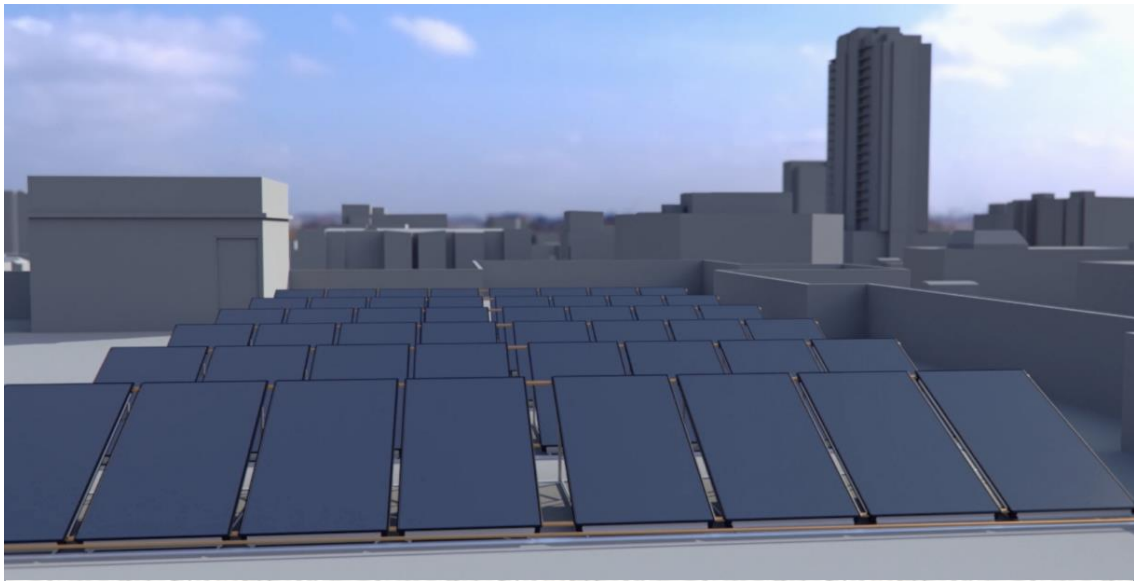




# ***Rheem HS Series Applications Guideline***

***Rev A 4/11/15***



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## System Description

The Solahart HS Series Commercial Solar system is a versatile solution. It offers designers the flexibility to use it in many ways to meet the specific requirements of each project.

This guide cannot cover every conceivable combination, however covers the most common systems encountered by Solahart. If an application is outside the scope of this guide, please contact Solahart. We will endeavour to provide a solution that meets the project needs and can then add it to this guide.

The system comprises a quantity of Solahart's proven high performance solar collectors, connected to a central heat store located at a lower level, which serves as the energy source to instantaneously heat the fresh potable water supply on demand, via a highly efficient delivery skid.

Boosting can be conducted using a variety of energy types including gas, electric resistance heating and heat pump. These in turn can be integrated in a variety of ways including in-tank or auxiliary heating directly into the solar heat store, or in-series boosting either in the primary circuit or the secondary circuit.

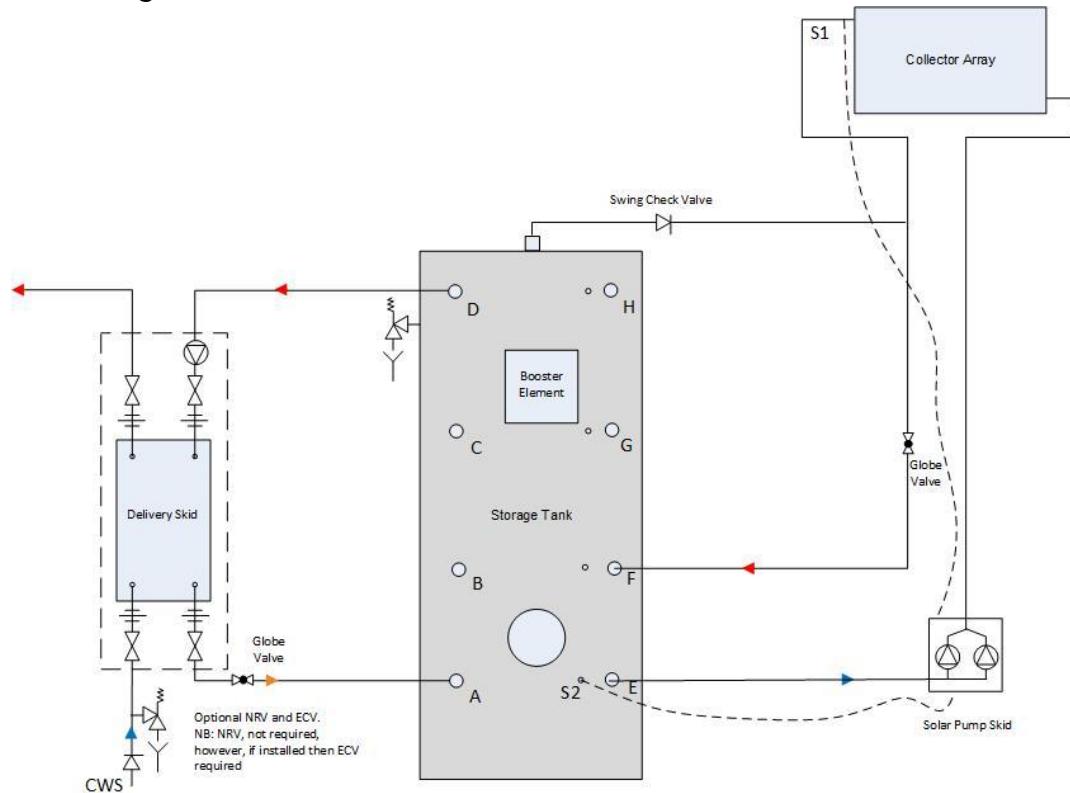
Further iterations are possible incorporating time control or 3 way valves to maximize solar contribution.

The guide provides basic plumbing schematics as well as wiring diagrams specific to the application type, however should be read in conjunction with the HS Series Owners' Manual.

If in doubt, please consult your Solahart representative, who can provide the right guidance which will save both time and project costs.

