



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.

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Part 1 – General Information

1.1 – Special Instructions to Owner

This manual supplies 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.

NOTE: RETAIN THIS MANUAL FOR FUTURE REFERENCE
WARNING
It is important that all gas appliances are installed by a qualified installer/technician that is trained by CAMUS Hydronics. It is in your own interest and that of safety to ensure that all local codes, and all the following “NOTES”, “CAUTIONS”, 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 technician must utilize a combustion analyzer with CO ₂ , CO, and draft gauge, to set the appliance according to CAMUS Hydronics’ recommendations, prior to commissioning.
WARNING
To minimize the possibility of serious personal injury, fire or damage to your appliance, never violate the following safety rules
WARNING
IMPROPER INSTALLATION, ADJUSTMENT, ALTERATION, SERVICE OR MAINTENANCE can cause injury or property damage. Refer to this manual. For additional information, consult a qualified installer, service agency or gas supplier.
WARNING
Should overheating occur or the gas supply fails to shut off, shut off the gas supply at a location external to the appliance.
DO NOT
Do not use this appliance if any part of it has been under water . The possible damage to a flooded appliance can be extensive and present numerous safety hazards. Any appliance that has been under water must be replaced.
WHAT TO DO IF YOU SMELL GAS
Do not try to light any appliance. • Do not touch any electric switch: do not use any phone in your building. • Immediately call your gas supplier from a neighbor’s phone. Follow the gas supplier’s instructions. • If you cannot reach your gas supplier, call the fire department.
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 authorize and inspect all gas and flue connections. Installation and service must be performed by CAMUS qualified factory trained service technicians. Water heaters are heat producing appliances. To avoid damage or injury, do not store materials against the appliance or the vent-air intake system. Use proper care to avoid unnecessary contact (especially children) with the appliance and vent-air intake components. Never cover your appliance, lean anything against it, store trash or debris near it, stand on it or in any way block the flow of fresh air to your appliance. UNDER NO CIRCUMSTANCES may flammable materials such as gasoline or paint thinner be used or stored in the vicinity of this appliance, vent-air intake system or any location from which fumes could reach the appliance or vent-air intake system. A gas appliance that draws combustion air from the equipment room where it is installed must have an adequate supply of fresh air circulating around it during burner operation for proper gas combustion and proper venting.

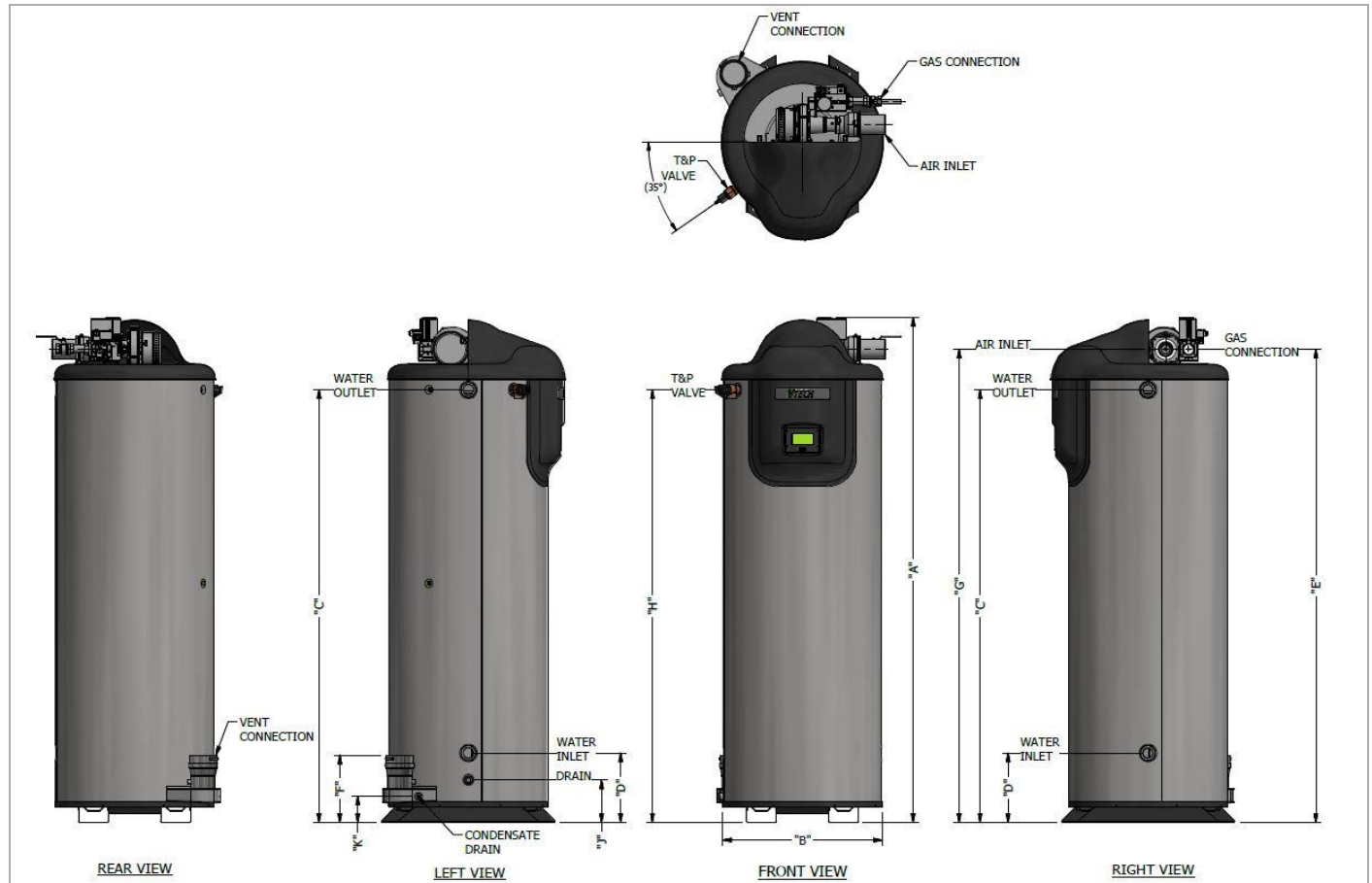
1.2 – Product Overview

The **VTech** is a condensing, direct fired, forced draft water heater with a fully passivated stainless steel storage tank. It is designed for use with a fully pressurized domestic hot water system, at working pressures up to 160 PSI. The water heater will automatically modulate to provide heat outputs between 100% and 20% of maximum design. Modulation rate is determined by the built-in digital control according to current load demands.

The **VTech** utilizes a premix power burner based on a push-through design, which offers several venting options. Fuel input is controlled by a one-to-one air/gas ratio gas valve. The operation of the blower generates a negative pressure that varies according to the current rate of modulation and current combustion air density. The gas control valve will match this pressure on the gas side, ensuring air and gas are metered in precise proportion (1:1 ratio). Steady state efficiency is maintained across the entire range of modulation, because the combustion characteristics which determine efficiency remain the same. The gas valve also automatically adjusts to changes in combustion air density caused by seasonal air temperature (or altitude) differences, providing an “inherent O₂ trim” correction to maintain the desired combustion settings.

1.3 – Product Ratings

1.3.1 – Dimensions, Connections and Weight



ALL DIMENSIONS IN INCHES

All units have 1 1/2" Water Connections and 1" Temperature & Pressure Relief Valve Connection

Model	"A"	"B"	"C"	"D"	"E"	"F"	"G"	"H"	"J"	"K"	Diameter of Vent/Intake Pipe			CAT II	Air Inlet	Ø Gas Inlet (NPT)	Ship Weight (lbs.)
											25ft to 100ft	15ft to 25ft	Up to 15ft				
0080	53	27	41	11 3/4	49 1/2	11 1/2	48	41	7 1/4	4 1/2	3	3	2	4	2	1/2	465
0100	53	27	41	11 3/4	49 1/2	11 1/2	48	41	7 1/4	4 1/2	3	3	2	4	2	1/2	465
0125	66	27	54	11 3/4	62 1/2	11 1/2	61	54	7 1/4	4 1/2	3	3	2	4	2	1/2	520
0150	66	27	54	11 3/4	62 1/2	11 1/2	61	54	7 1/4	4 1/2	3	3	2	4	2	1/2	520
0199	76	27	64	11 3/4	72 1/2	11 1/2	71	64	7 1/4	4 1/2	3	3	2	4	2	1/2	648
0250	76	27	64	11 3/4	72 1/2	11 1/2	71	64	7 1/4	4 1/2	3	3	2	4	2	1/2	739
0299	76	27	64	11 3/4	72 1/2	11 1/2	71	64	7 1/4	4 1/2	4	3	3	5	3	3/4	752
0399	76	27	64	11 3/4	72 1/2	11 1/2	71	64	7 1/4	4 1/2	4	3	3	5	3	1	752
0499	85 3/4	27	73 3/4	11 3/4	80 3/4	11 1/2	80 3/4	73 3/4	7 1/4	4 1/2	4	3	3	6	3	1	845

1.3.2 – Performance, Storage and Electrical Ratings

Model	Input [Btu/h]	Output [Btu/h]	Minimum Input [Btu/h]	Tank Capacity [US GAL.]	Tank Capacity [LITERS]	Electrical Full Load Amps*
0080	80,000	76,000	16,000	60	227	5.7
0100	100,000	95,000	20,000	60	227	5.7
0125	125,000	118,750	25,000	80	302	6.3
0150	150,000	142,500	30,000	80	302	6.3
0199	199,000	189,050	40,000	100	378	6.6
0250	250,000	237,500	50,000	100	378	6.6
0299	299,000	284,050	60,000	100	378	8.9
0399	399,000	379,050	80,000	100	378	8.9
0499	499,000	474,050	100,000	115	435	9.6

*Provide 15amp over current protection.

1.3.3 – First Hour Recovery

Model	140°F Rise GPH	78°C Rise LPH	120°F Rise GPH	67°C Rise LPH	100°F Rise GPH	56°C Rise LPH	80°F Rise GPH	44°C Rise LPH	60°F Rise GPH	33°C Rise LPH	40°F Rise GPH	22°C Rise LPH
0080	125	473	136	515	151	571	174	659	212	802	288	1090
0100	141	534	155	587	174	659	202	765	250	946	345	1306
0125	182	689	199	753	222	840	258	977	317	1200	436	1650
0150	202	765	222	840	251	950	293	1109	365	1382	507	1919
0199	262	992	289	1094	327	1238	383	1450	478	1809	667	2525
0250	303	1147	337	1276	385	1457	456	1726	575	2177	812	3074
0299	343	1298	384	1454	440	1665	525	1987	668	2527	951	3600
0399	425	1609	479	1813	554	2097	668	2529	857	3244	1236	4679
0499	521	1972	589	2230	683	2585	826	3127	1062	4020	1536	5814

1.3.4 – Continuous Recovery

Model	140°F Rise GPH	78°C Rise LPH	120°F Rise GPH	67°C Rise LPH	100°F Rise GPH	56°C Rise LPH	80°F Rise GPH	44°C Rise LPH	60°F Rise GPH	33°C Rise LPH	40°F Rise GPH	22°C Rise LPH
0080	65	246	76	288	91	344	114	431	152	575	228	863
0100	81	307	95	360	114	431	142	537	190	719	285	1079
0125	102	386	119	450	142	537	178	674	237	897	356	1348
0150	122	462	142	537	171	647	214	810	285	1079	427	1616
0199	162	613	189	715	227	859	283	1071	378	1431	567	2146
0250	203	768	237	897	285	1079	356	1348	475	1798	712	2695
0299	243	920	284	1075	341	1291	426	1613	568	2150	851	3221
0399	325	1230	379	1435	454	1718	568	2150	757	2865	1136	4300
0499	406	1537	474	1794	568	2150	711	2691	947	3585	1421	5379

1.4 – Sequence of Operation

1. Supply power connection as per Section 1.3.2.
2. The power switch is placed in the “ON” position. 120 VAC power is supplied to the control transformer. 24 VAC is supplied to the ignition module and low voltage controls for all models.
3. If a Low Water Cut-off (LWCO) is supplied, it must be closed to allow operation. The LWCO is to be wired into the appropriate contacts on the unit control panel.
4. The control activates the unit when the temperature measured by the top tank sensor drops below the setpoint (“SETPOINT”) by the programmed tank differential (“DIFF ON”).
5. The control energizes the blower, increasing the voltage to the electrically commutated DC motor on the combustion fan.
6. If the airflow switches are closed the fan will run at pre-purge speed until the pre-purge timer is satisfied.
7. After pre-purge, the control will target the ignition fan speed.
8. The control energizes the hot surface igniter for about 10 seconds. At the end of this period, the main gas valve is energized for 4 seconds, during which time the flame must be established.
9. The hot surface igniter is de-energized at the end of the ignition period.
10. At the end of the flame establishing period, a signal of 0.8 Vdc must be recognized by the controller at the flame sensor (“CURRENT”) to keep the main gas valve in an open position. The fan is kept at ignition speed until the stabilization timer is satisfied, and the main flame is established.
11. The control will enter operation and release to modulation.
12. The control will modulate fan speed through Pulse Width Modulation (PWM), adjusting water heater input to meet and then maintain target temperature.
13. Fan speeds will modulate down when the temperature measured by the temperature sensor is approaching setpoint.
14. The control will stage the unit off when the temperature measured by the top tank sensor reaches setpoint.
15. The burner will shut off and the fan speed will ramp up to post-purge speed until the post-purge timer is satisfied.
16. The unit will then go into standby until the next demand.

1.5 – Codes

The equipment shall be installed in accordance with those installation regulations in force in the local area where the installation is to be made. These shall be carefully followed in all cases. Authorities having jurisdiction shall be consulted before installations are made. In the absence of such requirements, the installation shall conform to the latest edition of the National Fuel Gas Code, ANSI Z223.1. NFPD 54 and/or CSA B149.1-15 and CSA B149.2-15 Natural Gas and Propane 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 American Society of Mechanical Engineers Safety Code for Controls and Safety Devices for Automatically Fired Boilers, ASME CSD-1. All water heaters conform to the latest edition of the ASME Boiler and Pressure Vessel Code, Section II. Where required by the authority having jurisdiction, the installation must comply with the CSA International, CSA B149.1-15 and CSA B149.2-15 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 Z21.10.3.

1.6 – Warranty

- Factory warranty (shipped with unit) does not apply to units improperly installed or improperly operated.
- Factory warranty (shipped with unit) does not apply to units with no or improperly installed or operated **pump assembly**.
- Factory warranty shall apply only when the appliance is installed in accordance with local plumbing and building codes, ordinances and regulations, the printed instructions provided with it and industry best practices.
- Excessive **water hardness** causing a scale buildup in the stainless steel coils or tubes is not a fault of the appliance and is not covered by warranty.
- Using or storing **corrosive chemicals** in the vicinity of this appliance can rapidly attack the stainless steel tubes and coils and voids warranty.
- Damage caused by **freezing or dry firing** voids warranty.
- This appliance is not to be used for **temporary service** of buildings under construction.
- The manufacturer shall **NOT** be held liable for any personal injury or property damage due to ice formation or the dislodging of ice from the vent system or the vent termination.

1.7 – Scald Prevention

Water should be stored above 122°F (50°C) to avoid the bacterial growth that happens at cooler temperatures. Bacteria won't grow above this level but are not destroyed, so systems often require water be heated to 158°F (70°C) or above to kill any bacteria that are present (140-160°F (60-71°C) is common in commercial kitchens). This temperature causes the water to become more aggressively corrosive, shortening the tank's service life, so the commonly recommended storage temperature is 140°F (60°C).

These temperatures have the potential to scald with enough exposure time, so thermostatic mixing valves that temper water to safe levels should be provided. Such valves are required in some jurisdictions. Storing and mixing water to cooler levels also increases the effective storage volume, maximizing the delivery potential of a given tank capacity.

Temperature, °F (°C)	Time for 1 st Degree Burn (Less Severe)	Time for 2 nd or 3 rd Degree Burn
110 (43)	High-end of Normal Shower Temperatures	
116 (47)	35 Minutes	45 Minutes
122 (50)	1 Minute	5 Minutes
131 (55)	5 Seconds	25 Seconds
140 (60)	2 Seconds	5 Seconds
149 (65)	1 Second	2 Seconds
154 (68)	Instant	1 Second

Part 2 – Installation

2.1 – Checking the Equipment

Check for signs of shipping damage upon receiving equipment. Pay particular attention to the powder coat stainless finish outer shell, 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 freight carrier. Pump assembly ships loose with the unit which needs to be installed in the field.

Do not attempt to pry any panel off.

If applicable, the Normally-Open dry contacts in the low water cut-off (LWCO) are to be wired into the appropriate terminals on the control board. Locate the probe type LWCO in the piping above the highest point of the water heater. In all cases check with local codes.

2.2 – Mechanical Environment

Install this appliance in a clean, dry location with adequate air supply. Due to low jacket losses from the appliance, temperatures in a typical mechanical room may be significantly colder than the rest of the structure. In cases where combustion air is being supplied into the mechanical room, the temperature may be below freezing. Supplemental heat is sometimes required to maintain ambient temperature at acceptable levels and prevent freezing of various system components.

The mechanical room **MUST NOT** be used to store corrosive or flammable chemicals, such as gasoline or paint thinner, which may be harmful to the water heater, or contaminate the combustion supply air. Such chemicals must not be stored in the vicinity of this appliance, the vent termination, or combustion air intake, or any location from which fumes could reach the appliance, the vent termination, or combustion air intake. Chillers or other equipment utilizing refrigerant should also not be installed in the same mechanical room as fuel burning appliances.

In cases where the mechanical environment is a concern, the water heater should be installed as a “sealed combustion” appliance, with combustion supply air connected directly to the blower. Please contact the factory for more information on this installation method.

2.2.1 – Freeze Protection

Freezing is less of a concern with a tank type water heater than with some other equipment, as the unit will fire when the stored water volume begins to cool. However, since the unit can be manually deactivated, installations are still not recommended in areas where the danger of freezing exists. Proper freeze protection (i.e. a supplemental heat source dedicated to the mechanical space) must be provided for appliances installed 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 not covered under warranty.

Water heaters must be located in a room with a consistent temperature of at least 50°F (10°C).

CAUTION

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 freeze a heat exchanger. This condition must be corrected to provide adequate freeze protection.

Appliance installations are not recommended outdoors in areas where danger of freezing exists. Precautions can be taken to protect the appliance from damage.

If for any reason, the unit is to be shut off where danger of

freezing exists, the following precautionary measures must be taken:

- Shut off gas supply
- Shut off water supply
- Shut off electrical supply
- Drain the water heater and connecting piping completely.

2.3 – Locating the Equipment

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. The appliance must be installed so that the ignition system components are protected from water (dripping, spraying, etc.) during appliance operation and service (circulator replacement, control replacement, etc.).

