



Infiniti® Series Tankless (Condensing) Gas Water Heater



(Indoor)



(Outdoor)

SERVICE MANUAL

Troubleshooting Guide
and Instructions for Service

(To be performed ONLY by
qualified service providers)

Models Covered by This Manual:

Indoor Gas:	Indoor Propane:
RTG-K-160-N1	RTG-K-160-X1
RTG-K-199-N1	RTG-K-199-X1
RTG-L-160-N1	RTG-L-160-X1
RTG-L-199-N1	RTG-L-199-X1

Outdoor Gas:	Outdoor Propane:
RTG-K-160-N2	RTG-K-160-X2
RTG-K-199-N2	RTG-K-199-X2

TRAINING AND SERVICE INFORMATION
This document is restricted to exclusive use
by the official service partners.



As required by the state of California Proposition 65.

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1. Introduction

This manual is a complement to the instruction/operation manual delivered with the appliance, with the main important technical details that are relevant for the **official service partners and trainers in the country**.

2. Appliance Description

This appliance is a fan pressurized gas water heater offering a wide range of modulation and installation advantages with both indoor and outdoor models available.

2.1 Appliance Designation

The designation allows the identification of the main characteristics of the units, especially when a report is needed through Bradford White Tech Services.

Infiniti Tankless™ K and L Series

Segment	Model #	Description
INDOOR	RTGK160N1	160 KBTU/NATURAL GAS/INDOOR
	RTGK199N1	199 KBTU/NATURAL GAS/INDOOR
	RTGL160N1	160 LBTU/NATURAL GAS/INDOOR
	RTGL199N1	199 LBTU/NATURAL GAS/INDOOR
	RTGK199X1	199 KBTU/PROPANE/INDOOR
	RTGK160X1	160 KBTU/PROPANE/INDOOR
	RTGL160X1	160 LBTU/PROPANE/INDOOR
	RTGL199X1	199 LBTU/PROPANE/INDOOR
OUTDOOR	RTGK199N2	199 KBTU/NATURAL GAS/OUTDOOR
	RTGK160N2	160 KBTU/NATURAL GAS/OUTDOOR
	RTGK199X2	199 KBTU/PROPANE/OUTDOOR
	RTGK160X2	160 KBTU/PROPANE/OUTDOOR

Table 1 – Appliance Identification

2.2 Available Accessories

Anti-Freeze Kit

Allows the protection of the appliance against water freezing inside of its pipes / heat exchanger. The anti-freeze kit can be used where ambient temperatures are as low as -30°F/-35°C for short periods of time.

Additional measures must be taken to the surrounding pipes connected to the unit in case it is installed in a place where freezing temperatures are constant.

The heating elements in the Anti-Freeze kit are protected by ceramics and are clipped to the copper pipes.

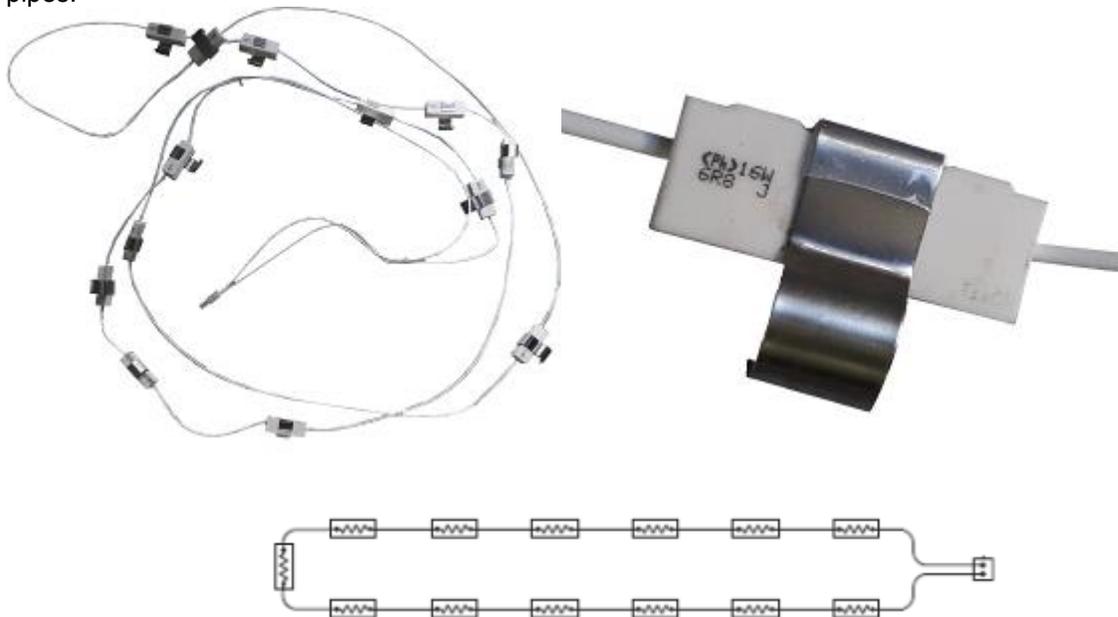


Figure 1 – Anti-Freeze Kit

The kit includes 16 resistances for the indoor version and 13 resistances for the outdoor version, which activate under conditions from table 2. Each resistance has +/- 16W of expected dissipated power.

Activation	Deactivation
$T_{\text{box}} \leq 5^{\circ}\text{C} / 41^{\circ}\text{F}$	$T_{\text{box}} \geq 10^{\circ}\text{C} / 50^{\circ}\text{F}$

Table 2 – Anti-freeze activation conditions

3. Installation

The installation manual of each product must be checked and used by the installer to optimize and leave the appliance in correct operation conditions.

Check Lists for Technicians/Installers:

3.1 Appliance Mounting on the Wall

Requisite	Confirmation
Appliance is levelled and in the vertical position?	
Delivered accessories are used accordingly?	
Appliance is supported exclusively by the wall mounting and not by hydraulic and/or gas connections?	

Table 3 – Check List for Mounting

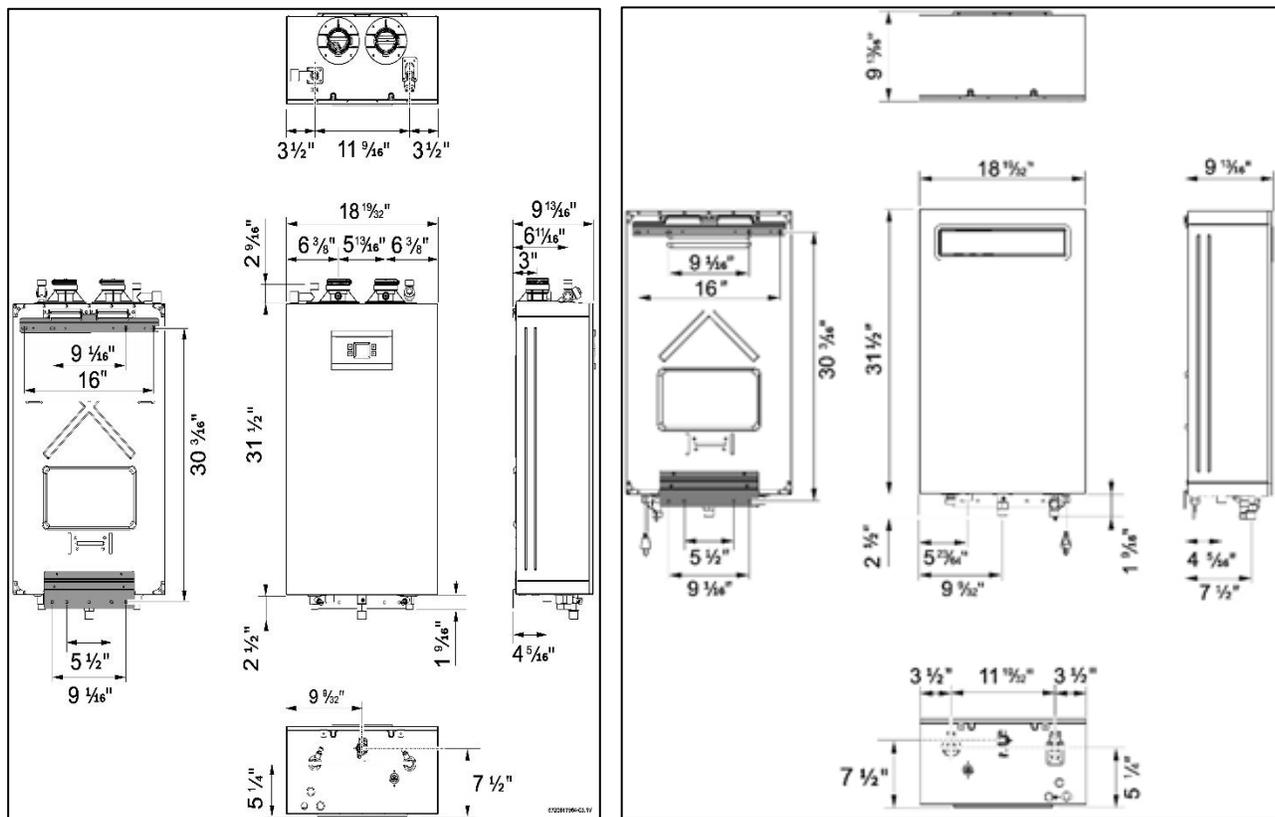


Figure 2 – Pre-installation distances for Indoor appliance (left) and outdoor appliance (right)

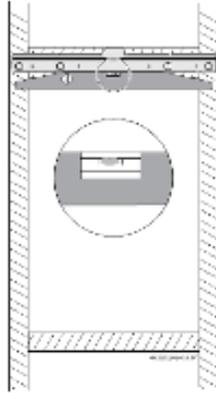


Figure 3 – Wall mounting preparation using supplied wall hung bracket

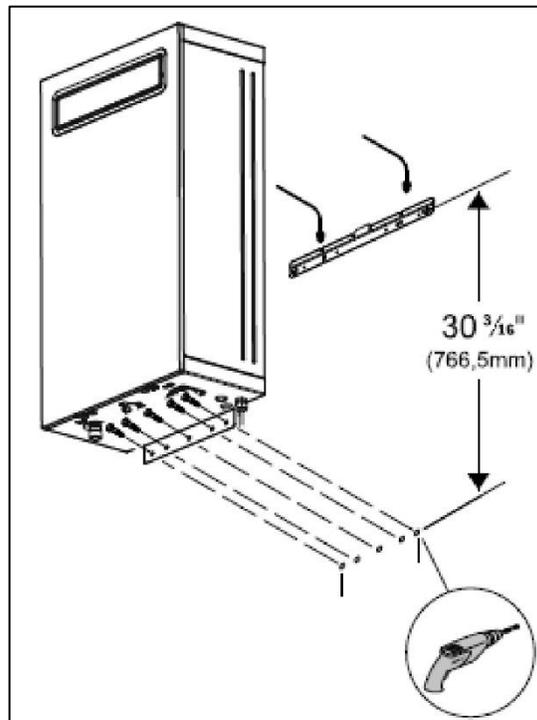
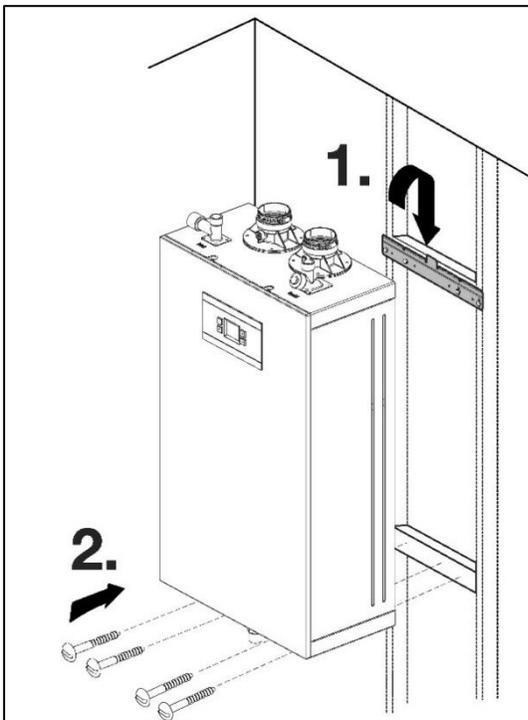


Figure 4 – Wall mounting for indoor appliance (left) and outdoor appliance (right)

3.2 Water Connections

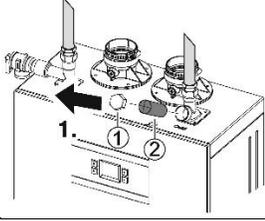
Requisite	Observations	Confirmation
Water pipes were cleaned before being connected to the appliance?		
Inlet water filter was checked and is cleaned, ensuring the necessary water flow rate?		
Accessories for water connections are adequate and without water leak?		
Water pressure and flow are according to the appliance specifications?	<ul style="list-style-type: none"> - Minimum pressure: 1.2 bar / 18 PSI - Maximum pressure: 10 bar / 150 PSI 	

Table 4 – Check List for Water Connections

3.3 Gas Connection

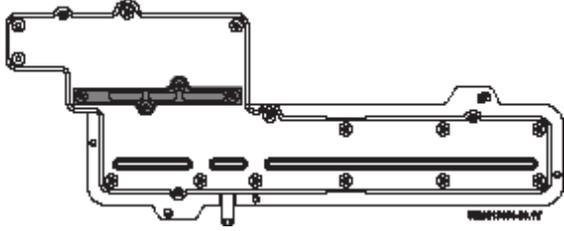
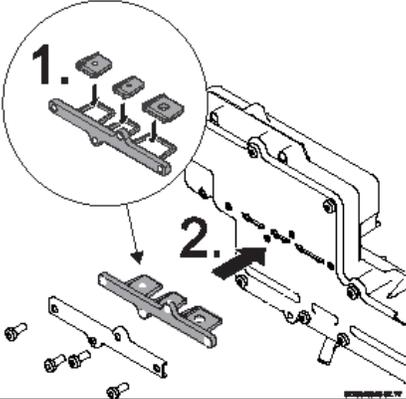
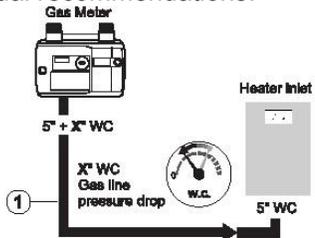
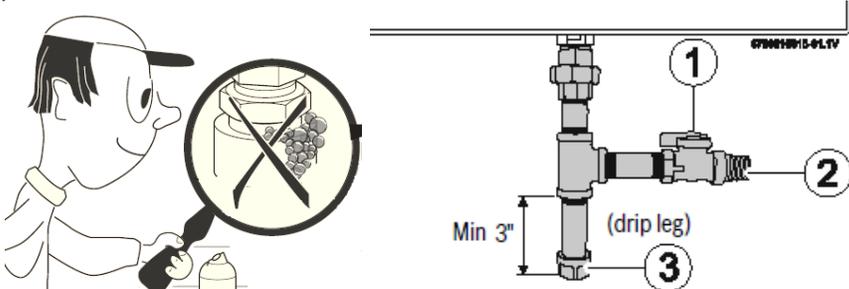
Requisite	Confirmation
<p>The appliance is suitable for the available gas type?</p> <p><u>Unit Supplied as NG (without gas flow restrictors)</u></p>  <p><u>Unit set up for LP (with gas flow restrictors)</u></p> 	
<p>Pressure reducer and gas pipe are adequate for the required pressure and gas flow? Refer to manual recommendations.</p> 	
<p>Accessories for gas connection are adequate and according to the country specification/standards?</p> 	

Table 5 – Check list for Gas Connections

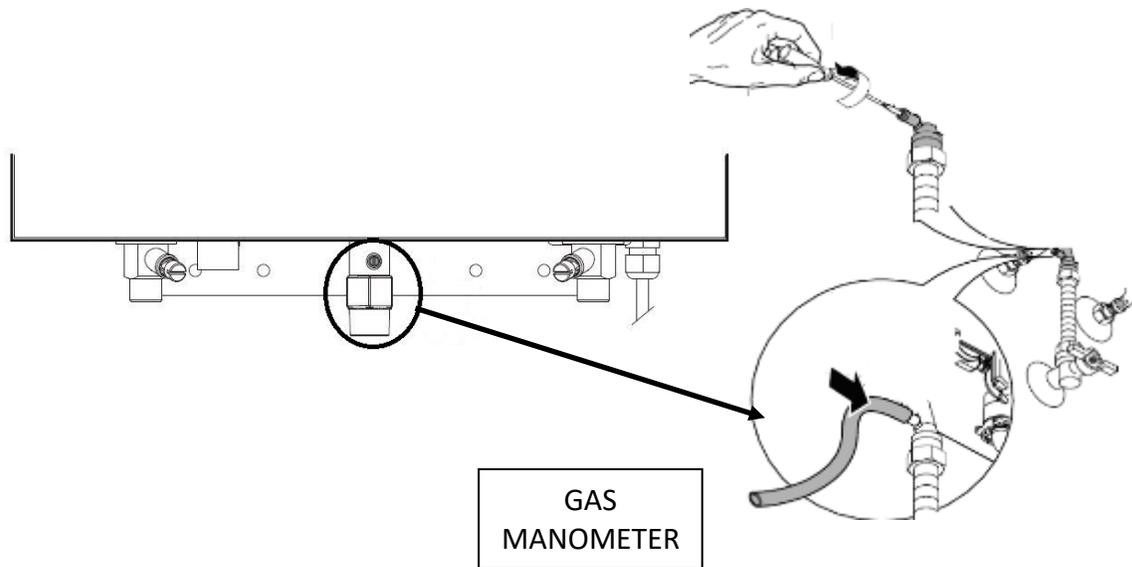


Figure 5 – Manometer pipe connection to measure static/dynamic gas supply pressure