# 1. In-tank Electric Resistance Boosting

## a. Dead leg not timer controlled

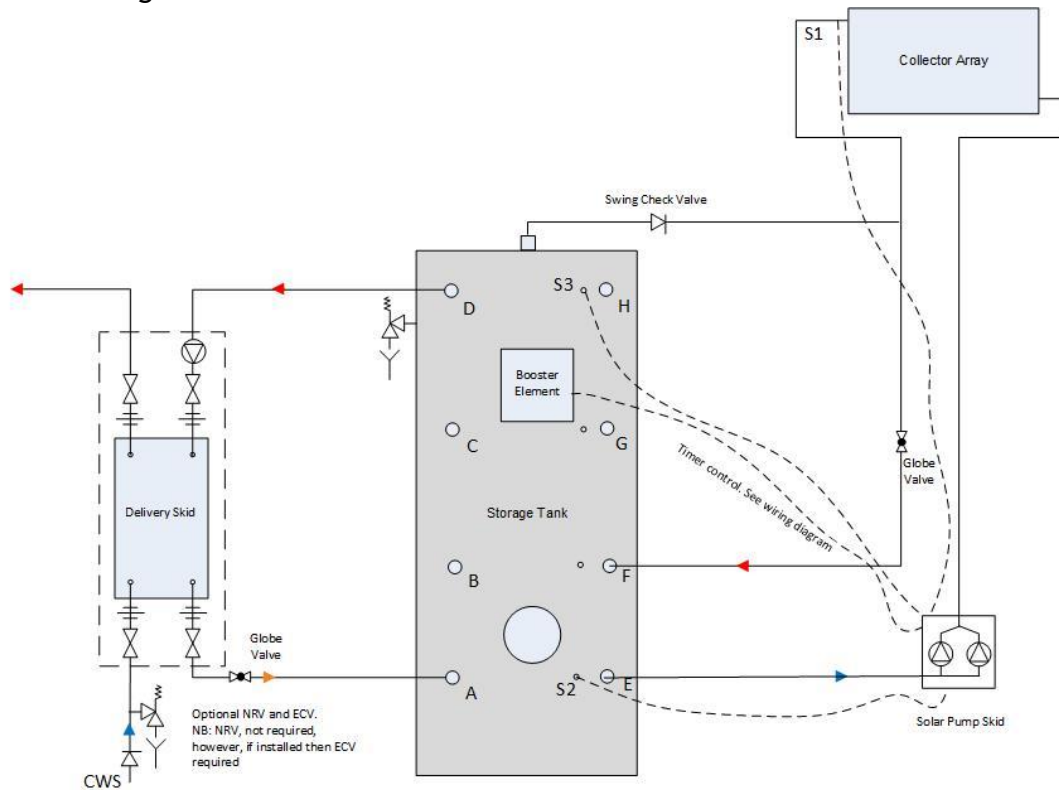


Note: If booster element is timer controlled,  
secondary side should be on a dead leg.

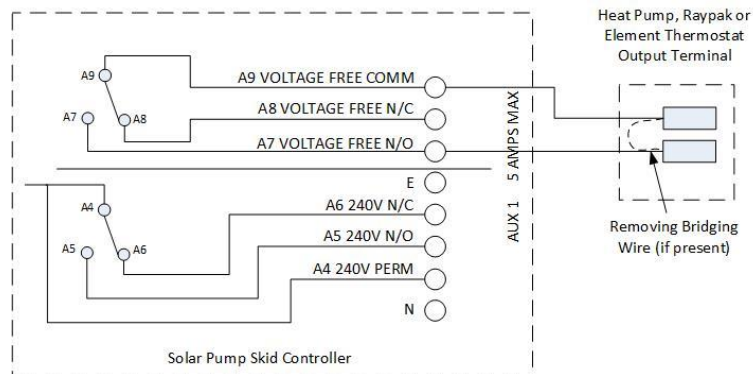
### Notes:

- The booster heating unit will maintain the top 1/3 of the tank at the temperature set on the heating unit thermostat.
- Operation is totally independent of the Solar Pump Skid and Delivery Skid.
- The heating unit thermostat should be set 5°C higher than the Delivery Skid desired outlet temperature

b. Dead leg timer controlled



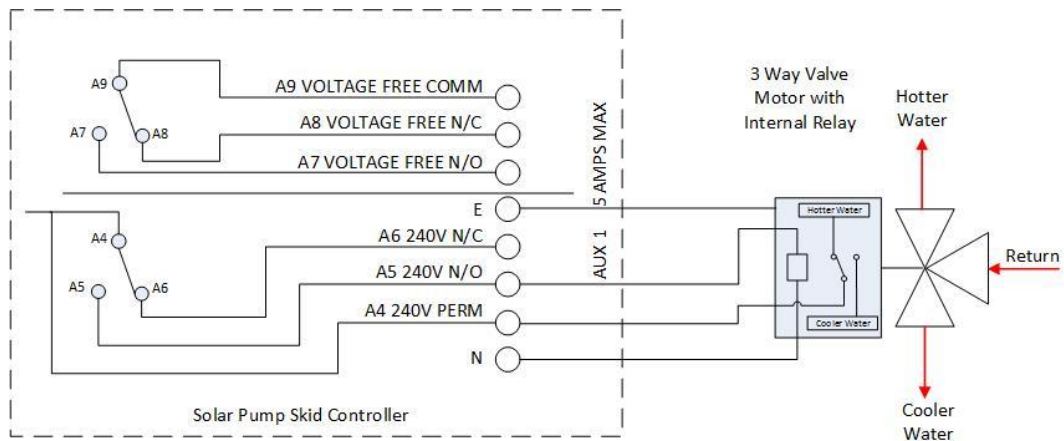
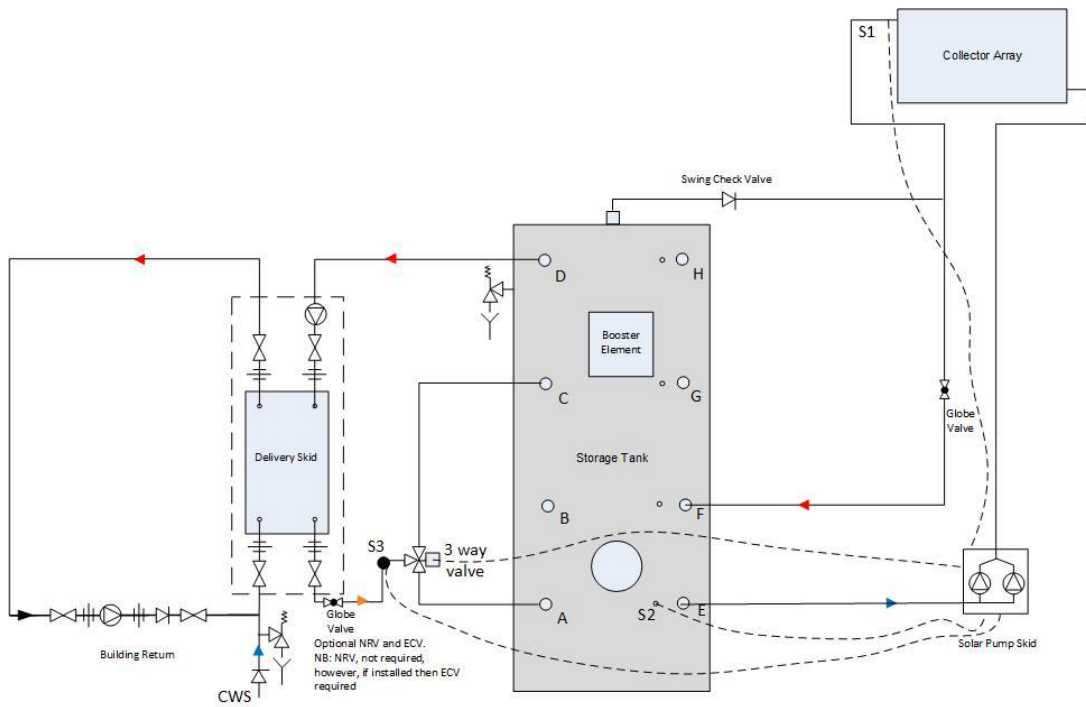
Note: If booster element is timer controlled, secondary side should be on a dead leg.