If the appliance is installed above the level of the building's distribution system, a low water cut-off device may be required above the heat exchanger inlet/outlet connections. Some local codes require the installation of a low water cut-off on all systems. Please check with the authority having jurisdiction.

Appliances located in a garage and in adjacent spaces that open to the garage and are not part of the interior space must be installed so that all burners and burner ignition devices have a minimum clearance of not less than 18" (46cm) above the floor. The appliance must be located or protected so that it is not subject to physical damage by a moving vehicle.

- **DO NOT** install this appliance in any location where gasoline or flammable vapors are likely to be present.
- 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 should be 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.
- **DO NOT** install this appliance on top of carpet flooring. The appliance must be installed on a level floor. Maintain required clearances from combustible surfaces.

Every VTech is designed for either indoor installation, where they are protected from exposure to wind, rain and weather, or outdoor installation (by using special kit). Always consider the use of a shelter such as a garden shed in lieu of direct exposure of the appliance to the elements when installed outdoors. The additional protection afforded by the shelter will help to minimize nuisance problems with electrical connections and will allow easier servicing of the appliance under severe weather conditions.

2.4 – Clearances

This appliance is suitable for alcove (a closet without a door) installation with minimum clearances to combustibles as follows:

Table 1: Clearances From Combustibles

All Models			
Top/Rear	0" (0cm)	Front	6" (15cm)
Sides	0" (0cm)	Vent	1" (2.5cm)

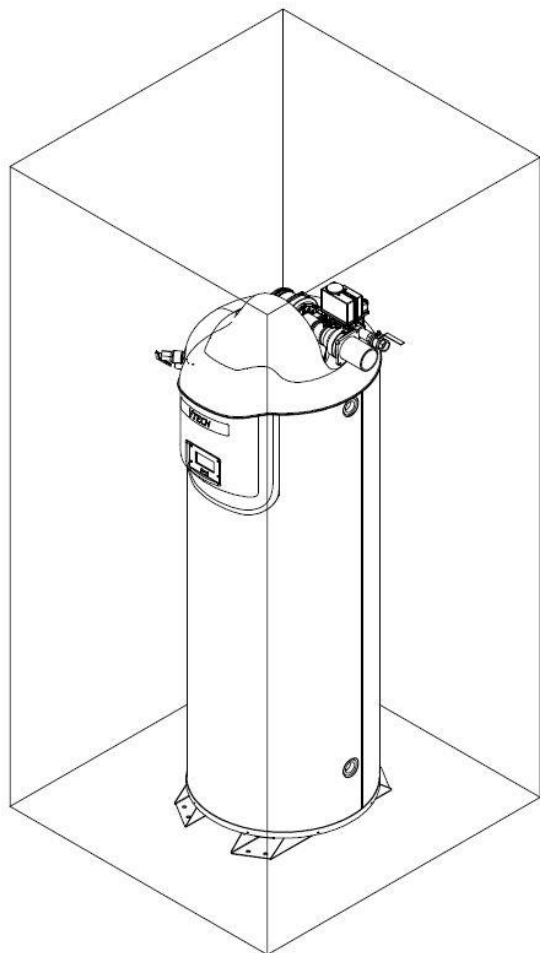


Table 2: Recommended Service Clearances

All Models				
Top	Right Side	Left Side	Back	Front
24" (60cm)	12" (30cm)	12" (30cm)	12" (30cm)	12" (30cm)

Clearances from combustible construction are noted on the appliance rating plate. When installed directly on combustible flooring, the appliance shall be installed on a metal panel extending beyond the full width and depth of the appliance by at least 3 inches (76.2mm) in any direction. The floor must be strong enough to support the full weight of the heater. When placing the appliance be aware that a minimum clearance of 24" (60cm) must be provided at the front to allow easy access to the heat exchanger. A service clearance of 24" must be provided above the top panel to allow access to the burner. Maintain specified clearances for adequate operation. All installations must allow sufficient space for servicing the vent connections, water pipe

connections, circulating pump, bypass piping and other auxiliary equipment, as well as the appliance.

2.5 – Condensate Removal and Treatment

This high efficiency appliance operates in a condensing mode due to the low temperatures of incoming water supply. 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 3.5 to 5.0 as it is discharged from the condensate drain at the rear of the appliance. Many codes will require neutralization before it can be piped to a drain system. Neutralization is recommended with every appliance.

The neutralizer consists of an industrial grade, non-corrosive reservoir for collection of the condensate, filled with a consumable fill media that raises the pH of the water. As the reservoir fills, it provides an extended residency time to neutralize the condensate. As the pH number increases in numerical value, the relative acidity of the discharge decreases. The neutralized condensate may then be discharged into a suitable drain system without fear of damaging the drain piping. Condensate must be able to flow freely from the appliance. Condensate flow is accomplished by gravity, requiring a minimum downward slope of 1/4" per foot (21mm/m) to ensure proper flow to the neutralizer and/or a suitable drain. The neutralizer **MUST** always be mounted on the same level or lower than the condensate drain at the vent connection.

The VTech and vent condensate drain requires a trap of some kind upstream of the neutralizer, to ensure that flue gas does not exit through the drain (this must be provided external of the water heater). Prime the trap with water during commissioning. Use standard 1/2" vinyl, PVC, CPVC or suitable hose to run to floor drain. Neutralizers may be used in series to raise pH. See Section 3.1.2 for more information on proper drainage of condensate.

Always check with local codes for specific pH requirements. All condensate piping and connections must be easily accessible for routine maintenance and inspection.

2.6 – Insulation

The VTech incorporates a foam insulation around the storage tank, underneath the outer shell. No additional insulation is required. If additional insulation is used, it must not extend beyond lower edge of the top dome of the water heater (i.e. it must not cover any portion of the top of the water heater, which could obstruct air flow and restrict serviceability).

2.7 – Pump Assembly

The pump assembly (ships loose with the water heater) needs to be installed on all installations. The pump assembly can be installed either on right or left side of the unit depending on where the water connections are. **Refer to Appendix B** on how to install the pump assembly.

Installation of pump assembly would help to reduce the build-up of scale, improves efficiency by creating more contact between the heating surfaces and the water and improves performance by equalizing tank temperature.

Factory warranty does not apply to units with no pump assembly installed or improperly installed or operated **pump assembly**.

Part 3 – Venting & Combustion Air

3.1 – General Venting Guidelines

All vent installation should follow the instructions of the venting supplier. Insulation on vent runs is not recommended, and may not be permitted for some materials.

WARNING

These venting instructions **MUST** be carefully followed. Failure to do so can cause substantial property damage, severe personal injury, or death.

WARNING

Use of cellular core PVC (ASTM F891), cellular core CPVC or Radel (polyphenosulfone) in venting systems shall be prohibited.

Gas burning appliances are divided into four categories based on the pressure and temperature produced in the exhaust stack and the likelihood of condensate production in the vent.

- **Category I.** An appliance operating with a non-positive vent static pressure and with a vent gas temperature that avoids excessive condensate production in the vent (i.e. “B Vent”).
- **Category II.** An appliance operating with a non-positive vent static pressure and with a vent gas temperature that may cause excessive condensate production in the vent.
- **Category III.** An appliance operating with a positive vent pressure and with a vent gas temperature that avoids excessive condensate production in the vent.
- **Category IV.** An appliance operating with a positive vent pressure and with a vent gas temperature that may cause excessive condensate production in the vent (i.e. “BH Special Gas Vent”).

The VTech water heater can be vented as either a Category II or IV appliance. It must be vented and supplied with combustion and ventilation air as described in this section. Provisions for combustion and ventilation air are to be in accordance with the section “Air for Combustion and Installation”, of the **National Fuel Gas Code, ANSI Z223.1/NFPA 54, or clause 8.2, 8.3, 8.4 of “Natural Gas and Propane Installation Code”, CSA B149.1-15 and CSA B149.2-15**, or appliance provisions of the local building codes. The distance of the vent terminal from adjacent buildings, windows that open and building openings must comply with the latest edition of the **National Fuel Gas Code, ANSI Z223.1**. In Canada, the installation and clearances must comply with the latest edition of **CSA B149.1-15 and CSA B149.2-15 Installation Code for Gas Burning Appliances and Equipment**.

For indoor installations, venting must be in accordance with **Part 7 “Venting of Equipment” of the National Fuel Gas Code, ANSI Z223.1, or Section 7 “Venting of Equipment and Air Supply for Appliances” of the CSA B149.1-15 and CSA B149.2-15** installation code, or applicable provisions of the local building codes. Horizontal runs of vent pipe shall be securely supported (approximately every 4 feet) to prevent sagging and maintain a minimum slope of $\frac{1}{4}$ " per foot to provide drainage of the vent towards the nearest drain or the vent termination.

The weight of the venting system must not rest on the unit. Adequate support of the venting system must be provided in compliance with local codes and other applicable codes. Vent connection is made directly to the flue outlet opening on the back of the unit. All connections should be secured and sealed per the

vent manufacturers specifications. When a positive vent system is disconnected for any reason, the flue must be reassembled and resealed according to the vent manufacturer's instructions. Do not use an existing chimney as a raceway if another appliance or fireplace is vented through the chimney.

3.1.1 – Venting Transition

All VTech have a round stainless steel vent connection suitable for direct connection to PVC or CPVC piping, of the size listed in Section 1.3.3.

Adaptors for stainless steel venting are available from CAMUS. Polypropylene vent adaptors are available from the venting manufacturer directly.

Depending on the venting category chosen and the design provide by the vent manufacturer, an increaser may be required for the proper vent configuration.

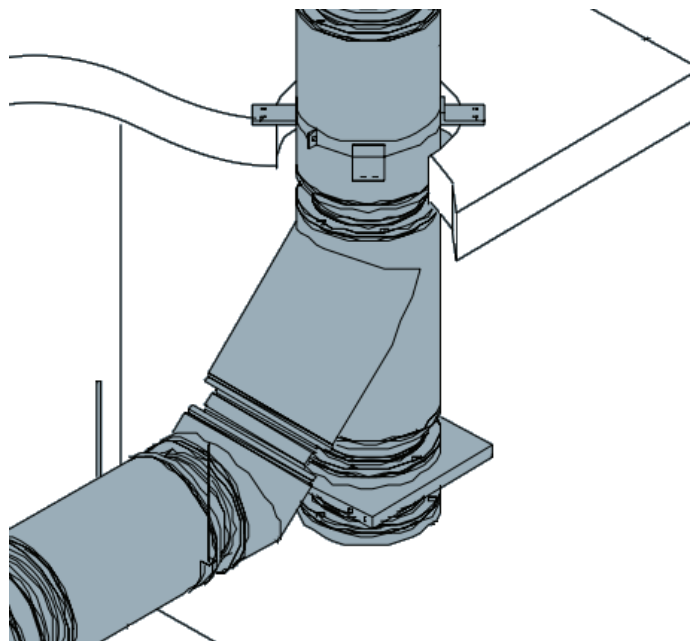
3.1.2 – Vent Drainage

Care must be taken to properly seal all joints against leakage of exhaust or condensate. All horizontal runs should be provided with a slope or $\frac{1}{4}$ " **per linear foot** to ensure efficient drainage of condensate. This slope should be designed to take condensate away from the water heater, and towards the nearest vent drain.

The bottom of any vertical vent run should have a combination **45° tee/elbow with drain cap** installed to remove condensate in this area of the vent. If this vertical run includes several horizontal or angled offsets, all components must be arranged to provide a continuous downward slope to the tee at the base of the run. Horizontal sections from this tee must be sloped away, either to the next tee in the system, or back to the water heater.

NOTE: Any drain in the venting system will require a trap to ensure flue gas does not enter the interior space.

Combination Tee and Elbow, w/ Drain Cap

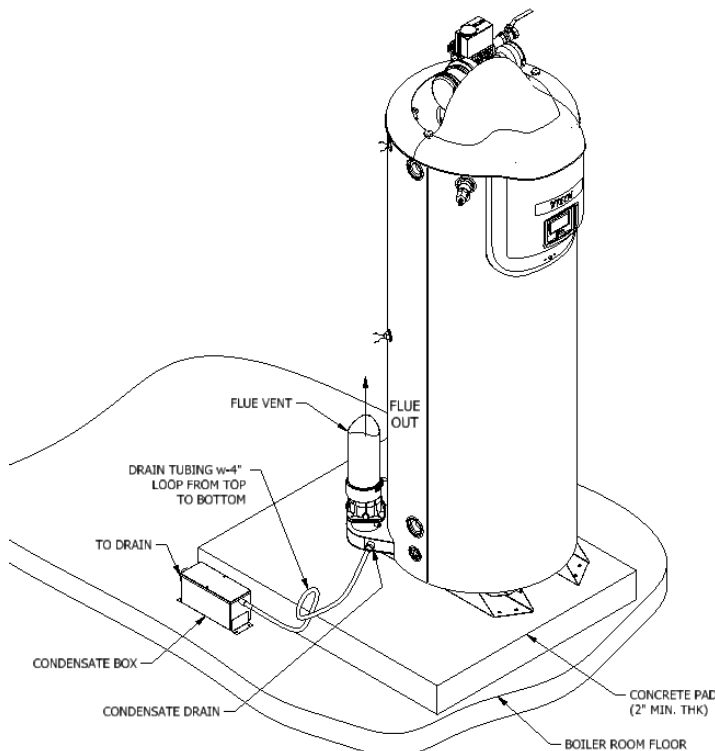


In systems where the vent remains horizontal after the initial vertical rise from the water heater vent connection, it should be sloped to drain through the sidewall. In cases where the

condensate cannot be drained outside, a horizontal drain section should be installed in the venting before penetrating the sidewall.

The water heater connects directly to a vertical vent run and does not require a base tee. A drain line must be connected to the water heater to collect and dispose of condensate.

Drain and Neutralizer Cartridge Installation



Plastic drain tubing shall be provided as a drain line for the water heater condensate drain. The tubing must have a trap (a 4" (10cm) diameter circular trap loop in the drain tubing is sufficient). Prime the trap loop by pouring a small quantity of water into the drain hose before assembly to the water heater connection. Use caution not to collapse or restrict the condensate drain line. The drain must be routed to the condensate neutralization system or a suitable drain for disposal of condensate that occurs in both the water heater and in the vent system. Ensure that the drain from the condensate tee is not exposed to freezing temperature.

3.1.3 – CAT II Venting

A Category II venting system operates with a negative pressure in the vent **at all times**, and with flue gas temperatures sufficiently cool for condensation to occur before reaching the termination. As a result, a corrosion resistant stainless steel, such as AL29-4C or 316L, must be used for the venting. AL29-4C is typically recommended for having higher corrosion resistance. **(This recommendation does not supersede local codes or the provisions of CSA B149.1-15 and CSA B149.2-15 in Canada or the National Fuel Gas Code in the United States.)** 316L is limited to use in applications where there is no possibility of contaminants in the air such as refrigerants, chlorine etc. Always choose the venting system which best satisfies the requirements of the application.

The Category II vent systems can be used for single appliances, but they can also be used to vent multiple appliances combined into a common vent. This special venting system **must be engineered by a venting manufacturer or other qualified professional**, using a proven vent-sizing program with

knowledge of accurate operating parameters. Approval of the installation is at the discretion of the authority having jurisdiction.

Acceptable Breach Pressure For CAT. II Vent Systems

-0.05" WC to -0.15" WC

For Category II vent systems, the pressure at the appliance breaching must be kept within a range of -0.05" WC to -0.15" WC. If the calculated draft at any unit exceeds this range (i.e. $\leq -0.16"$ WC), a single acting barometric damper, or suitable alternative draft control approved by the vent designer or engineer, must be used to prevent the extra suction from decreasing the pressure at the breaching.

If the vent cannot support a negative draft under all conditions, and a positive pressure will be developed during some operation, then the vent design must be changed accordingly. Possible options include changing the design to Category IV, or providing an extractor (or "draft inducer") at the vent outlet, interlocked with the appliance operating circuit, in order to maintain a negative draft in the vent while the unit is operating. The designer must ensure that the solution utilized will maintain the vent system at the desired minimum draft under all conditions.

Category II vents typically terminate vertically through the roof. The flue from a Category II vent system must have a condensate drain with provisions to properly collect, neutralize and dispose of any condensate that may occur.

3.1.4 – CAT IV Venting

The Category IV venting system operates with positive pressure at the appliance breaching generated by the combustion air fan, which operates the combustion process and also exhausts the flue products from the building. The pressure may be positive throughout, though it is conceivable to operate with negative pressure in part of a Category IV vent system. In either case, the entire Category IV vent system must have all joints and seams sealed gas-tight. The flue products in the vent system will be cooled below their dew point and form condensate, so Category IV systems must use AL29-4C or 316L stainless steel, or approved thermoplastics like UL/ULC S636 PVC or CPVC, and polypropylene (PPE, to maximum 12" diameter).

Acceptable Breach Pressure For CAT. IV Vent Systems

+0.01" WC to +1.00" WC

The installed length of the positive pressure Category IV vent, from the appliance to the point of termination outside of the building, **must not exceed a maximum of 100 equivalent feet (30.5M) in length.** The straight length that each elbow equates to depending on the diameter and centerline radius, typically 7 to 19 feet per 90° elbow and roughly half this value for each 45° elbow. The equivalency values must be verified with the individual vent manufacturer, as they are not standard, and depend on the precise dimensions, surface roughness, etc., that a particular product is built with. For site conditions exceeding 100 equivalent feet an engineered vent system approved by the local authority will be required.

Category IV vents may terminate either vertically through the roof, or horizontally on a side wall. See the information about the specific vent termination location for recommended location and clearances. The flue from a Category IV vent system must have a condensate drain with provisions to properly collect, neutralize and dispose of any condensate that may occur.

3.1.5 – Venting Materials

When selecting vent material take into consideration that appliances installed near a corrosive or potentially corrosive air supply must be isolated from it or they will suffer damage to the appliance and the venting system. The VTech may be vented with the following manufactured products:

- Manufactured prefabricated UL/ULC listed vents of AL29-4C, single or double wall.
- 316L stainless steel in applications free of contaminants like refrigerants, chlorine, etc.
- **In Canada**, the following plastic vent materials can be used, if permitted by local jurisdictions:
 - UL/ULC S636 approved schedule 40 PVC
 - UL/ULC S636 approved schedule 80 PVC
 - UL/ULC S636 approved schedule 40 CPVC
 - UL/ULC S636 approved schedule 80 CPVC
 - UL/ULC S636 approved polypropylene (PPE)
- **In the US**, the following plastic vent materials can be used, if permitted by local jurisdictions:
 - ANSI/ASTM D2665 approved PVC-DWV
 - ANSI/ASTM D1785 approved PVC Schedule 40
 - ANSI/ASTM F441 approved CPVC Schedule 40
 - UL/ULC S636 approved schedule 40 PVC
 - UL/ULC S636 approved schedule 80 PVC
 - UL/ULC S636 approved schedule 40 CPVC
 - UL/ULC S636 approved schedule 80 CPVC
 - UL/ULC S636 approved polypropylene (PPE)

WARNING

Use of cellular core PVC (ASTM F891), cellular core CPVC or Radel (polyphenosulfone) inventing systems is prohibited
Covering non-metallic vent pipe and fittings with thermal insulation is prohibited

Stainless steel venting can be ordered as single or double wall, depending on the installation. Double wall is recommended on Category II installations to ensure flue gas stay buoyant enough to maintain draft. Double wall is also recommended anywhere the vent may be contacted by personnel operating in the mechanical room.