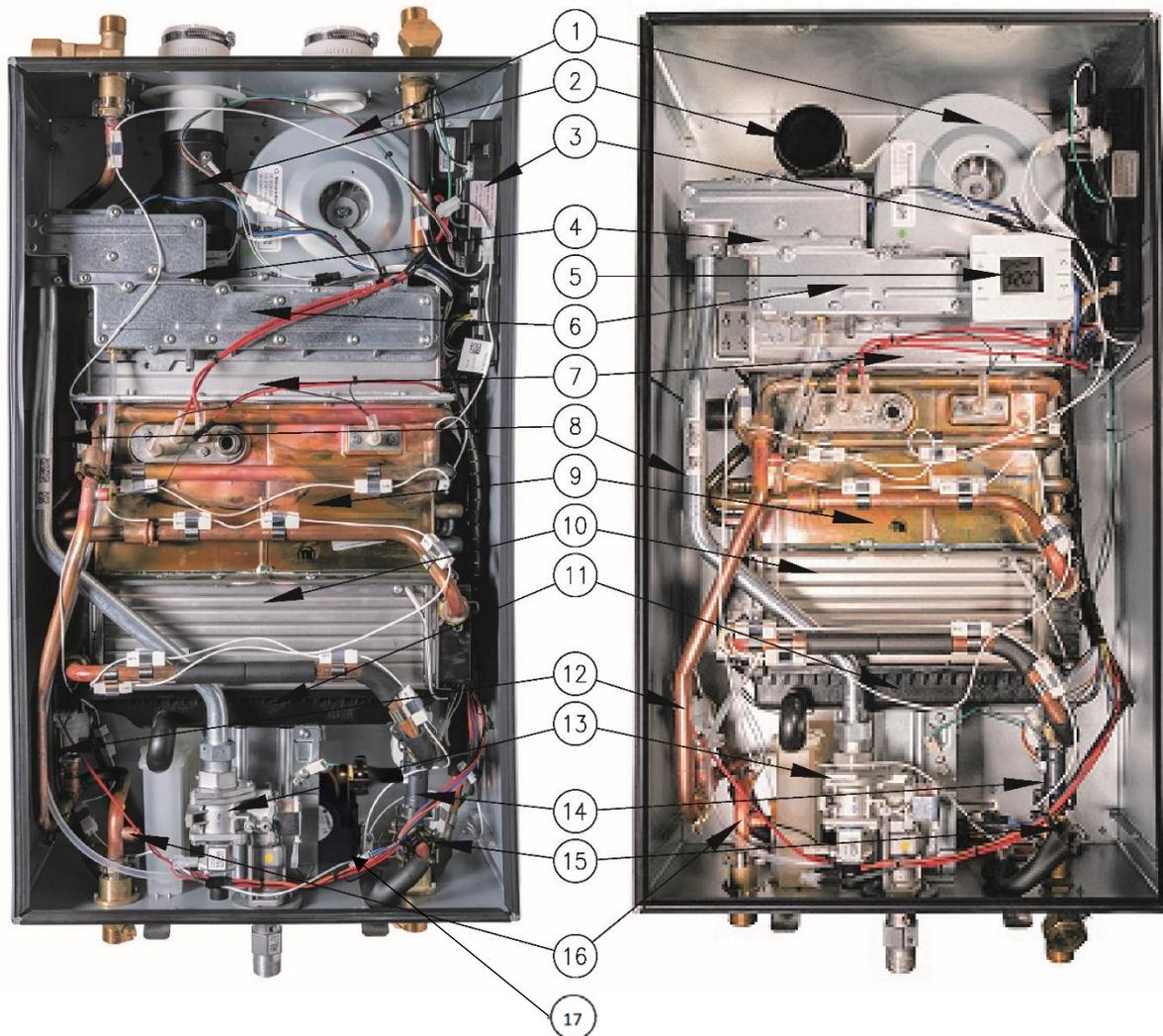
3.4 Appliance Performance

Measure water flow and temperature increase to check temperature and instantaneous water flow, assuring correct operation of the appliance.



Figure 6 – Use of Water Flow Meter and Thermometer

4. Components Overview

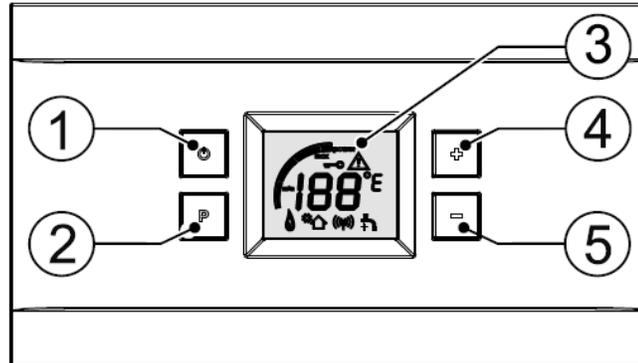


- | | |
|---|--|
| 1 – Fan | 9 – Primary heat exchanger |
| 2 – Exhaust tube | 10 – Secondary heat exchanger |
| 3 – Control unit | 11 – Condensate collector |
| 4 – Gas restrictor | 12 – Bypass valve |
| 5 – HMI for installer (outdoor version) | 13 – Gas valve |
| 6 – Manifold | 14 – Water valve (Stepper motor+Flow sensor) |
| 7 – Burner | 15 – Temperature sensor (inlet water) |
| 8 – Gas tube | 16 – Temperature sensor (outlet water) |
| | 17 – Built-in recirculating pump (L-Series only) |

Figure 7 – Internal View of Model – Indoor: L-Series (left) and Outdoor K-Series (right)

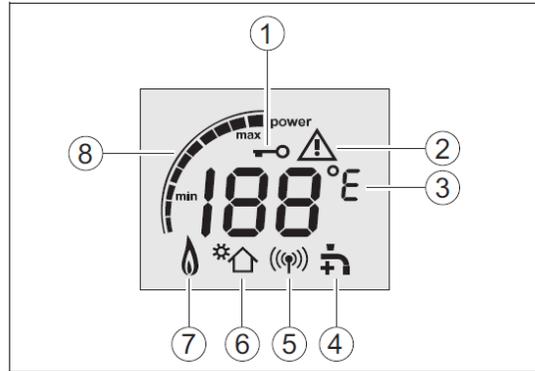
4.1 Control Panel for User (Indoor Version)

The control panel, located on the front cover of the appliance, allows the final user to control the operations needed. The following figures show the overall control panel and the display icons, respectively. See Table 8 for more display icon information.



- [1] On/Off button
- [2] Program Key
- [3] LCD display
- [4] Up button
- [5] Down button

Figure 8 – Control Panel on the Front Cover of the Appliance (Indoor Version)



- [1] Locked condition indicator
- [2] Error indicator
- [3] Temperature indicator
- [4] Activation water flow
- [5] Cascading Master indicator
- [6] Solar mode indicator
- [7] Flame indicator
- [8] Power bar indicator

Figure 9 – Display LCD Description

Control Panel Operation:

Power:

- To start the appliance, press the On/Off button.
- To shut down the appliance, press the On/Off button again.

Reset Errors:

- Some error codes can be solved by resetting the appliance. To do this, press and hold the On/Off button for more than 3 seconds. The appliance will initiate the start-up sequence.

Set Water Temperature:

- By default, the unit is set for 120 °F.
- Press the Up or Down button until you reach the desired temperature.
- Once the user has selected the desired temperature and would like to set this as the default temperature, press the P button for 3 seconds. The selected temperature will blink. Once this is completed, the default temperature is saved.
- If the desired temperature setpoint is above the limit of the appliance, the user must change the Setpoint Limit (continue reading below).

Control Panel Sub-Menus:

To access the sub-menus, simultaneously press the P, Up, and Down buttons for 3 seconds. The display should default to displaying P4. The available sub-menus are:

Display	Description
P4	Information
P7	Gas Type
P9	Purge
SA	Settings
SL	Temperature Limit
PE	Appliance Type
PF	Bypass
PA	Actuator Calibration
IC	ICC
E	Exit
P0	L2 Gas Adjust
P1	Maximum Power
P2	Minimum Power
UC	Automatic Calibration
P3	Powerbus Address

Table 6 – LCD Sub-Menus

To navigate the sub menus, press the Up or Down buttons. To enter a sub menu, press the P button. If you would like to exit a sub menu, or the menu all together, navigate the Up or Down buttons until the display shows E. Press the P button to Exit back to the previous menu, or back to the main display. Holding the P button for 3 seconds or more will confirm a change. The display will blink while a change is being saved.

P4 – Information Menu: Displays informational data regarding the unit. This submenu can be useful for diagnosing the appliance, as needed.

P4	P4 - Information		
	OD	OD - Operation Data	
		0d	Chamber NTC - Water Temperature at exit of heat exchanger
		1d	Inlet NTC - Current temperature of the temperature sensor of the water inlet pipe
		2d	Outlet NTC - Current temperature of the temperature sensor of the water outlet pipe
		3d	Flow - Total water flow through the unit. Includes flow through both the main and bypass valves
		4d	Barometric Pressure - Current barometric pressure at installation location
		5d	Fan Speed - Current fan speed (Hz.)
		6d	Output Power - Current burner power %
		7d	SS Hex NTC - Temperature sensor of the flue gases between the Primary and Secondary Heat Exchanger
		8d	Exhaust Gas NTC - Temperature sensor of the flue gases at the exhaust
		9d	Ambient NTC - Current temperature inside the cabinet. Sensor is located near the fan.
		10d	External Tank - Current temperature on the external tank (if connected)
	E	Exit - (Return to P4 menu)	
	FH	FH - Failure History	
		1F	First most recent error code
		2F	Second most recent error code
		3F	Third most recent error code
		4F	Fourth most recent error code
		5F	Fifth most recent error code
		6F	Sixth most recent error code
7F		Seventh most recent error code	
8F		Eighth most recent error code	
9F		Ninth most recent error code	
10F	Tenth most recent error code		
E	Exit - (Return to P4 menu)		

P7 – Gas Type Menu: This menu allows selection of the gas type for the appliance. Improper gas type will affect appliance performance and can lead to unsafe operating conditions. To change the gas type, press the Up and Down buttons to the correct gas type. Press the P button to set the appliance to the specific gas type. See the Manifold section for more information on gas type conversion.

P7	P7 - Gas Type	
	nA	Natural Gas (NG)
	LP	Liquid Petroleum Gas (LPG)

P9 – Purge: This menu allows the blower to run, purging the exhaust venting. To engage this function, use the Up and Down buttons to select P9. Within 2-5 seconds, the fan should begin working. To exit this function, use the Up and Down buttons to move to a different menu.

SA – Settings: This menu allows several different settings for the appliance to be changed, such as recirculation loop, units (°F/°C), etc. A summary of menu options is as follows:

SA	SA - Settings		
	A0	A0 - Time	
		Hours	12 or 24
		Minutes	AM or PM
		d1	Monday
		d2	Tuesday
		d3	Wednesday
		d4	Thursday
		d5	Friday
	d6	Saturday	
	d7	Sunday	
	A1	A1 - Recirculation	
		OF	Off - Recirculation system is not installed or is not in use
		Hr	House Recirculation - The inlet water temperature sensor of the unit controls the action of the pump. This will be used to regulate the temperature in the recirculation loop. Recirculation settings can be adjusted within SA -> rS
		tl	Tank Loading Internal NTC - The inlet water temperature sensor of the unit is used to regulate an external tank and control the actions of the pump.
tE		Tank Loading External NTC - An external temperature sensor is used to regulate temperature in an external tank. The sensor controls action of the pump.	
tA	Tank Loading Aquastat - An external aquastat is used to regulate temperature in an external tank. The aquastat controls action of the pump.		
A8	A8 - Startup delay: this allows the appliance to delay igniting the burner after detecting water flow. Can be set between 0-60 seconds.		
A9	A9 - Units Set		
	°C	Metric - Will set the temperature and flow measurements to display in Metric units.	
	°F	Imperial/Standard - Will set the temperature and flow measurements to display in imperial units.	
Ab	AB - Region Selection		
	EU	Europe - For use in Europe	
	nA	North America - For use in North America	
RS	RS - Recirculation Settings		
	1...9	Comfort Level - When setting the recirculation type (A1), using the RS menu will allow the unit to be adjusted for recirculation comfort. A higher comfort level (9) will cause the temperature in the recirculation loop to be closer to the setpoint of the appliance, at the cost of greater cycling of the appliance (higher gas, electricity costs) plus general wear and tear on the unit. A lower comfort level (1) will increase energy efficiency (and reduce cost) with the cost of less comfort (recirculation system will be cooler).	

LM – Temperature Limit: This setting allows the maximum setpoint limit of the appliance to be set. The maximum temperature for a residential model is 140 °F. To change the limit, access the SL menu, and set the desired limit with the Up and Down buttons. You can also turn off the limit by selecting OF (off) in the limit menu. Pressing the P button for 3 seconds will save the changes.

PE – Appliance Type: This menu allows changes to several options, including: appliance type, power, and model. After initial setup, this menu should not be accessed.

PE	PE - Appliance Type	
	TP	Appliance Type
	AP	Appliance Power (160/199)
		kBtu
	nO	Appliance model (IN/OU: indoor/outdoor)
E	Exit	

PF – Bypass Activation: This menu allows the main bypass valve to be activated or deactivated. Normal state is for this valve to be activated: allowing the bypass valve to function will let the appliance maintain better temperature stability and overall optimized performance.

PF	PF - Bypass Activation	
	EN	Enable
	DI	Disable

PA – Actuator Calibration: This menu controls access to the calibration of the two water valves. The main valve controls overall water flow to the appliance: if water flow exceeds the heating capacity of the appliance, the main valve will restrict water flow to allow the appliance to maintain temperature setpoint. The Bypass valve allows colder inlet water to be blended with water from the heat exchanger, to create a consistent outlet water temperature. Both calibrations require water to be flowing before beginning the calibrations. Further details on the process of the calibrations can be found in this manual or the Installation/Operation Manual.

PA	PA - Actuator Calibration	
	bP	Bypass Actuator Calibration
	nF	Main Water Actuator Cal.

IC – Ionization Correction: This menu controls the parameter for the ionization correction model. The ionization control model is an auxiliary method for the appliance to determine air flow during operation. Using this parameter allows greater reliability in operation. There are two different options for IC: on or off. Default is on; there are no real applications where it would be beneficial for IC to be turned off. Ionization control is a menu option in the P1 menu (see P1 menu table below); here it is default-set to off. Because P1 is a manual calibration, it is best operating procedure to again leave the default setting.

E – Exit: This allows exiting from the main menu back to the home screen of the display. Scrolling to the “E” option within the menu or submenu will always allow the user to move back to the previous menu.

P0 – L2 Gas Adjust: This menu allows for the verification of minimum power adjustment. There are two different options for P0: on or off. The default setting is off. Again, it is best operating procedure to leave the default setting.

P1 – Maximum Power: This menu allows adjustment to the fuel/air ratio at maximum power. This is a manual adjustment; before proceeding, read about the procedure in the Installation/Operation manual.

P1	P1 - Maximum Power	
	A1	High Fire Air Adjustment
	L1	High Fire Gas Adjustment
	b1	Low Power Air Flow Calibration
	rP	Reset Parameters
	IC	Ionization Correction
E	Exit	

P2 – Minimum Power: This menu allows adjustment to the fuel/air ratio at minimum power. This is a manual adjustment; before proceeding, read about the procedure in the Installation/Operation manual.

P2	P2 - Minimum Power	
	A2	Low Fire Air Adjustment
	L2	Low Fire Gas Adjustment
	rP	Reset Parameters
	E	Exit

UC – Automatic Calibration: This menu begins the process of performing the appliance’s automatic fuel/air ratio adjustment. After entering this menu, the display will show “01”, indicating the first step of the adjustment. Do not perform the automatic calibration without first reading about it in the Installation/Operation manual.

P3 – Powerbus Address: This menu allows the selection of a powerbus address for a wired remote control. The default address is 20.

4.2 Control Panel Inbuilt (Outdoor Version)

The control panel, located inside the appliance, allows the installer or technician to perform all the different operations needed during commissioning / diagnostic procedures, as described above in the indoor section. The buttons and functionality of the control panel is the same between the indoor and the outdoor models.



Figure 10 – Wired Control inside the Appliance (Outdoor Version)

		<p>On / Off button</p> <p>The main switch is assembled on the PCB and disconnects the unit.</p> <p>Anti-Freeze function is assured even in the OFF position</p> <p>Note: When pressed for 3 seconds or longer, errors are reset.</p>
		<p>Program Button</p> <p>Used to enter in to different services:</p> <ul style="list-style-type: none"> - "Enter" in service mode - Scroll in the service mode menu - Save value or adjust set values - Save a temperature set (user)
		<p>Selection button</p> <p>Used to select temperature values, adjustments and navigation on parameters inside the visualisation mode.</p>

Table 7 – Control Panel Buttons

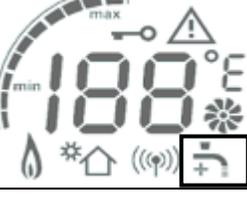
Symbol	Description	Observation
	<u>Temperature Unit:</u> °C – default value °F – alternative value	Selection can be done by changing default value on service mode
	<u>Power bar indicator:</u> Indication of the current operation power	Indicative Value (in %) Note: each line corresponds to 10%
	<u>Flame indication:</u> Indication of flame in the burner	Symbol displayed when ionization is detected - flame presence
	<u>Warning symbol:</u> Combined with an error indication / warning code indicates a faulty performance	
	<u>Tap symbol:</u> Indication of not enough power to reach set point	In case symbol is displayed, decrease (-) or increase (+) flow accordingly
	<u>Solar application:</u> Indication that the automatic solar function is activated, meaning that the appliance is receiving pre-heated inlet water, with no need for burner to start	The symbol is displayed and burner is shutdown when T _{in} is under following conditions: $T_{in} \geq T_{set} - 1K$
	<u>Fan operation:</u> Indication that the fan is in operation	

Table 8 – Display Symbols

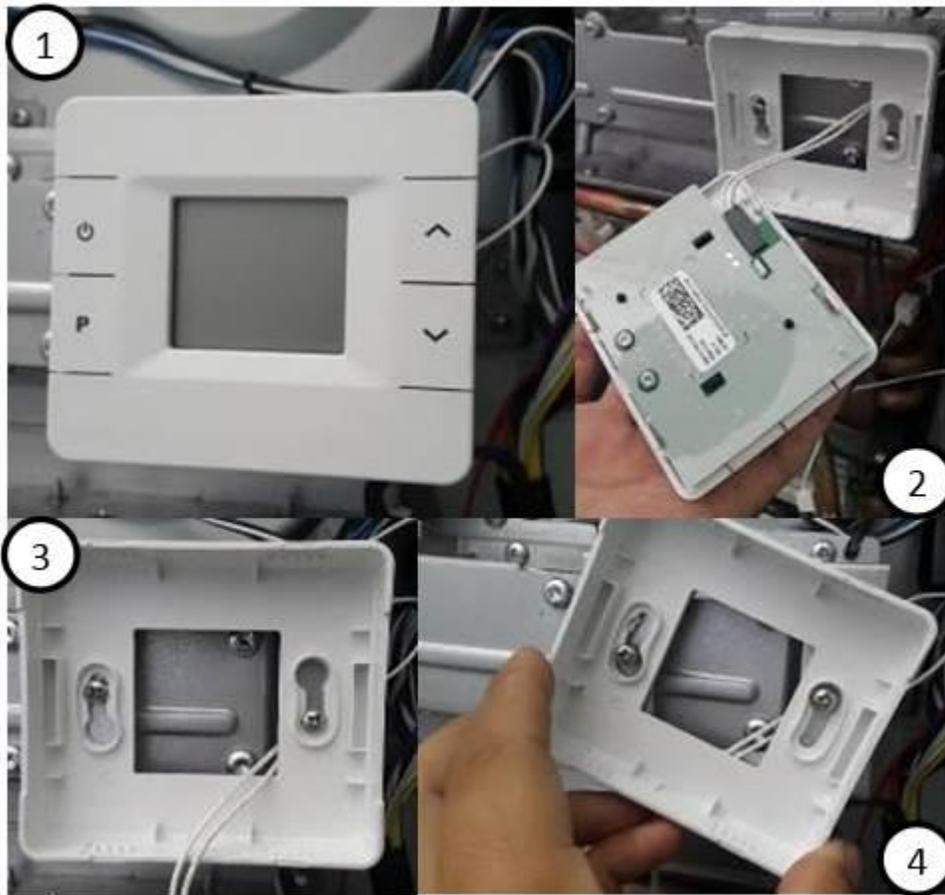


Figure 11 – Disassembling the Control Panel for Installer

To disassemble this HMI, the necessary steps are the following:

1. Pull the HMI (Remember that a cable is still connected).
2. Disconnect the cable.
3. Loosen the 2 screws.
4. Rotate the base of the HMI and pull it.
5. Remove the support of the HMI.

