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DEMAND DUO

Contents:

Demand Duo Principle of Operation:

Cold water enters the storage tank after passing through an isolation and non return valve. A tee is fitted to the cold inlet pipe down stream from the non return valve. From this tee, one branch connects to the lower inlet of the storage tank and the other branch connects to the primary (tank circulation) pump. This pumps water to the inlet of the infinity(s) heat source. The infinity will only operate when this pump is running.

The heated water from the infinity returns to the storage cylinder at the second lowest connection point, located above the cold inlet.

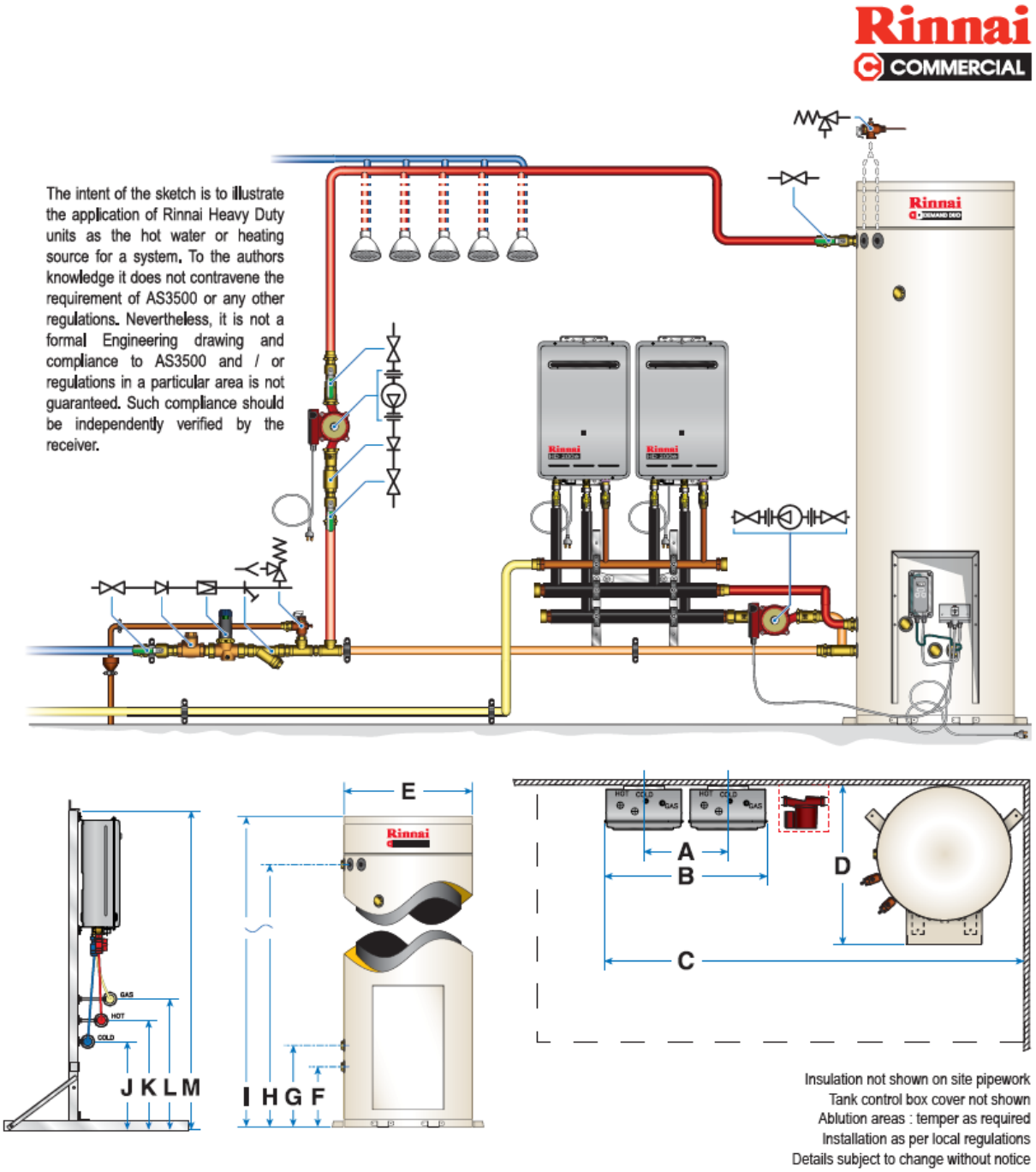
Hot water leaves the tank from the top of the storage cylinder. This may be circulated around the building and returned, via a ring-main pump (set) to the cold inlet after the non-return valve and before the tee as described above.

When there is a hot water draw off, cold water enters the storage cylinder and pushes the hot water out of the storage cylinder towards the outlet, as per any storage hot water system.

When the water temperature at the bottom of the storage cylinder drops below the thermostat set point, the thermostat activates the primary pump(s). They draw water from the cold water feed to the storage cylinder, or the storage cylinder itself, or a combination of both. As stated previously, this water is then heated by the infinity and returns to the storage cylinder heated. This process is continued until the thermostat set point is reached and the pump is switched off.

The outlet temperature setting of the infinity must be set at least three (5) degrees hotter then the thermostat set point. Standard factory settings are: Infinity 75°C, thermostat 65°C.

Schematic of Demand Duo:



Demand Duo Fault Finding Check List:

Basic Demand Duo system consists of the following components

- Infinity(s) Hot Water unit
- Storage cylinder
- Electronic thermostat
- Circulating pump

Basic operating principle of Demand Duo Thermostat:

When the water temperature at the bottom of the storage cylinder drops to the pre-determined thermostat set point (normally 60ºC), the thermostat contacts will close and provide power to the primary circulating pump(s).