Vent Material	Maximum Flue Temperature, °F
PVC	149
CPVC	194
Polypropylene (PPE)	230
316L Stainless	+300*
AL29-4C Stainless	+300*
*Stack is limited only by the allowable temperature rating of the gas tight seals.	

Always follow local codes when venting this appliance into a masonry chimney. A standard masonry chimney must NOT be used to vent the products of combustion from a positive pressure appliance, or any condensing appliances, whether positive or negative pressure (Category II, III or IV). As the VTech is a high efficiency appliance, if a masonry chimney is to be used, it must be used as a raceway for installation of a sealed, corrosion resistant liner system. Chimney liner systems are typically made from a high grade of corrosion resistant stainless steel such as AL29-4C or equivalent. The corrosion resistant liner must be properly sized and fully sealed throughout the entire length. Both the top and the bottom of the masonry chimney must be capped

and sealed to provide a dead air space around the liner contained within. Single wall venting is typically acceptable for the liner, but any portion of the vent located outside of the masonry chimney raceway should be double wall design.

Consult with local code officials to determine code requirements or the advisability of using a masonry chimney with a sealed corrosion resistant liner system.

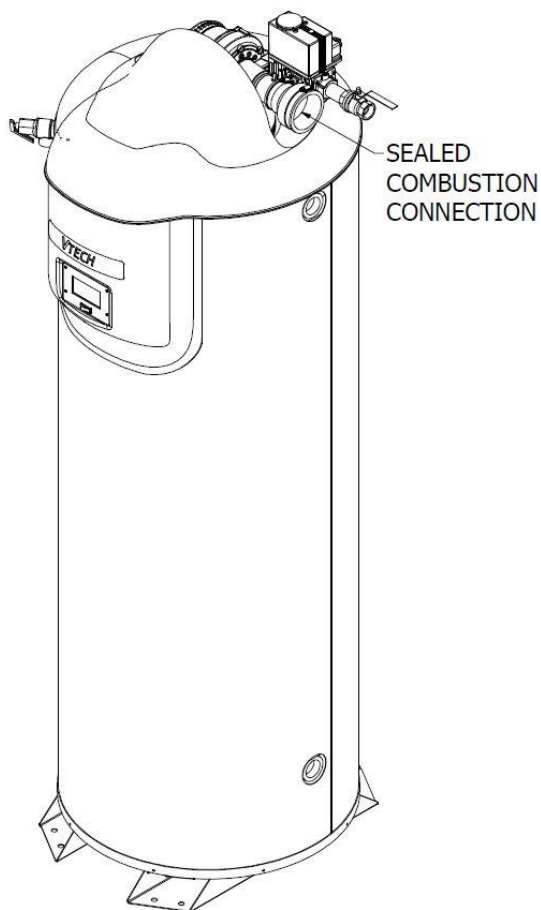
3.2 – General Combustion Air Guidelines

Provisions for combustion and ventilation air are to be in accordance with the section “Air for Combustion and Ventilation” of the National Fuel Gas Code, ANSI Z223.1/NFPA 54, or clause 8.2, 8.3, and 8.4 of “Natural Gas and Propane Installation Code”, CSA B149.1-15 and CSA B149.2-15, or applicable provisions of the local building codes. Combustion air can be supplied by means of conventional venting, where combustion air is drawn from the area immediately surrounding the appliance (mechanical room must be positive pressure) which will require openings in the mechanical room for fresh make-up air supply, or with direct vent (direct vent combustion) where air is drawn directly from the outside into the water heater jacket or blower. Refer to the NFGC, Section 8.3 for additional information.

3.2.1 – Direct Combustion Air Supply

- **Direct Vent/Sealed Combustion** – The combustion air can be connected directly to the blower. No filter is included; one would only be needed if the intake termination may occasionally ingest debris. Such a filter (supplied by others) should be installed in an easily serviceable location.

VTech with Sealed Combustion



The installed length of the sidewall or vertical combustion air inlet pipe, from the appliance to the inlet terminal outside of the building, **must not exceed a maximum of 100 equivalent feet (30.5M) in length**. The straight length that each elbow equates to depending on the diameter and centerline radius, typically 7 to 19 feet per 90° elbow and roughly half this value for each 45° elbow. The equivalency values must be verified with the individual vent manufacturer, as they are not standard, and depend on the precise dimensions, surface roughness, etc., that a particular product is built with.

3.2.3 – Combined Combustion Air Supply

The air inlet pipes from multiple appliances can be combined in a single common air inlet pipe if the cross-sectional area, and the combustion air opening free area, are equal to or larger than the total area of all air inlet pipes connected together. This exterior opening for combustion air must connect directly to the outdoors. Deduct the restriction in area provided by any screens, grills or louvers installed in the common air inlet point, which can reduce the free area by 25% to 75% based on the materials used. Determine cross-sectional area using the equation below.

$$\text{Eq. } \emptyset = \sqrt{[(d_1)^2 + (d_2)^2 + (d_3)^2 + \dots + (d_n)^2]}$$

Where,

Eq. \emptyset = Equivalent Total Diameter

d = Individual Pipe Diameters

Example: Find the equivalent diameter of 3x pipes at 8" (20.3 cm), 10" (25.4 cm) and 12" (30.5 cm).

$$\text{Eq. } \emptyset = \sqrt{[(8)^2 + (10)^2 + (12)^2]} = \sqrt{308} = 17.5"$$

Select 18" (82.8 cm) diameter pipe or larger

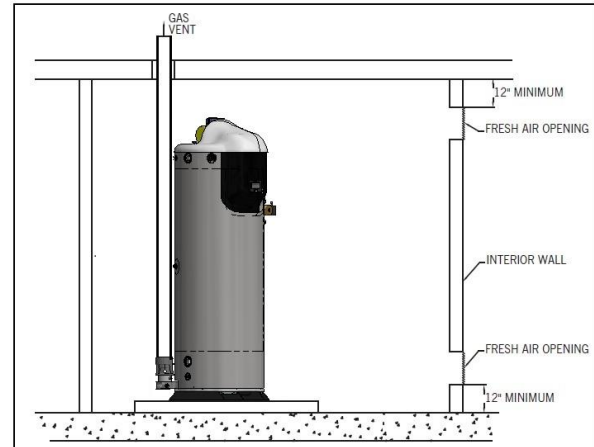
The total length of air inlet pipe for a water heater must be calculated individually, and must not exceed a maximum 100 equivalent feet (30.5M) regardless of pipe diameter. The total equivalent length of the common piping must be added to equivalent length of the branch for an individual water heater. For instance, if the common piping is 50' (15.25M) equivalent, and the water heater's individual pipe branch is also 50' (15.25M) equivalent, this water heater is at its maximum length. **The total equivalent length of the common air inlet pipe must not exceed a maximum of 100 equivalent feet (30.5M) under any circumstances.**

3.2.3 – Room Combustion Air Supply

- **All Air From Inside the Building (US Only)** - If combustion air is drawn from inside the building (the mechanical equipment room does not receive air from outside via louvers or vent openings and the water heater is not equipped with direct vent combustion) and the water heater is located in a unconfined space, use the following guidelines:
 - The mechanical equipment room must be provided with two permanent openings linked directly with additional room(s) of sufficient volume so that the combined volume of all spaces meet the criteria for an unconfined space. Note: An "unconfined space" is defined as a space whose volume is more than 50 cubic feet per 1,000 Btu per hour of aggregate input rating of all appliances installed in that space.
 - Each opening must have a minimum free area of one square inch per 1,000 Btu per hour of the total input rating of all gas utilizing equipment in the mechanical room.

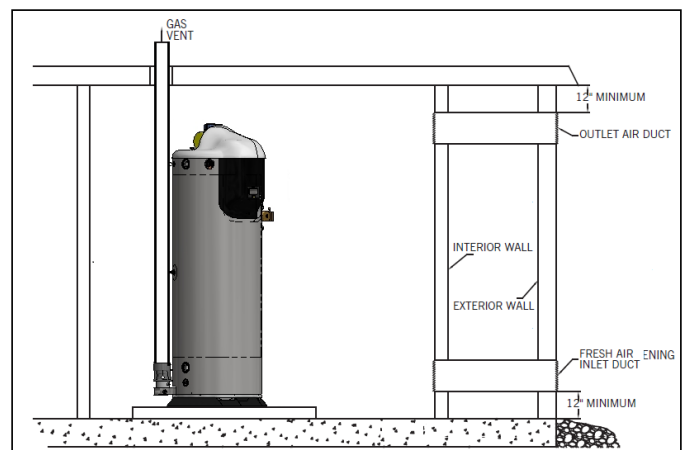
- One opening must terminate within twelve inches of the top, and one opening must terminate within twelve inches of the bottom of the room.

Figure 1 – All Air From Inside, Two Openings



- **All Air From Outdoors, Two-Opening** - If all combustion air will be received from outside the building (the mechanical room equipment is linked with the outdoors), the following method can be used:
 - The mechanical equipment room must be provided with two permanent openings, one terminating within twelve inches from the top, and one opening terminating within twelve inches of the bottom of the room.
 - The openings must be linked directly or by ducts with the outdoors.
 - Each opening must have a minimum free area of one square inch per 4,000 Btu per hour of total input rating of all equipment in the room, when the opening is directly linked to the outdoors or through vertical ducts.
 - The minimum free area required for horizontal ducts is one square inch per 2,000 Btu per hour of total input rating of all the equipment in the room. The ducts should not exceed 100 equivalent feet (30.5M) in length.

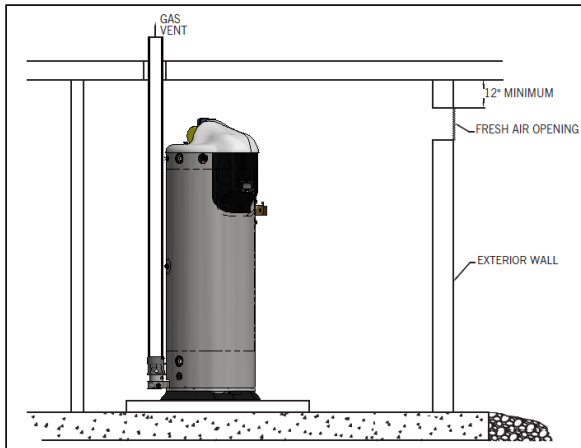
Figure 2 – All Air From Outside, Two Openings (Optional Duct)



- **All Air From Outdoors, One-Opening** - If all combustion air will be received from outside the building (the mechanical room equipment is linked with the outdoors), the following method can be used:
 - One permanent opening, commencing within 12 inches of the top of the enclosure, shall be provided.

- The equipment shall have clearances of at least 1 inch from the sides and back and 6 inches from the front of the appliance.
- The opening shall directly communicate with the outdoors and shall have a minimum free area of 1 square inch per 3000 BTU's per hour of the total input rating of all equipment located in the enclosure, and not less than the sum of the areas of all vent connectors in the confined space.

Figure 3 – All Air From Outside, One Opening



3.2.4 – Exhaust Fans

Any fan or equipment which exhausts air from the equipment room may deplete the combustion air supply and/or cause a downdraft in the venting system. Spillage of flue products from the venting system into an occupied space can cause a very hazardous condition that must be immediately corrected. Sealed combustion should be selected in cases where exhaust fans cannot be avoided or isolated.

3.3 – Installation and Termination

3.3.1 – Vertical Configuration Guidelines

➤ Rooftop Vent Terminations:

- Rooftop vents can terminate vertically, but in areas where heavy rainfall is projected, a rain cap should be considered. Rain entering the venting will drain out through the condensate removal system, but may waste neutralizer media, so it should be avoided where possible.
- Position terminations so they are not likely to be damaged by foreign objects, or exposed to a build-up of snow, ice debris, etc., which can cause a blocked flue condition.
- Position vents away from points of roof top access (i.e. hatches and walkways) whenever possible.
- Flue gas condensation can freeze on the vent cap causing a blocked flue situation. Select proper diameter piping and cap designs to avoid excessive ice build-up.
- **NOTE:** If the hydronic system design uses high water temperatures, uncondensed water vapour in the flue products will find its way into the vent, and could form large plumes of steam at the vent termination. This is not harmful to the water heater but can be unsightly. The steam can also cause discoloration on exterior building surfaces. Adjacent brick or masonry surfaces should be protected with a rust resistant sheet metal plate.

➤ Rooftop Combustion Air Inlets:

- A roof top air inlet consists of two 90° elbows. The first 90° elbow is installed on the rooftop at the highest vertical

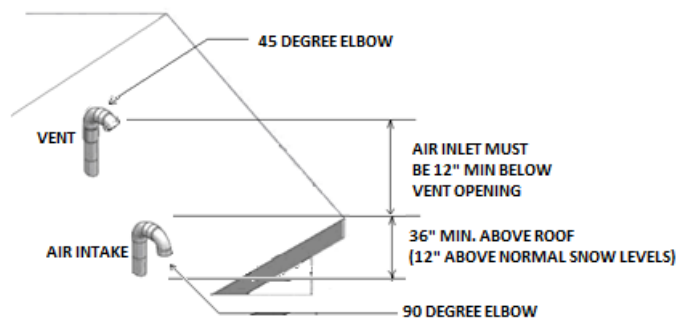
point of the air inlet pipe and turned horizontal; the second 90° elbow is screened and is installed on the horizontal outlet of the first elbow and turned down. If a straight piece of pipe is used between the two elbows, it should not exceed 6" (150mm) in length. A bird screen should be installed on the open end of the second elbow.

- Combustion air supplied from outdoors must be free of contaminants.
- Incorrect installation and/or location of the air inlet cap can allow flue products to be drawn back into the appliance. This can result in incomplete combustion and potentially hazardous levels of carbon monoxide in the flue products. This will cause operational problems with the appliance and if left uncorrected, will lead to conditions that can cause personal injury or death.

➤ Clearances:

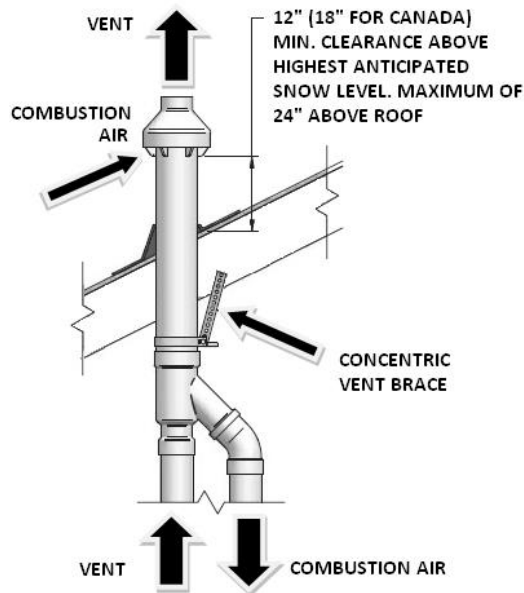
- The vent terminal must exhaust outside the building at least 2 feet (0.61M) above the highest point of the roof within a 10 foot (3.05M) radius of the termination.
- A vertical termination less than 10 feet (3.05M) from a parapet wall must be a minimum of 2 feet (0.61M) higher than the parapet wall.
- The termination of the vent/air intake must be a minimum of 3 feet (0.91M) above the roof penetration, and at least 12 inches (30cm) above the projected snow level.
- The inlet **MUST** be at least 1 foot (0.3M) below the point of flue gas termination (vent cap) if located within a 5 foot (1.5M) radius of the flue outlet. Ensure that the 90° elbow assembly is properly installed on the air inlet pipe.

Vertical Direct Venting Configuration



- **Concentric Venting** - Kits can be ordered to provide venting and combustion air supply through one opening. Vent/air pipe still limited a maximum 100 equivalent feet (30.5M) in length.

Vertical Concentric Vent Clearances



3.3.2 – Sidewall Configuration Guidelines

➤ Sidewall Vent Terminations:

- Sidewall vents can terminate horizontally, but in areas with heavy rain a downturned 45° elbow can be installed to keep water from blowing into the opening. Rain entering the venting will drain out through the condensate removal system, but may waste neutralizer media, so it should be avoided where possible.
- In penetrating through a windward wall, a horizontally mounted tee (i.e. with all openings on the same plane) can be installed to reduce the effect of wind loading.
- Position terminations so they are not likely to be damaged by foreign objects, or exposed to a build-up of snow, ice debris, etc., which can cause a blocked flue condition.
- Do not terminate the vent in a window well, stairwell, alcove, courtyard or other recessed area. The vent cannot terminate below grade.
- Position the vent termination where vapours will not damage walls or plants or may otherwise be objectionable.
- The vent outlet **MUST NOT** terminate below a forced air inlet at any distance.
- **NOTE:** If the hydronic system design uses high water temperatures, uncondensed water vapour in the flue products will find its way into the vent, and could form large plumes of steam at the vent termination. This is not harmful to the water heater but can be unsightly and obstruct views from windows. The steam can also cause discoloration on exterior building surfaces. Adjacent brick or masonry surfaces should be protected with a rust resistant sheet metal plate.

➤ Sidewall Combustion Air Inlets:

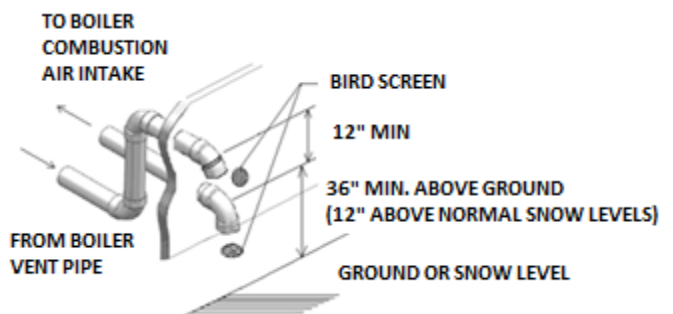
- Sidewall combustion air inlets consist of a single 90° elbow, installed on the end of the horizontal pipe penetrating the wall. A bird screen should be installed on the open end of the elbow.
- Combustion air supplied from outdoors must be free of contaminants.
- Incorrect installation and/or location of the air inlet cap can allow flue products to be drawn back into the appliance. This can result in incomplete combustion and potentially

hazardous levels of carbon monoxide in the flue products. This will cause operational problems with the appliance and if left uncorrected, will lead to conditions that can cause personal injury or death.