4.3 Condensate Siphon

The appliance includes a condensate siphon which stores condensate generated during operation from the condensate collector below the stainless-steel condensing heat exchanger. The siphon must also connect to an adequate PVC drainage pipe (1) to drain the acidic condensate once full. As this unit is a high-efficiency appliance, condensate flow can be as high as 2 gallons per hour at full power.

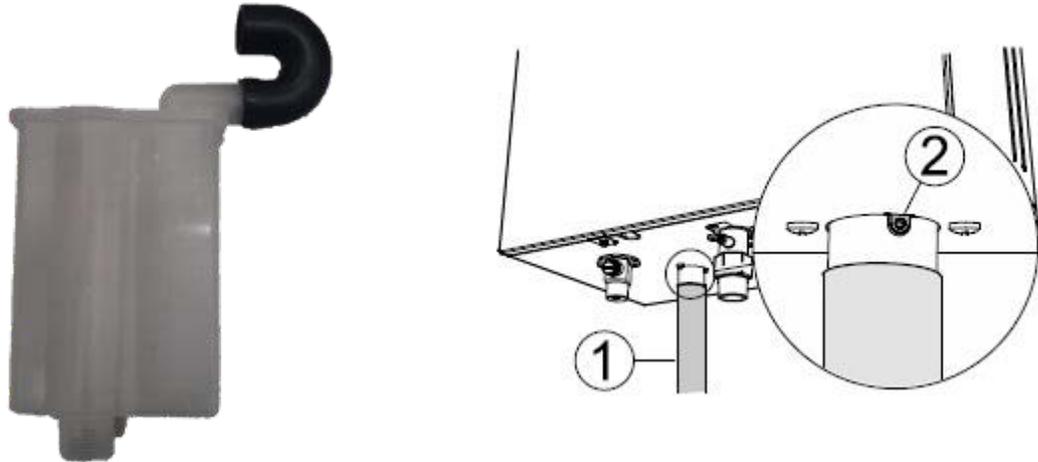


Figure 12 – Condensate Siphon



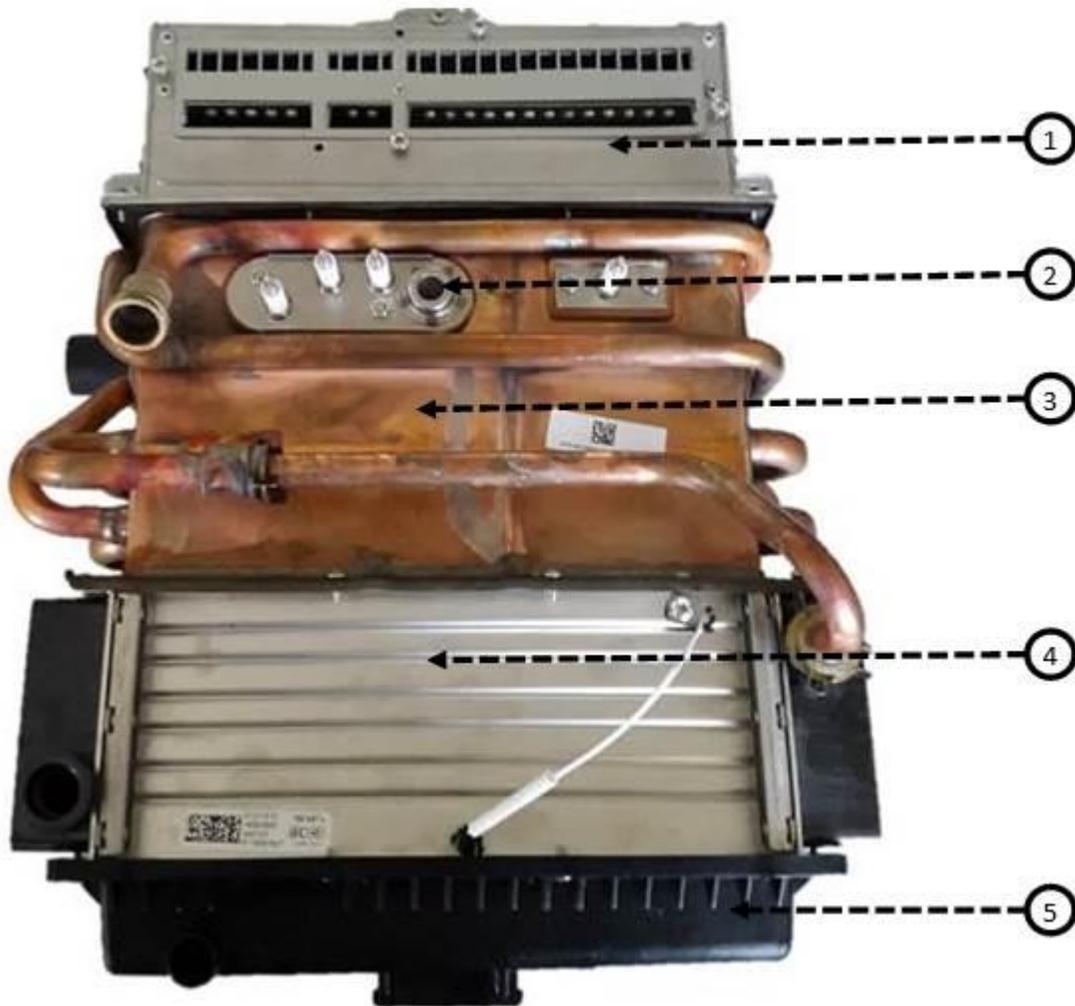
Figure 13 – Disassembling the Condensate Siphon from the Unit

To disassemble the siphon from the metal box and heat cell the necessary steps are the following:

1. Pull the tube between the siphon and the condensate collector.
2. Remove the screws on the bottom of the appliance.
3. Pull the siphon out.

4.4 Heat Cell

The heat cell includes a heat exchanger with flame sight window, ignition and ionization electrodes, condensing unit, and condensate collector.



- | | |
|---------------------------|-------------------------------------|
| 1 – Burner | 4 – Stainless Steel Condensing unit |
| 2 – Electrodes | 5 – Condensate collector |
| 3 – Copper Heat exchanger | |

Figure 14 – Heat Cell

To disassemble the heat cell from the metal box the necessary steps are the following:

1. Remove the condensate collector (2 screws)
2. Remove the control unit (2 screws and cables)
3. Loosen the gas tube on the manifold
4. Remove the 4 screws from the gas valve
5. Remove the clips between the heat cell and all the water tubes.
 - a. Cold water tube from the condensing unit
 - b. Hot water tube from the heat exchanger

4.5 Gas Manifold

The gas manifold is a gas distribution pipe with integrated drilled injectors.

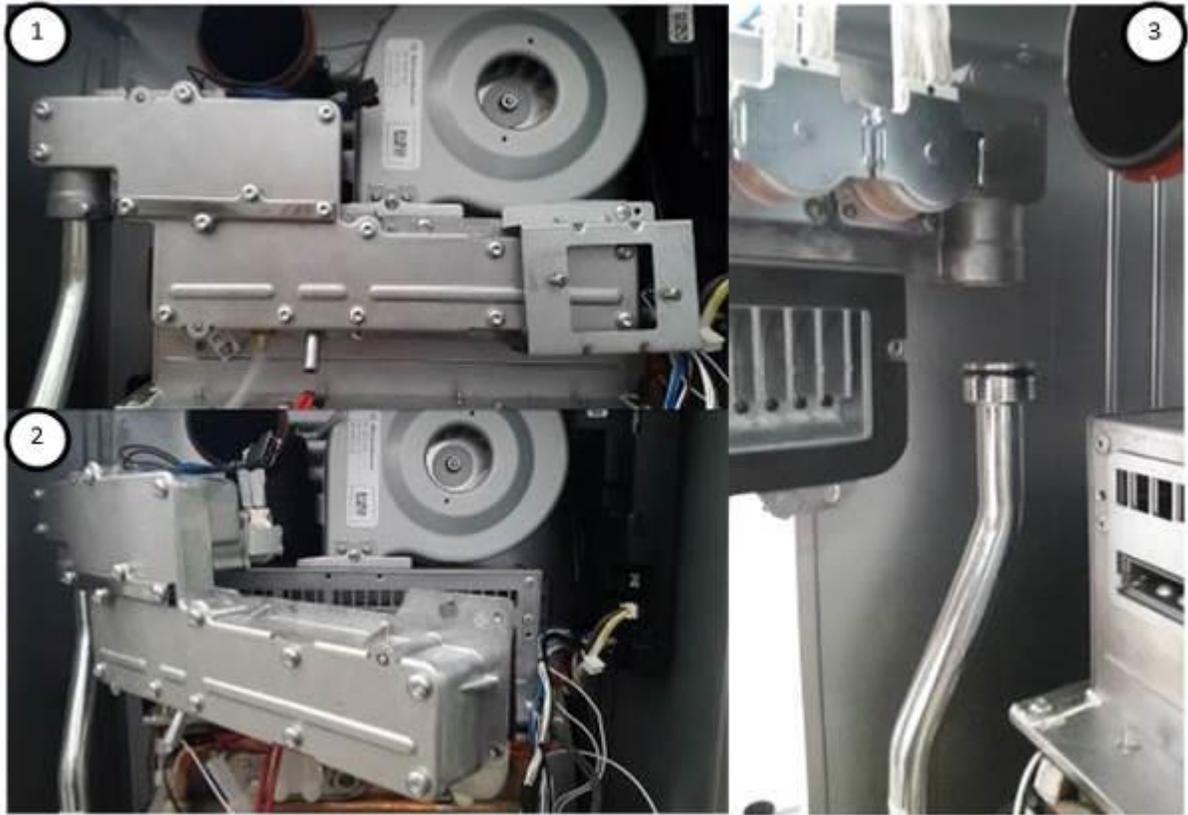
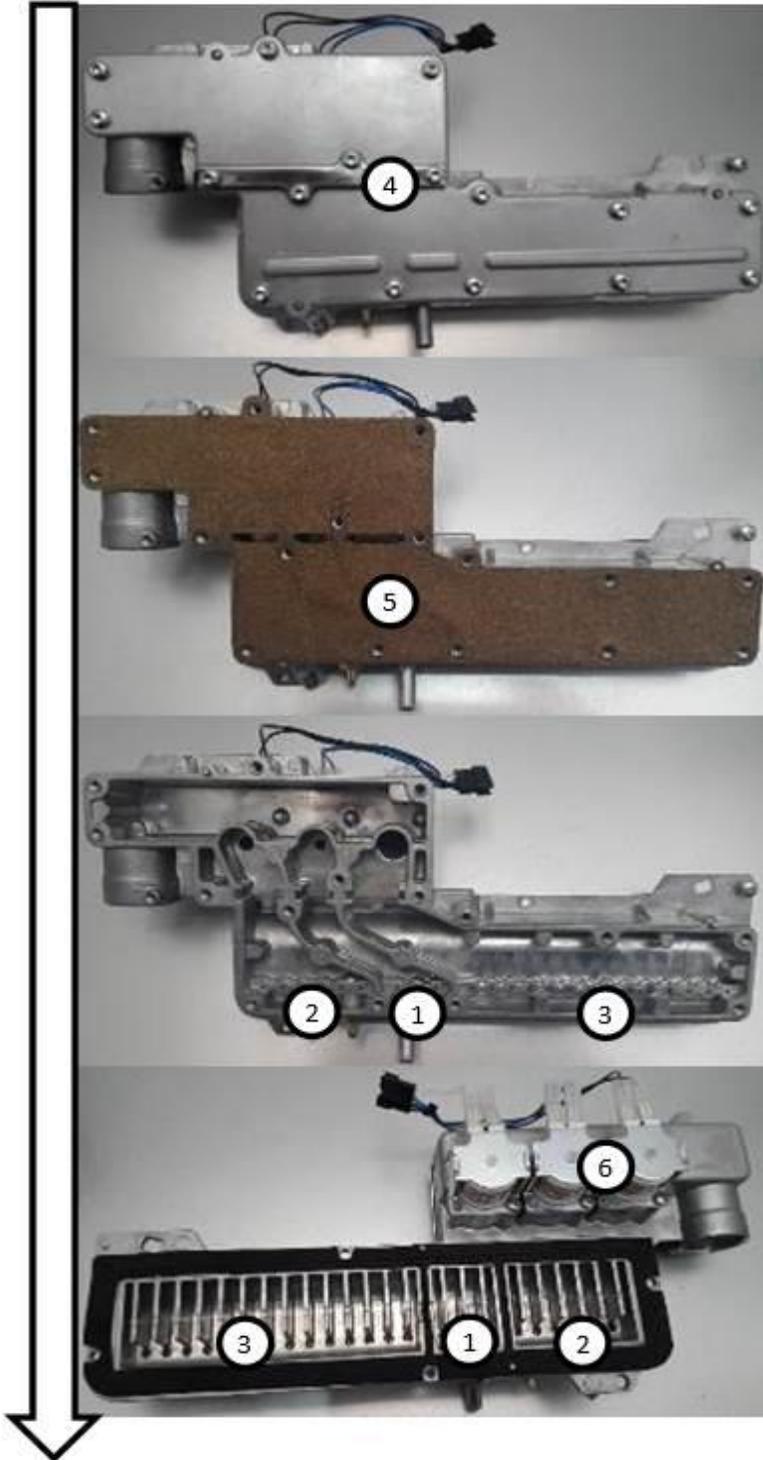


Figure 15 – Disassembling the manifold from the heat cell

To disassemble the manifold from the burner the necessary steps are the following:

1. Remove the fan
2. Disconnect the solenoids from the top left of the manifold
3. Disconnect the segmentation safety valves
4. Remove the HMI for installer (see figure 13). In the first picture the HMI is already removed except its base.
5. Remove 4 screws from the manifold to separate it from the burner.
6. Loosen the screw from the gas tube.
7. Rotate and push up the manifold at the same time to remove it from the appliance

To assure a wide modulation range for the appliance, the manifold cover allows the gas supply to be utilized across 3 different segments.



- 1 – Burner segment 1
- 2 – Burner segment 2
- 3 – Burner segment 3
- 4 – Gas restrictor seal
- 5 – Gas seal
- 6 – Segmentation safety valves

Figure 16 – Disassembling the Manifold

As shown in the previous figure, the manifold contains 3 solenoids valves (SV) that are responsible for the release of gas in each burner segment. This allows the unit to have 6 burner level stages according to the solenoid combination:

- Stage 1 – SV 1
- Stage 2 – SV 2
- Stage 3 – SV1 + SV2
- Stage 4 – SV3
- Stage 5 – SV1 + SV3
- Stage 6 – SV1 + SV2 + SV3

The manifold is only available as one spare part. However, for maintenance purposes it may be required to open the manifold. The Gas Seal is made of cork and is not available as an individual spare part.

For maintenance purposes the process of disassembling the manifold has the following steps:

1. The manifold is already separated from the appliance. If not, follow the steps in Figure 15.
2. Remove the gas restrictor seal (4 screws) (see figure below)
3. Remove the front cover (12 screws)
4. Remove the cork seal
5. Remove the rubber seal from the reverse side of the manifold. Every time that the manifold is disassembled, this seal must be replaced.

The new manifold allows the installer or technician to easily convert the appliance between natural gas (NG) and Liquid Propane Gas (LPG). The appliance comes factory installed in NG configuration, so if the unit is being used in a NG application, no additional modification is necessary. To operate the unit with LPG, a gas restrictor must be installed, as detailed in the following figures.