Once the primary pump(s) start, and water is drawn from the bottom of the storage cylinder and circulated through the Infinity(s) , the flow turbines within the Infinity(s) sense the water flow and water heating commences.

Heated water from the Infinity(s) is fed back into the storage cylinder.

It is normal for the burner on the Infinity(s) to modulate back to a low burner rate as the water temperature within the storage cylinder rises close to thermostat set temperature.

Types of Demand Duo Thermostats:

There have been two models of thermostats used within the Demand Duo systems;

- Johnson A419 Thermostat
  Max current rating 1kW
  Able to be adjusted to turn on or off at set temperature

- AIMS Thermostat.
  Max current rating 1 kW

Johnson A419 Control Thermostat:

Operating principle.

The Johnson A419 control is a Single-Pole, Double-Throw output relay. The control features a lockable three button touch pad for set-up and adjustment, and a liquid crystal display (LCD) which displays the sensed temperature and other control functions.

A front panel light emitting diode, (LED) indicates the output relay status. When the relay contact is energized and the thermostat contacts close, the LCD will be illuminated.

The control fitted to the Demand Duo cylinder will be factory locked to a set point temperature of 65^{o}C, unless an alternative temperature has been specified for a specific job.

When the power is turned on to the thermostat, the digital display should scroll through and settle on the temperature reading of the water within the storage cylinder.

As water is heated, the display temperature will increase to indicate current temperature of water within the cylinder.

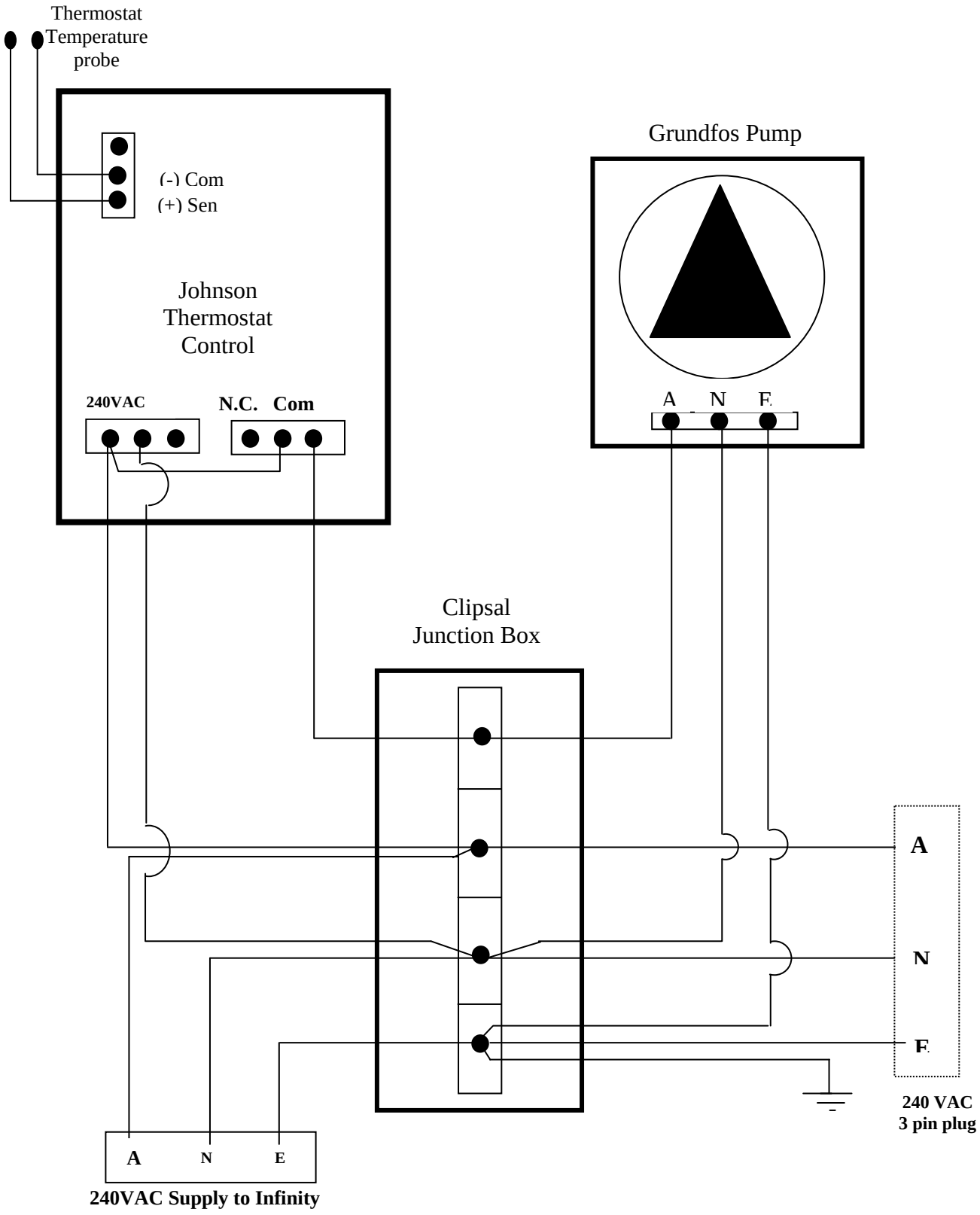
Johnson control has an inbuilt fault monitoring system, which can display the following faults.