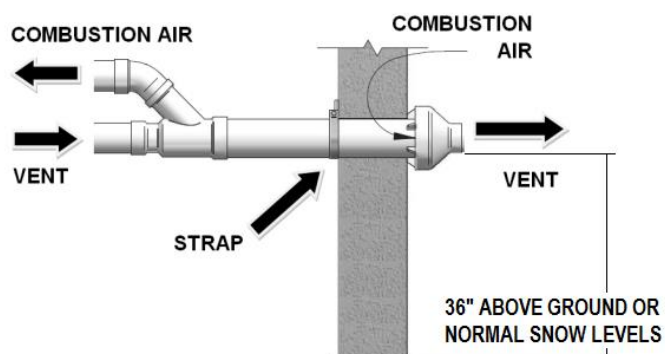
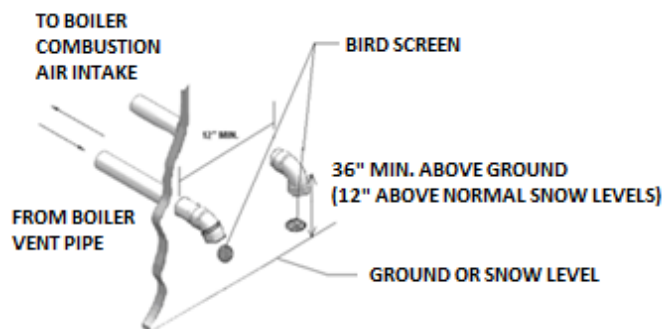
➤ Clearances:

- The vent terminal shall terminate at least 3 ft. (1M) above any forced air inlet within 10 ft. (3M) horizontally.
- The vent shall not terminate less than 7 ft. above a public walkway due to the normal formation of water vapour in the combustion process.
- The vent system shall terminate at least 3 foot (1M) above grade, or above projected snow levels.
- The vent terminal shall not be installed closer than 3 feet (1 m) from an inside corner of an L-shaped structure, window well, stairwell, alcove, courtyard or other recessed area as wind eddies could affect water heater performance or cause recirculation.
- **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
- Position the vent termination where vapours will not damage walls or plants or may otherwise be objectionable.
- The vent outlet **MUST NOT** terminate below a forced air inlet at any distance.
- The combustion air opening shall be at least 12" inches (30cm) above grade, or above projected snow levels.
- The combustion air opening should be 12" from the wall, to remove it from the surface pressure zone.
- The point of termination for the sidewall combustion air inlet terminal **MUST** be located a minimum of 3 feet (1M) horizontally or 12 inches (0.30M) below the point of flue gas termination (vent cap) if it is located within a 10 foot (3M) radius of the flue outlet.

Sidewall Vent and Air Intake - Vertical Arrangement



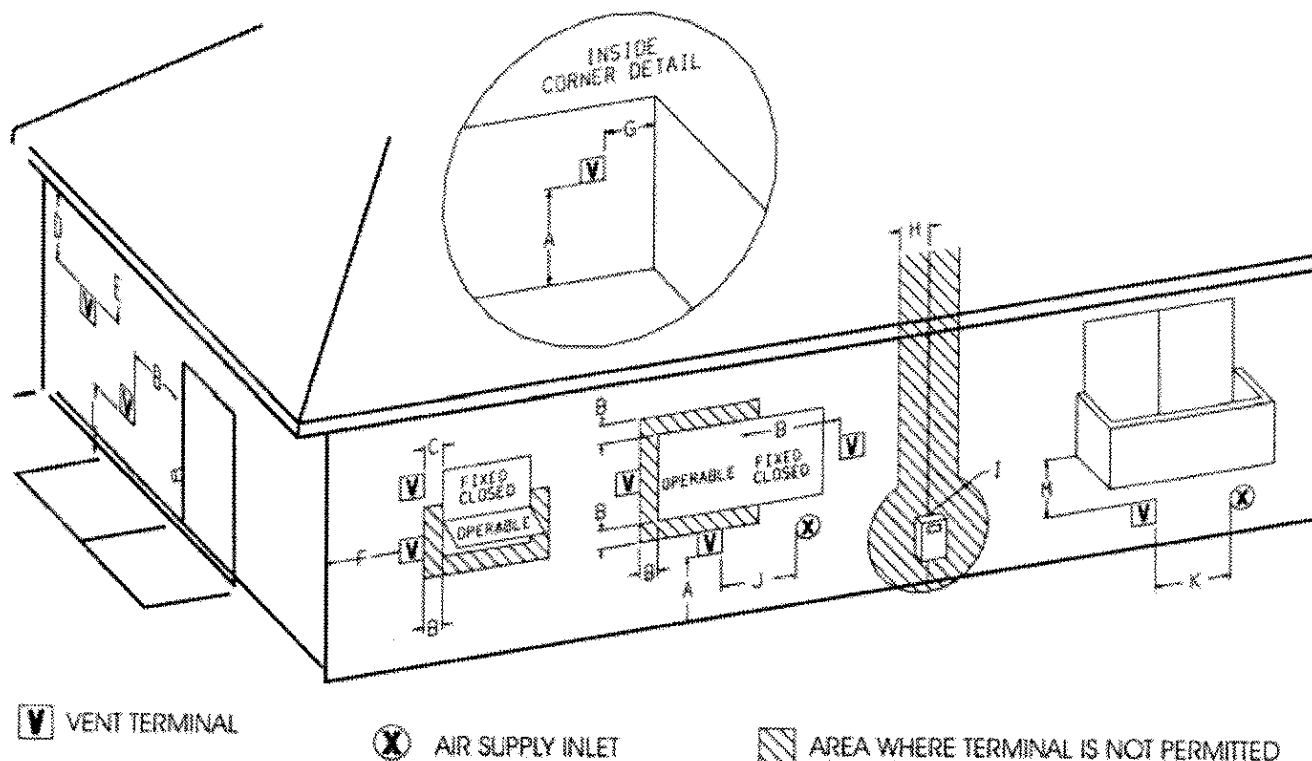
Sidewall Vent and Air Intake - Horizontal Arrangement



- **Concentric Venting** - Kits can be ordered to provide venting and combustion air supply through one opening. Vent/air pipe still limited a maximum 100 equivalent feet (30.5M) in length each.

Horizontal Concentric Vent Clearances

3.3.3 – 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) ^a	-
M	Clearance under veranda, porch deck, or balcony	12" (30 cm) ^b	-

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

^a A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings

^b 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

3.4 – 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.
7. 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.

3.5 – Outdoor Venting

The VTech windproof cabinet protects the unit from weather, meaning it is suitable for outdoor installation (By using special kit).

1. Periodically check to ensure that air intake and vent cap are not obstructed.
2. Locate appliance at least 3 feet away from any overhang.
3. Locate appliance at least ten feet from building air intake.
4. Avoid installation in areas where runoff from adjacent building can spill onto appliance.

For outdoor installations, always consider the use of a shelter such as a garden shed in lieu of direct exposure of the appliance to the elements. The additional protection afforded by the shelter will help to minimize nuisance problems with electrical connections and will allow easier servicing of the appliance under severe weather conditions.

Part 4 – Gas and Combustion Hardware

Verify that the appliance is supplied with the type of gas specified on the rating plate. Heating values of local natural gas are to be between 950 and 1010 Btu/ft³. Consult factory if heating values are outside this range or if a gas with a mixture of constituents is being used. Consult factory for high altitude installations.

4.1 – Gas Piping and Connections

Safe operation of the VTech unit 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 than appliance connection, if required for a specific pressure drop, but it must not be smaller than the water heater connection. Table 3 can be used for gas line sizing data, please verify pipe size requirements with gas supplier.

Table 3: Recommended Gas Pipe Size for Single Appliance

Input KBtu/hr	Equivalent Length from NG Meter or LP Regulator					
	0-100 FT		101-200 FT		201-300 FT	
	NAT.	L.P.	NAT.	L.P.	NAT.	L.P.
80	¾"	½"	¾"	½"	1"	¾"
100	¾"	½"	1"	¾"	1"	¾"
125	1"	¾"	1 ¼"	1"	1 ¼"	1"
150	1"	¾"	1 ¼"	1"	1 ¼"	1"
199	1"	¾"	1 ¼"	1"	1 ¼"	1"
250	1 ¼"	1"	1 ¼"	1"	1 ½"	1 ¼"
299	1 ¼"	1"	1 ½"	1 ¼"	1 ½"	1 ¼"
399	1 ¼"	1"	1 ½"	1 ¼"	2"	1 ½"
499	1 ½"	1 ¼"	2"	1 ½"	2"	1 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 and before the gas valve, 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.

4.2 – Gas Supply Pressure

Gas supply pressure must be maintained within the specified range in Table 4. 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 4: Gas Supply Pressure Range

Pressure Range	Propane	Natural Gas
Minimum (inches WC)	11	3*
Maximum (inches WC)	11	14
*7" WC recommended regulator setting		

4.2.1 – 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 VTech 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 by the water heaters, 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.

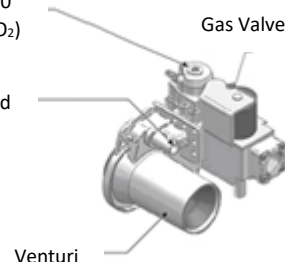
4.3 – Air/Gas Ratio Control Valve

Operation of the gas valve in combination with the combustion air fan allows the burner input rate to vary from 20% 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).

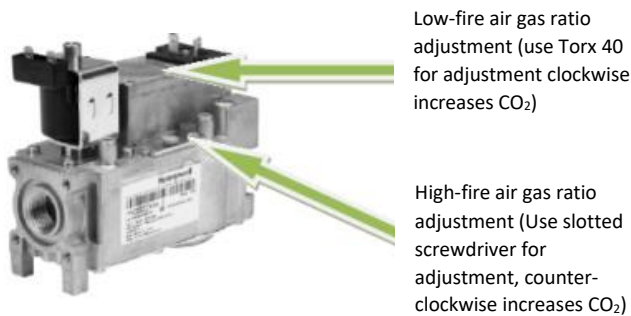
VT80 to 250 – 1:1 Negative Pressure Control Valve

Low-fire adjustment screw (use Torx 40 for adjustment, clockwise increases CO₂)

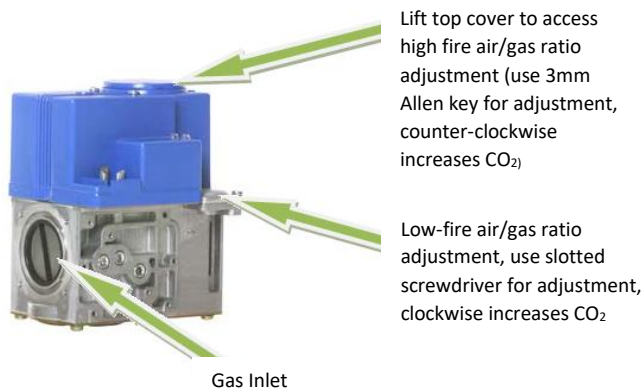
High-fire adjustment screw (use slotted screwdriver for adjustment, counter-clockwise increases CO₂)



VT299 to VT399 – Negative Pressure Control Valve



VT499 – Negative Pressure Control Valve



4.4 – Gas Pressure Switches

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.

4.4.1 – 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.

4.4.2 – High Gas Pressure

High gas pressure switches may be ordered to comply with CSD-1 code. These will either be integrated in to 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.

Gas Pressure Switch (Cover Removed)



4.5 – Air Pressure Switches

4.5.1 – Blocked Flue Switch

All models use a normally closed blocked flue switch to shut down the appliance under the following conditions:

- Air intake 50% blocked
- Vent outlet 80% blocked

4.5.2 – 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.

4.6 – Combustion Air Blower

The VTech use 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. The power draw of the motor is proportional to the modulated gas input rate of the appliance.

VTech Combustion Air Fan



4.7 – 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 knitted burner port material is a metal fiber material which is a unique alloy of iron, chrome, aluminum and several rare earth metals. This alloy is designed to operate stress free as a burner port surface. The burner port surface can sustain operation from a blue flame down to infrared conditions as the burner input varies.

VTech Burner



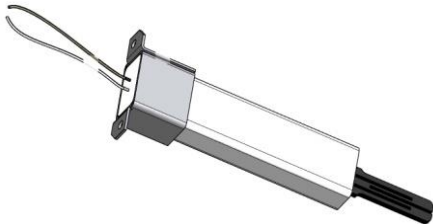
There is a unique burner for each model. Burners may not be interchanged between different input models.

4.8 – Ignition System

4.8.1 – Hot Surface Igniter (Glow Bar)

The silicon carbide igniter is inserted directly through the fan flange and held in place by two screws. A hold down bracket as well as sealing gasket above and below the igniter assures a good seal. Care must be taken when removing and/or installing the igniter since the silicon carbide element is brittle. Always remove the igniter prior to removing the fan assembly for inspection of the burner and Tank. A properly prepared igniter will have a bead of silicone sealing the end mounting bracket to the ceramic shaft.

Hot Surface Igniter



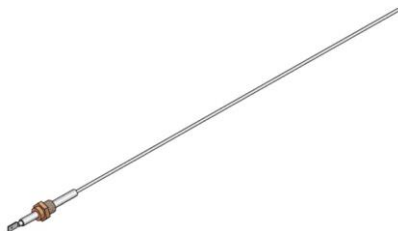
During trial for ignition a properly operating igniter will generate a minimum $3.2 \pm 0.2A$ which is the current required for reliable ignition. Direct ignition is standard. The burner mounting flange provides a flame view port and the mounting point for the hot surface igniter and the flame sensor.

The hot surface igniter and flame sensor are removable from the burner mounting flange without removing the burner assembly from the heat exchanger.

4.8.2 – 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.

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 5 – Water

5.1 – Installation Guidelines

The Tank is comprised of vertical tubes welded directly into a stainless steel combustion chamber. This assembly is contained in a pressure vessel, incorporating a storage volume to accommodate “dump” loads. This Tank is designed to withstand 160 PSIG working pressure.

Check all applicable local plumbing and building safety codes before proceeding. If the appliance is installed above the system it may require a low water cut-off device at the time of appliance installation (available from factory). 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 Water Heater and Pressure Vessel Code, Section IV. The relief valve is installed in the side of the pressure vessel near the top of the appliance. 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.**

T&P Relief Valve



CAUTION

Avoid contact with hot discharge water.

NOTE: If the water heaters are used for charging a large storage tank and installed with a pump circulating water between the tank and this appliance, then an expansion tank connected to this loop becomes the “Point of No Pressure Change”, since the pressure at this point will remain constant regardless of pump operation. In this case always pump away from the expansion tank connection and into the VTech inlet connection. Pumping away from the expansion tank means that the pressure on the suction side of the pump is dissipated at the expansion tank, allowing the

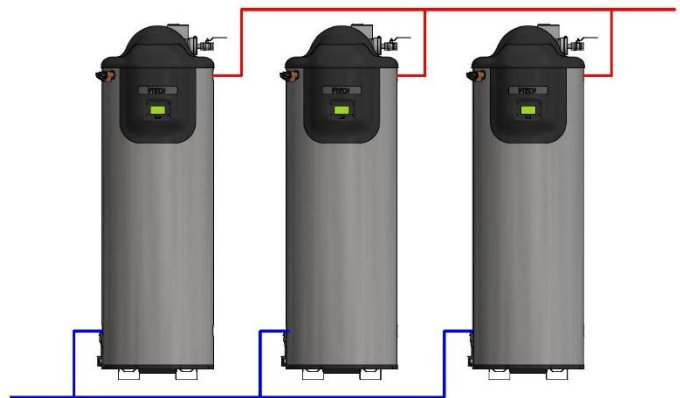
pump differential to *add pressure* to the system, enhancing system performance.

5.2 – Connecting to the Tank

All water connections are FNPT fittings. For ease of service, install unions on the inlet and outlet of the appliance. The incoming cold water must be connected to the lower port connections on either the left or right side of the appliance. The hot water supply to the building must be connected to the upper port connections on either the left or right side of the appliance.

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.

VTech Reverse-Return Piping Configuration



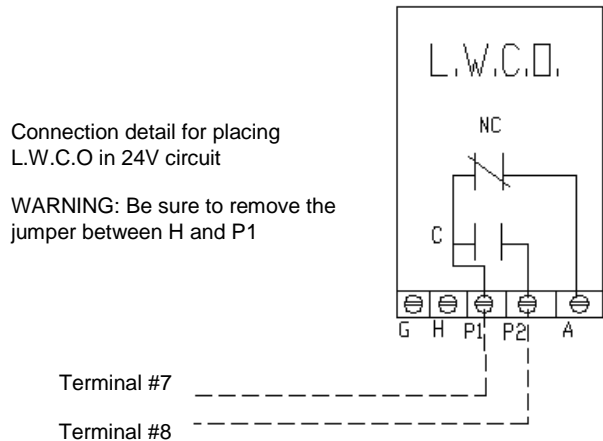
5.3 – Hydraulic Safeties

All safeties are installed in a common circuit, ensuring any safety is capable of deactivating the unit. Please see the electrical drawings in this manual for more information.

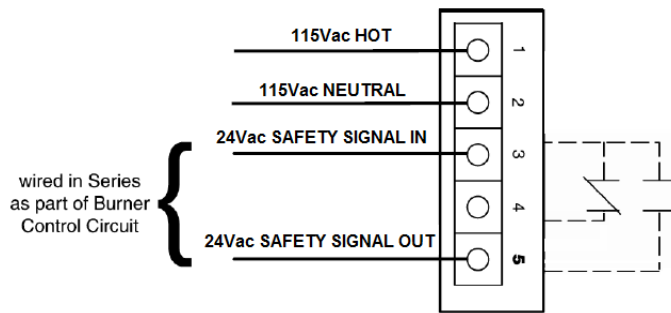
5.3.1 – Low Water Cut-off (LWCO)

If the VTech is installed above the hot water distribution system (as is the case with penthouse mechanical room installations), then a LWCO device may be required. Some local codes require the installation of a LWCO on all systems. Low water cut-offs should be tested every six months.

Watts LWCO - Electrical Connections



ITT LWCO - Electrical Connections



5.3.2 – High Limit

A high limit aqua-stat control is located at the back of the appliance and the control bulb is installed in a dry well in the heat exchanger header outlet. The setting of this control limits maximum discharge water temperature. A manual reset high limit will have a red reset button which must be pushed whenever water temperature has exceeded the set point of the manual reset limit. The temperature of the water in the tank must drop a minimum of 15°F (8.3°C) below the setting of the high limit control before the reset function can be activated. Whenever an appliance is supplied with both an auto reset and manual reset high limit always set the auto reset limit 10°F (5.5°C) below the manual reset limit to prevent nuisance tripping.