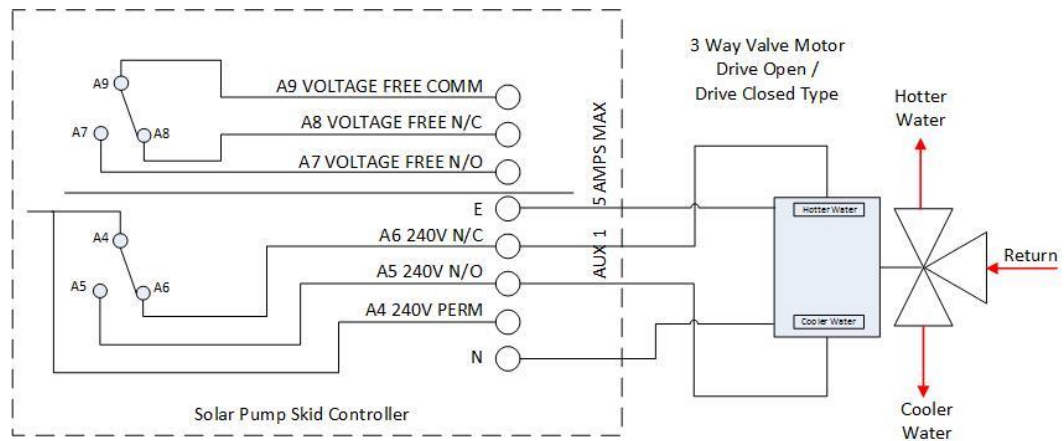
**Notes:**

- Timer control of heating unit is best used when water usage peak period is of a known nature, eg shower blocks. This maximises solar input potential.
- Operation in a ring main is not possible with timer controlled heating unit.
- Solar Pump Skid controller, sensor S3, is required to be fitted to the tank at the position shown. Arrangement 3 to be selected on SHCX Controller.
- Remove bridging wire on terminals located within heating unit electrical cover and connect to VFC terminals in Solar Pump Skid, as shown above. Refer to Solar Pump Skid wiring diagram for location of VFC terminals.
- Set SHCX to required temperature, eg AHF = 65°C / AHO = 60°C.
- Set heating unit thermostat OFF = AHF + 5 / ON = AHO + 5.
- Power for heating unit is supplied separately.

c. Secondary flow and return circuit with diverter valve



**3 Way Motorised Valve with Internal Drive Relay**



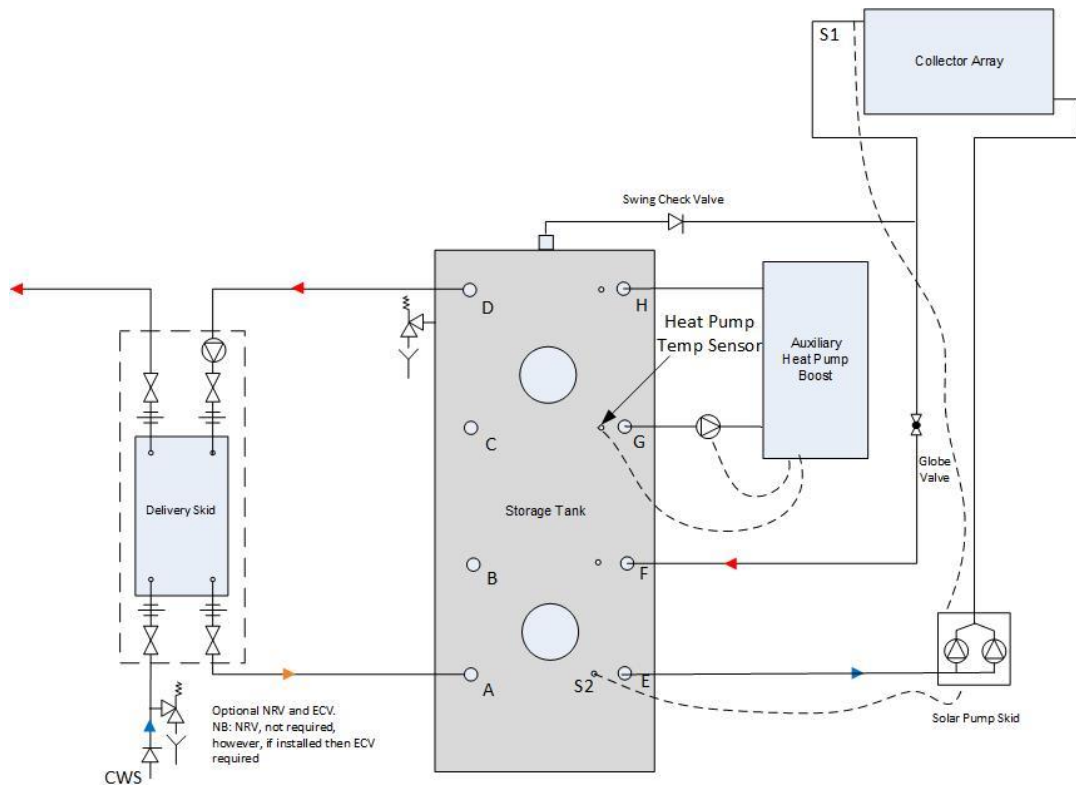
**3 Way Motorised Valve - Drive Open / Drive Closed Type**

**Notes:**

- Booster element cannot be timer controlled.
- Solar Pump Skid controller, sensor S3, is required to be fitted in the Delivery Skid return line at the position shown. Arrangement 3 to be selected on SHCX Controller.
- Valve to be wired such that non-potable (primary) return is diverted to fitting 'A' when cooler water is sensed at S3, eg AHO  $\leq 40^{\circ}\text{C}$  and to fitting 'C' when hotter water is sensed at S3 eg AHF  $\geq 45^{\circ}\text{C}$
- Refer to Solar Pump Skid wiring diagram for appropriate terminal locations depending on type of 3 way valve used.