Error Code	Definition	System Status	Solution
SF Flashing alternatively with *OP*:	Open temperature sensor or sensor wiring	Output functions according to the selected sensor failure mode. (SF Setting)	See *trouble shooting* section. Cycle power to reset the control
SF Flashing alternatively with *SH*	Shorted temperature sensor or sensor wiring.	Output functions according to the selected sensor failure mode (SF setting)	See *trouble shooting* section. Cycle power to re-set the control
EE	Program failure	Output is off	Reset the control by pressing the **menu** button. If problem persists, replace the control

Repairs & Replacement.

Do not attempt to repair or recalibrate the Johnson A419 temperature control. In the case of a defective or improperly functioning control, the control will require to be replaced.

Typical Wiring Diagram (DD1) Johnson A419 Thermostat:



The A419 Control Functions Explained:

Set-point (SP)

The set-point establishes the temperature value at which the equipment will be switched on or off, depending on the user selected mode of operation. Set-point range *-30 to 212 –^{O}F (-34 to 100^{O}C)* in one degree increments.

If set-point mode is set to cut-in, the set point is the temperature value at which the control closes the normally open (N.O.) contacts. If the set-point mode is set to cut out, the set-point is the temperature at which the (N.O.) contacts will open.

For the Demand Duo, this cut out set-point is normally 65^{O}C.

Differential (diF)

The differential establishes the difference in temperature between the cut in value and the cut out value. The difference is set relative to the set-point and may be between 1 to 30 ^{O}F or ^{O}C.

For the Demand Duo, this setting is the same as the factory default setting of 5^{O}C.

Anti- Short Cycle Delay. (Asd)

The Anti-Short Cycle Delay establishes the minimum time that the output relay remains de-energized before the next on-cycle. The Asd does not allow the output relay to re-energize until the programmed time delay has elapsed. The delay is activated when the control is first turned on and every time an on-cycle ends. When the display is activated, the LCD alternatively flashes the sensor temperature and the Asd. The Asd range is 0 to 12 minutes in One minute increments.

For the Demand Duo, the Asd setting is 1 minute.

Temperature Offset (OFS)

The OFS establishes a set secondary Set-point and Differential values that may be invoked to control an application where the circuit is closed between the Binary input (BIN) and Common (COM) terminals (and BIN appears on the display) Offset range is 0 to 50^{O}F or ^{O}C (in one degree increments).

A typical application might use a switching time clock to involve night-setback temperature settings.

For the Demand Duo system, this function is not used.

Settings & Adjustments of Johnson A419 temperature Control:

The Johnson A419 Temperature Controller is ‘locked ‘ at Demand Duo to a set temperature. Adjusting the UP & DOWN buttons will have no effect on the thermostat. On normal servicing & fault finding, there is no need to adjust the thermostat.

If ordering a new/replacement Johnson A419 temperature control as a spare part, then the control will need to be correctly set to suit the Demand Duo system.

The touchpad cannot be unlocked without a jumper installed across the P5 jumper pins. Do not discard jumpers in case they are required in the future.

Positioning the Jumpers:

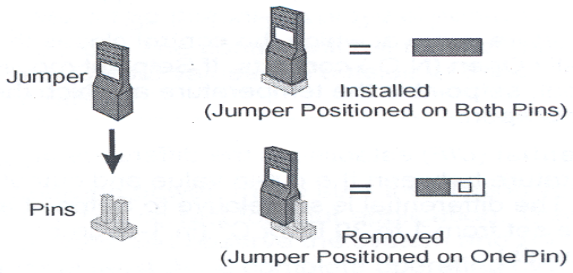
The P5 jumper position determines if the touchpad is locked or unlocked.

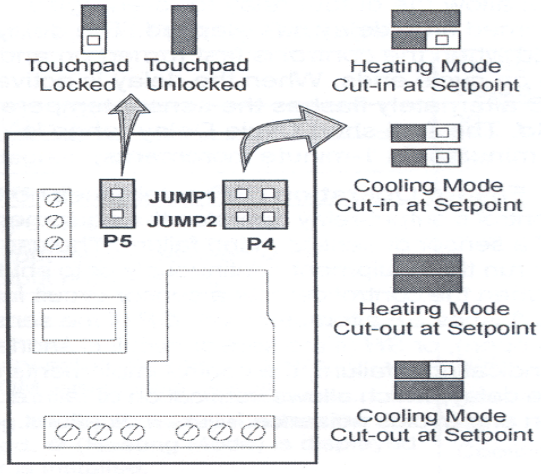
The P4 jumper pin block has two pairs of jumper pins. The top pair of pins (JUMP1) ,determines if the control is set for heating or cooling mode. The bottom pair of pins, (JUMP2) establishes whether set-point is at cut in or cut out.

NOTE: Make sure the Touchpad Lock jumper is installed (Unlocked) before attempting to adjust the A419 control functions.

Jumper Designations, Jumper Positions and Control Settings

Function	Jumper Pins Designation on Control	Setting	Jumper position	Factory Default Setting (and jumper position)
Cooling / Heating Operating Mode	**JUMP1** Top pair of pins on Block P4	Cooling Mode	Removed	Cooling Mode. Jumper Removed
		Heating Mode	Installed	
Set-point at Cut-In or Cut-out.	**JUMP2** Bottom pair of pins on Block P4	Set-point at Cut In	Removed	Cut In Jumper Removed
		Set-point at Cut Out	Installed	
Touch Pad Lock	**P5**	Locked	Removed	Unlocked Jumper Installed
		Unlocked	Installed	





Changing the A419 control temperature units:

The A419 control is factory set to display Fahrenheit temperature. To change to Celsius, press the UP and DOWN arrows simultaneously.
Press UP & DOWN arrows simultaneously again to return to a Fahrenheit temperature.