5.5 – Expansion Tank

Systems with a backflow preventer (BFP) on the incoming water connection must be supplied with expansion tanks (i.e. diaphragm or bladder type) suitable for potable water applications, to accommodate thermal expansion of stored water. Some jurisdictions will require an expansion tank in all cases. Expansion tanks must be installed on the building side of the BFP.

Expansion tanks must be sized to accommodate at least the volume of water in the water heater, but should also be able to accommodate system piping volume. Expansion tank suppliers have tank size calculators available.

Part 6 – Electrical

*** See electrical schematics in Appendix B ***

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 220°F (105°C) 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!

WARNING

The voltage output from the variable frequency drive to the combustion air fan is 230VAC, 3 Phase. **AVOID** contact with high voltage wiring

This appliance uses a transformer to supply a low voltage control circuit. The voltage on the secondary side should be 24 to 28VAC when measured with a voltmeter. A secondary voltage of 21VAC or less supplied to 24VAC components may cause operational problems. A 4A circuit breaker is provided on the secondary side of the transformer. A tripped circuit breaker indicates a short in the 24VAC controls and must be corrected.

6.1 – Blower Motors

The VTech uses a 120V/1PH electrical supply to power a DC motor on 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.

6.2 – Ignition Control

All models use the same 120VAC/1PH electrical supply used to power blower to provide voltage for the ignition circuit, including the hot surface igniter.

The VTech operates with a Fenwal Platform Ignition Module (PIM) to control firing rates from 20% - 100%. It is equipped with the latest flame supervision, combustion air blower control, DHW control and hot surface ignition technology. This allows for more efficient water heater operation, reduced operating costs, reduced emissions and improved load control. The operation of the VTech controller proves the presence of main flame using a flame sensor proof current (0.8µA). A status of Ignition Failed will be displayed on the main panel if the water heater fails to light after three (3) consecutive ignition attempts. The VTech controller is an electronic proportional integrated combination ignition limit/operator control accurate to 1°F and is equipped with a PWM output signal suitable for control of a variable frequency motor drive for modulating fan speeds.

Each appliance has one ignition module, one hot surface igniter and one flame sensor. These parts are not repairable, a faulty ignition module or hot surface ignitor **MUST** be replaced with a new factory part. **DO NOT** use general purpose field replacement parts. 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.

Fenwal Platform Ignition Module



Table 5: Ignition Module Connector Description

Connector	Connector Description
J1	LWCO, Alarm Contacts
J2	Not used
J3	Not used
J4	Ethernet connection to BTCII display
J5	Not used
J6	VTech ID Card
J7	Outlet Sensor/ High limit
J8	Blocked flue, low air proving switch
J9	Inlet sensor, stack sensor
J10	PWM signal to combustion air blower
J11	24Vac power
J12	24Vac gas valve
J13	Not used
J14	115Vac incoming power for HSI
P1	115Vac to HSI

The ignition module has a manual reset button to recycle the control. Pushing the reset button is the only way to reset an ignition module that is in lockout. Turning the main power “OFF” and then “ON” will not reset a lockout condition.

Part 7 – VTech Control Panel

The appliance is provided with a control panel at the front. Operating controls are installed inside the control box and are accessible behind the front enclosure. Diagnostic information, setpoint and operational controls, as well as the on/off switch are all accessible with the cover in place.

The controller initiates the local call for heat and sets the target setpoint temperature. This controller offers a range of operation modes which provides set point as well as modulating control. It provides the following:

- Reading for inlet and outlet water temperatures.
- Reading for flame signal and fan speed.
- Records highest and lowest values for certain parameters.
- Operation as a manual reset high limit.
- Operation for inlet, outlet and system temperature control.
- Flame failure signal.
- Run time tracking and cycle count.
- JST and Molex connectors for ease of service.
- Error message display in text.
- Manual override of water heater input rate for combustion setup.

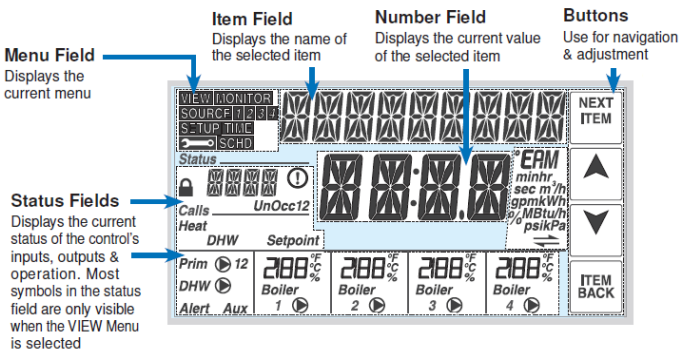
7.1 – Levels of Access

The control has two levels of access to restrict menu and setting adjustment to properly trained technicians.

- **User** – Access to general water heater and display settings and adjustments to the setpoint. No code is required for this level.
- **Installer** – Access to all user parameters and allows for changes to additional parameters to allow for ease of startup and serviceability. This level is unlocked by entering the correct code into the control. Press the bottom left corner of the home screen to enter the code.

7.2 – VTech Touchscreen Display

Touchscreen Display – Overview



The VTech control features a touchscreen display for parameter adjustment, including setpoint, differential ON and OFF, high limit adjustment, pre and post purge time adjustments, modulation rate limiting, light-off firing rate, clock adjustment and Celsius or Fahrenheit unit selection.

The VTech control also offers appliance monitoring, including top and bottom sensors, flue temperature sensing, cycle count, burner run time, firing rate, fan speed, flame signal, alarm reporting, and manual firing rate control during product commissioning.

On-Screen Control Navigation Buttons

Button	Description
<div>NEXT ITEM</div> <div>ITEM BACK</div>	To toggle parameters
<div>▲</div> <div>▼</div>	To adjust parameter values
<div>ENTER</div>	To confirm access to a menu block

Default Control Home Screen

VIEW	TARGET				NEXT ITEM
Status	IDLE				
Calls					
	-				ITEM BACK
	1	2	3	4	

7.3 – Lockout/Alert Condition

If the unit is currently in either a lockout or alert/hold condition, this will be displayed on the home screen.

WARNING
Lockout and alert conditions should not be cleared by anyone who does not have adequate training on the appliance and the meaning of the codes. Clearing lockouts and alerts without rectifying the circumstance that caused the condition can cause substantial property damage, severe personal injury, or death.

If the ignition module is in a hard lockout, it may be necessary to press the physical reset button on the module to clear the lockout. Faults caused by manual reset safeties (i.e. High Limit, Low Water Cut-off or gas switches) will also require a physical switch be reset before the lockout can be cleared on the control.

Other faults are determined in the control logic and place the unit into lockout because they require acknowledgement before returning the unit to normal operation. When displayed with the error description on the control screen, these faults will be cleared by pressing the "OK" button.

Alert conditions do not deactivate the appliance, and automatically clear when the conditions that caused the alert are removed. However, the alert message will remain until on screen until cleared. To clear an alert press "OK".

See section 10.8 – Troubleshooting for more information on the reset codes below, and what action is required when these conditions are encountered.

7.3.1 – Manual Reset Codes

Message	Description
CHECK PIM/BTC II BOARDS	Internal hardware fault
CHECK FTBUS WIRING	Poor connection between PIM and display
TANK TOP ERR/OPEN/SHRT	Tank top open Tank top short
HI LIMIT ERR/OPEN	High limit open
TANK BOT ERR/OPEN/SHRT	Tank bottom open Tank bottom short
FLE	Fan speed not proved, ignition failure
67	ILK Off
79	Heater Outlet high limit tripped
91	Inlet sensor fault
92	Outlet sensor fault
93	DHW sensor fault
95	Stack sensor fault
96	Outdoor sensor fault
105	Flame detected out of sequence
106	Flame lost in Main Flame Establishing Period (MFEP)
107	Flame lost early in run
108	Flame lost in run
109	Ignition failed
112	Pilot test flame timeout
113	Flame circuit timeout
149	Flame detected

7.3.2 – Automatic Reset Codes

#	Description
0	None
29	Burner switch turned OFF
30	Burner switch turned ON
47	Flame rod to ground leakage
49	Abnormal 24Vac voltage
50	Modulation Fault
61	Anti-short Cycle
62	Fan speed not proved
67	Interlock Off, safety circuit is open
69	Pilot test hold
78	Demand lost in run
79	Outlet high limit tripped (internal limit)
81	Delta-T limit exceeded (30°F)
91	Inlet sensor fault
92	Outlet sensor fault
93	DHW sensor fault
95	Stack sensor fault
96	Outdoor sensor fault
97-99	Internal Fault
128	Fan speed failed during pre-purge
129	Fan speed failed during pre-ignition
130	Fan speed failed during ignition
131	Fan movement detected during standby
132	Fan speed failed during run
137	Interlock failed to close, safety circuit is open
110	Ignition failure occurred
111	Flame current below threshold (0.8Vdc)
149	Flame detected
150, 291	Flame not detected
301-310	Interlock Off, safety circuit is open
353	Stack limit (PVC: 149°F, CPVC: 194°F, PPE: 230°F, SS, AL29-4C: 250°F)
460	LCI lost in run, safety circuit is open
614	Lead water heater was rotated based on measured run time

7.4 – Control Menus

7.4.1 – View Menu (Read-Only)

	Menu Description	
	<p>The standard home screen of the VTech is the VIEW MENU, which allows easy review of the current operating condition. The standard screen displayed is the current TARGET SETPOINT. Operational status (i.e. “IDLE”) is also displayed.</p> <p>The menu is view only, no parameters are adjusted here.</p>	
Level	Parameters - Read-Only	
USER	TANK TOP – Real-time water temperature at the top of the tank.	
USER	TANK BOTTOM – Real-time water temperature at the bottom of the tank.	
USER	TANK AVG – Average water temperature between the top and bottom sensors.	
USER	TANK ΔT (or Temperature Difference) – Temperature difference between the top and bottom sensors.	
USER	FLUE TEMPERATURE – Real-time flue temperature of the appliance.	
USER	FLAME CURRENT – Real-time measure of the flame sensor reading (varies from 0.0 to 5.0).	

7.4.2 – Setup Menu

	Menu Description	
	The SETUP MENU allows adjustment of basic operating parameters. The setpoint is adjustable to the user at this level.	
Level	Parameters - Adjustable	
USER	SETPOINT – This is the desired setpoint. Default – 140°F Range – 70°F to 190°F	
USER	DIFF ON – Used to activate the unit if the TANK TOP temperature drops to the setpoint minus DIFF ON. Default – 5°F Range – 0°F to 15°F	
USER	DIFF OFF – Used to de-activate the unit if the TANK TOP temperature reaches the setpoint minus DIFF OFF. Default – 2°F Range – 0°F to 15°F	
USER	DIFF – Defines the range below DIFF OFF to modulate heating output. Default – 15°F Range – 2°F to 60°F	

7.4.3 – Monitor Menu

	Menu Description	
	The MONITOR MENU allows viewing of more detailed operational data than the VIEW MENU . This menu will also record historical data for later reference. Press CLEAR for three (3) seconds to clear any of these parameters. This level is accessible to the user.	
Level	Parameters - Read-Only	
USER	BURNER RUN TIME – Burner operational time as recorded in hours.	
USER	CYCLES – Number of operating cycles on the appliance.	

USER	FLUE LOW – Lowest recorded flue gas temperature.	<div> <div>MONITOR</div> <div>FLUE LOW</div> <div>Status _____</div> <div>Calls _____</div> <div>130 °F</div> <div>1 2 3 4</div> <div>NEXT ITEM</div> <div>ITEM BACK</div> </div>
USER	FLUE HIGH – Highest recorded flue gas temperature.	<div> <div>MONITOR</div> <div>FLUE HIGH</div> <div>Status _____</div> <div>Calls _____</div> <div>130 °F</div> <div>1 2 3 4</div> <div>NEXT ITEM</div> <div>ITEM BACK</div> </div>
USER	TANK TOP LOW – Lowest recorded temperature at the tank top sensor.	<div> <div>MONITOR</div> <div>TANK TOP</div> <div>Status _____</div> <div>Calls _____</div> <div>40 °F</div> <div>1 2 3 4</div> <div>NEXT ITEM</div> <div>ITEM BACK</div> </div>
USER	TANK TOP HIGH – Highest recorded temperature at the tank top sensor.	<div> <div>MONITOR</div> <div>TANK TOP</div> <div>Status _____</div> <div>Calls _____</div> <div>140 °F</div> <div>1 2 3 4</div> <div>NEXT ITEM</div> <div>ITEM BACK</div> </div>
USER	TANK BOTTOM LOW – Lowest recorded temperature at the tank bottom sensor.	<div> <div>MONITOR</div> <div>TANK BOT</div> <div>Status _____</div> <div>Calls _____</div> <div>40 °F</div> <div>1 2 3 4</div> <div>NEXT ITEM</div> <div>ITEM BACK</div> </div>
USER	TANK BOTTOM HIGH – Highest recorded temperature at the tank bottom sensor.	<div> <div>MONITOR</div> <div>TANK BOT</div> <div>Status _____</div> <div>Calls _____</div> <div>100 °F</div> <div>1 2 3 4</div> <div>NEXT ITEM</div> <div>ITEM BACK</div> </div>
USER	TANK ΔT HIGH – Highest recorded temperature difference between the tank top and tank bottom sensors.	<div> <div>MONITOR</div> <div>TANK Δt</div> <div>Status _____</div> <div>Calls _____</div> <div>100 °F</div> <div>1 2 3 4</div> <div>NEXT ITEM</div> <div>ITEM BACK</div> </div>

7.4.4 – Time Menu

	Menu Description	
	The TIME MENU allows adjustment of time and date settings. This level is accessible to the user and does not require a code.	<div> <div>TIME</div> <div>TIME MENU</div> <div>Status _____</div> <div>Calls _____</div> <div>1 2 3 4</div> <div>NEXT ITEM</div> <div>ITEM BACK</div> </div>
Level	Parameters - Adjustable	
USER	SET TIME – Enter the current time, including AM/PM settings if 12 hour clock format selected.	<div> <div>TIME</div> <div>SET TIME</div> <div>Status _____</div> <div>Calls _____</div> <div>12:00 AM</div> <div>1 2 3 4</div> <div>NEXT ITEM</div> <div>ITEM BACK</div> </div>

USER	SET DATE – Set current date, including month, day and year.	
USER	DST – Enable or disable daylight savings time.	
USER	TIME DISP – Adjust to display the current time in either a 12 or 24 hour format.	
USER	CLOCK – Enable or disable to clock readout in the VIEW MENU .	

7.4.5 – Toolbox Menu

	Menu Description	
	The TOOLBOX MENU contains the error log. It is also where the login to the PIM at the installer level takes place. Adjustment of the display units to metric is through this menu.	
Level	Parameters - Adjustable	
LOGIN	ACCESS – Used to login to the control at the installer level, to have access to more advanced settings. Default: USER Option: INST (Installer)	
USER	SW – Device type, not used. This is for factory purposes only.	
USER	TEMP UNIT – Select between Fahrenheit or Celcius. Default: Fahrenheit	
USER	ERROR LOG – The BTCII will store the last 15 errors, accessed by pressing NEXT ITEM or ITEM BACK .	

7.4.6 – Source Menu

	Menu Description	
	The SOURCE MENU allows adjustment and viewing of more advanced operational parameters. This level is restricted to the installer and requires a code to access.	
Level	Parameters - Adjustable	
INST	ENABLE – Enable or disable the unit while it is powered. Default setting is enabled.	
INST	IGNITION – Water heater ignition status: (1) IDLE ; (2) PREP = Unit is in pre-purge; (3) IGN = Ignition attempt under way; (4) BURN = Unit is running; (5) PURG = Unit is in post-purge; (6) FAIL = Unit is in lockout/error mode.	
INST	VENT TYPE – Select the type of venting material. Material corresponds to stack temperature limits, to protect the venting from damage by overheating: (1) PVC = 149°F; (2) CPVC = 194°F; (3) PPS = Polypropylene, 230°F; (4) SS = Stainless Steel, AL29-4C, 250°F.	
INST	FIRE RATE – READ ONLY – Actual real-time firing rate, as percent of maximum.	
INST	BLOW SPD – READ ONLY – Actual real-time blower speed in RPM (x1000)	
INST	HI LIMIT – READ ONLY – Temperature at which the control manual reset high limit trips.	
INST	HL OFFSET – READ ONLY – The amount below the high limit setting that the tank must cool by before the manual reset high limit can be reset.	
INST	OPERATOR – READ ONLY – The maximum temperature the SETPOINT can be set to.	

