



Heat Smart Plus Inc.



Portage & Main Est. 1973

Aqua Stat Operation and Replacement

Portage and Main BL series boilers use a total of two (2) different Johnson Control aqua stats to control the function and operation of your outdoor boiler. Over the years Portage and Main has used a total of three different models of aqua stats, these include:

Johnson Controls - **A419ABC-2C or A421ABC-03 (A419 or A421)** is a digital aqua stat and controls most thermostatic functions of the boiler.

Johnson Controls - **A19ABC-12C** is a mechanical aqua stat and controls the high limit function, meaning if for some reason the A419 / A421 aqua stat fails, then the high limit acts as a redundancy to shut the blower fan off, to prevent further overheating. Portage and Main recommends having this mechanical aqua stat dial turned to 190°F.

Before energizing the electrical circuits with power, make sure wiring connections are correct. Then power, operate and observe the system and A419 / A421 control for at least two complete operating cycles before leaving the installation.

Portage and Main [A419](#) Aqua Stat Default Settings

Display Symbol	Control Function	Range - Units/Value	Factory Default Settings
SP	Set Point*	-30 to 212 - °F (-34 to 100 - °C)	30
DIF	Differential*	1 to 30 - (°F or °C in 1-degree increments)	5
ASD	Anti-short cycle Delay	0 to 12 - (in 1-minute increments)	1
OFS	Temperature Offset	0 to 50 (°F or °C in 1-degree increments)	0
SF	Sensor Failure Operation	0 = output relay de-energized 1 = output relay energized	1
F or C	Temperature Units	°F or °C	F°
BIN	Temperature Offset Indicator	(No range) - BIN is displayed and the A419 control operates on the secondary set points when the circuit between the BIN and COM terminals is closed.	N/A
Snowflake or Flame picture	Cooling or Heating Mode of Operation	Snowflake (Cooling Mode) is displayed when the Jump1 jumper is removed. Flame (Heating Mode) is displayed when the Jump1 jumper is installed	

Heat Smart Plus Inc.

Portage & Main Est. 1973

Portage and Main recommends ensuring all settings are programmed to match the factory default settings. Once they are matched, you may wish to further adjust the SP (set point) and the DIF (differential). The SP controls the highest operating temperature that the outdoor furnace will achieve, before it shuts the blower motor down. The DIF determines what operating temperature reduction is allowed before the blower starts up to reheat the boiler back to the SP.

Portage and Main recommends an initial SP of 175°F, and a DIF of 7 to 10°F. If further assistance is needed to complete programming of the aqua stat, please contact Portage and Main for a copy of the A419 electronic manual.

Setting the [A419 Digital Control Set Point Value and Differential Value](#)

To view and adjust Set Point (SP) on the A419, follow these steps:

- Press and hold MENU (about 2 seconds) until the display flashes SP (Set Point).
- Press MENU again to display the existing SP value.
- Press ▲ or ▼ to adjust the SP to the temperature that you wish to use.
- Press MENU again to save the new SP value selected. The display will then return to display the current temperature of the boiler solution.

To view and adjust Differential (DIF) on the A419, follow these steps:

- Press and hold MENU until the display flashes SP.
- Press ▲ or ▼ to scroll until the desired function is displayed (DIF).
- Press MENU to display the current value.
- Press ▲ or ▼ to adjust the DIF to the desired value that you wish to use.
- Press MENU to save the new setting. The display will then return to display the current temperature of the boiler solution.

NOTE: If MENU is not pressed after changing the value, the control reverts to the previously programmed value. If no entry is made for 30 seconds, the control reverts to the (normal) temperature display.

Any saved A419 control settings are non-volatile and remain in the control's memory during power interruptions.

IMPORTANT: Do not set SP and DIF values which (when totaled) fall out of A419 control's Set Point range (-30 to 212 °F [-34 to 100°C]). The control will not function properly if cut-in or cut-out values are outside of the control's SP range.

Heat Smart Plus Inc.

Portage & Main Est. 1973

Portage and Main [A421](#) Digital Aqua Stat Default Settings

Display Code	Display Description (Menu)	Range of Useable Values	Factory Default Settings
OFF	Relay OFF temperature	-40 to 212°F (-40 to 100°C)	70°F
ON	Relay ON Temperature	-40 to 212°F (-40 to 100°C)	75°F
SF	Sensor Failure Action	0 = output relay de-energized 1 = output relay energized	1 Output relay energized

Portage and Main recommends ensuring all settings are programmed to match the factory default settings. Once they are matched, you may wish to further adjust the OFF and the ON. The OFF controls the highest operating temperature that the outdoor furnace will achieve, before it shuts the blower down. The ON determines what operating temperature reduction is allowed before the blower starts up to reheat the boiler back to the OFF value.

Portage and Main recommends an initial OFF of 175°F, and an ON of 167 to 165°F. If further assistance is needed to complete programming of the aqua stat, please contact Portage and Main for a copy of the A421 electronic manual.

Setting the A421 Digital Control OFF Value

To view and adjust the OFF value on the **A421**, follow these steps:

- Press MENU, the display (LCD) displays OFF.
- Press MENU again to display the current OFF value temperature.
- Press ▲ or ▼ to select desired temperature and display the preferred temperature.
- With the OFF temperature displayed, press MENU to save the displayed value.
- Press ▲ and ▼ together to go to Main screen.