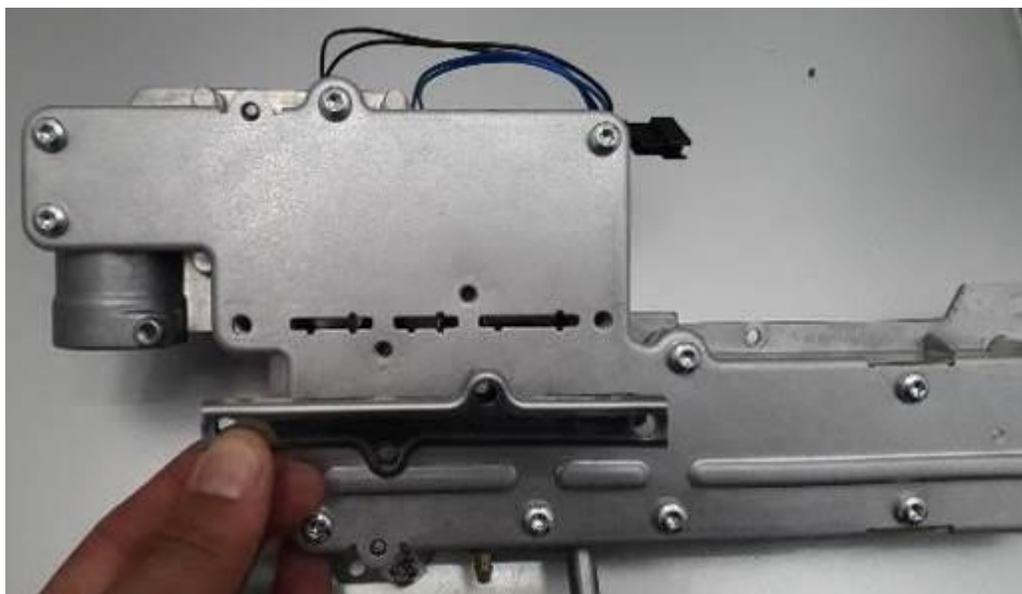


Figure 17 – Gas Restrictor Seal on the manifold (unit set up for natural gas operation)



Figure 18 – Gas Restrictor Diaphragm for Propane Operation

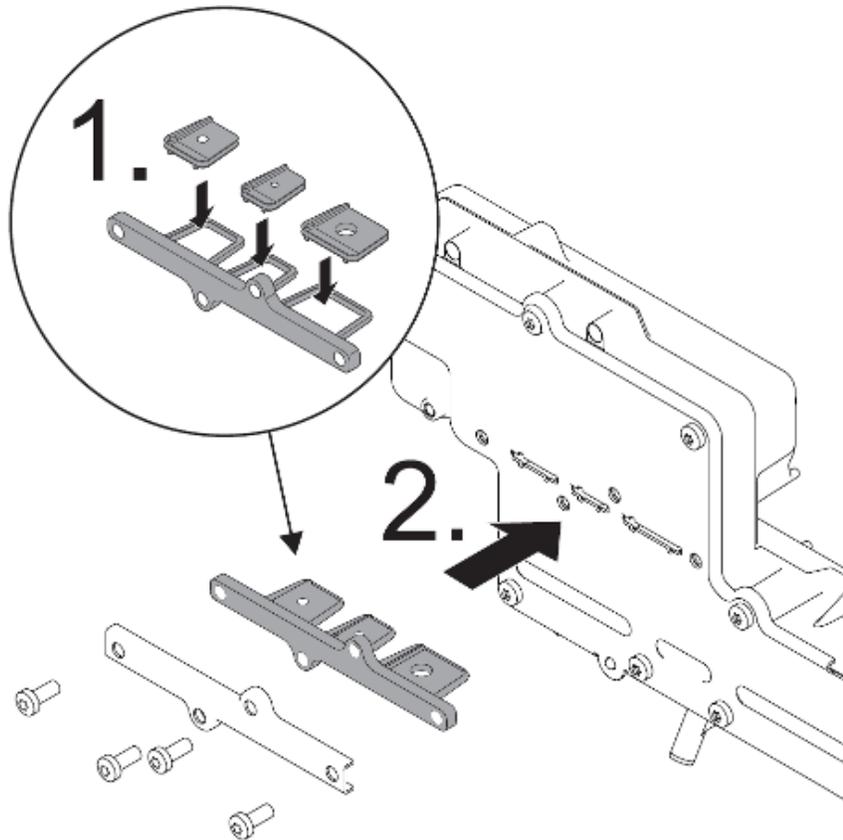


Figure 19 – Gas Conversion Procedure for LPG Operation

For gas restrictor conversion, the manifold doesn't need to be disassembled. The steps for restrictor conversion are:

1. Disassemble the gas restrictor seal by removing the 4 screws.
2. If the appliance is working with NG, there is no restrictor inside. If the appliance is working with LPG, there is a rubber diaphragm with 3 restrictors.
3. Remove the diaphragm if the objective is to convert the appliance from LPG to NG or install the diaphragm if the objective is to make the conversion from NG to LPG.

4.6 Fan

The control unit monitors the primary air flow to the burner by varying the fan motor power supply voltage (DC), ensuring a correct variable speed according to the output needed.

The fan motor provides an additional control signal to enable/disable operation and the speed of the fan is measured by the feedback signal provided by the fan's motor. The signal consists of a square wave with a frequency proportional to the speed of the fan.

Additionally, this system allows the appliance to detect the size of the installed vent pipes and adapt the fan to the exhaust needs.

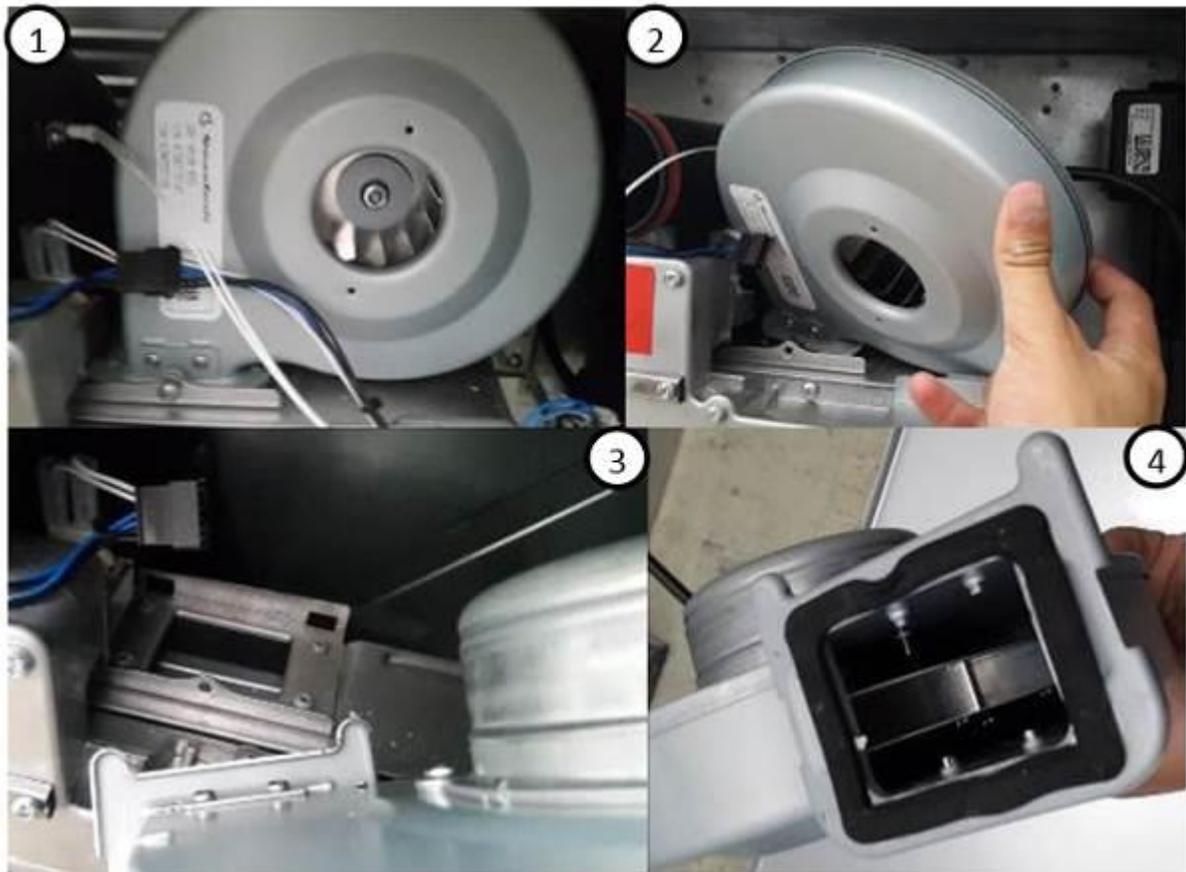


Figure 20 – Disassembling the Fan

Disassembly of the fan does not require removing the control unit. The steps for fan removal are:

1. Disconnect the gas sensor.
2. Disconnect the segmentation safety valves.
3. Remove the front screw.
4. Remove the fan paying attention to the fan base (the fan is trapped on the back).

4.7 Gas Valve

It is possible to control gas flow to the burner by the modulating gas valve (MV) in addition to the control unit. The gas valve is composed of an additional solenoid identified as safety valve (SV1) releasing the modulated gas to and from the solenoid gas valve.

Safety Solenoid Valve

The safety valve (SV) is the first safety element that releases gas to the burner. The second safety level elements are the solenoid valves in the gas manifold of the burner. They release gas to the first, second, and third burner segments, respectively, acting as safety and segmentation valves.



Figure 21 – Gas Valve View

Modulating Valve

Mechanical modulated valve

The gas flow (thermal load) is automatically modulated to ensure the correct outlet water temperature, even under water flow or inlet temperature variations.

To disassemble the gas valve, the necessary steps are the following:

1. Release the nut on the gas tube.
2. Remove the 4 screws on the buttons of the appliance.

4.8 Heat Exchanger

The copper heat exchanger has different size and fin amounts according to the appliance model (160 or 199). This configuration ensures the sealed heat transfer from the flame heat to the water that flows through the copper pipes.



Figure 22 – Heat exchanger

To disassemble the heat exchanger from the entire heat cell the necessary steps are the following:

1. Disassemble the heat cell from the appliance (See Section 4.4)
2. Remove burner (8 screws). Remove condensing unit (8 screws).
3. The seals must be always replaced when the heat exchanger is disassembled.

4.9 Water Valve

The inlet water valve contains the flow sensor responsible for the flow rate detection and a motor stepper responsible for the maximum water flow control through the unit.



Figure 23 – Inlet Water Valve

Water flow is measured by a turbine flow sensor that is fed by a DC signal and gives a feedback signal proportional to the measured water flow (see Table 9).

- Minimum Flow rate to start up the appliance: 0.45 gpm (1.7 l/min)
- Flow rate to shut off the appliance: < 0.5 gpm (1.8 l/min)

In case $Q > \text{min}$ start up flow following P_{out} verification occurs:

- If $P_{\text{out}} > \text{Minimum Power}$, the appliance will run with the calculated minimum water flow, in order to reach the set point with a temperature stability of $\pm 2^{\circ}\text{F}$ ($\pm 1^{\circ}\text{C}$);
- If $P_{\text{out}} < \text{Minimum Power}$, the T_{out} is assured by a pulsating burner mode + cold water mixing (easy minimum).

Flow [l/min]	Flow (g/min)	Frequency [Hz]
27	7.13	108
24	6.34	96
18	4.75	72
14	3.69	56
10	2.64	40
8	2.11	32
4	1.05	16
2	0.52	8

Table 9 – Water Flow Sensor Values



Figure 24 – Inlet Water Valve Composed by a Motor Stepper (left) and a Flow Sensor (right)

In order to disassemble the water valve, it is necessary to remove the clips attaching the valve to the water piping. Note that the motor stepper and the flow sensor are one only spare part. However, for maintenance purposes it may be required to open the water valve.

4.10 Circulation Pump (L-Series only)

The circulation pump is responsible for recovering the home re-circulation loop to minimize wasted water and increase user comfort.

⚠WARNING

Before performing any service, ensure the power is disconnected from the appliance.



Figure 24 – Circulation Pump

Removing Circulation Pump for Servicing

1. Remove the Water Valve prior to pump service (refer to Section 4.8). Once the Water Valve has been removed, disconnect the pump harness.

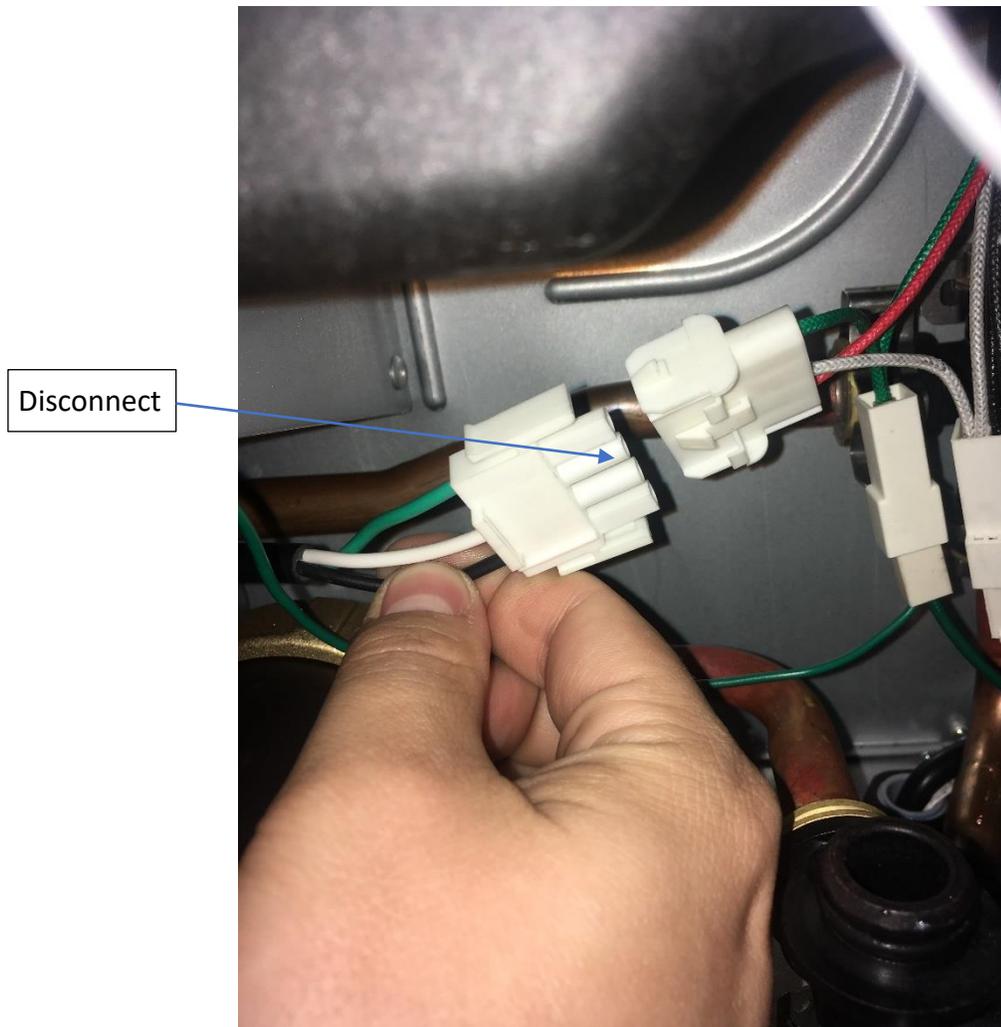


Figure 26 – Step 1: Disconnect Wire Harness

2. Remove clips holding the anti-freeze resistors, then remove the anti-freeze heaters from the water pipes as shown below.

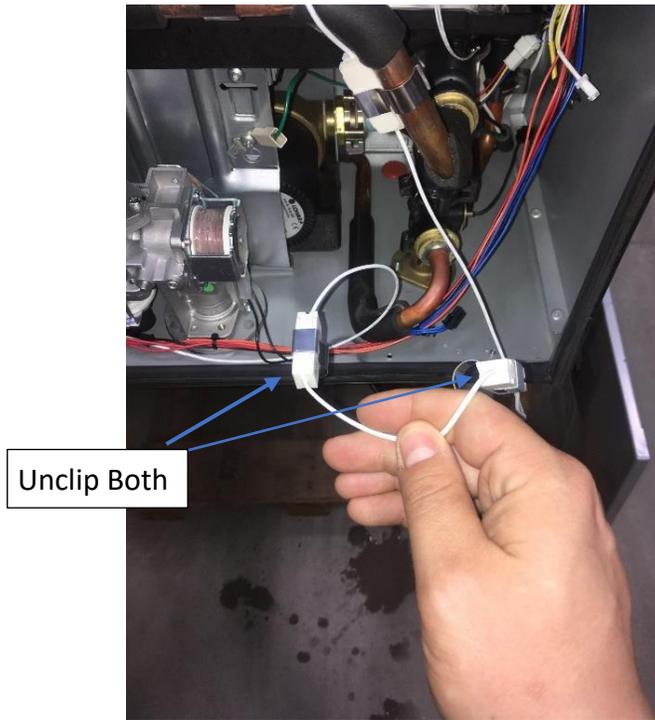


Figure 26 – Step 2: Unclip Anti-Freeze Resistors

3. Remove the clips holding in the pump outlet and inlet pipes.

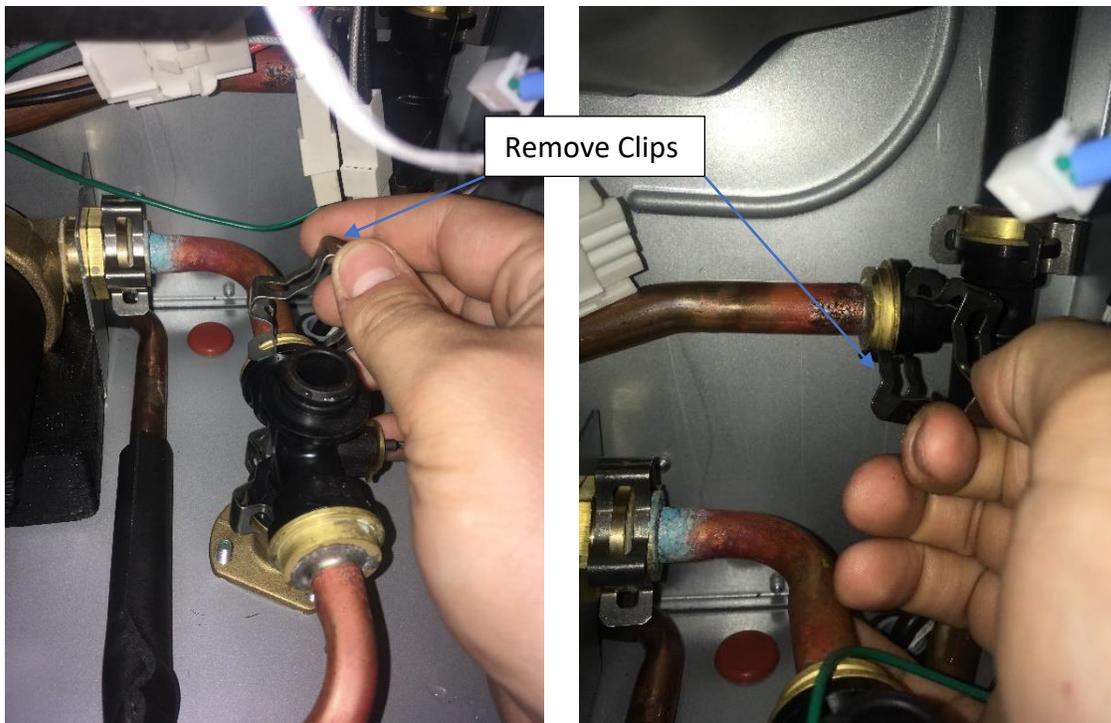


Figure 27– Step 3: Remove the clips holding in the pump outlet and inlet pipes.

- Using a T20 Torx driver, remove the 4 screws holding the pump bracket.