## 2. Auxiliary Boosting with Heat Pump

### a. Dead leg not timer controlled

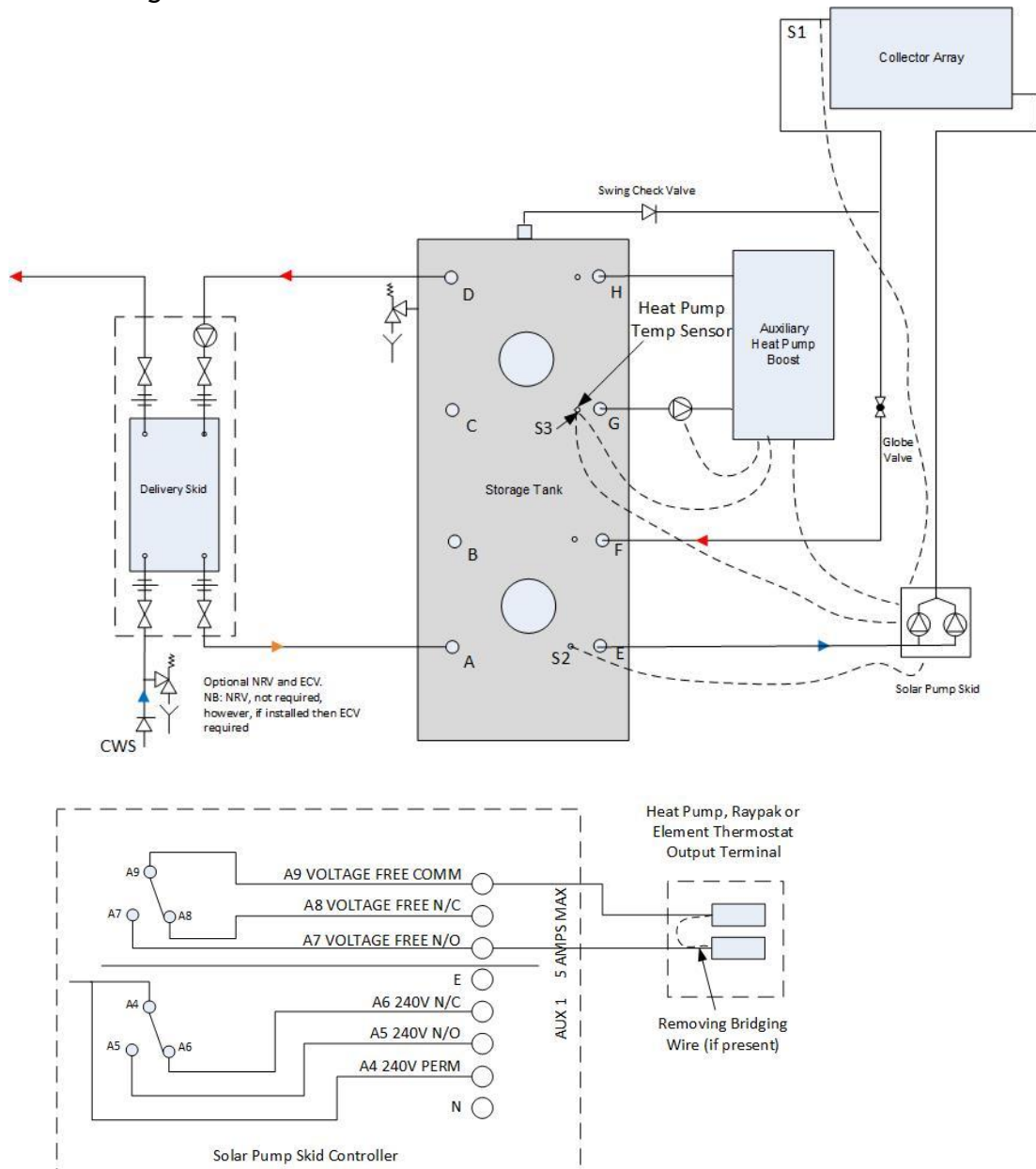


#### Notes:

- The auxiliary heat pump will maintain the top 1/3 of the tank at the temperature set on the heat pump thermostat.
- Operation is totally independent of the Solar Pump Skid and Delivery Skid.
- Heat Pump and primary circulation pump are powered separately from the Solar Pump Skid
- The heat pump thermostat should be set 5°C higher than the Delivery Skid desired outlet temperature. Note heat pumps are able to heat to between 60 and 65°C depending on the model.