Setting the A421 Digital Control ON Value

- Press MENU.
- Press ▲ or ▼ to scroll till ON is displayed.
- Press MENU to display the current ON value temperature.
- Press ▲ or ▼ to select desired temperature and display the preferred temperature.
- With the desired temperature displayed, press MENU to save the displayed value.
- Press ▲ and ▼ together to go to Main screen.

NOTE: If MENU is not pressed after changing the value, the control reverts to the previously programmed value. If no entry is made for 30 seconds, the control reverts to the (normal) temperature display.

Heat Smart Plus Inc.

Portage & Main Est. 1973

Any saved A421 control settings are non-volatile and remain in the control's memory during power interruptions.

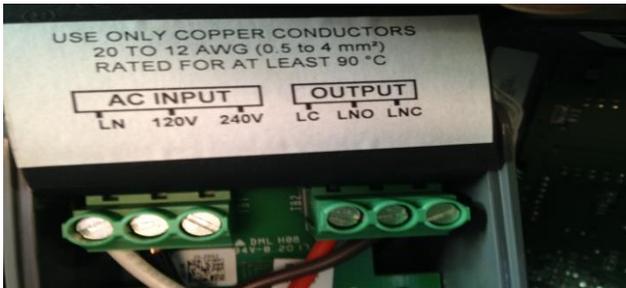
If a boiler overheats, the overheating can cause problems and issues such as, burnt sensor wires or sensor probe failures. If a boiler significantly overheats, then in many cases, replacement of the sensor(s) and/or aqua stat(s) is required.

To Replace the [A419ABC-2C / A421ABC-03 \(A419 / A421\) Digital Aqua Stat\(s\)](#):

1. Disconnect power from the boiler.
2. Remove the two (2) screws at the bottom of the cover of the **A419 / A421** aqua stat.
3. Once the cover is removed, we recommend taking a picture of the wiring connections, so the re-install can be completed accurately
4. There will be two wires supplying AC power to the unit and two sensor wires from the sensor probe.
 - a. The power connections are located in the lower half of the aqua stat.
 - b. The sensor wires are located near the top of the aqua stat on the left hand side. It is important that all connections are wired correctly.
5. In order to replace the sensor probe, trace the grey sensor wire to the dry well location.
 - a. This is on the right hand side of the boiler, (when facing boiler from the front). There are two dry wells side by side, the dry well on the outer most edge is for the **A419 / A421** and the second one is for the A19ABC-12C.
 - b. The sensor probes are positioned in the dry well and held in place with a set screw and the base of the sensor is secured with high temp silicone.
6. Loosen the set screw holding the sensor probe, you may need to cut through old silicone to release old probe.
7. Remove old sensor probe, clean the dry well very well, to remove any scale or corrosion. Failure to do so could cause mis-readings by the aqua stat probe.
8. Apply some high temp silicone around the base of the sensor, insert new sensor probe into cleaned dry well and secure the probe wire to the dry well with the set screw.
9. Complete the wiring connections of the sensor wires into **A419 / A421** aqua stat.
 - a. These two wires go into the small green wiring block located near the top of the aqua stat on the left hand side.
10. Complete the wiring connections for the AC power.
11. **Note: if changing from a A419 to a A421 aqua stat, then the A421 aqua stat will wire in differently than the previous A419. – See Picture below on how to wire the A421 Aqua Stat.**

Heat Smart Plus Inc.

Portage & Main Est. 1973



- 12.
13. Re-install cover for the A419 / A421 aqua stat.
14. After completing the replacement of your **A419 / A421** aqua stat, you may wish to check your aqua stat settings against the factory default settings.

To Replace the [A19ABC-12C Manual Aqua Stat](#):

1. Disconnect power from the boiler.
2. To remove the cover on the **A19ABC-12C** aqua stat, remove the single screw at the bottom of the cover.
3. Once the cover is removed, we recommend taking a picture of the wiring connections, so the re-install can be completed accurately.
4. There will be two wires supplying AC power to the unit and a solid copper sensor wire for the sensor probe. It is important that all connections are wired correctly.
5. In order to replace the sensor probe. Trace the copper sensor wire to the dry well location.
 - a. This is on the right hand side of the boiler, (when facing boiler from the front). There are two dry wells side by side, the dry well on the outer most edge is for the A419 / A421 and the second one is for the **A19ABC-12C**.
 - b. The sensor probes are positioned in the dry well and held in place with a set screw and the base of the sensor is secured high temp silicone.
6. Loosen the set screw holding the sensor probe, you may need to cut through old silicone to release old probe.
7. Remove old sensor probe, clean dry well very well, to remove any scale or corrosion. Failure to do so could cause mis-readings by the aqua stat probe.
8. Apply some high temp silicone around the base of the sensor, insert new sensor probe into cleaned dry well, and secure the probe wire to the dry well with the set screw.
9. Complete the wiring connections for the AC power.
10. Re-install cover for the **A19ABC-12C** aqua stat.

Dry Wells

Heat Smart Plus Inc.

Portage & Main Est. 1973



Do NOT remove Drywells