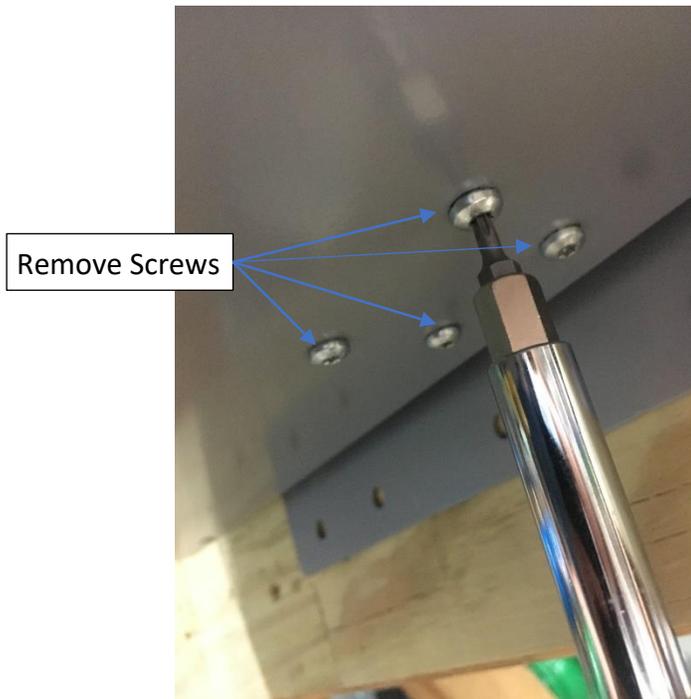


Figure 28– Step 3: Remove 4 Screws

- Finish disconnecting the pump inlet pipe and remove the circulation pump from the cabinet.



- Service circulation pump as necessary. Reverse Steps 1-5 to reassemble circulation pump once servicing is complete.

4.11 Water Temperature Sensors

The outlet and inlet water temperature is measured by a 10k Ω NTC (See Table 13). Both NTC are equal, but connected to different cable colors (blue wires to inlet water / red wires to outlet water).



Figure 29 – Outlet Water Temperature Sensor (left) and Inlet Water Temperature Sensor (right)

4.12 Box Temperature Sensor

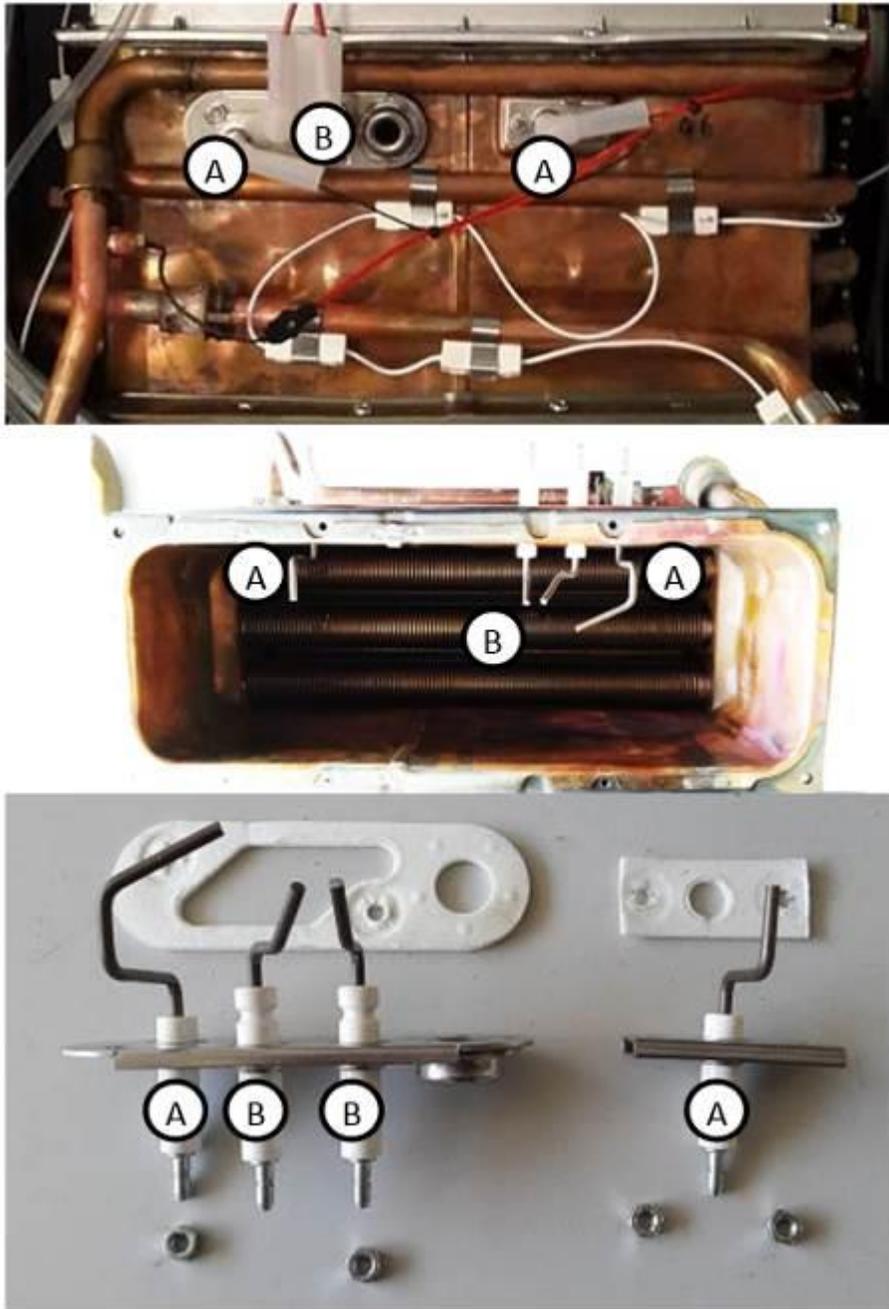
The Box air temperature is measured by a 220k Ω NTC (See table 12) and is assembled on the control unit back panel, in order to monitor the temperature inside of the sealed box.



Figure 30 – Box Air Temperature Sensor

4.13 Electrodes

The spark generation is started immediately before opening the gas valve and stopped when ionization is sensed. The flame is sensed through an ionization electrode, and detection is granted for ionization currents greater than 0.5 micro-amps (μA).



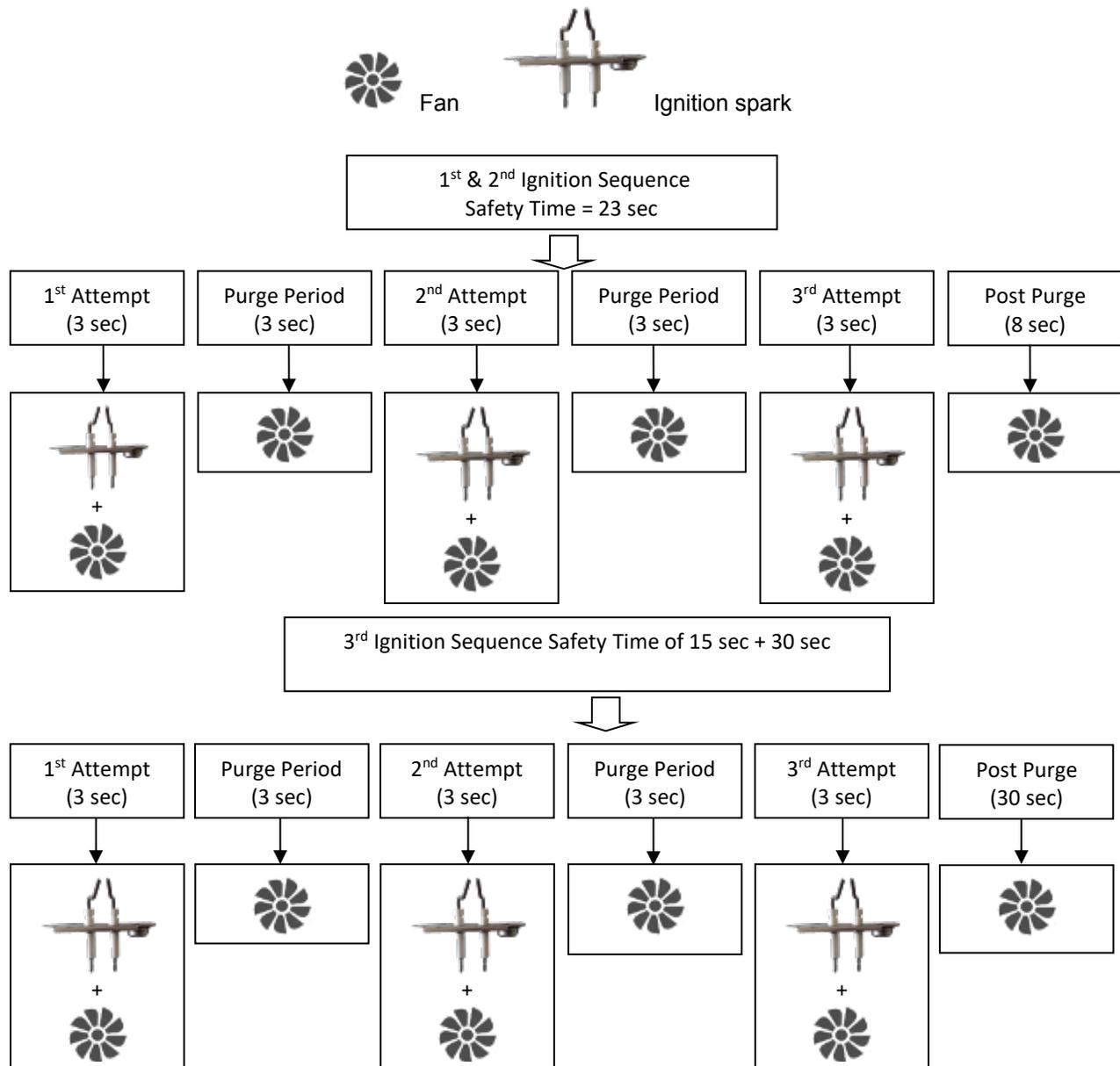
- A - Ionization electrodes
- B - Ignition electrodes

Figure 31 – Electrodes Overview

Ignition Electrode

To prevent harder than necessary ignition cycles and to ensure the correct gas supply and burner stability conditions, the following situation is verified during the safety time period.

During each ignition attempt, the system monitors the ionization signal; this signal drives the start of normal operation. However, in the case where the ionization signal is not detected during the ignition sequence, the failure code EA will flash on the display. When this occurs, a non-volatile lock-out is activated, and only a manual reset will allow the system to resume normal operation. Finally, if the ionization signal is interrupted during normal operation, the ignition sequence shown below is re-started.

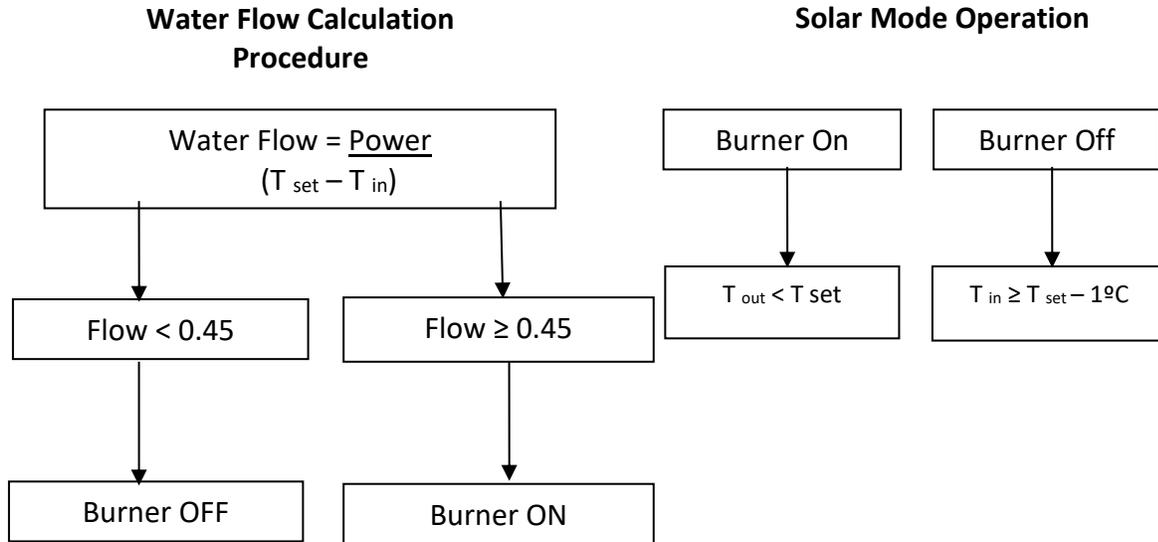


Ionization Electrode

Flame is sensed through an ionization electrode, and detection is granted for ionization currents higher than 0.5 μA . The two ionization electrodes are spaced to allow flame detection on both sides of the burner.

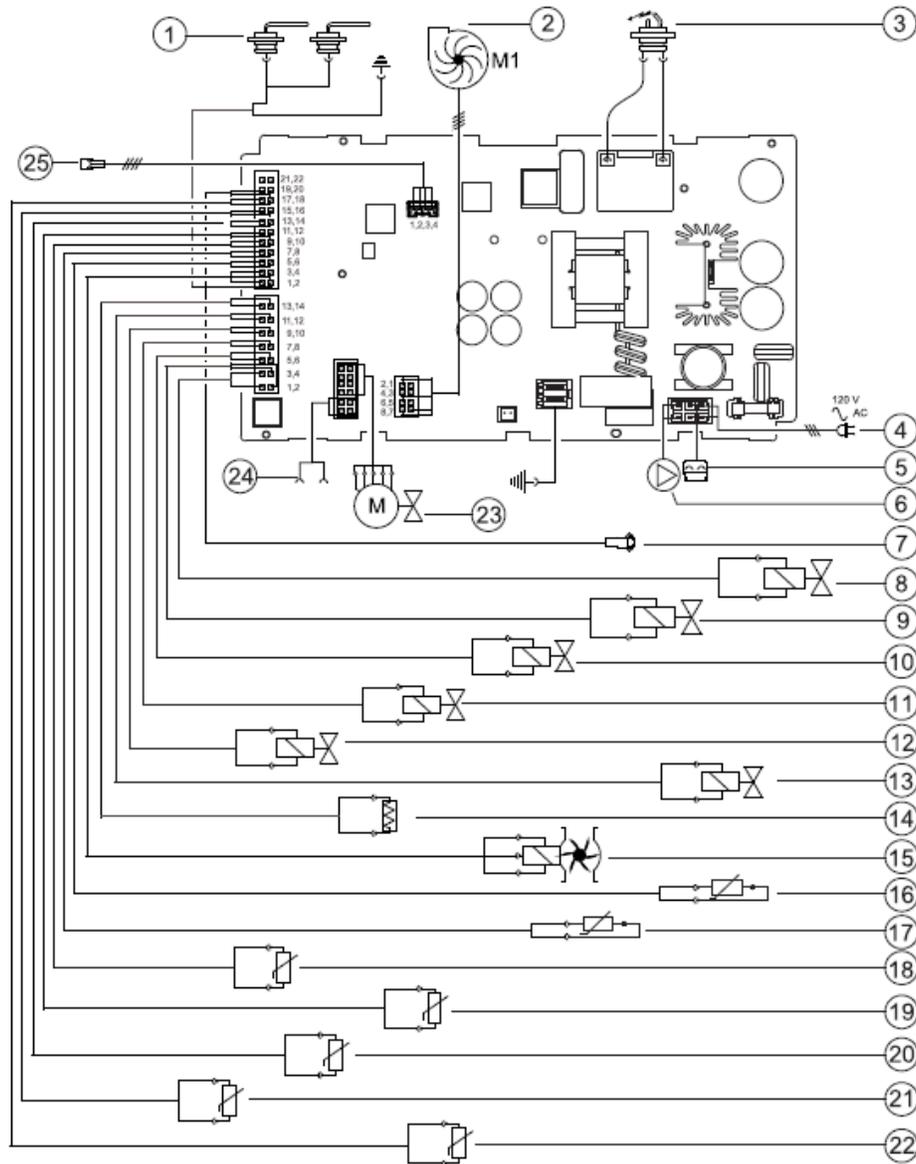
5. Working Principle / Electric Measurements

Water Flow Detection and Solar Mode Operation



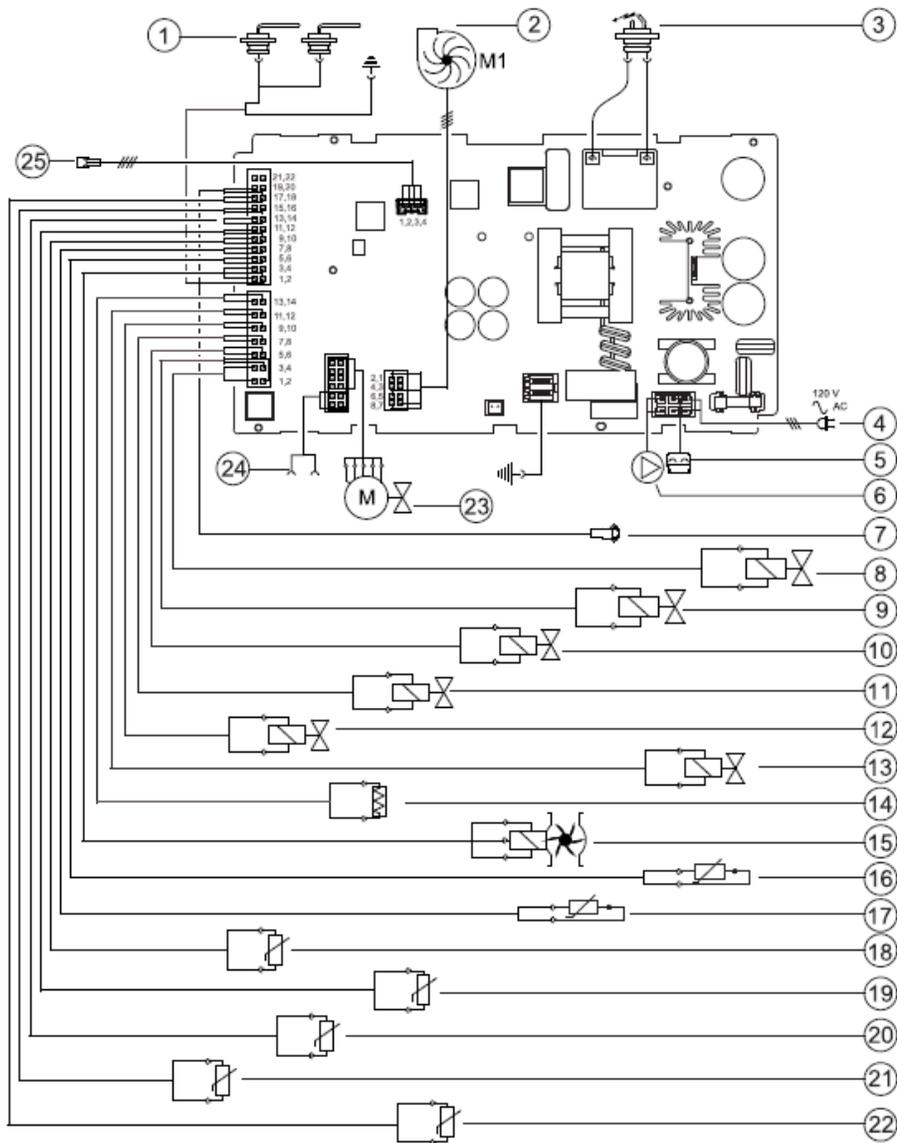
Operation	Action	Connection to the control unit	Result
Standby (Inputs signals must be within expected limits)	Flow Sensor	Input	ON
	Electrical plug connected	Input	120 V _{AC} 60 Hz
	Thermal fuse with continuity	Input	Contact closed
	Ionization reading	Input	0 μA
	Temperature sensors OK	Input	Ohm Value inside range
Hot Water Demand (tap opening)	Turbine detects water flow	Input	Frequency value to control unit
	Spark to ignition electrodes	Output	
	Gas valve solenoid activation	Output	13 V _{DC}
Flame on main burner	Ionization detection (spark stops)	Input	I > 0.5 μA
Hot Water Delivery	Safety devices monitor operation	Input	