INST	BLOW PRET – READ ONLY – Duration of the blower pre-purge cycle. Default: 5 seconds	<div> <div>SOURCE</div> <div><i>BLOW PRET</i></div> <div>Status _____</div> <div>Calls _____</div> <div>0:05 min</div> <div>1</div> <div>2</div> <div>3</div> <div>4</div> <div>NEXT ITEM</div> <div>ITEM BACK</div> </div>
INST	BLOW PRER – READ ONLY – Blower modulation rate during pre-purge. Default: 50%	<div> <div>SOURCE</div> <div><i>BLOW PRER</i></div> <div>Status _____</div> <div>Calls _____</div> <div>50%</div> <div>1</div> <div>2</div> <div>3</div> <div>4</div> <div>NEXT ITEM</div> <div>ITEM BACK</div> </div>
INST	BLOW POST – READ ONLY – Duration of the blower post-purge cycle. Default: 30 seconds	<div> <div>SOURCE</div> <div><i>BLOW POST</i></div> <div>Status _____</div> <div>Calls _____</div> <div>0:30 min</div> <div>1</div> <div>2</div> <div>3</div> <div>4</div> <div>NEXT ITEM</div> <div>ITEM BACK</div> </div>
INST	BLOW POSR – READ ONLY – Blower modulation rate during post-purge. Default: 50%	<div> <div>SOURCE</div> <div><i>BLOW POSR</i></div> <div>Status _____</div> <div>Calls _____</div> <div>50%</div> <div>1</div> <div>2</div> <div>3</div> <div>4</div> <div>NEXT ITEM</div> <div>ITEM BACK</div> </div>
INST	MIN MOD – Minimum blower modulation speed, as percent of full firing rate. Set at factory.	<div> <div>SOURCE</div> <div><i>MIN MOD</i></div> <div>Status _____</div> <div>Calls _____</div> <div>20%</div> <div>1</div> <div>2</div> <div>3</div> <div>4</div> <div>NEXT ITEM</div> <div>ITEM BACK</div> </div>
INST	START MOD – Blower modulation speed at light off. Set at factory.	<div> <div>SOURCE</div> <div><i>START MOD</i></div> <div>Status _____</div> <div>Calls _____</div> <div>45%</div> <div>1</div> <div>2</div> <div>3</div> <div>4</div> <div>NEXT ITEM</div> <div>ITEM BACK</div> </div>
INST	MAX MOD – Maximum blower modulation speed, as percent of full firing rate. Set at factory.	<div> <div>SOURCE</div> <div><i>MAX MOD</i></div> <div>Status _____</div> <div>Calls _____</div> <div>100%</div> <div>1</div> <div>2</div> <div>3</div> <div>4</div> <div>NEXT ITEM</div> <div>ITEM BACK</div> </div>
INST	FLAME CURRENT – READ ONLY – Actual real-time flame sensor reading, varies from 0.5 to 5.0.	<div> <div>SOURCE</div> <div><i>FLAME CUR</i></div> <div>Status _____</div> <div>Calls _____</div> <div>0.0</div> <div>1</div> <div>2</div> <div>3</div> <div>4</div> <div>NEXT ITEM</div> <div>ITEM BACK</div> </div>
INST	IGN TYP – READ ONLY – Not used, MOD (or “modulating blower”) is the only option.	<div> <div>SOURCE</div> <div><i>IGN TYP</i></div> <div>Status _____</div> <div>Calls _____</div> <div>MOD</div> <div>1</div> <div>2</div> <div>3</div> <div>4</div> <div>NEXT ITEM</div> <div>ITEM BACK</div> </div>

INST	ID CARD – READ ONLY – Not used, for factory use only.	<div> <div>SOURCE</div> <div>ID CARD</div> <div>Status _____</div> <div>Calls _____</div> <div>2</div> <div>1234</div> <div>NEXT ITEM</div> <div>ITEM BACK</div> </div>
INST	SOFTWARE ID – READ ONLY – Not used, for factory use only.	<div> <div>SOURCE</div> <div>SOFTWARE</div> <div>Status _____</div> <div>Calls _____</div> <div></div> <div>1234</div> <div>NEXT ITEM</div> <div>ITEM BACK</div> </div>
INST	ERROR CODE – READ ONLY – Current error code, if in lockout condition.	<div> <div>SOURCE</div> <div>ERROR</div> <div>Status _____</div> <div>Calls _____</div> <div></div> <div>1234</div> <div>NEXT ITEM</div> <div>ITEM BACK</div> </div>

7.4.7 – Manual Override Menu

	Menu Description	
	<p>The MAN OVR MENU can be used to force the unit into operaiton. This level is restricted to the installer and requires a code to access.</p> <p>Default: AUTO, control decides operaiton based on programmed settings Option: OFF, force disable Option: HAND, force enable</p>	<div> <div>MAN OVR</div> <div>AUTO</div> <div>Status _____</div> <div>Calls _____</div> <div></div> <div>1234</div> <div>NEXT ITEM</div> <div>ITEM BACK</div> </div>
Level	Parameters - Adjustable	
INST	TIME OUT – Set the maximum amount of time to operate in manual override mode, before reverting to AUTO , in hours. Default: one (1) hour.	<div> <div>TIME OUT</div> <div>1 hr</div> <div>Status _____</div> <div>Calls _____</div> <div></div> <div>1234</div> <div>NEXT ITEM</div> <div>ITEM BACK</div> </div>
INST	HTR MOD – Specify firing rate during manual override. Default: OFF .	<div> <div>HTR MOD</div> <div>OFF</div> <div>Status _____</div> <div>Calls _____</div> <div></div> <div>1234</div> <div>NEXT ITEM</div> <div>ITEM BACK</div> </div>

Part 8 – Commissioning/Start-up

8.1 – Checking the Installation

Inspect the water, gas and electrical connections. Confirm they are all in compliance with the instructions in this manual. Verify gas pressure is within the ranges listed in Table 4 before proceeding. Confirm that all gas connections to the heater are tight, and that there are no leaks or missing test plugs. Repair any leaks and replace plugs before proceeding.

All units are test fired and factory set. A test sticker with actual reading is affixed to the unit.

Check the wiring to see that it agrees with the wiring diagram supplied. Confirm that all terminal strips and field connections are identified. Confirm that the VTech controller is set in the proper mode. Auto reset limits are fixed in all modes.

The coldest water temperature possible must be used when setting up low fire combustion. Cold temperatures cause flue products to condense, resulting in large amounts of condensate build up on the stainless steel heat transfer tubes, which in turn creates the highest back pressure through the unit. At minimum input this creates the most critical combustion setup point. It is recommended to perform setup under these conditions quickly, to ensure low temperatures are maintained throughout the commissioning, for single or multiple appliance installations.

8.2 – Checking Gas Supply Pressure

- Turn the main power switch to “OFF” position.
- Shut off gas supply at the manual gas cock in the gas piping to the appliance. If fuel supply is LP gas, shut off gas supply at the tank.
- Remove the 1/8" hex plug from the gas pressure test port located on the inlet gas supply connection at the rear of the appliance. Install a fitting in the inlet pressure tapping suitable to connect to a manometer (or magnahelic gauge). Range of scale should be 0 to 14 inch WC or greater.
- Turn on gas supply at the field installed manual gas cock; turn on LP gas at tank if required.
- Ensure inlet pressure is within specified range. Minimum and maximum gas supply pressures are specified in Table 4.

IMPORTANT

If gas pressure is out of range, contact the gas utility, gas supplier, qualified installer or service agency to determine necessary steps to provide proper gas pressure to the control.

Upon completion of any change to the gas system, leak test all gas connections with a soap solution. Immediately repair any leak found in the gas train or related components. DO NOT operate an appliance with a leak in the gas train, valves or related gas piping.

Do not attempt to fire the unit with insufficient gas supply pressure. Never use an open flame (match, lighter, etc.) to check gas connections.

- Turn the power switch to “ON” position. If filled with cold water the tank should automatically observe a demand to heat the water. Verify target temperature is higher than current water temperature.
- Once safety checks are complete, the control will run through the ignition cycle. It is normal during initial startup, when air

is being purged from the piping, to require several attempts before successful ignition. This may require clearing a lockout for failed ignition. **Continued ignition failures may indicate a problem with the gas supply.**

- When ignition is successful and the unit is in operation, check for flue gas leaks along the inner cabinet joints and around the flue outlet. If any leaks are found, deactivate the unit and repair immediately.
- Unit should modulate to 100% of rated input, observe the gas supply pressure at this level. Ensure that gas pressure remains stable within the ranges listed in Table 4. The inlet gas pressure must not exceed a 30% reduction between light-off and full fire conditions.
- If gas supply pressure is within normal range, proceed adjust combustion settings, if necessary.

8.3 – Combustion Setup

At the factory adjustments were made to achieve proper input and acceptable burner performance at full input and at minimum input. Depending on field conditions, the combustion setup may require some adjustment. To ensure the coldest possible water temperatures for set up on multiple water heater systems, the low fire combustion should be established on all water heaters before setting any water heater high fire combustion rates.

Table 6: Target Combustion Values

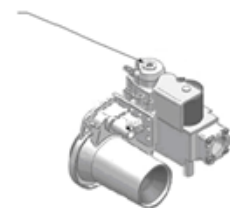
	Natural Gas		Propane	
	CO ₂	CO	CO ₂	CO
Max. Input	8.5% - 9.0%	<100 PPM	9.5% - 10.0%	<100 PPM
Min. Input	8.0% - 8.5%	<100 PPM	9.0% - 9.5%	<100 PPM

In order to perform adjustments to the gas valve the VTech must be firing before proceeding, and the gas inlet pressure must already have been verified.

8.3.1 – Adjust Low Fire Setting

VT80 to 250 – Negative Pressure Control Valve

Low-fire adjustment screw (use Torx 40 for adjustment, clockwise increases CO₂)



VT299 to VT399 – Negative Pressure Control Valve








Low-fire air gas ratio adjustment (use Torx 40 for adjustment clockwise increases CO₂)

VT499 – Negative Pressure Control Valve



Low-fire air/gas ratio adjustment, use slotted screwdriver for adjustment, clockwise increases CO₂

- Press the “” button on the control screen.
- Press **[Test]** and press 
- Select **[Forced Rate]** and Press 
- Select **[Set Low Fire]**
- Once the water heater has run for at least 10-15 minutes at low fire, with the coldest possible water, the condensate in the lower heat exchanger will be at maximum volume. At this point adjust the combustion for CO₂.
- Turn the gas valve low fire adjustment clockwise to increase CO₂, and counter-clockwise to decrease CO₂.

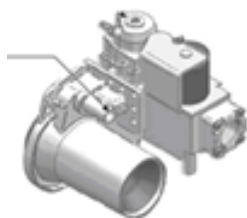
	Increase CO ₂	Decrease CO ₂
Low Fire Adjustment	 Clockwise	 Counter-Clockwise

- After adjusting the setting, wait for the combustion levels to stabilize before attempting to make any further adjustments.
- Continue this procedure until combustion levels are satisfied.
- Once settings are complete, continue to run the machine for at least 5 minutes and record the final combustion data.

8.3.2 – Adjust High Fire Setting

VT80 to 250 – Negative Pressure Control Valve

High-fire adjustment screw (use slotted screwdriver for adjustment, counter-clockwise increases CO₂)



VT299 to VT399 – Negative Pressure Control Valve








High-fire air gas ratio adjustment (Use slotted screwdriver for adjustment, counter-clockwise increases CO₂)

VT499 – Negative Pressure Control Valve



Lift top cover to access high fire air/gas ratio adjustment (use 3mm Allen key for adjustment, counter-clockwise increases CO₂)

- Ensure low fire adjustment is completed first.
- Press the “” button on the control screen.
- Press **[Test]** and press 
- Select **[Forced Rate]** and Press 
- Select **[Set High Fire]**
- Bring the temperatures up to 130F or the highest system design temperatures to minimize or eliminate condensate
- Turn the gas valve low fire adjustment counter-clockwise to increase CO₂, and clockwise to decrease CO₂.

	Increase CO ₂	Decrease CO ₂
High Fire Adjustment	 Counter-Clockwise	 Clockwise

- After adjusting the screw wait a moment for the combustion levels to stabilize before attempting to make any further adjustments.
- Continue this procedure until combustion levels are satisfied.
- Once settings are complete, continue to run the machine for at least 5 minutes and record the final combustion data.

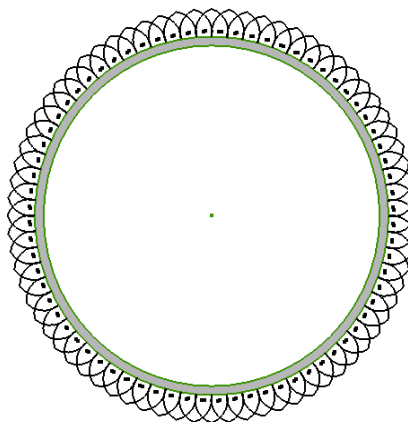
8.3.3 – Flame Monitoring

Throughout the combustion setup process, it is important to visually check flame to verify combustion settings.

WARNING

The area around the burner view port is hot and direct contact could result in burns

Normal Burner Flame Profile (Short, Dense and Blue)



- **Normal Flame** – A normal flame at 100% of burner input is blue, with slight yellow tips a well-defined flame and no flame lifting.
 - **Yellow Tip** – A yellow tip can be caused by blockage or partial obstruction of air flow to the burner.
 - **Yellow Flames** – A yellow flame can be caused by blockage of primary air flow to the burner or excessive gas input. This condition **MUST** be corrected immediately
 - **Lifting Flames** – Lifting flames can be caused by over firing the burner, excessive primary air, or excessive draft.
- If improper flame is observed, examine the venting system; ensure proper gas supply and adequate supply of combustion and ventilation air.

8.4 – Final Commissioning

- Check appliance performance by cycling the unit repeatedly. The burner should ignite promptly each time. Turn system off and allow burner to cool, then cycle burner again to ensure proper ignition and flame characteristics.
- The unit must continue to run with stable combustion without making any howling noise which usually happens from an overly rich mixture.

Part 9 – Service/Maintenance

Listed below are items that must be checked periodically to ensure safe reliable operations. Verify proper operation after servicing. Before doing any service to the appliances please ensure these two steps are taken:

- Turn off main electrical power to the appliance.
- Shut off gas at the main manual gas valve.

Check frequently to be sure that the flow of combustion and ventilation air to the appliance is not obstructed. Combustion and ventilation air must be provided to the mechanical room with openings sized per the requirements of the CSA B149.1-15 and CSA B149.2-15 or National Fuel Gas Code. The optional outdoor air kit brings combustion air from the outdoors directly to the appliance.

CAUTION

KEEP APPLIANCE CLEAR FROM COMBUSTIBLE MATERIALS; DO NOT STORE GASOLINE AND OTHER FLAMMABLE VAPORS AND LIQUIDS IN THE PROXIMITY OF THE APPLIANCE.

CAUTION

It is important that all gas appliances to be serviced by a CAMUS trained service technician. 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. To service or adjust this appliance, it is imperative that the CAMUS trained service technician utilize a combustion analyzer to read CO₂, CO and flue pressure according to CAMUS Hydronics recommendation.

CAUTION

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

NOTE

All gaskets/sealant on disassembled components or jacket panels must be replaced with new gaskets/sealant on re-assembly. Gasket and sealant kits are available from the factory

9.1 – Examine the Venting System – Annual

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 hose with water to clean. Clean screens in the venting air intake system as required. Have the entire system, including the venting system, periodically inspected by a qualified service agency. A qualified service technician should follow this procedure when inspecting and cleaning the tank and vent pipe.

- Turn off electrical power and main manual gas shut-off and allow appliance to cool down.
- Remove the vent pipe running to the chimney and check heat exchanger, vent and chimney for obstruction and clean as necessary.

CAUTION

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

9.2 – Combustion Air Blower – Annual

The combustion air blower should be inspected annually to ensure it is not blocked with dust or debris. The fan opening should be inspected for signs of contaminants or any other air restriction. If dirt and dust are built up on the blower inlet, the filter should be inspected and the blower and tank should be cleaned.

9.3 – Burner Maintenance – Annual

The burner should be removed for inspection and cleaning on an annual basis. An appliance installed in a dust or dirt filled environment will require inspection and cleaning on a more frequent schedule. The fan assisted combustion process may force airborne contaminants such as dust, dirt, concrete dust, or drywall dust 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.

9.3.1 – Burner Removal

Access to the burner will require the following steps:

- Remove the top cover.
- Disconnect the gas supply connection to the fan inlet.
- Disconnect the fan motor power wires at the harness.
- Remove the hot surface igniter and the flame sensor.
- Remove the sensing tubes from the gas valve to the combustion air fan.
- Remove the nuts holding the fan assembly to the tank and remove the fan assembly. On occasion the red silicone gasket may adhere to the underside of the fan's flange. Carefully pry the flange away from the gasket before removing the fan assembly.
- With the blower removed the burner can now be lifted vertically out of the tank cavity. A graphite-backed ceramic paper gasket is located directly under the burner flange. This gasket must be replaced if it is damaged.
- Use care to prevent damage to the knitted metal fiber of the burner surface.
- Check all gaskets and replace as necessary. Gaskets affected by heat will not reseal properly and must be replaced.
- To reinstall the burner, follow these steps in the reverse order.
- Insert the igniter and sensor before doing the final tightening on the fan mounting nuts.
- Evenly tighten the nuts (specified at 3 Ft.lbs).

NOTE

When the combustion air fan is removed for any reason, the inlet to the burner tube must be covered, to prevent further 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. 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.

9.3.2 – Burner Cleaning – As Required

Remove any visible dust or dirt blockage from the surface of the burner using water from a garden house. Wash the burner with low pressure water only. Never wipe or brush the surface of the burner. Never clean with high pressure water or air.

CAUTION

Never use a pressure washer to clean the burner

The burner may best be cleaned by immersing the burner port area in a solution of dishwashing detergent and hot water. Allow the burner to remain in the solution for a short period of time to loosen dust, dirt and oil or grease laden contaminants. Rinse the burner thoroughly with clean water to remove any residue from the detergent cleaner. The burner should be air dried after removal from the cleaning solution and rinsing. **DO NOT** use chlorine based solvents or cleaning agents.

9.5 – Check the Condensate Neutralizer –6 Months

Neutralizer medium is expected to last approximately three to six months depending on the amount of condensate produced.

➤ Condensate Produced, USgal/h = [KBtu/h Input / 100]

In higher temperature systems less condensate will be produced, extending the life of the neutralizer media. Media viability can be verified with pH test strips (i.e. litmus paper). Replace media as needed to maintain neutral state of discharged condensate, as required by code.

9.6 – Draining and Flushing – Annual

It is recommended that the water heater tank be drained and flushed annually to reduce sediment buildup. The water heater

should be drained if being shut down during freezing temperatures.

9.7 – Complete the Service

- Update the appliance service records immediately upon completing service.
- Restore electrical power and gas supply to appliance.
- Cycle unit and check for proper operation. At minimum the following parameters should be checked to verify they fall within acceptable limits. Deviation from the readings made during commissioning can also indicate a problem that is otherwise undetectable.
 - Verify all combustion settings, including incoming gas pressure, differential air pressure, and CO₂ settings (see Section 8).
 - Visually inspect burner flame to verify combustion.
- Confirm proper operation of all safety devices.
- Check for gas leaks and proper vent operation.
- Check control settings.
- Install top cover once all checks and adjustment are complete.