Verify that the control is displaying the desired temperature units before setting the set-point.

Setting the A419 Control Set-Point.

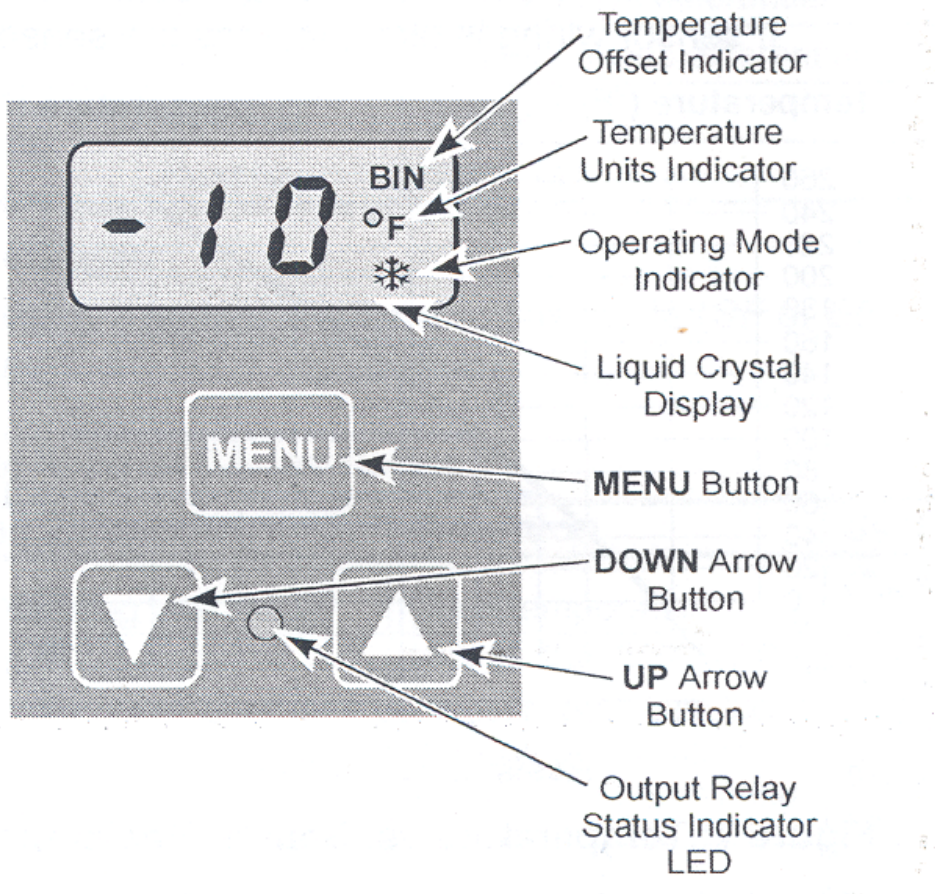
To view & adjust set-point:
Press and hold MENU (about 2 seconds) until the display flashes 'SP'

Press MENU again to display existing set point value.

Press UP or DOWN arrows to change set-point value. (Typically 65^{O}C)

Press MENU again to save new value. The display will now return to the sensed temperature.

NOTE; If no set-up entry is made for 30 seconds, the control reverts to (normal) temperature display.



Setting the other A419 Control functions:

To set the Differential, Anti sort cycle display, Temperature offset or Sensor failure operation, use the following method.

Press and hold MENU until display changes to flashing 'SP'. (Normally takes about 2 seconds)

Press UP or DOWN arrows repeatedly until the desired function is displayed. (see table below)

Press MENU to display the functions current value.

Press UP or DOWN arrows until the desired temperature is displayed.

Press MENU to save the new value. The display will then return to the sensor temperature.

NOTE: If MENU is not pressed after changing the setting, the new setting will not be saved and the control will revert to the previously programmed setting values.

Display Symbol	Control Function	Range – Units / Value	Factory Set Value
SP	Set point	-30 to 212 –^{o}F (-34 to 100^{o}C)	30
diF	Differential	1 to 30 – (^{o}F or ^{o}C in 1 degree increments	5
ASd	Anti-short Cycle	0 to 12 – (in One minute increments)	1
OFS	Temperature Offset	0 to 50 (^{o}F or ^{o}C in 1-degree increments)	0
SF	Sensor Failure Operation	(No Range) 0 = output relay de-energized 1 = output relay energized	1
F or C	Temperature Units	(No Range) - ^{o}F or ^{o}C	^{o}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 are closed.	N/A
Ice symbol or Flame symbol	Cooling or heating mode	(No Range) Cooling mode (Ice symbol), is displayed when the JUMP1 jumper is removed. Heating (Flame symbol) is displayed when JUMP1 jumper is installed	Ice Symbol Cooling mode.

NOTE: Do not set the Set-point and Differential values, which (when their values are totaled), fall outside the A419 control's set-point range (-30 to 212^{o}F or –34 to 100^{o}C). The control will not function properly if the Cut In or Cut Out values are outside the control set-point range.

If no setup 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 controllers memory during power interruptions.