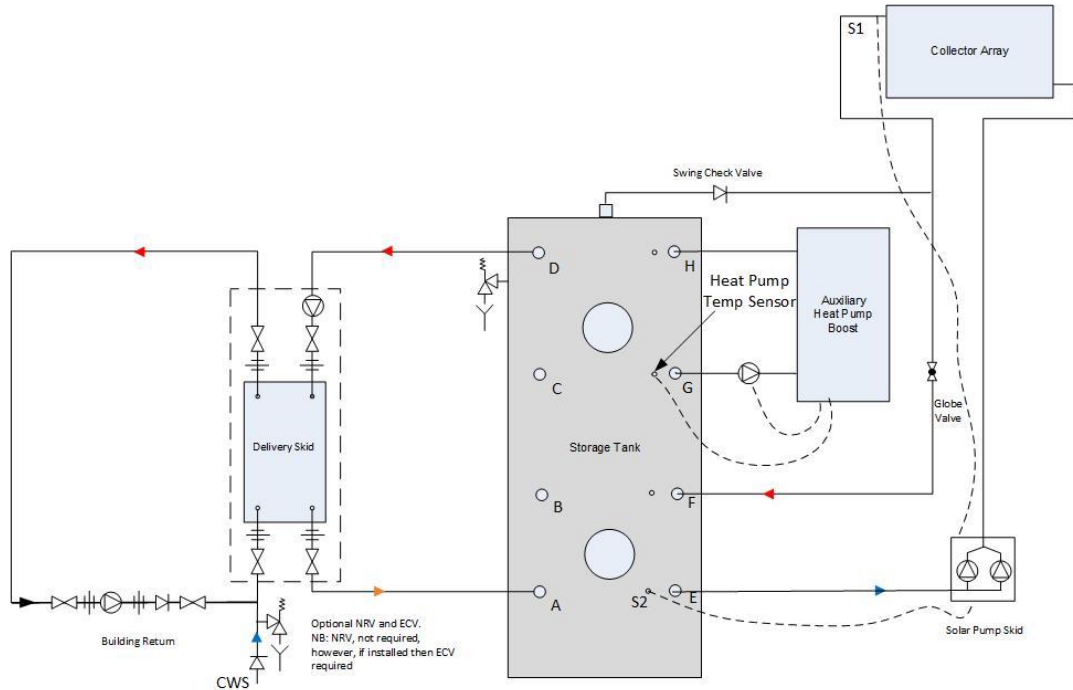
## b. Dead leg timer controlled



### Notes:

- Timer control of heat pump is best used when water usage peak period is of a known nature, eg shower blocks. This maximises solar input potential.
- Operation in a ring main is not possible with timer controlled heat pump.
- Solar Pump Skid controller, sensor S3, is required to be fitted to the tank at the position shown, as well as the heat pump sensor. Arrangement 3 to be selected on SHCX Controller.
- Connect thermostat output signal via VFC terminals in Solar Pump Skid, as shown above. Refer to Solar Pump Skid wiring diagram for location of VFC terminals.
- Set SHCX to required temperature, eg AHF = 60°C / AHO = 55°C.
- Set heat pump thermostat OFF = AHF + 5 / ON = AHO + 5.
- **Solar pump skid interrupts thermostat signal to heat pump only.** Power for heat pump and primary circulating pump is supplied separately from the power for Solar Pump Skid.

c. Secondary flow and return circuit without diverter valve

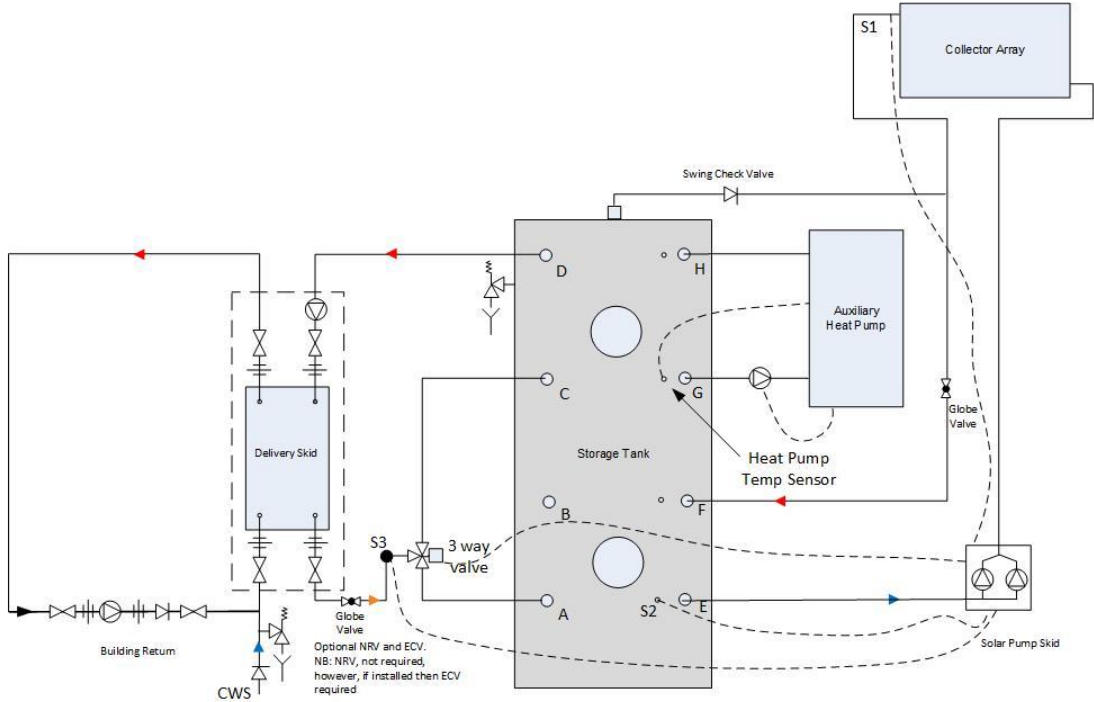


Note: If heat pump booster is timer controlled, building return pump should also be timed or secondary side should be on a dead leg.

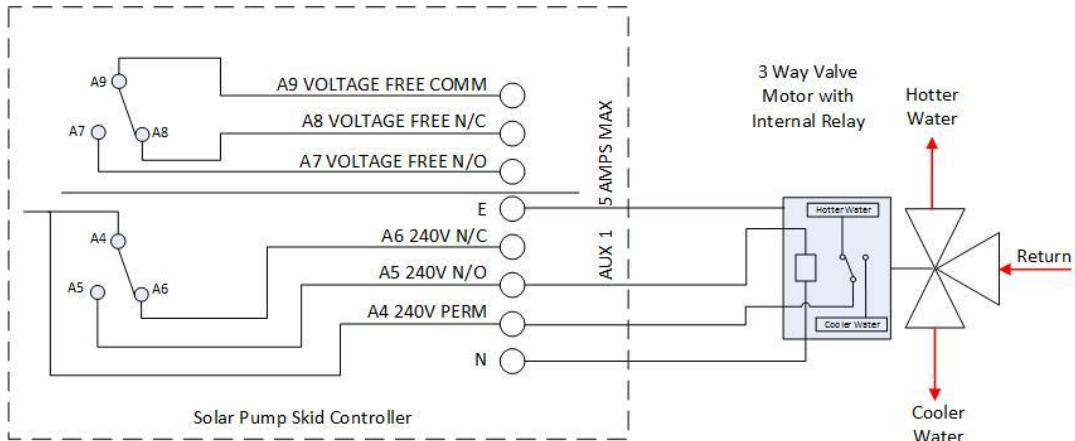
**Notes:**

- The auxiliary heat pump will maintain the top 1/3 of the tank at the temperature set on the heat pump thermostat.
- During building recirculation, the temperature rise across the delivery skid is small (eg 5°C) and the building flow rate is relatively low. The Delivery Skid return temperature will be 5°C lower than the supply temperature and the pump will also operate at a low speed. In larger tanks, the returning primary side hot water will stream to the hot zone at the top of the tank and not blend with the potentially cooler solar zone.
- Operation is totally independent of the Solar Pump Skid and Delivery Skid.
- Power for heat pump and primary circulating pump is supplied separately from the power for Solar Pump Skid.
- The heat pump thermostat should be set 5°C higher than the Delivery Skid desired outlet temperature. Note heat pumps are able to heat to between 60 and 65°C depending on the model.