9.8 – Troubleshooting

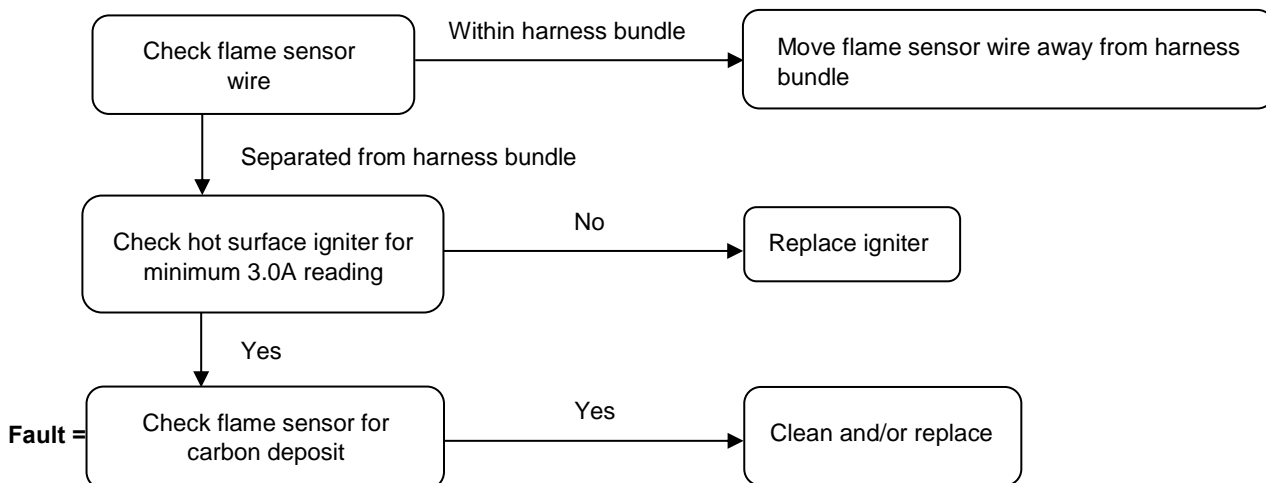
SYMPTOM	FAILURE MODE	ANALYSIS
Incoming Power	• Two wires interchanged	• No effect on safety • Live and Neutral wires are interchanged.
Transformer Tripped	• The 24Volts and 120 Volts wired are interchanged	• Transformer immediately burns out, replace transformer
Relief Valve	• System pressure exceeds relief valve setting	• Replace the standard relief valve with a higher rated valve up to the maximum pressure of the heat exchanger. • Improperly sized expansion tank.
Low Water Cut-Off	• LWCO contacts are open	• Verify for closed valves or obstructions in water heater piping • Verify that all air has been purged from the system • Verify that wiring is correct
Stack Temperature Limit Trips	• Stack temperature has exceeded the limit set on the water heater. • Error: FLUE MAX	• PVC: Reduce desired setpoint to less than 140°F. • Measure the resistance of the flue sensor at room temperature, it should be approximately 10kΩ. • PVC: 149°F • CPVC: 194°F • PPE: 230°F • Stainless Steel, AL29-4C: 250°F
Blocked Flue Switch	• Error: FLUE OPEN	• Blocked flue switch wire(s) is/are loose • Blocked flue switch is set too light if it trips at full fan speed, reduce sensitivity by turning screw 1 turn clockwise.
Fan Not Turning	• Fan refuses to rotate • Error: BLOW SPD	• Check fan power wires • Fan signal wires are interchanged • Minimum fan speed must be greater than 10%
Flame Disappears During a Run Cycle (Pressing the manual OK button on the VTech Control Panel to restart the ignition sequence)	• The VTech water heater was running and flame signal suddenly disappeared.	• Verify that all air has been purged from gas line • Inspect hot surface igniter and related wiring for damage and connection errors. • Inspect flame sensor and associated wiring. Replace if necessary • Verify that water heater is properly grounded • Verify incoming gas supply pressure and that it coincides with Table 9. • Verify that the gas line connections to the water heater are adequate • Verify that the vent/ air inlet piping (if equipped) are correctly installed and obstructions are not present • Verify that 24 VAC is being supplied to the gas valve during ignition. If a signal cannot be detected, the transformer needs to be replaced • Inspect the burner. Refer to Burner Maintenance in section 9.7 • Replace the VTech Controller if necessary

Flame Failure (Pressing the manual OK button on the VTech Control Panel to restart the ignition sequence)	<ul style="list-style-type: none"> The water heater has failed to ignite the burner after 3 consecutive attempts 	<ul style="list-style-type: none"> Verify that all air has been purged from gas line. Inspect hot surface igniter and related wiring for damage and connection errors. Verify igniter is glowing and draws at least 3.0A. Inspect flame sensor and associated wiring. Replace if necessary. Verify that water heater is properly grounded Verify incoming gas supply pressure and that it coincides with Table 4. Verify that the vent/ air inlet piping are correctly installed with no obstructions. Check wiring from VTech Controller, Gas Valve Transformer. If a signal cannot be detected, the VTech Controller needs to be replaced If 24 VAC is present, check the valve. Connect a manometer to the outlet pressure tap. Negative pressure should be present during pre-purge. When the valve is energized the pressure should change. If not the gas valve has failed or is passing insufficient gas. Consider adjusting combustion settings. Inspect the burner, and clean if necessary. Replace the VTech Controller
Flame Detection is out of Sync	<ul style="list-style-type: none"> Error: FLAME FALSE 	<ul style="list-style-type: none"> Verify supply voltage for proper polarity. Check external wiring for voltage feedback Check internal wiring for proper connections Check the flame sensor and verify that it is clean Replace VTech Controller
Sensor Not Connected	<ul style="list-style-type: none"> Tank Bottom sensor open Tank Top sensor open Flue sensor open 	<ul style="list-style-type: none"> Verify that the sensors are connected Verify that they are wired correctly. Measure the resistance of the sensors, 10kΩ sensors. Replace the sensor if necessary
Noisy Operation	<ul style="list-style-type: none"> Supply Gas Issue 	<ul style="list-style-type: none"> Refer to Part 3 Gas Connection in this manual. Natural Gas Pressure should read between 3" w.c. and 14" w.c. L.P. Gas Pressure should be at 11" w.c.
	<ul style="list-style-type: none"> Air/Gas Mixture Issue 	<ul style="list-style-type: none"> Refer to Gas Valve Adjustment Procedure in section 10.2 of this manual for the proper combustion setting.
	<ul style="list-style-type: none"> Air Inlet and/or vent configuration 	<ul style="list-style-type: none"> Refer to Part 2 Air Inlet and Venting
	<ul style="list-style-type: none"> Dirty/ Damaged Burner 	<ul style="list-style-type: none"> Refer to Burner Maintenance in section 9.7 of this manual for the burner removal and inspection procedure. Clean or replace the burner, if required.
	<ul style="list-style-type: none"> Air in the piping system 	<ul style="list-style-type: none"> Purge all air from the piping system
Blank Display Screen	<ul style="list-style-type: none"> Blank display screen 	<ul style="list-style-type: none"> Check that display is connected to the PIM using a CAT5 cable on the back of the display
Internal Fault	<ul style="list-style-type: none"> Error: Internal 	<ul style="list-style-type: none"> Reset VTech Controller If fault persists, replace VTech Controller
ID Card Failure	<ul style="list-style-type: none"> Error: ID CARD 	<ul style="list-style-type: none"> Reset VTech Controller If fault persists, contact factory

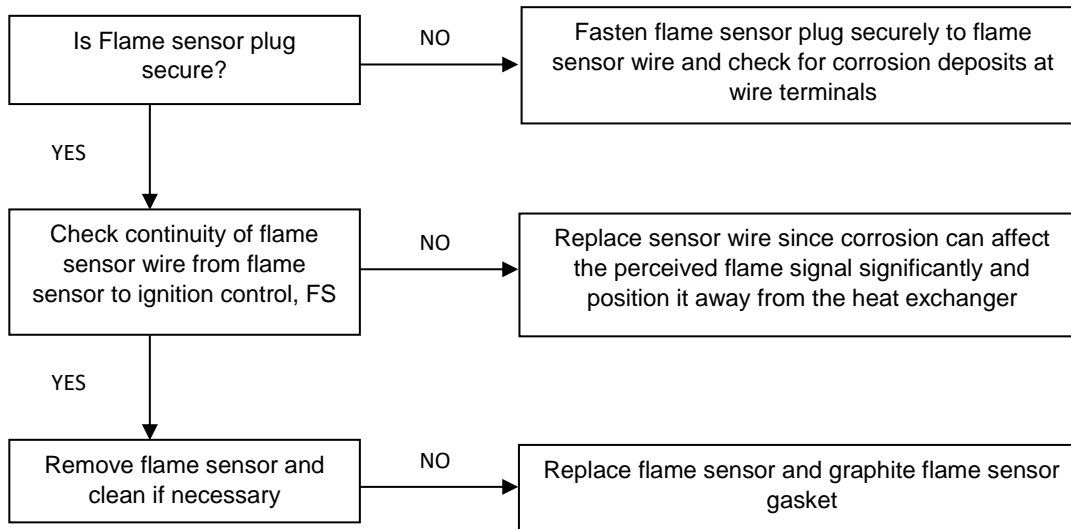
9.8.1 – Flow Diagrams

Fault = "IGNITION FAIL"

This error occurs when a flame signal is not detected by the flame sensor. A minimum signal of 0.8Vdc must be detected by the flame sensor to prove the flame.

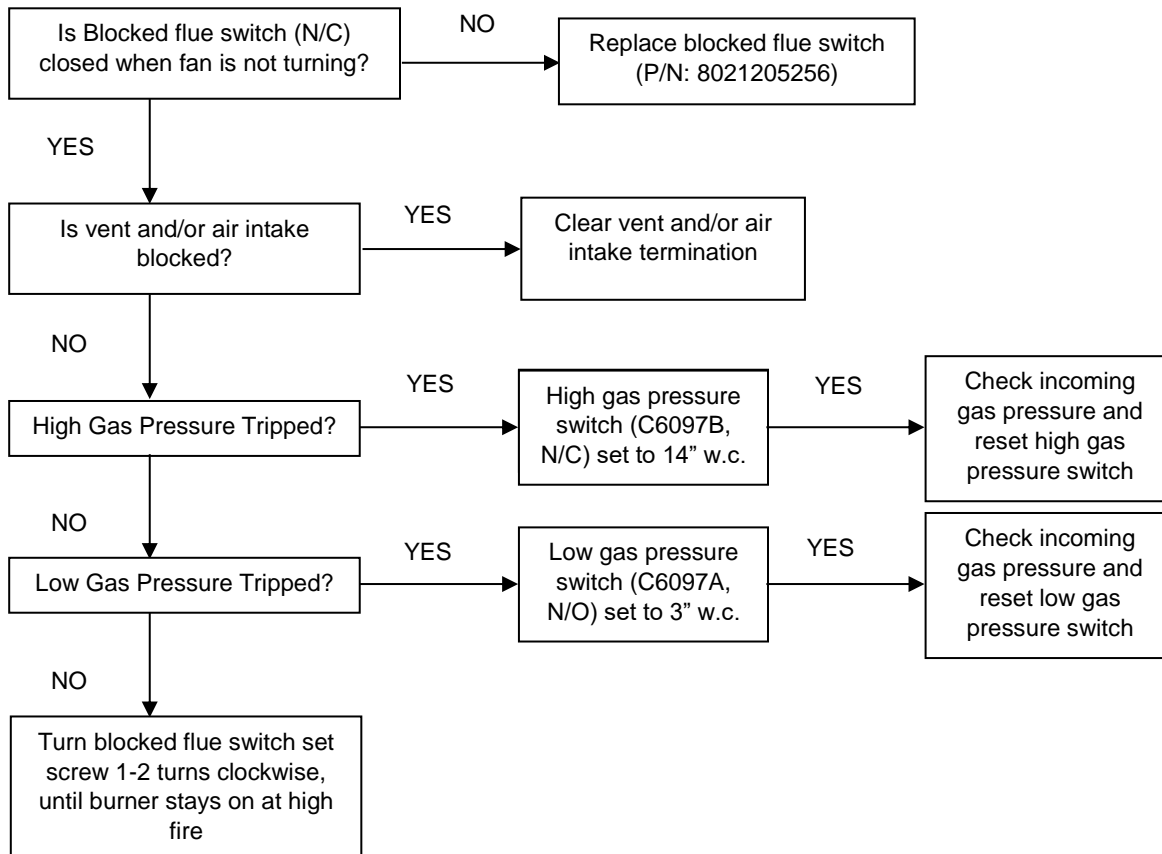


This type of failure indicates a flame rectification signal issue through the flame rod.



Fault = "AIR FLOW FAIL"

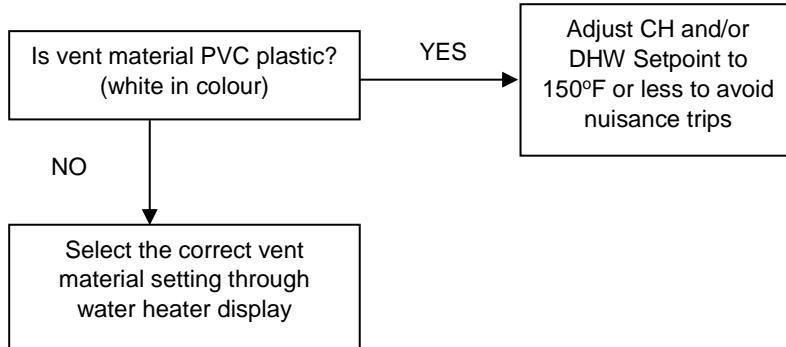
This error can indicate a blocked flue or blocked intake condition, low gas pressure switch tripped (optional) or high gas pressure switch tripped (optional). To identify the safety that is open set the multimeter to Vac and measure the voltage from one contact to ground. The contacts produce a 24Vac when the circuit is closed.



Fault = “STACK LIMIT EXCEEDED”

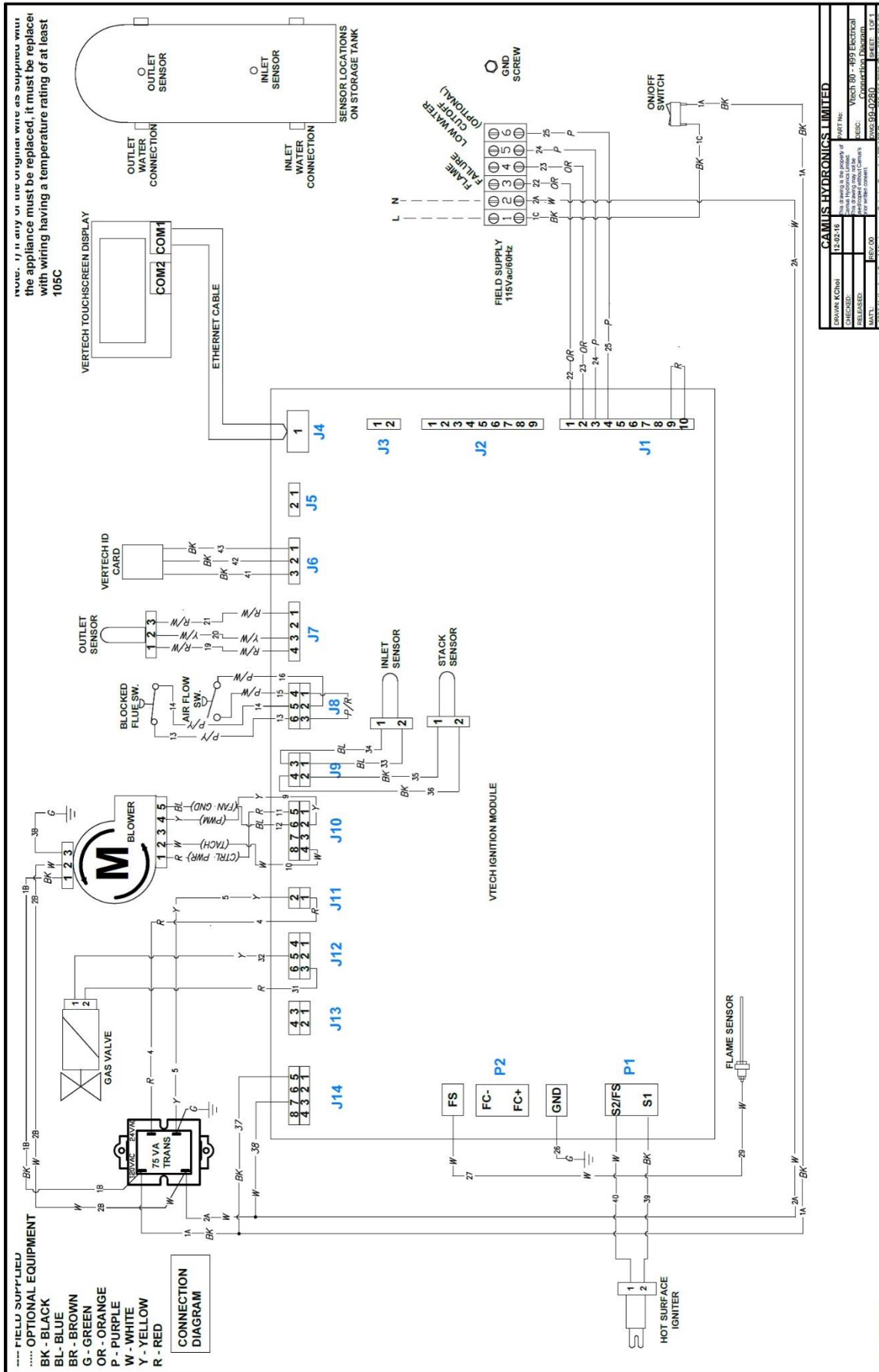
A flue gas error occurs when the stack temperature has exceeded the maximum limit allowed by the vent material. This is an automatic reset error, when the stack temperature drops 20°F below the limit allowed the water heater is allowed to restart and an ignition attempt is made if the call for heat is not yet satisfied. In the event that a setpoint greater than 150°F is selected and PVC venting is used the setpoint must be reduced to below 150°F to avoid nuisance flame failures. If a setpoint greater than 150°F is required, venting with CPVC, AL29-4C, 316LL or PPE is strongly advised.

The stack temperature is between 15-30°F above the incoming (return) water temperature to the appliance.