Table 10 – Minimum Operation Conditions Signals



- | | |
|------------------------------------|---|
| [1] Ionization sensor | [13] Thermofuse |
| [2] Fan | [14] Water flow sensor |
| [3] Ignition electrode | [15] Exhaust temperature sensor |
| [4] Power supply | [16] Exhaust temperature sensor in heat exchanger |
| [5] Connection for anti freeze kit | [17] Water outlet bypass temperature sensor |
| [6] Connection for remote control | [18] Cabinet air temperature sensor |
| [7] Gas valve - Modulation | [19] Heat Exchanger outlet temperature sensor |
| [8] Water bypass valve | [20] Water inlet temperature sensor |
| [9] Manifold solenoid 3 | [21] Water outlet temperature sensor |
| [10] Manifold solenoid 1 | [22] Water valve stepper |
| [11] Manifold solenoid 2 | [23] Cascading in/Out |
| [12] Gas valve – Safety Solenoid | [24] Touch control display |
| | [25] Connection for Recirculation Pump |

Figure 32 – K Series Electric Wiring Diagram



- | | |
|------------------------------------|---|
| [1] Ionization sensor | [13] Thermofuse |
| [2] Fan | [14] Water flow sensor |
| [3] Ignition electrode | [15] Exhaust temperature sensor |
| [4] Power supply | [16] Exhaust temperature sensor in heat exchanger |
| [5] Connection for anti freeze kit | [17] Water outlet bypass temperature sensor |
| [6] Connection for remote control | [18] Cabinet air temperature sensor |
| [7] Gas valve - Modulation | [19] Heat Exchanger outlet temperature sensor |
| [8] Water bypass valve | [20] Water inlet temperature sensor |
| [9] Manifold solenoid 3 | [21] Water outlet temperature sensor |
| [10] Manifold solenoid 1 | [22] Water valve stepper |
| [11] Manifold solenoid 2 | [23] Cascading in/Out |
| [12] Gas valve – Safety Solenoid | [24] Touch control display |
| | [25] Connection for Recirculation Pump |

Figure 33 – L Series Electric Wiring Diagram

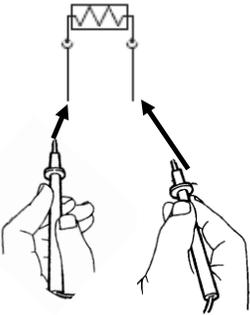
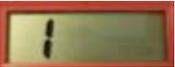
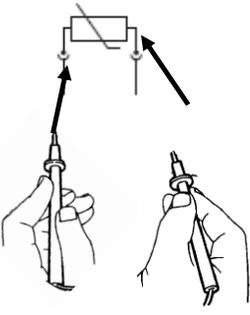
ID	Component Description	Measuring Wire Colors	Value	Remarks
14	Water Flow Sensor	Red-Blue GND	5 V _{DC}	Control power
		Yellow-Blue GND	≈ 2.5 to 2.9 V _{DC} or (pulse frequency ~Hz)	On: ≥ 0.45 gpm (1.7l/min) Note: See Table 9 to check correspondence between water flow and frequency signal.
22	Water Valve Stepper Motor	Black – Red	5 V dc	When replaced by a new spare part, calibration is needed using MF parameter in PA (Actuator) menu of display.
8	Bypass Water Valve	Red – Red	0 v to 24 V dc	When replaced by a new spare part, calibration is needed using bP parameter in PA (Actuator) menu of display.
13	Thermal Fuse (actuation temperature: 237°F / 114°C)	Multimeter for Resistance Measurement R (Ω) White cable – White cable 		Circuit Open – Not Ok (infinity – no continuity)  Circuit Closed – Ok (0 Ohm – continuity) 
19	Heat Exchanger temperature NTC		10 kΩ NTC 	See corresponding values in Table 13.
21	Outlet water temperature NTC			
20	Inlet water temperature NTC			
18	Air Box temperature NTC		220 kΩ NTC	See corresponding values in Table 12.

Table 11 – Electric Values

Operating Temperature (°C)	Operating Temperature (°F)	Resistance (KΩ)
-10	14	1373
-5	23	1034
0	32	784.7
5	41	600
10	50	462.1
15	59	358.4
20	68	279.9
25	77	220
30	86	174
35	95	138.5
40	104	110.9
45	113	89.24
50	122	72.24
55	131	58.78
60	140	48.08
65	149	39.51
70	158	32.63
75	167	27.07
80	176	22.56
85	185	18.88
90	194	15.87
95	203	13.39
100	212	11.34
105	221	9.642
110	230	8.228

Table 12 – NTC Resistance Values for Air Box NTC

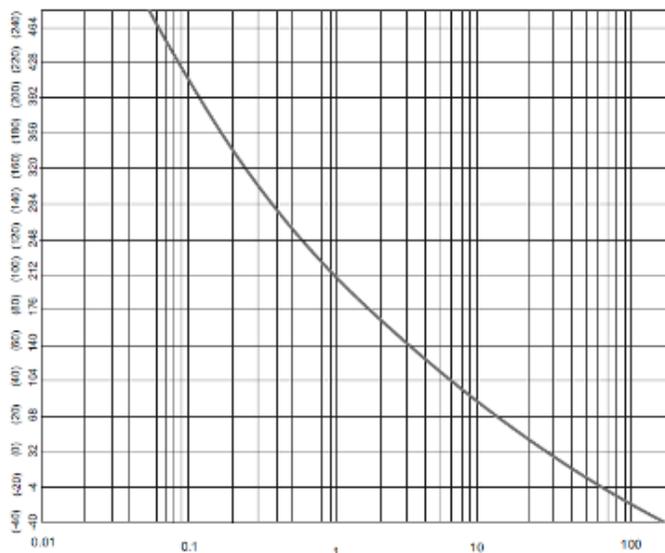


Figure 34 – Diagram for Combustion NTC's

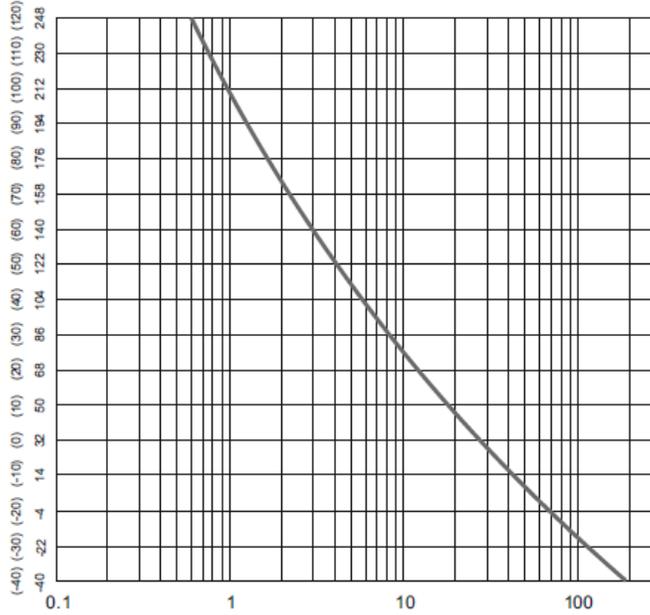


Figure 34 – Diagram Water NTC

Operating Temperature (°C)	Operating Temperature (°F)	R min (KΩ)	R nominal (KΩ)	R max (KΩ)
0	32	30.34	30.4	36.47
5	41	23.674	25.902	28.129
10	50	18.617	20.247	21.878
15	59	14.749	15.95	17.151
20	68	11.768	12.657	13.547
25	77	9.454	10.115	10.777
30	86	7.644	8.138	8.632
35	95	6.218	6.589	6.959
40	104	5.089	5.367	5.646
45	113	4.188	4.398	4.608
50	122	3.466	3.624	3.782
55	131	2.883	3.002	3.122
60	140	2.41	2.5	2.59
65	149	2.009	2.092	2.175
70	158	1.683	1.759	1.835
75	167	1.416	1.486	1.555
80	176	1.197	1.26	1.323
85	185	1.016	1.074	1.131
90	194	0.866	0.918	0.97
95	203	0.741	0.788	0.836
100	212	0.637	0.68	0.722
105	221	0.549	0.588	0.627
110	230	0.475	0.51	0.545

Table 13 – NTC Resistance Values for Water Temperature NTC's

The following pictures show cable location in each connector on the PCB (printed circuit board):

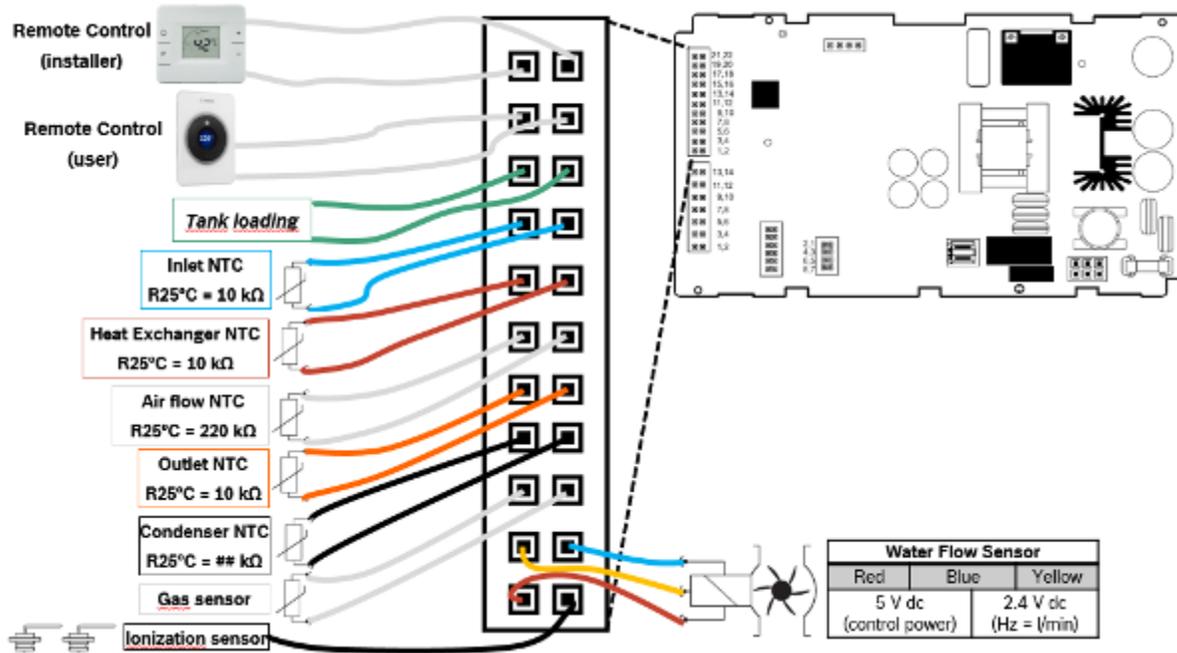


Figure 35 – Sensor Connector with 22 pins

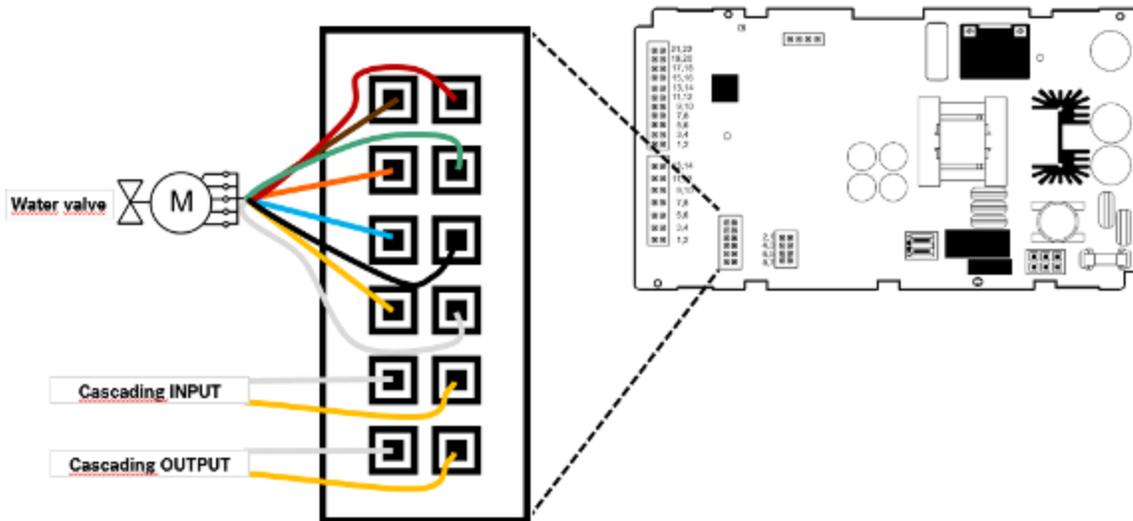


Figure 36 – Water Valve and Cascading System Connector with 12 pins

ID	Component Description	Measuring Wire Colors	Value	Remarks
1	Ionization electrode	White wire to ionization electrode	Multimeter in position for current measurement, with scale for μA range of values Ionization current > 0.5 μA	Note: Cables connected in series between ionization cable from control unit and electrode.
2	Combustion fan	Brown-Blue GND	$\sim 0 - 45 \text{ V}_{\text{DC}}$	Supply power
		Red-Blue GND	$\sim 10.8 - 13.2 \text{ V}_{\text{DC}}$	Control power
		Yellow-Blue GND	DC~V (pulse frequency $\sim \text{Hz}$)	Feedback from hall sensor
7	Mechanically modulated valve (MV1)	Red-Black	$\sim 4 - 12 \text{ V}_{\text{DC}}$ Resistance $\sim 80 \Omega$	Modulation Valve
12	Main safety solenoid valve (SSV)	Black-Black	$\sim 20.4 - 24 \text{ V}_{\text{DC}}$ (open) Resistance $\sim 120 \Omega$	Inlet Safety Valve
10	Solenoid valve (SV1)	Blue-Blue	$\sim 12 - 13 \text{ V}_{\text{DC}}$ Resistance $\sim 105 \Omega$	Burner Manifold Segment 1
11	Solenoid valve (SV2)	Black-Black	$\sim 12 - 13 \text{ V}_{\text{DC}}$ Resistance $\sim 105 \Omega$	Burner Manifold Segment 2
9	Solenoid valve (SV3)	White-White	$\sim 12 - 13 \text{ V}_{\text{DC}}$ Resistance $\sim 125 \Omega$	Burner Manifold Segment 3