A 419 COMONENT TEST SHEET:

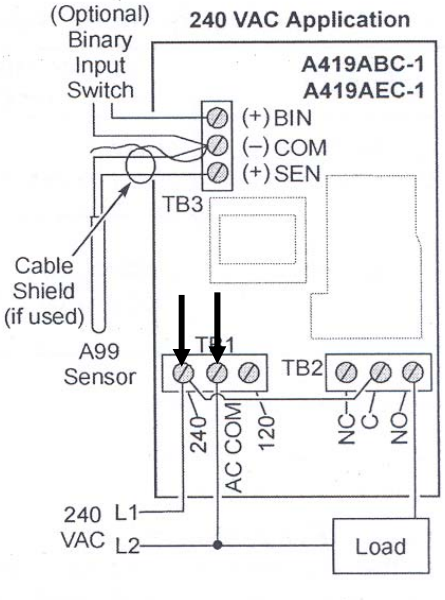
Hazardous Voltages.
CAUTION – RISK OF ELECTRIC SHOCK
Hazardous voltages may be present at electrical terminals and other exposed internal metal surfaces. Do not touch any metal parts within the control when cover is removed. Any contact with metal parts including with metal conductive tools may result in serious injury or death.

Testing if power is available to thermostat

Remove lower cover panel from storage cylinder.

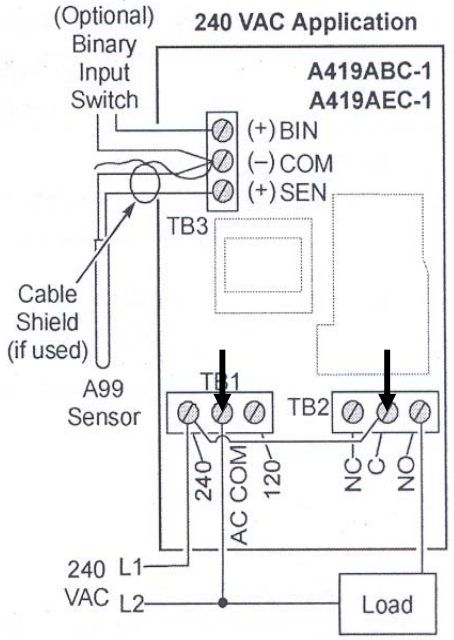
Remove four (4) screws holding cover of Johnson controls thermostat.
Carefully lift up cover. Note: Cover is attached by wiring to PCB inside thermostat, so cover can note be removed, just moved.

Check for 240 volt power supply on supply terminals located under card cover.



Testing if power is available to common terminal on thermostat.

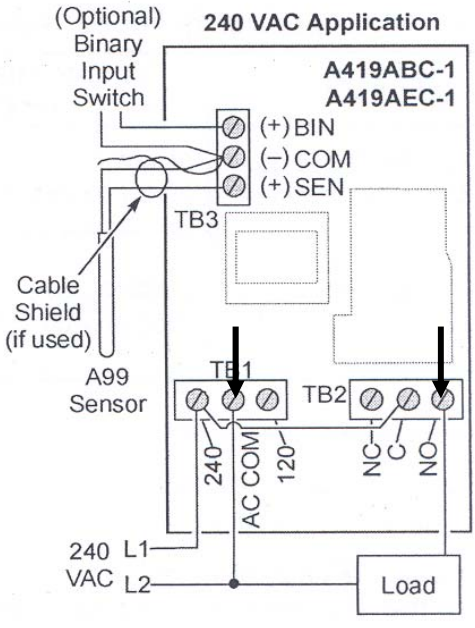
Check 240VAC power is available on thermostat common terminal.



Testing if thermostat contacts have closed.

Once temperature displayed on thermostat is less than set temperature, check for 240 VAC available on terminal supplying voltage to pump and neutral.
Note: You should be able to hear the thermostat contact close and control LCD illuminate when power is switched to primary circulating pump.

If contacts have not closed, thermostat is faulty.
Replace thermostat



Testing to see if temperature probe is operating correctly.

Disconnect all power sources to control

Remove lower cover panel from storage cylinder.

Remove four (4) screws holding cover of Johnson controls thermostat.

Carefully lift up cover. *Note: Cover is attached by wiring to PCB inside thermostat, so cover can note be removed, just moved.*

Using an accurate thermometer, take a temperature reading at the sensor location.

Disconnect sensor from control.

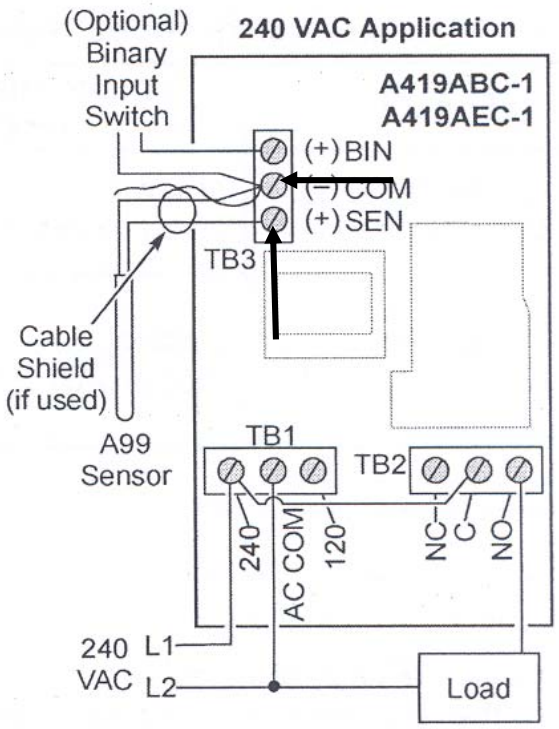
Check resistance of temperature probe, across two wires.