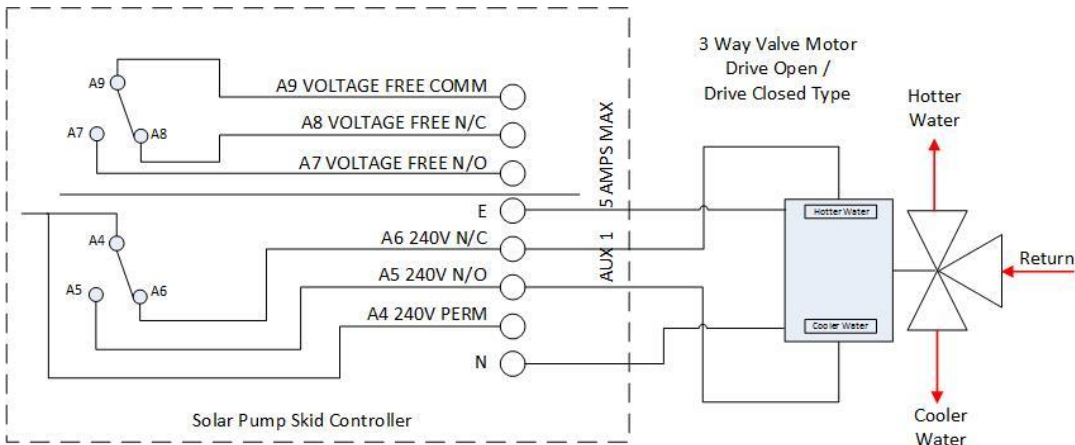
d. Secondary flow and return circuit with diverter valve



Note: If Heat Pump booster is timer controlled, building return pump should also be timed or secondary side should be on a dead leg.



**3 Way Motorised Valve with Internal Drive Relay**



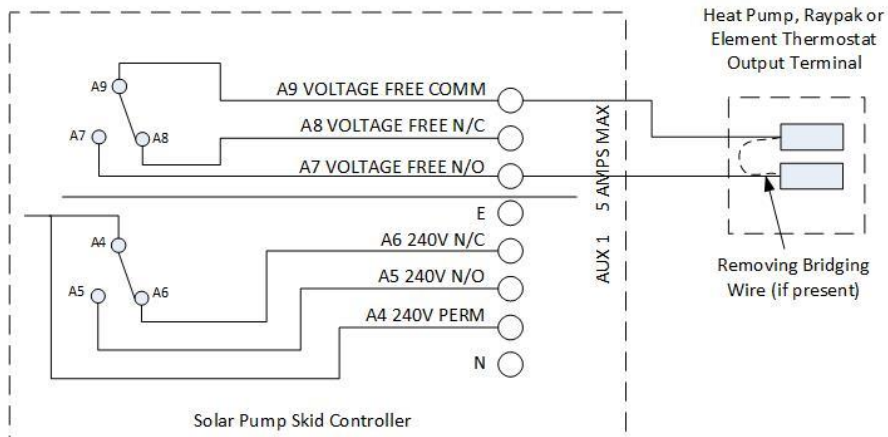
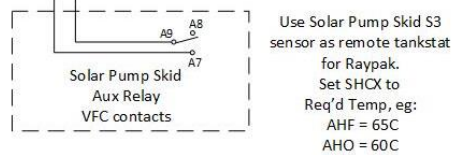
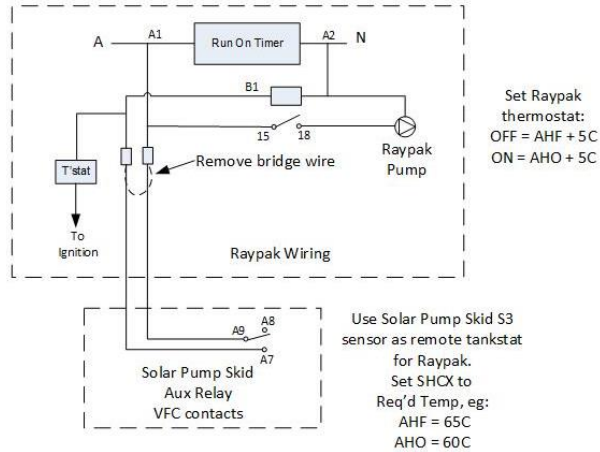
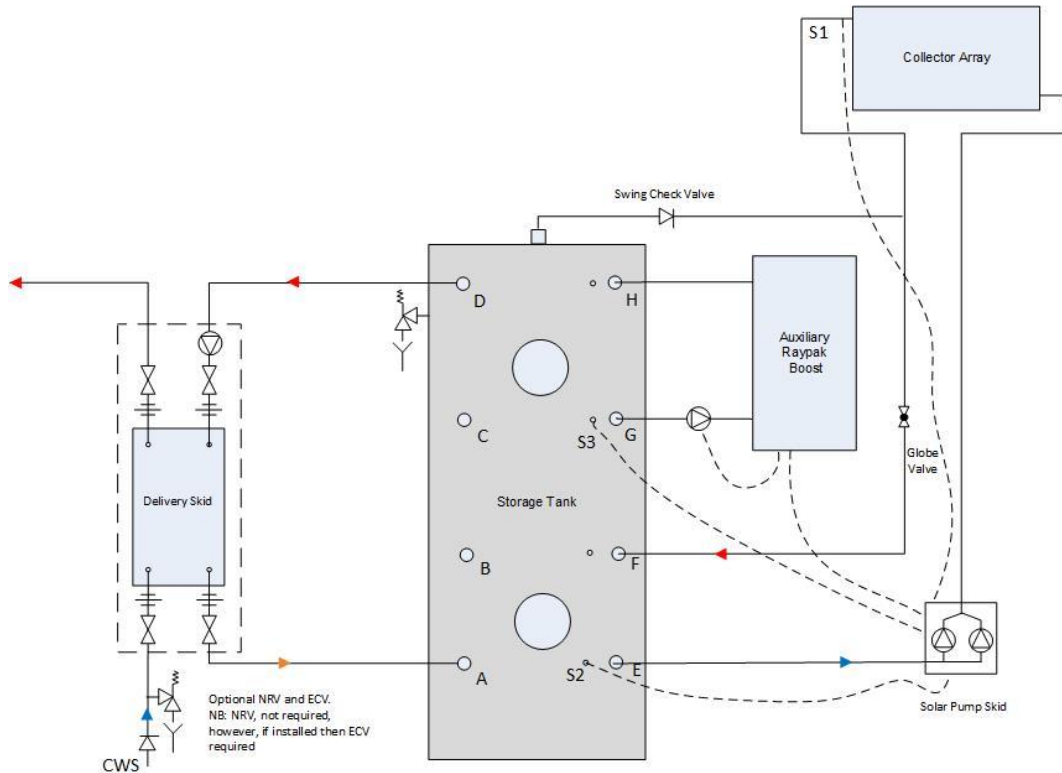
**3 Way Motorised Valve – Drive Open / Drive Closed**