Table 14 – Component Electrical Measurements and Values

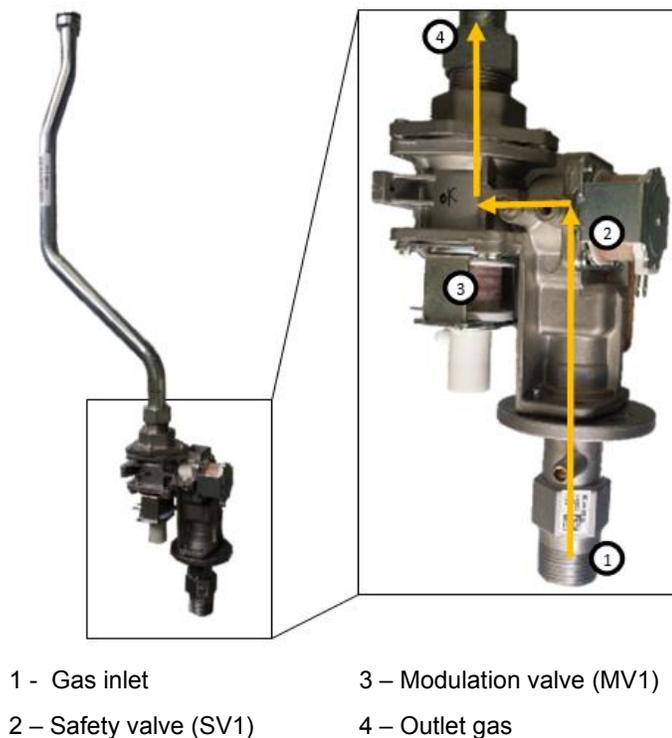


Figure 37 – Gas Valve Solenoids

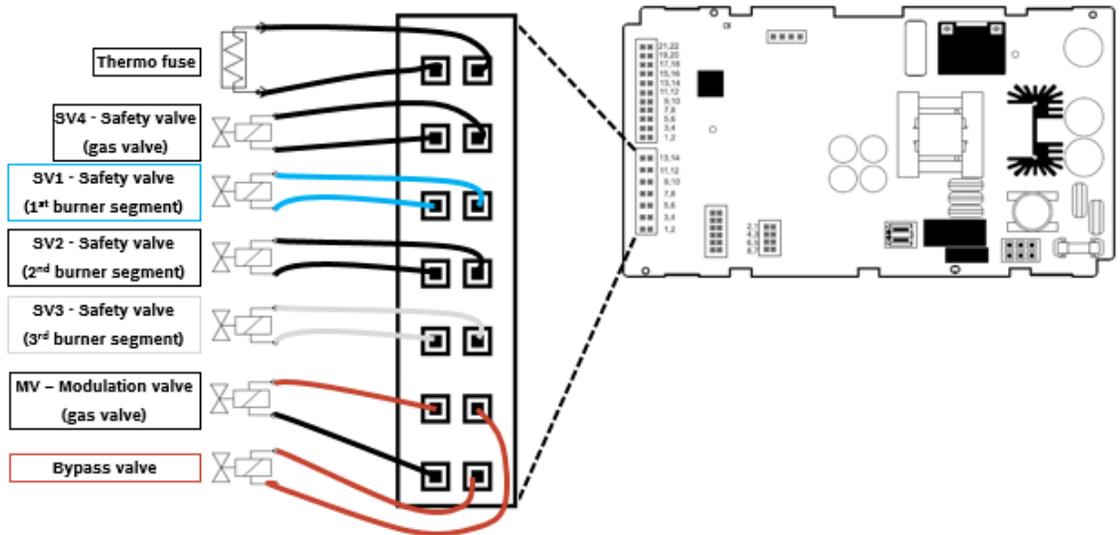


Figure 38 – Gas and Bypass Valve Connector with 14 pins

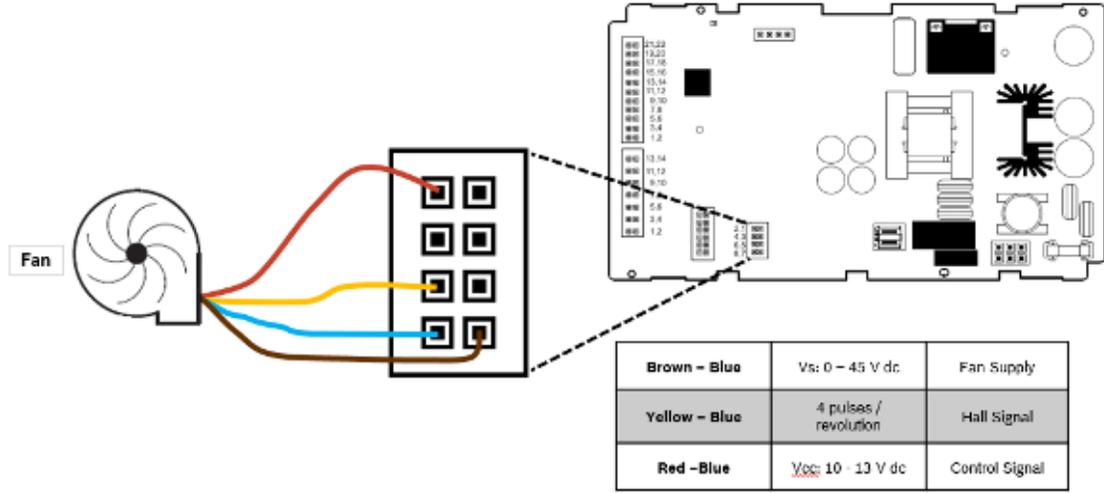


Figure 39 – Fan Connector with 8 pins

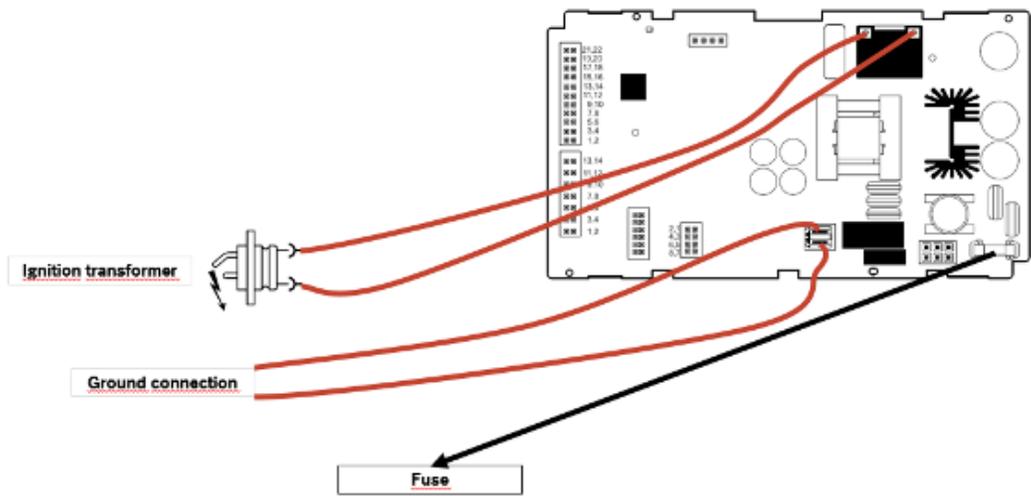


Figure 40 – Ignition Transformer



Figure 41 – Inside View of the Control Unit

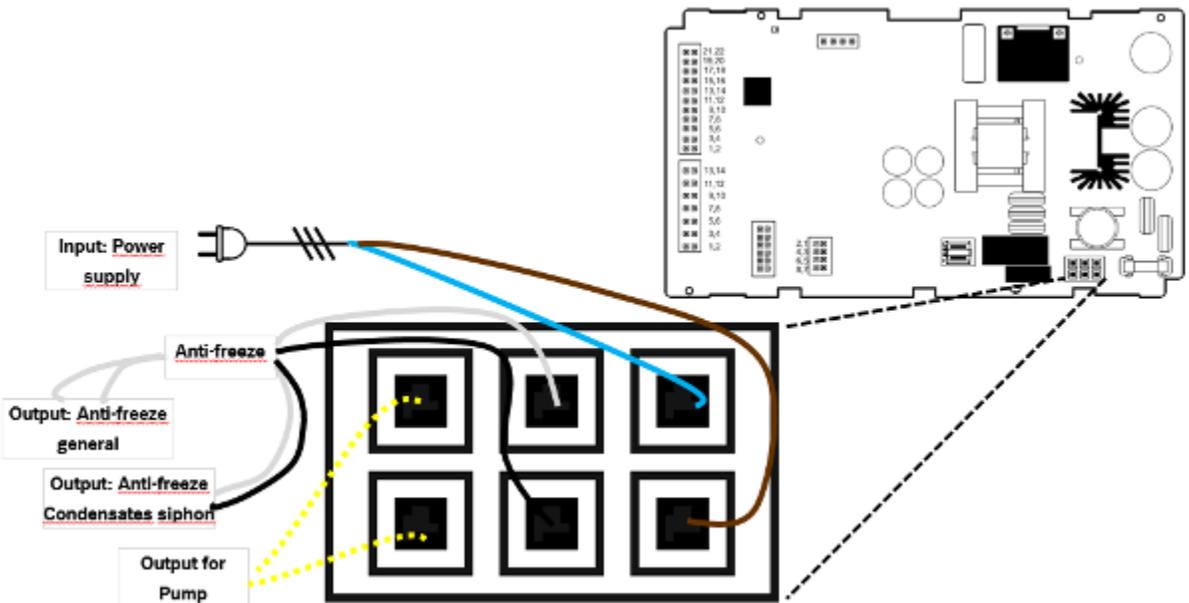


Figure 42 – Power supply and anti-freeze connector with 6 pins

6. After Sales Service

In order to ensure a correct start-up of the appliance and a correct function after any intervention on the appliance, the service manual must be read and main recommendations followed to avoid wrong diagnostic / components replacement and premature failures.

To ensure correct start-up of the appliance and correct function after any maintenance procedures, the service manual must be read and fully followed to avoid incorrect diagnostics and prevent incorrect component replacement or premature failure of components or the appliance.

6.1 PCB Replacement:

When replacing the control unit, configurations need to be checked and set accordingly. Not following precautions will result in potential wrong operation of the unit with abnormal combustion, noise and temperature instability.

Attention:

Control units are supplied as spare part with the following default values:

- NG = Natural Gas (setting visible in P7)
- Indoor Model (visible in PE – nO)

Recommended Procedures:

1st – Combustion Parameters Registration:

- Take note of P1 / P2 combustion adjustment values (settings memorized in factory regulation);

Mode	Parameter	Setting
P1 (Max Power)	A1	
	L1	
P2 (Min Power)	A2	
	L2	

2nd – PCB replacement

- Switch off the electrical supply.
- Unscrew fixation screw of PCB.
- Disconnect the connectors in PCB.
- Reassemble all the connections.



Figure 43 – Confirmation of HMI Configuration (gas type)

3rd – Configuration of the New PCB

- Switch ON electrical supply.
- Follow configuration tips in HMI.

Question	Options
Region Selection	USA eV Europe
Appliance Power	160 kBTU 199 kBTU
Type	Residential Commercial

4th Combustion Parameters Configuration

- Confirm P7 = NG or change it to LPG in case of unit operating with Propane.
- Confirm nO (in PE) = Indoor or change it to Outdoor in case of outdoor unit.
- Insert manually the values taken from previous PCB (the default setting in A1 / L1 / A2 / L2 = 20).

Attention:

Procedure to enter in Service Mode (only for outdoor units with inbuilt internal HMI):

From this position and using the selection buttons “+” and “-“, different service modes can be assessed.

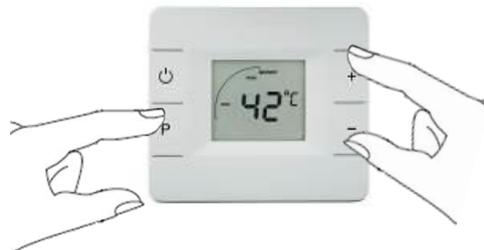


Figure 44 – Service Mode Entry Procedure

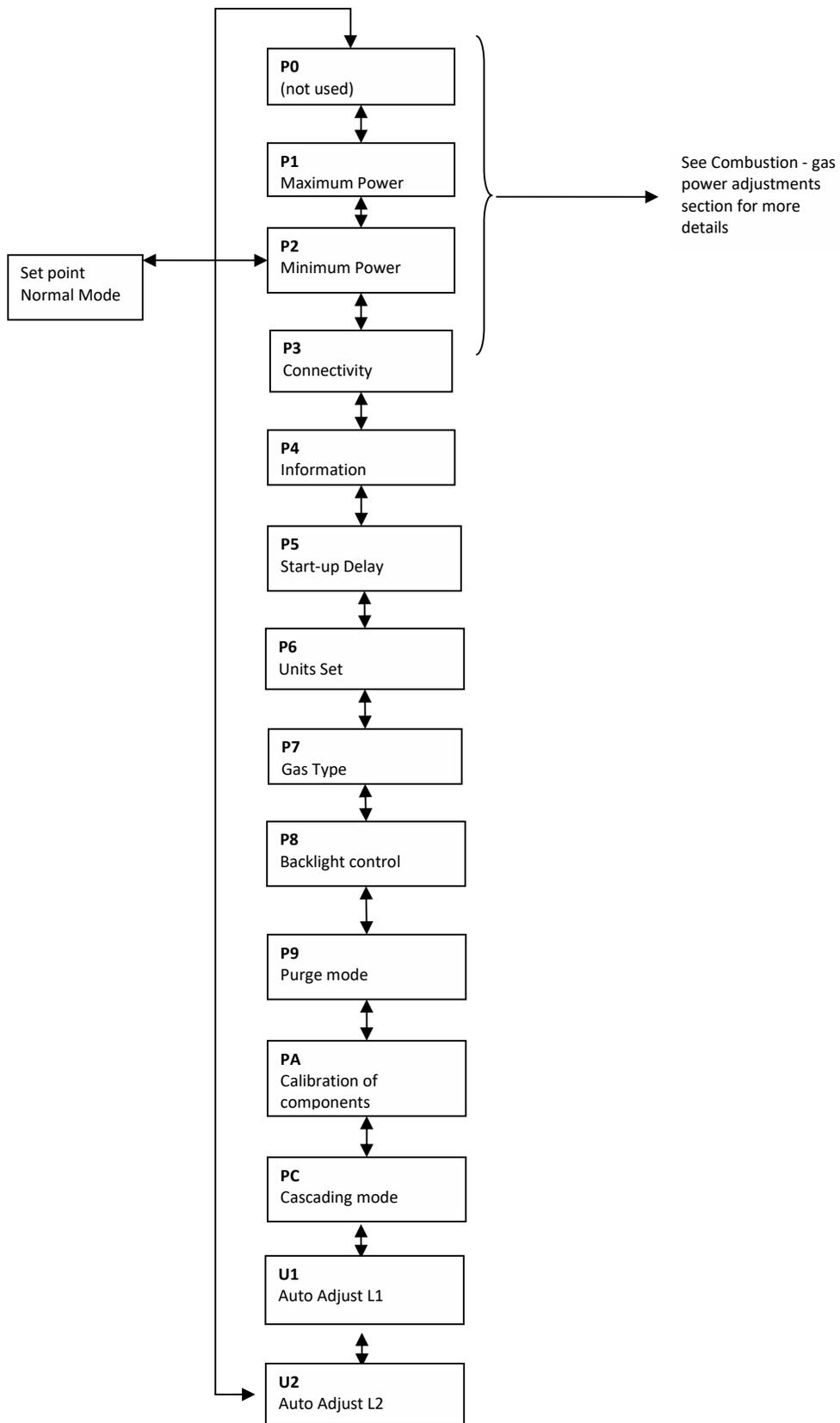


Table 15 – Service Mode Parameters List (1st level)

Combustion – Gas Power Adjustment Parameters

The adjustment of the appliance for minimum (P2) / maximum (P1) power operation may be needed under the following conditions:

- Gas valve replacement – run the U1 and U2 to find L1 / L2 values according characteristic of new gas valve;
- Fan replacement – use flue gas analyzer as described in manual to find correct setting of A1 / A2 (air flow);

The following image indicates the 2 measurement points to be used:

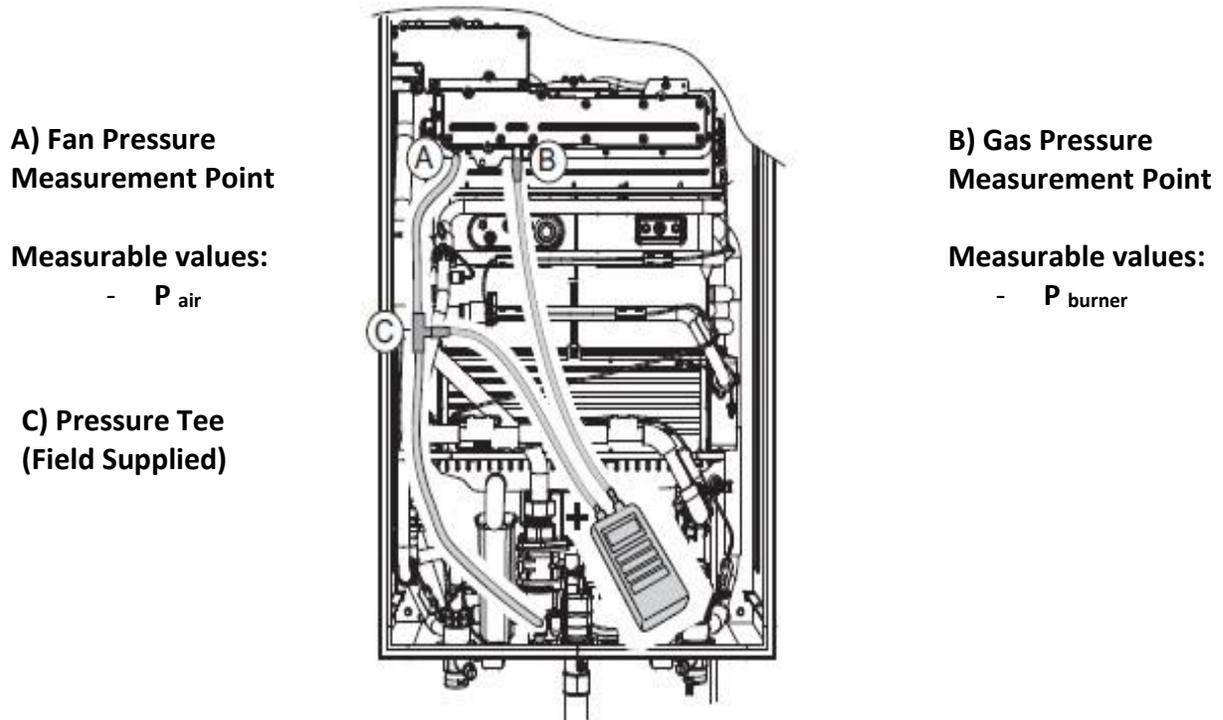


Figure 46 – P1 / P2 deltaP Measurement Points

	Technician Level	Comments
	NOT USED	Range of value in control unit is from 0 to 40 Spare part default setting is 20

Table 16 – P0

The P1 mode can be accessed in the service mode, depending on the adjustment and/or confirmation need.

To keep the appliance in P1 (maximum power adjustment), it is important to assure a minimum water flow, otherwise the appliance will jump automatically to P2 (minimum power).

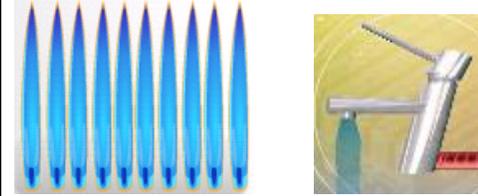
	160 kBTU: > 3 GPM
	199 kBTU: > 4 GPM

Table 17 – Minimum Water Flow Needed to Keep P1

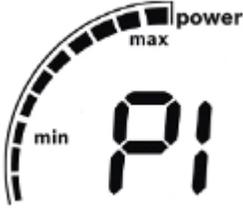
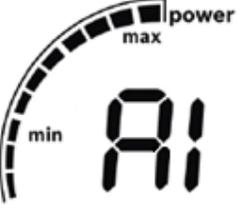
Maximum Power Adjustment	Technician Level	Comments
	Maximum power burner adjustment after repairs / maintenance / gas conversions	P1 contains the fan speed setting (A1) and gas power (L1) at maximum power (depends on gas type / model)
	When P1 is visible, press "P" and enter in the 2 nd level accessing "E" for enter and/or exit P1	
	Adjustment of air flow without change gas conditions	Range from 0 to 40 Spare part default setting is 20
	Adjustment of gas flow without change air conditions	Range from 0 to 40 Spare part default setting is 20

Table 18 – P1 Sub-Menus

Values in P1 mode are settled according to the appliance selection and gas type from factory. To check default value or to change parameter, press "Program" button when inside of P1.

The P2 mode can be accessed in the service mode, depending on adjustment and/or confirmation need.

Minimum Power adjustment (Minimum gas and water flow)	Technician Level	Comments
	Minimum power burner adjustment after repairs / maintenance / gas conversions	P2 contains the fan speed setting (A2) and gas power (L2) at maximum power (depends on gas type / model) (depends on gas type / model)
	When P2 is visible, press "P" and enter in the 2 nd level accessing "E" for enter and/or exit P1	
	Adjustment of air flow without change gas conditions	Range from 0 to 40 Spare part default setting is 20
	Adjustment of gas flow without change air conditions	Range from 0 to 40 Spare part default setting is 20

Table 19 – P2 Sub-Menus

Remote control registration	Comments
	Not used

Table 20 – P3

The access to the data visualization mode, is made by entering first in the “service mode” and then, scrolling to the parameter “P4” of the adjustment mode.

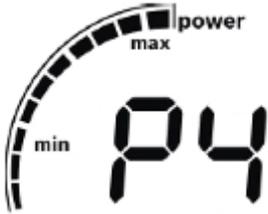
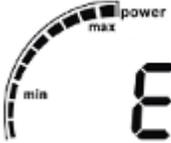
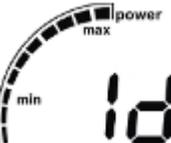
Diagnostic mode and visualization mode	Installer Level	Technician Level	Comments
	This mode helps the installer in the startup to check parameters such as water flow through the appliance and inlet / outlet temperatures	This mode helps the technician to find some information useful to adjust and to check functionality of the appliance.	Main recommendation is to perform always a check on the last 10 failures in memory in order to analyze eventual problems in installation that might need to be corrected

Table 21 – P4

By pressing the “P” button while the display shows “P4”, the LCD will enter into visualization mode and will show “E”, meaning “Exit” from the visualization mode. By pressing “P” button again, the LCD will show “P4”, i.e. the visualization mode has been exited.