Check measured value conforms to table below.

Temperature ^{o}C	Electrical ValueΩ
10	930
20	1000
40	1150
60	1320

If sensors measured resistance value is substantially different from the expected value for that temperature, check the sensor wiring.

If sensor wiring is OK, replace the sensor. *(Johnson Controls/PENN A99 temperature sensor)*
Sensor leads are not polarity sensitive.



AIMS Thermostat Control:

Later model Demand Duo hot water systems, (DD1, DD2-4 & DD5-6) use the AIMS thermostat controller. It is possible to change the temperature cut off point and temperature differential via dip switches.

Thermostat to control the operation of primary pumps between storage tank and external heat source, such as HD200 or HD250.

Circuit board is housed in a plastic box with a clear front cover. Power lead with plug, two sockets and a temperature probe on lead leave the base of the box.

Can be set up as a DD1, where one power outlet is activated if the tank temperature drops below set point and the other is permanently active for the HD200 or HD250 to plug into or as a DDCOMBO where one or both power outlets are activated if the tank temperature drops below set point..
NOTE: One DD1 unit, Ensure HD Unit is plugged into correct GPO on thermostat.

Circuit board includes a display that shows measured water temperature.
"tt" indicates tank temperature when set point is reached.
"P" indicates that temperature has fallen below set point (less differential) and power to primary pump(s) is activated.
Circuit board mounted LED is lit when power outlet is active when configured to provide power to a pump. When set as power supply to HD, as a DD1, LED is not lit when power outlet is active.

Pump load per power outlet is maximum 1000 watts. Total power supply to run both pumps simultaneously is 7.5 Amps. Confirm load with pump details.

Available temperature set points are 65°C, 70°C, 75°C, and 80°C.

Available temperature differentials are 3°C and 5°C.

Example: if temperature set point is 65°C and differential is -3°C pump will be switched on when temperature is below 62°C and is switched off when temperature reaches 65°C

Start up sequence for above example will initiate then show: Lo 62, Hi 65.

AIMS Thermostat Temperature Dip Switches:

Located across the top LHS of the control PCB is 8 dip switches that control the various functions of the control.

- Dip switch position of 1 &2 control cut off temperature (65°C, 70°C, 75°C, and 80°C)
- Dip switch position of switch 3 control temperature differential (either 3ºC or 5ºC)
- Dip switch position of switch 7 & 8 control power point combinations

It is normal that only dip switches 1 to 3 need be altered in the field.

Dip Switches

SW 8	LH GPO	SW 7	RH GPO	SW 3	DETA	SW 2	SW 1	Set Temp
OFF	Not Switched	OFF	Not Switched	OFF	3°C	OFF	OFF	65°C
ON	Switched	ON	Switched	ON	5°C	OFF	ON	70°C
						ON	OFF	75°C
						ON	ON	80°C

Pumps:

Primary pumps on the Demand Duo system are selected to provide the most suitable water flow through the installed Infinity(s) on the system, to provide the best performance of the system as a whole.

As such, sequencing using either PAM Valves or a MEC's system is not used on a Demand Duo system.

Typical pump selection.

- DD1 = 1 x Grundfos 2060N Pump
- DD2-DD4 = 1 x Grundfos 2580B Pump
- DD5-DD6 = 2 x Grundfos 2580B Pumps.

Check power is available to primary circulating pump.

Grundfos 20-60N

Make sure power is isolated before removing access covers.
Remove one (1) screw from black plastic pump cover and remove cover.

Check for 240 volt AC across L & N terminals See Fig 4

If power available and pump does not operate, isolate power and check resistance of motor windings. (200Ω between terminal L & N)

If motor windings are open/short circuited, replace pump.

If motor windings are correct, check pump for mechanical damage such as seized impeller or impeller dislocated from motor drive shaft.

Free impeller if seized, replace pump if impeller is dislocated from motor drive shaft.

Replacement of Pump:

Ensure water is bled through pump prior to use.

Grundfos 25-80

Make sure power is isolated before removing access covers.
Remove one (1) screw from black plastic pump cover and remove cover.

Check for 240 VAC across L & N terminals.
If power available and pump does not operate, isolate power and check resistance of motor windings. (66Ω between terminal L & N)

If motor windings are open/short circuited, replace pump.

If motor windings are correct, check pump for mechanical damage such as seized impeller or impeller dislocated from motor drive shaft.

Free impeller if seized, replace pump if impeller is dislocated from motor drive shaft.

Bleeding Air from Pump.

Caution, if hot water system has been operating, the water being bled from the pump could be very hot.

Grundfos 20-60N & Grundfos 25-80B

Turn on power supply to pump.