**Notes:**

- The auxiliary heat pump will maintain the top 1/3 of the tank at the temperature set on the heat pump thermostat.
- During building recirculation, the temperature rise across the delivery skid is small (eg 5°C) and the building flow rate is relatively low. The Delivery Skid return temperature will be 5°C lower than the supply temperature and the pump will also operate at a low speed. In smaller tanks, streaming may not occur as readily as in larger tanks, thus disturbing the stratification layer.
- Solar Pump Skid controller, sensor S3, is required to be fitted in the Delivery Skid return line at the position shown. Arrangement 3 to be selected on SHCX Controller.
- Valve to be wired such that non-potable (primary) return is diverted to fitting 'A' when cooler water is sensed at S3, eg AHO  $\leq 40^{\circ}\text{C}$  and to fitting 'C' when hotter water is sensed at S3 eg AHF  $\geq 45^{\circ}\text{C}$
- Refer to Solar Pump Skid wiring diagram for appropriate terminal locations depending on type of 3 way valve used.
- Operation is totally independent of the Solar Pump Skid and Delivery Skid.
- Power for heat pump and primary circulating pump is supplied separately from the power for Solar Pump Skid.
- The heat pump thermostat should be set 5°C higher than the Delivery Skid desired outlet temperature. Note heat pumps are able to heat to between 60 and 65°C depending on the model.

### 3. Auxiliary Boosting with Raypak

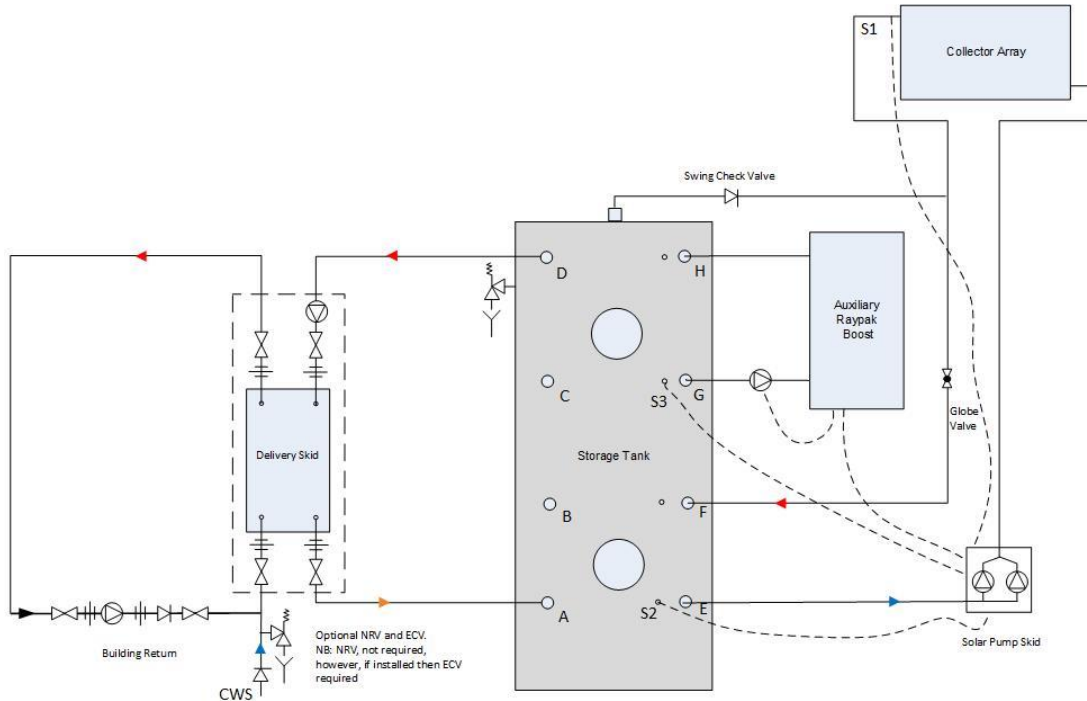
#### a. Dead Leg with or without Timer Control



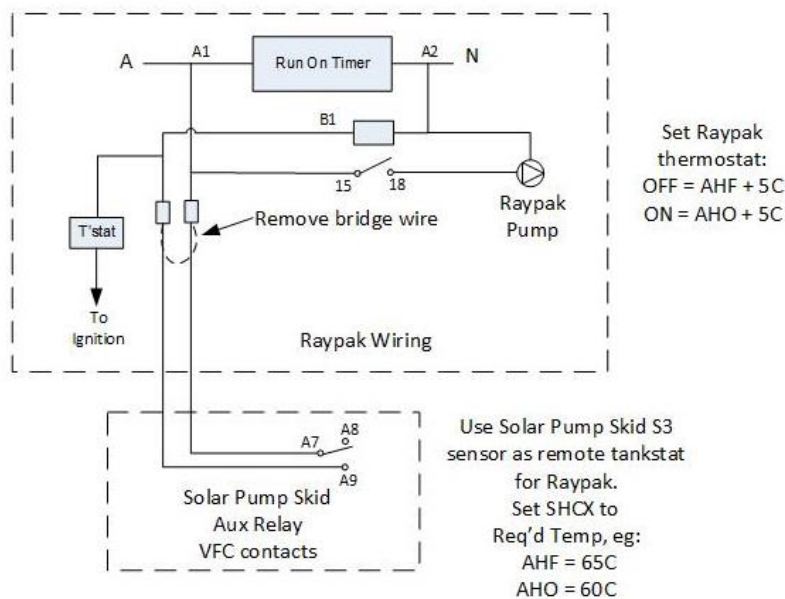
**Notes:**

- The auxiliary Raypak water heater will maintain the top 1/3 of the tank at the temperature set on the SHCX controller. The SHCX controller acts as a remote 'Tankstat' and can also be used to time control operation of the Raypak heater. Time control of the Raypak heater is best used when water usage peak period is of a known nature, eg shower blocks. This maximises solar input potential.
- Solar Pump Skid controller, sensor S3, is required to be fitted in the storage tank at the position shown. Arrangement 3 to be selected on SHCX Controller.
- Power for Raypak and primary circulating pump is supplied separately from the power for Solar Pump Skid.
- The SHCX thermostat should be set 5°C higher than the Delivery Skid desired outlet temperature, eg AHF = 70°C / AHO = 65°C.
- Connect remote thermostat output signal via VFC terminals in Solar Pump Skid, as shown above. Refer to Solar Pump Skid wiring diagram for location of VFC terminals.
- Set Raypak thermostat OFF = AHF + 5 / ON = AHO + 5.