After entering into data visualization mode (showing “E”) and then pressing “+” or “-” button, the parameter and failure visualization fields can be selected as shown in Table 22.

Sequence of Parameters in P4	Comment	Value / Unit
	Entry / Exit of visualization mode	
	Possible change of set point without leave service mode and perform any needed control	°C or °F
	Temperature indication Inlet water temperature	Temperature read by inlet sensor °C or °F
	Temperature indication Hot water temperature	Temperature read by outlet sensor °C or °F
	Water flow indication l/min (±0.5l/min)	Indicates water flow measured by the turbine (l/min or gal/min.)

	Not existing	
	Temperature of air in room sealed box	Temperature read by box sensor °C or °F
 until 	Last 10 Failures for diagnostic purposes	<p>Failure 1 is last failure occurred</p> <p>Failure 2 occurred before Failure1</p> <p>Failure 3 occurred before Failure2</p> <p>Failure 4 occurred before Failure3</p> <p>Failure 5 occurred before Failure4</p> <p>Failure 6 occurred before Failure5</p> <p>Failure 7 occurred before Failure6</p> <p>Failure 8 occurred before Failure7</p> <p>Failure 9 occurred before Failure8</p> <p>Failure 10 occurred before Failure9</p>

Table 22 – Visualization Mode Parameters

The following parameter is only applicable when correspondent component is replaced in field.

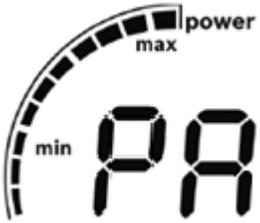
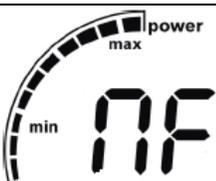
Components Calibration	Technician Task	Comments
	Only applicable when components are replaced	Allows the technician to calibrate components operation range after a replacement
	Entry / Exit parameter	
	Calibration of bypass	Open tap with flow of 5 to 6 l/min or 1.2 to 1.6 gal/min. The calibration will be done by itself while calibration of by-pass valve is being done and successful calibration will be confirmed on the display
	Calibration of motorized water valve (stepper motor)	Open hot water tap in any flow rate and automatically the unit will close the water flow and start opening slowly for calibration

Table 23 – PA Sub Menus

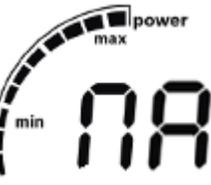
	<p>Cascading Mode Parameter</p>	<p>This mode allows the installer to configure the units to operate in cascading (optional kit with cable required)</p>
	<p>Deactivation of cascading mode</p>	
	<p>Selection as Master</p>	<p>Press "P" for > 3 sec to define unit as Master (only 1 unit in system)</p>
	<p>Selection as Slave</p>	<p>Press "P" for > 3 sec to define / confirm unit as slave</p>

Table 24 – PC

7. Maintenance

To ensure continued efficient operation of the appliance, checking and servicing the appliance at regular intervals is recommended. The frequency of servicing depends on the individual installation conditions and use profile, but in general, once a year should be adequate. Any maintenance work in the appliance must be carried out by a competent person such as a registered and competent technician. Before any service operation, turn off the gas supply at the main gas service valve upstream. Carry out the maintenance procedure as described in the manual.

The service partners have all necessary accessories and tools for maintenance tasks.



L641 – O-rings in contact with water
Hf1 v5 – Gaskets in contact with gas

Figure 47 – Recommended Lubricants for Connections

Cleaning the Filter

For the cleaning of the filter, first loosen the nut (1), then remove the filter (2) that is fixed in the body of the inlet water valve. Clean the filter with water and / or air pressure. Assembly is reverse of disassembly.

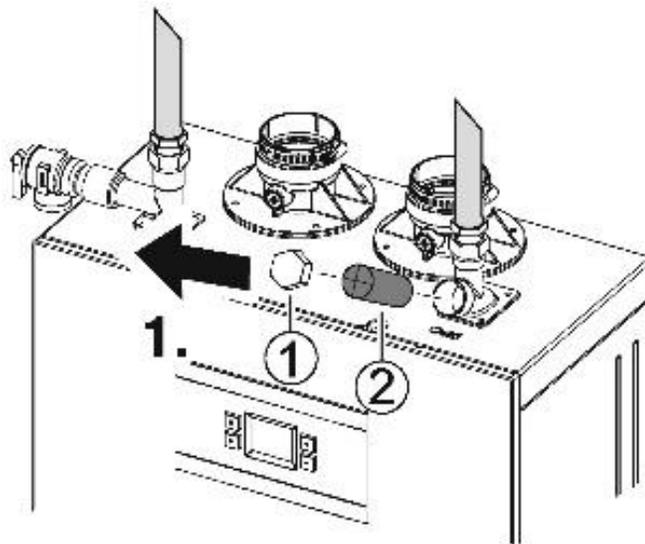


Figure 48 – Water Filter Removal

Inspect and clean the heat exchanger when needed. To remove the heat exchanger, begin by turning off the cold-water supply to the unit. Open the taps to release any remaining water pressure and drain the appliance.

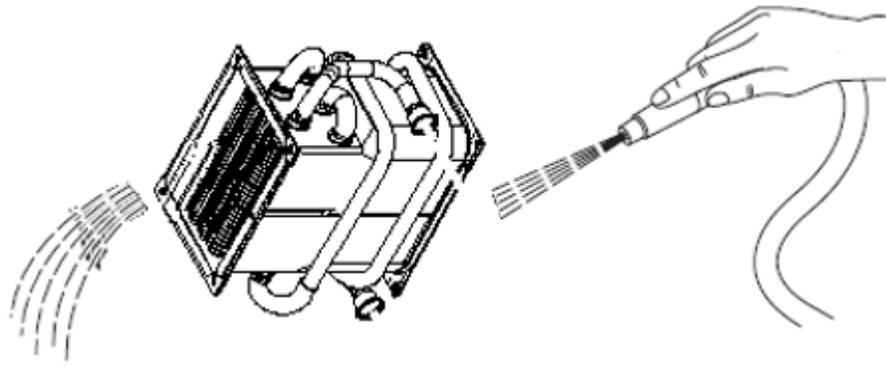


Figure 49 – Heat Exchanger Cleaning

Heat Exchanger Fin Coils

Inspect the heat exchanger fin coils for soot build-up or blockage. If there is evidence of soot build-up or blockage, the heat exchanger should be removed by a professional and cleaned thoroughly. Soot is an indication of incomplete combustion and a clear sign of a serious problem. Venting, gas pressure, and flue gases should be examined to determine the cause of the problem. Damage to the water heater caused by incorrect installation or adjustment are not covered by the manufacturer's warranty

Take care not to damage the seals that ensure tightness between the heat exchanger, the heat cell, and collector and ensure correct clearing and alignment of the fins.

In hard water regions it may be necessary to descale the heat exchanger body, using a proper descaler. Fill the heat exchanger with the descaling solution and let it act until the solution stops bubbling. Drain and thoroughly wash out the exchanger with clean water.

Warning: Acid/water solutions must be used with extreme caution. Take care not to splash on to the skin or into the eyes. Wash any affected areas with large amounts of cold water and seek medical advice.

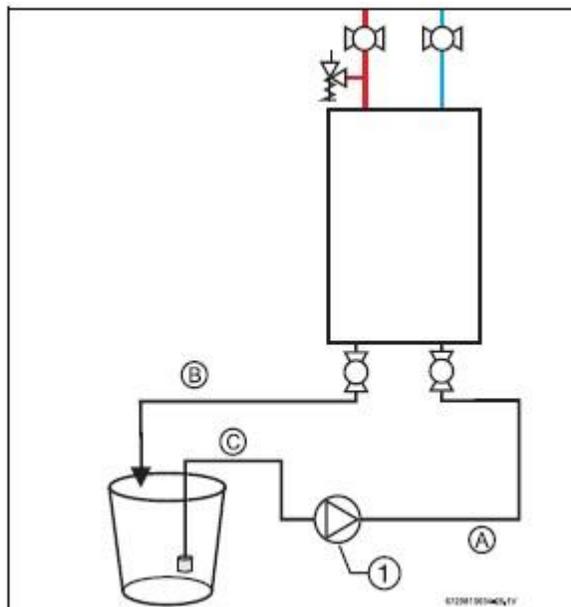


Figure 50 – Heat Exchanger Descaling

Descaling Using a Pump

- ▶ Disconnect the electrical supply from the water heater.
- ▶ Shut off the water supply to the water heater.
- ▶ Open hot water taps to drain and relieve pressure from the plumbing system.
- ▶ Shut off hot water valve to the water heater.
- ▶ Connect a line (A) from the outlet of the circulating pump (installer supplied) to the inlet drain connection on the water heater.
- ▶ Using another line (B), connect the outlet drain connection of the water heater. Route the other end of this line into a descaling reservoir.
- ▶ Using a 3rd line (C) from the descaling reservoir, connect to the inlet side of the circulating pump. Install a filter on the end of the line in the descaling reservoir.
- ▶ Make sure all connections are water tight.
- ▶ Fill the descaling reservoir with descaling solution so both lines inside are submersed. We recommend a straight white vinegar solution. If using a commercial descalant, refer to the manufacturer's instructions for proper dilution ratio.
- ▶ Ensure both drain connections are open.
- ▶ Operate the circulating pump.
- ▶ Make sure there are no leaks and the solution is flowing from the descaling reservoir through the heater and returning to the reservoir.
- ▶ Run the solution through the heater until the solution returning to the descaling reservoir comes out clear. (Changing to a fresh solution may be necessary during this process).
- ▶ Disconnect all lines and drain all solution from heat exchanger. Properly discard the solution.
- ▶ Close the inlet drain connection.
- ▶ Position a container below the outlet drain connection and connect the cold-water supply. Open the cold-water supply shutoff valve and flush the heat exchanger with clean water.
- ▶ Close the cold-water shutoff valve and reconnect hot water supply to the water heater.
- ▶ Close the outlet drain connection.

Re-assemble the heat exchanger ensuring its correct position on the two support hooks in the appliance back plate, good conditions of seals and tightness between heat exchanger, collector and burner.

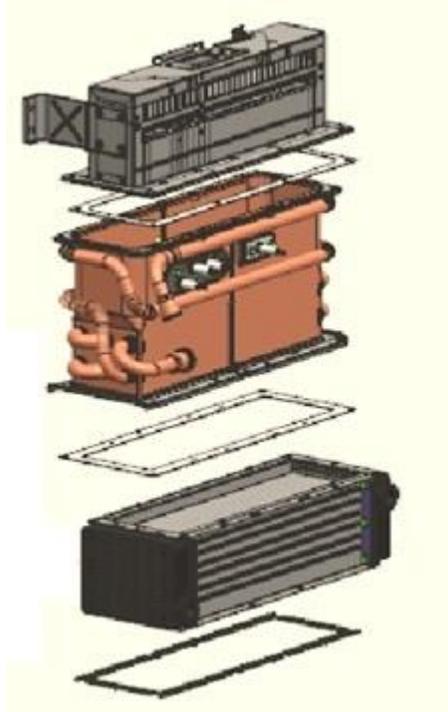


Figure 51 – Heat Exchanger

Replacement of Parts

Any service work must be carried out by a competent person such as the technician indicated by the after sales organization. Before any service operation, turn off the gas supply at the main gas service valve.

When replacing components, always use the supplied gaskets / sealings provided with the parts and / or always order the maintenance kit.

8. Trouble Shooting

Display	Description	Solution
A0	Either cold or hot water temperature sensor fault	Check temperature sensors and associated connections.
A1	Temperature inside the cabinet is above 158 °F.	The appliance automatically regulates the performance of the appliance to avoid overheating. <input type="checkbox"/> External air temperature is above 140 °F. <input type="checkbox"/> Check for flue leakage inside the appliance or in concentric vent.
AA	Flue gas temperatures above 356 °F after the primary heat exchange and/or 176 °F at the exhaust sensor.	The appliance is protected against overheating. <input type="checkbox"/> Descale appliance. 1) <input type="checkbox"/> Check if inlet water temperature is above maximum limit.
A2	External Tank temperature sensor is not installed properly. Temperature sensor fault.	Check temperature sensor and associated connections.1) 2) <input type="checkbox"/> Check SA-A1 menu in HMI and select OFF if tank loading application is not in use
A3	Flue gas temperature sensor fault.	Check connections or replace sensor.
A4	Cabinet air temperature sensor fault.	Check connections or replace sensor.
A5	Primary or Secondary heat exchanger gas temperature sensor fault.	Check connections or replace sensor.
A6	Inlet water temperature sensor fault.	Check connections or replace sensor.
A7	Heat exchanger temperature sensor fault.	Check connections or replace sensor.
A8	Outlet water temperature sensor fault.	Check connections or replace sensor.
A9	Incorrect output power. Hot water temperature sensor is not installed properly. Incoming gas pressure too low (below 3.5" W.C. for NG or 8" W.C. for LP).	<input type="checkbox"/> Check incoming gas pressure.1) <input type="checkbox"/> Check hot water temperature sensor. <input type="checkbox"/> Check manifold solenoids are operating
C5	Fault in the bypass valve.	<input type="checkbox"/> Check bypass valve connections. <input type="checkbox"/> Perform calibration in submenu bP in PA
C7	Fan not working	<input type="checkbox"/> Check fan connections. <input type="checkbox"/> Close and open a hot water tap.
C8	Main Water valve disconnected	Check water valve connections
C9	Barometric pressure sensor fault	Replace electronic control unit

Display	Description	Solution
CA	Air in the water circuit (commissioning). Water flow above maximum value specified (□ 9.24GPM).	<ul style="list-style-type: none"> ▶ Disconnect the appliance and purge hydraulic circuit.1) ▶ Check that water pressure does not exceed 150 psi.
CF	- Vent blockage during operation (Flue vent outlet or air vent inlet). Insufficient combustion air.	<ul style="list-style-type: none"> ▶ Remove blockage from the exhaust/intake vent. ▶ Check room air inlet requirements. See Chapter 4.7. ▶ Reset the appliance.
C1	- Air flow insufficient for start-up (Before flame ignition).	
CE	- Flue outlet vent blockage (exhaust pressure above siphon water column). Excessive flue vent pressure.	
C3	Flow sensor does not detect water recirculation.	<p>Check pump and connections.</p> <ul style="list-style-type: none"> ▶ Check recirculation circuit for any blockage.
E0	Internal Failure in ECU	Flow sensor does not detect water recirculation.
E1	Hot water temperature sensor detects overheating (> 194 °F).	<ul style="list-style-type: none"> ▶ Let the appliance cool down and try again. ▶ Check sensor resistance.
E3	Flue gas temperature sensor detects high temperature (> 194 °F).	<ul style="list-style-type: none"> ▶ Let the appliance cool down and try again.1) ▶ Check sensor resistance.
E4	Temperature inside the cabinet is above 194 °F.	<ul style="list-style-type: none"> ▶ Check for flue gas leakage inside the cabinet. ▶ Let the appliance cool down and try again.1) ▶ Check sensor resistance.
E5	Copper heat exchanger gas temperature sensor detects temperature above 392 °F, the appliance is locked.	Descale appliance.
E7	Internal error	<ul style="list-style-type: none"> ▶ To unlock, reset the appliance by touching the ON/OFF button for 3 sec. ▶ If the problem persists replace ECU.
E8	Error during ionization test. ECU internal error.	ECU may need to be replaced.
E9	Thermofuse open. Temperature above 237 °F.	Replace thermofuse cable.
EA	Flame not detected. Ionization loss 9 consecutive times.	<ul style="list-style-type: none"> ▶ Check the gas supply pressure. ▶ To unlock, reset the appliance by touching the ON/OFF button for 3 sec. ▶ If the problem persists check the ignition electrode or the ionization electrode. ▶ Check Air/Gas flow adjustment.
EC	Partial ionization loss 5 times.	<ul style="list-style-type: none"> ▶ Check the gas supply pressure.1)

Display	Description	Solution
		<ul style="list-style-type: none"> ▶ To unlock, reset the appliance by touching the ON/OFF button for 3 sec. ▶ If the problem persists check the ignition electrode or the ionization electrode.
EE	Modulating gas solenoid valve disconnected.	<ul style="list-style-type: none"> ▶ Check valve connection.
EF	Wrong gas type.	<ul style="list-style-type: none"> ▶ Natural gas appliance supplied with liquid propane gas. ▶ Liquid propane gas appliance supplied with NG.
F2	ECU internal error	<ul style="list-style-type: none"> ▶ To unlock, reset the appliance by touching the ON/OFF button for 3 sec. ▶ If the problem persists replace ECU.
F3	Memory failure	<ul style="list-style-type: none"> ▶ To unlock, reset the appliance by touching the ON/OFF button for 3 sec. ▶ If the problem persists replace ECU.
F7	A flame is detected before gas valve open.	<ul style="list-style-type: none"> ▶ Check the electrodes and the cable.1) ▶ To unlock, reset the appliance by touching the ON/OFF button for 3 sec. ▶ If the problem persists replace ECU.
F9	Safety gas solenoid valve disconnected.	<ul style="list-style-type: none"> ▶ Check connections.1) ▶ To unlock, reset the appliance by touching the ON/OFF button for 3 sec.
FA	Fault in the main gas shut-off valve or gas manifold shut-off valve.	<ul style="list-style-type: none"> ▶ Main gas shut-off valve or gas manifold shut-off valve stuck/locked. ▶ Check main gas shut-off valve and gas manifold shut-off valve electric circuit.
FC	Buttons touched for more than 30s.	Release the button.
High Pitch Noise	Combustion flame with gas in excess or lack of air (combustion adjustment is rich).	<ul style="list-style-type: none"> ▶ Check that gas supply is the same as appliance gas type (NG or LP). ▶ Check appliance CO2 adjustment (excessive CO2, see table 19 or 20 located inside your Installation and Operation manual).
Low Pitch Noise with Vibration	Combustion flame with air in excess or lack of gas (combustion adjustment is lean).	<ul style="list-style-type: none"> ▶ Check that gas supply is the same as appliance gas type (NG or LP). ▶ Check gas pressure supply (gas pressure too low). ▶ Check appliance CO2 adjustment (low CO2, see table 19 or 20 located inside your Installation and Operation manual). Decrease A1 or A2 air adjustment parameter.



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