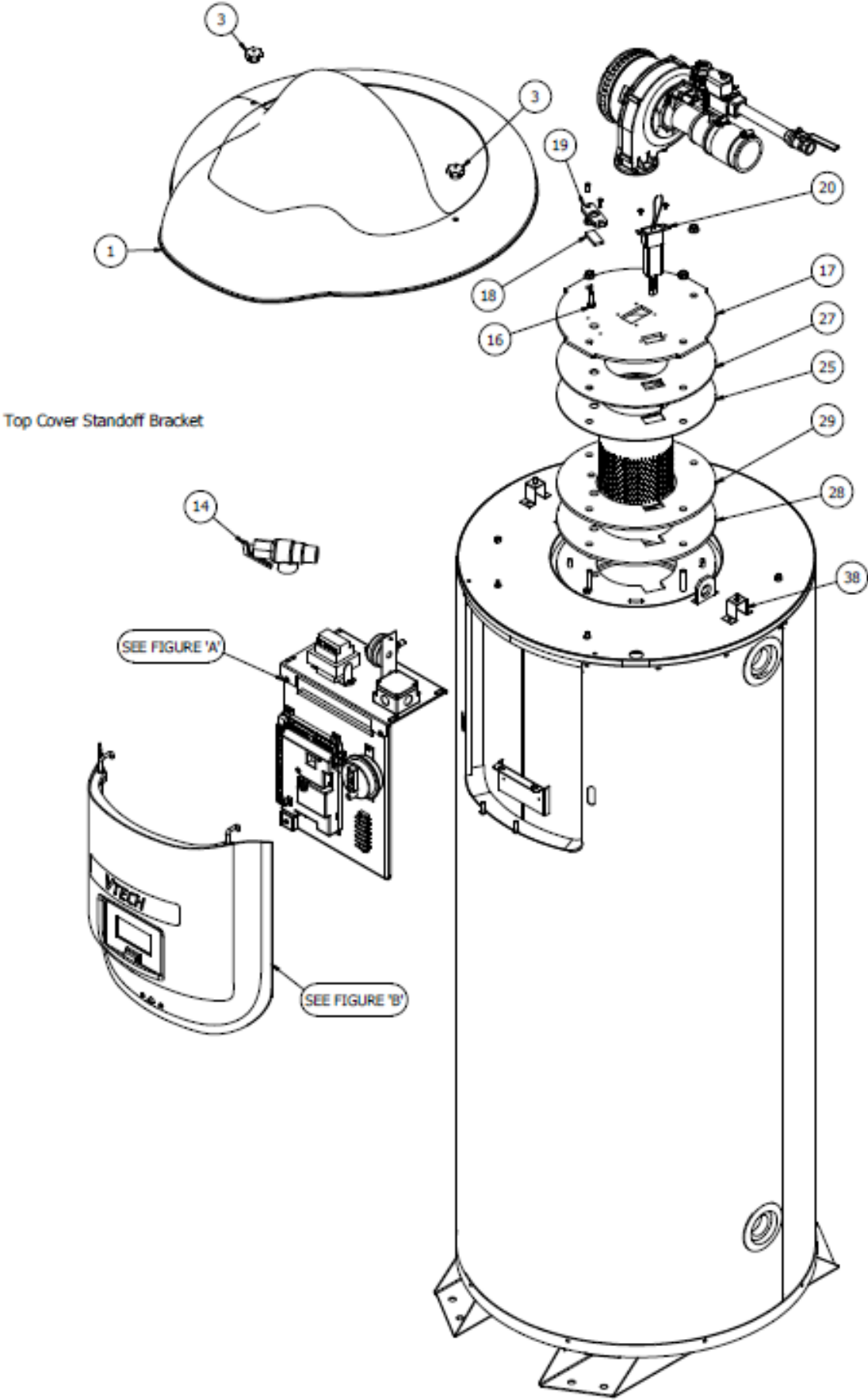


Material	Maximum Temperature [°F]
PVC	149
CPVC	194
PPE	230
AL29-4C	300+
316L SS	300+

Appendix A – Electrical Schematics



Appendix B – Parts – Exploded View



Appendix B – Controls

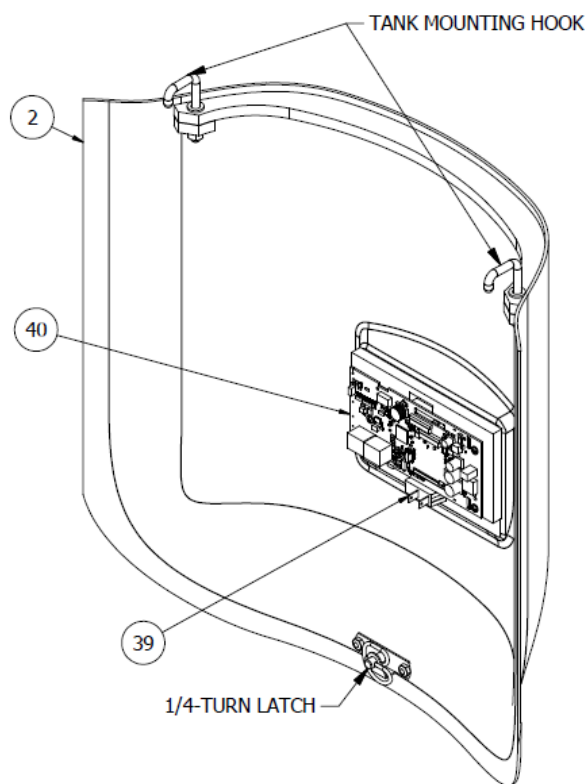


Figure B: Front Cover Assembly

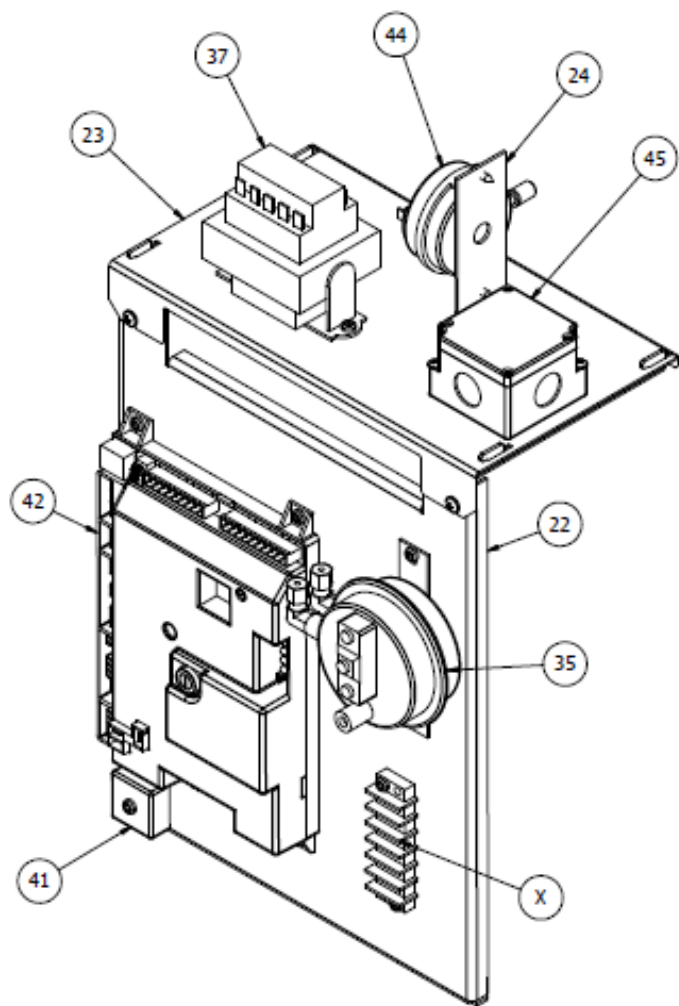


Figure A: Control Board

Appendix B – Gas Train

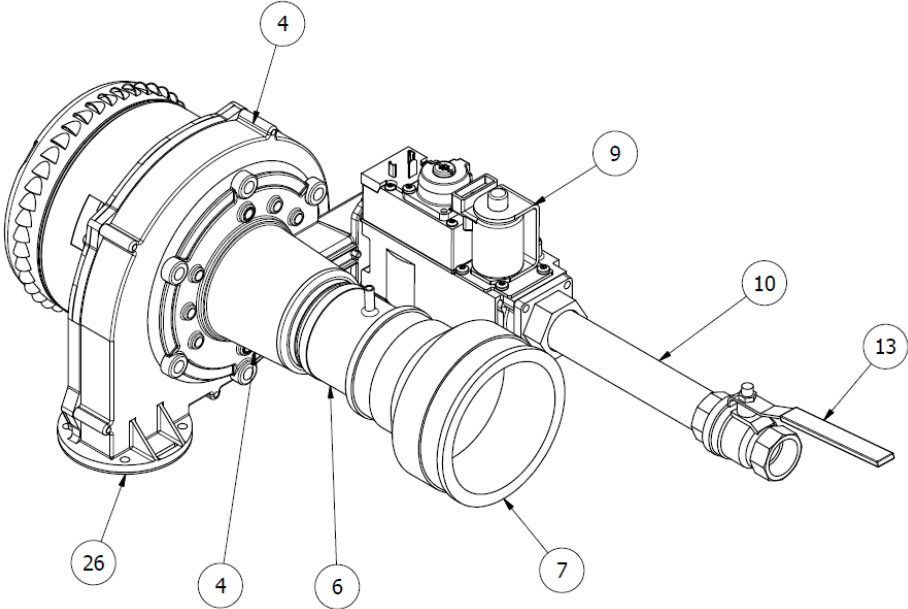


Figure C: Gas Train

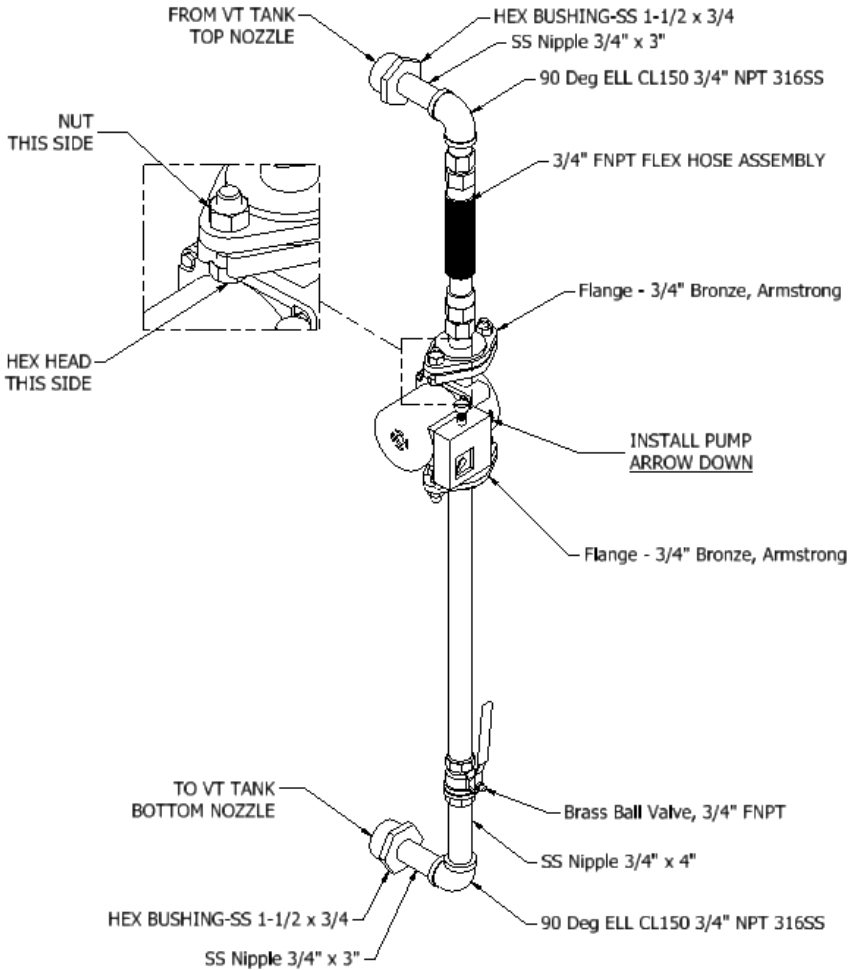


Figure D: Circulator Assembly

Appendix B – Parts – Exploded View

#	QTY	Part Description	Part Number	All	80	100	125	150	199	250	299	399	499
1	1	Plastic Top Cover	019-02304-000	x									
2	1	Plastic Front Cover assembly c/w 1/4-Turn Latch & Mounting Hooks	019-02305-000	x									
3	2	VT Top Cover Knob	120-00275-000	x									
4	1	Fan	813-02796-000										x
			813-02795-000								x	x	
			813-02794-000				x	x	x	x			
			813-02793-000		x	x							
5	1	Venturi (Manifold)	813-02805-000		x	x							
			813-02806-000				x	x					
			813-02807-000						x	x			
			813-02808-000								x	x	
			813-02809-000										x
6	1	Air Inlet Adapter w/ Pressure Test Port	957-05070-000	x									
7	1	Rubber Air Inlet Bushing	847-09257-000	x									
8	1	PVC Sleeve c/w Clamp	076-01024-000										x
			076-01023-000		x	x	x	x	x	x	x	x	
9	1	Gas Valve	918-10250-000										x
			833-25180-000								x	x	
			833-25178-000		x	x	x	x	x	x			
10	1	1/2" SCH40 Pipe – T.B.E. - 8" LG.			x	x	x	x	x	x			
		3/4" SCH40 Pipe - T.B.E. - 7" LG.									x		
		1" SCH40 Pipe - T.B.E. - 6" LG.										x	x
11	1	Straight Reducer, 3/4" x 1" FPT											x
12	1	1" NPT x 2" NPT Nipple											x
13	1	Brass Ball Valve	223-01366-000		x	x	x	x	x	x			
			223-01363-000								x		
			223-01371-000									x	x
14	1	T&P Valve 1" Male X 1" Female	210-02906-000	x									
15	2	11-0003 Dry Well for 3/8" Thermister 2-3/4" long	096-00308-000	x									
16	1	Ionization Electrode (Flame Sensor)	834-02000-000	x									
17	1	Fan Discharge Flange	285-00342-000	x									
18	1	Sight Glass	851-06444-000	x									
19	1	Sight Glass Holder	125-01179-000	x									
20	1	Hot Surface Igniter	873-01056-000	x									
21	1	Hot Surface Igniter Mount	285-03646-000	x									
22	1	Central Control Panel	283-01952-000	x									
23	1	HV mounting plate	283-01952-001	x									

#	QTY	Part Description	Part Number	ALL	80	100	125	150	199	250	299	399	499
25	1	VTech Burner w/ Burner Flange	829-01561-000		x	x	x						
			829-01562-000					x	x				
			829-01563-000							x	x		
			829-01565-000									x	x
26	1	Neoprene Blower Gasket	n/a	x									
27	1	Red Silicone Rubber Gasket	853-02527-000	x									
28	1	Graphite Backed White Ceramic Gasket	853-02525-000	x									
29	1	Graphite Gasket	853-02526-000	x									
30	1	Gas Valve Harness	832-18300-000		x	x	x	x	x	x			
			858-11559-000								x	x	
31	1	VTech Wire Harness	826-00500-000	x									
32	1	VT Circulator Piping Assembly	857-04406-001		x	x							
			857-04405-001				x	x					
			857-04404-001						x	x	x	x	
			857-04403-001										x
33	1	Tank Bottom Sensor	817-04468-000	x									
34	1	Tank Top Sensor	817-11088-000	x									
35	1	Vent 'Stack' Sensor	817-11087-000	x									
36	1	6-Pole Terminal Block	832-18289-000	x									
37	1	120/24V/QC 75VA Transformer	834-03852-000	x									
38	2	Top Cover Standoff Bracket	008-10250-000	x									
39	1	On/Off Switch with Rainproof Cover	817-11058-000	x									
40	1	BTC II Display	833-10864-000	x									
41	1	ID Card	833-07000-000	x									
42	1	Ignition Module	833-07001-000	x									
43	1	SMD Switch	817-11046-000	x									
44	1	Low Air Proving Switch	817-11073-000	x									
45	1	Enclosure, Terminal Box 120V AC-15A	848-12021-000	x									

[illegible]

CONDENSING WATER HEATER LIMITED WARRANTY

GENERAL

CAMUS Hydronics Limited ("CAMUS") extends the following LIMITED WARRANTY to the owner of this appliance, provided that the product has been installed and operated in accordance with the Installation Manual provided with the equipment. CAMUS will furnish a replacement for, or at CAMUS option repair, any part that within the period specified below, shall fail in normal use and service at its original installation location due to any defect in workmanship, material or design. The repaired or replacement part will be warranted for only the unexpired portion of the original warranty. This limited warranty does not cover failures or malfunctions resulting from: (1) Failure to properly install, operate or maintain the equipment in accordance with CAMUS' manual; (2) Failure to properly install, operate or maintain the pump assembly; (3) Abuse, alteration, accident, fire, flood, foundation problems and the like; (4) Sediment or lime build-up, freezing, or other conditions causing inadequate water circulation; (5) Pitting and erosion caused by high water velocity; (6) Failure of connected systems devices, such as pump or controller; (7) Use of non-factory authorized accessories or other components in conjunction with the system; (8) failing to eliminate air from, or replenish water in, the connected water system; (9) Chemical contamination of combustion air or use of chemical additives to water; (10) Production of noise, odours, discolouration or rusty water; (11) Damage to surrounds or property caused by leakage or malfunction; (12) All labour costs associated with the replacement and/or repair of the unit; (13) Any failed component of the system not manufactured as part of the water heater.

HEAT EXCHANGER

Within ten (10) years of the appliance having declared FOB from CAMUS, a heat exchanger shall prove upon examination by CAMUS to be defective in material or workmanship, CAMUS will exchange or repair such part or portion if deemed warranty based on the number of years the appliance has been in service.

Years in Service	Vtech	Years in Service	Vtech
1	100%	6	100%
2	100%	7	100%
3	100%	8	30%
4	100%	9	25%
5	100%	10	20%

The exchanged or repaired heat exchanger will carry the balance of the remaining original warranty provided with the appliance based on the FOB date. In the event a replacement heat exchanger is delivered and if the defective heat exchanger is deemed to be repairable by CAMUS the repaired heat exchanger will be returned to the customer and a credit will not be issued. Heat Exchanger shall be warranted for (20) years of the appliance having declared FOB from CAMUS against "Thermal Shock" (excluded, however, if caused by appliance operation at large changes exceeding 150°F between the water temperature at inlet and appliance temperature or operating at temperatures exceeding 210°F.

BURNER

If within five (5) years of the appliance having declared FOB from CAMUS to be defective in material or workmanship, CAMUS will exchange or repair such part or portion.

ANY OTHER PART

If any other part fails within one (1) year after installation, or eighteen (18) months of the appliance having declared FOB from CAMUS whichever comes first CAMUS will furnish a replacement or repair that part. Replacement parts will be shipped FOB our factory.

DURATION OF LIMITED WARRANTY

Any limited warranty, including the warranty of merchantability imposed on the sale of the water heater under the laws of the state or province of sale are limited in duration to one year from date of original installation.

STATE LAW & LIMITED WARRANTY

Some states or provinces do not allow:

- Limitations on how long an implied warranty lasts
- Limitations on incidental or consequential damages.

The listed limitations may or may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which may vary from state to state and province to province.

CONDITIONS

We will not:

- Repair or replace any water heater, or part, subject to conditions outlined in 'This Limited Warranty Does Not Cover'
- Reimburse any costs associated with repair and/or replacement
- Replace and/or repair any water heater without complete model number/serial number
- Replace any water heater without prior receipt of actual rating plate from the appliance.

HOW TO MAKE A CLAIM

Any claim under this warranty shall be made directly to CAMUS Hydronics Limited Representative in your area. Please visit our website at www.camus-hydronics.com and use our "Rep Finder" tool to locate your local CAMUS representative.

SERVICE LABOR RESPONSIBILITY

CAMUS shall not be responsible for any labour expenses to service, repair or replace the components supplied. Such costs are the responsibility of the owner.

DISCLAIMERS

CAMUS shall not be responsible for any water damage. Provisions should be made that in the event of a water/appliance or fitting leak, the resulting flow of water will not cause damage to its surroundings.



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.

