	048-00655-000		x	x	x		
			813-00004-344					x	x
130		UV Sensor	817-00654	x					
131		UV Sensor Holder Block	001-01957-000	x					
132		1/2” NPT Sight Pipe	857-05100-000	x					
133		Honeywell Heat Block	001-01584-000	x					
134		1/8" Black Plug	858-11519-000	x					
135		Rain Screan Protector	008-06827-000	x					
136		Rain Screan Protector door	008-06827-003	x					
137		Rear Rain Cover	019-02783-000		x	x			
			016-02783-000				x		
			008-06827-100					x	x
138		Rear Rain Cover Door	008-06827-103	x					

PART 11 TUBING DIAGRAM



PART 12 WIRING DIAGRAM




Note: 1) If any of the original wire as supplied with the appliance must be replaced, it must be replaced with wiring having a temperature rating of at least 105C
CONNECTION DIAGRAM
FIELD SUPPLIED
OPTIONAL EQUIPMENT
BLK - BLACK
BLU - BLUE
BRW - BROWN
GRN - GREEN
ORG - ORANGE
PUR - PURPLE
WHT - WHITE
YEL - YELLOW
RED - RED
GRY - GREY
BLW - BLUE AND WHITE STRIPE
CLR - CLEAR
CAMUS HYDRONICS LIMITED
400-850 Valiant Series II, 115V, 60Hz
(Optional UV Sensor)
99-0810
GAS VALVE
WIDESCREEN DISPLAY

CAMUS Hydronics is a manufacturer of replacement parts for most copper finned and stainless steel water heaters and heating boilers as well as a supplier of specialty HVAC products. Our service line is open 24 hours, 7 days a week. The CAMUS CERTIFIED seal assures you that Reliability, Efficiency & Serviceability are built into every single unit. For more information on our innovative products from CAMUS Hydronics Limited, call 905-696-7800 today.