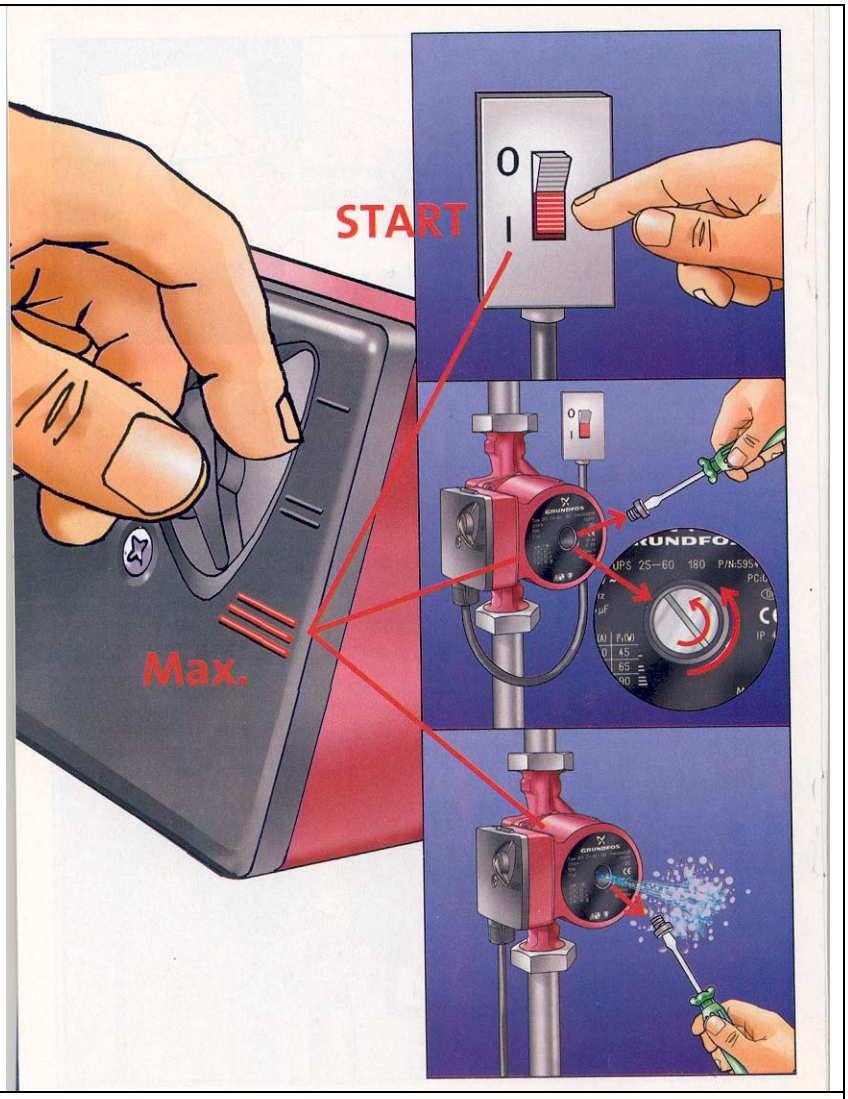
Make sure speed selection witch is on '3'.

Unscrew (counter clockwise) end cap in motor.

Allow air & water to dribble out of bleed hole.

When all air is bled through, replace end cap in motor.

Check for water leaks.



Positioning of Pump.

Grundfos 25-80B has the ability to rotate the pump motor through various positions in 90^{o} steps.
Typically, the electrical connection and speed selection switch can be located at the top or either side of the pump body.

DO NOT LOCATE THE ELECTRICAL CONNECTION & SPEED SELECTION SWITCH UNDERNEATH THE PUMP BODY.

Basic System Fault Finding:

Fault	Check & Remedy
Thermostat fails to respond to call to heat water	Check power is available to thermostat by watching for digital temperature display on thermostat LCD. Check thermostat temperature reading is less than thermostat set temperature. *(Normally 65^{O}C)* Check thermostat contacts have closed in response to call for hot water. *Refer component test sheet.*
Thermostat displays temperature in Fahrenheit instead of Celsius.	Check unit not recently subject to lighten storm /power surge. Control will default to Fahrenheit when subjected to power surge. Refer Johnson Control page for details of re-setting control.
Pump starts and water flows, but Infinity fails to begin purge & ignition sequence.	Check power is available to Infinity. Check inlet water filter to Infinity is clean. Check there is no air lock within pump. Bleed air from pump. Check pump has been installed with the correct water flow direction. *Refer to Infinity fault finding in Infinity service manual.*
Pump starts, Infinity starts and then Infinity stops.	Check incoming, flowing gas supply pressure is sufficient. *Refer to Infinity fault finding in Infinity service manual.*
Thermostat calls for heat but the pump does not start	Check thermostat contacts have closed in response to call for hot water. *Refer component test sheet.* Check pump is plugged in & turned on. *(Grunfos 25-80B)* Check for 240 VAC power available at pump. *Refer component test sheet.* If power is available, check for continuity of pump windings. *Refer component test sheet.* If power is supplied and pump windings show correct resistance, check for mechanical damage such as stuck impeller or impeller dislocated from drive shaft of motor.

Fault	Remedy
Pump starts but there is no water flow. Grunfos 25-80B	Check isolation ball valve in pump connections are turned to the 'open' position. Screwdriver slots should be aligned along pipe for 'open' position. Check pump has been installed with correct direction of water flow. Check pump impeller is spinning and not jammed or broken.
Water temperature taking excessive time to recover.	Check water inlet filters on Infinity's are clean. Check all Infinity's are operating. Check pump speed is set on maximum speed. *(Setting 3)* Check dip-switch settings on Infinity's to ensure correct temperatures selected. *(Infinity normally set to 75^{O}C and cylinder thermostat set temperature of 65^{O}C)* Check correct flowing gas pressure is correct to Infinity's. Check there is not excessive hot water being drawn from hot water storage cylinder during recovery time.
Noise in pump	Check all air is bled from pump. Check for worn bearings. *(Replace pump)*
Excessive time taken for hot water to reach hot water outlet.	Check length of pipe between hot water cylinder and hot water outlet. If excessive length, is a secondary building circulation pump fitted. Check power is available on building circulating pump. Check pump not turned off via incorrectly set time clock. Check secondary building circulation pump is operating correctly.
Water Leaking from Temperature & Pressure relief valve.	Check incoming water pressure to system does not exceed 850kPa. Fit cold water pressure reduction valve if inlet pressure excessive Check water temperature does not exceed 99^{O}C If pressure & temperature correct, Replace T&PR Valve

Fault	Remedy
Infinity flame rod not sensing flame	As these units can operate on a low gas flame for a considerable period of time, the flame rod can be left with carbon deposits which impede the flame signal. It is important to ensure the flame rod is cleaned with emery paper or similar to ensure a good connection through the gas flame.
Insufficient gas to burners	Check gas inlet filter located at the base of the gas solenoids. Small steel mesh can become blocked with thread seal, dust etc. Inlet test point will show adequate supply of gas, but blockage located just above inlet test point.

Infinity Heat Source:

- Ensure that filter at water inlet is clean. Note that this is an O ring seal and does not need to be excessively tightened. Just make sure O ring is engaged inside machined surface in brass housing.

- Ensure all Infinity's are operating. Ensure power is available to Infinity if it is not operating. Can check GPO with a power tool such as a drill or similar.

- Many new jobs or ones where the gas supply has been modified, there may be the need to purge the gas supply lines as they could be full of air.

- All models up to late 2006: Look at flame through window for conical shape, blue base and yellow tip. Flame height will vary if heater is modulating.

- All new HD models: when operating the number displayed should be higher than the temperature setting on the tank mounted thermostat.
    - Eg Tank = 65°C, Infinity = 75°C. These are factory standard settings.
    - Eg Tank = 75°C, Infinity 85°C. These are the maximum allowable settings.

- All new HD models will display a fault number if one has occurred. For example, codes 11 and 12 are common for gas supply faults. Below is a full list of fault codes.

- In situations where the heater fails to ignite of stay ignited, especially in windy areas there may be low air flow through the heater. This is indicated by fault 10 in most cases. Inspect outer and inner tubes of flue for internal heaters

- Internal heaters may operate for a short period of time and then stop. This can be caused by the co-axial flueing not being pushed together properly and exhaust gases are re-entering the inlet air. Push the flue together to remedy this. Also inspect flue terminal for any cause to divert exhaust air back into the inlet air.

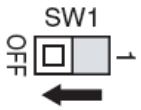
- In jobs that operate for long hours and/or in dusty or smoky environments the combustion air fan may become dirty. Simply unplug heater and then unplug and remove fan from heater in strict accordance to relevant Rinnai service manual. Inspect blades and clean with brush, remembering that damaging the fan can put it out of balance and it will need replacement.

- If the fan is excessively dirty the heat exchanger may also be. Remove ignition and flame sensor leads and remove metal cover from burner section. Look up into bottom of heat exchanger and inspect for cleanliness.

For Internal (FFU) models only

☑ Have you used only Rinnai FFU flueing components?

☑ If flue length exceeds 2m, dip-switch 1 of SW1 is to be switched to the **'OFF'** position as shown.



Infinity Error Codes:

ERROR	FAULT	REMEDY
-	Noticeable reduction in water flow.	Inlet water filter needs to be cleaned. Service call.
03	Power interruption during Bath fill (Water will not flow on power reinstatement).	Turn off all hot water taps. Press ON/OFF twice.
10	Air intake or flue blocked.	Service Call.
11	No ignition / No gas supply.	Check gas is turned on at water heater and gas meter or cylinder.
12	Flame Failure / Low gas flow.	Check gas is turned on at water heater and gas meter or cylinder. Check that nothing is obstructing flue outlet. Turn on gas supply to water heater.
14	Remaining Flame Safety Device.	Service Call.
16	Over Temperature Warning.	Service Call.
32	Outgoing Water Temperature Sensor Faulty.	Service Call.
33	Heat Exchanger Outlet Sensor Faulty.	Service Call.
34	Combustion Air Temperature Sensor Faulty.	Service Call.
52	Gas Modulating Valve Faulty.	Service Call.
61	Combustion Fan Failure.	Service Call.
65	Water Flow Control Faulty (Does not stop flow properly).	Service Call.
71	Micro-processor Failure.	Service Call.
72	Micro-processor Failure.	Service Call.

In all cases, you may be able to clear the Error Code simply by turning the hot water tap OFF, then ON again. If this does not clear the Error Code, try pushing the ON/OFF button OFF, then ON again. If the Error Code still remains, contact Rinnai for advice.

Ringmain Pump:

- These are used for circulating water around the building. They are normally either left connected directly to a GPO to provide continuous operation or may have a time clock to switch it off at night when the building is not in use.

- These pumps do not pressurise the system when installed on the return leg, they just remove the dead leg by circulating the water around the ring-main.

- They must have a non return valve.
    - Swing non return valves must be horizontal or upward as they rely on gravity to close the valve.
    - Spring check valves can be located on any plane but may contribute excessive back pressure and restrict the pump flow rate.

- Return water should only be slightly cooler than water leaving the tank. If the temperature drop around the circuit is too high it may indicate that the ring main pump flow rate is not high enough, and indicates a design fault or a blockage in the pipework (or poor pipework insulation). Investigate valves and operation of pump (same procedure as primary pump).