## b. Secondary flow and return circuit without diverter valve



Note: If Raypak booster is timer controlled, building return pump should also be timed or secondary side should be on a dead leg.



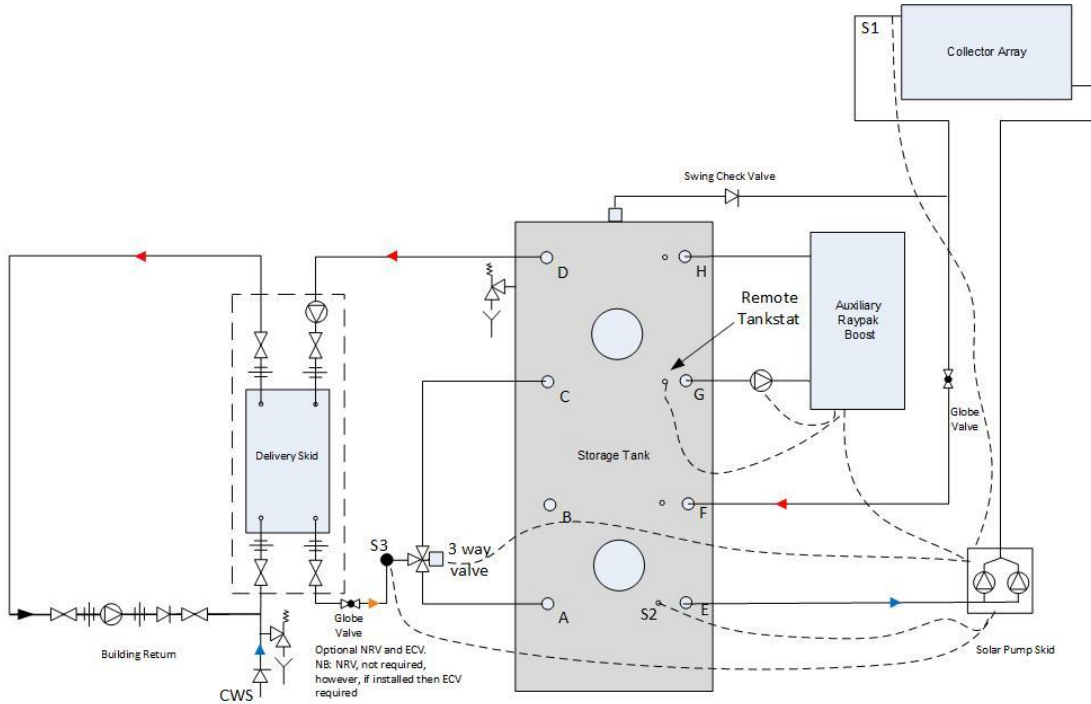
### Notes:

- The auxiliary Raypak water heater will maintain the top 1/3 of the tank at the temperature set on the SHCX controller. The SHCX controller acts as a remote 'Tankstat'.
- During building recirculation, the temperature rise across the delivery skid is small (eg 5°C) and the building flow rate is relatively low. The Delivery Skid return temperature will be 5°C lower than the supply temperature and the pump will also operate at a low speed. In larger tanks, the returning primary side hot water will stream to the hot zone at the top of the tank and not blend with the potentially cooler solar zone.

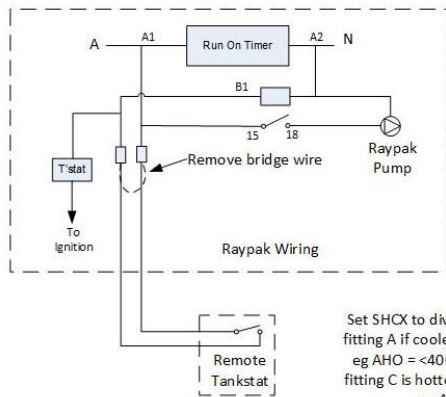
- Solar Pump Skid controller, sensor S3, is required to be fitted in the storage tank at the position shown. Arrangement 3 to be selected on SHCX Controller.
- Power for Raypak and primary circulating pump is supplied separately from the power for Solar Pump Skid.
- The SHCX thermostat should be set 5°C higher than the Delivery Skid desired outlet temperature, eg AHF = 70°C / AHO = 65°C.
- Connect remote thermostat output signal via VFC terminals in Solar Pump Skid, as shown above. Refer to Solar Pump Skid wiring diagram for location of VFC terminals.
- Set Raypak thermostat OFF = AHF + 5 / ON = AHO + 5.



c. Secondary flow and return circuit with diverter valve

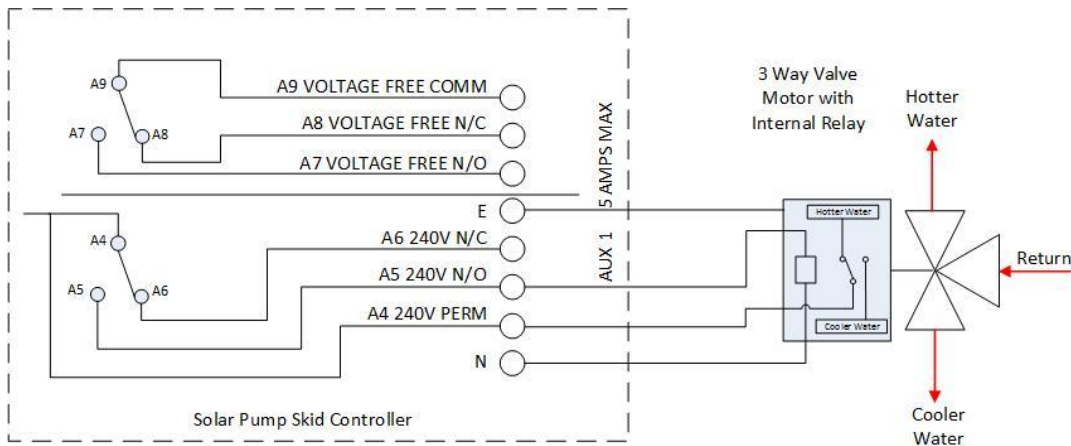


Note: Raypak booster cannot be timer controlled as additional sensor and relay not supported in solar pump skid for diverter valve operation and timer control.

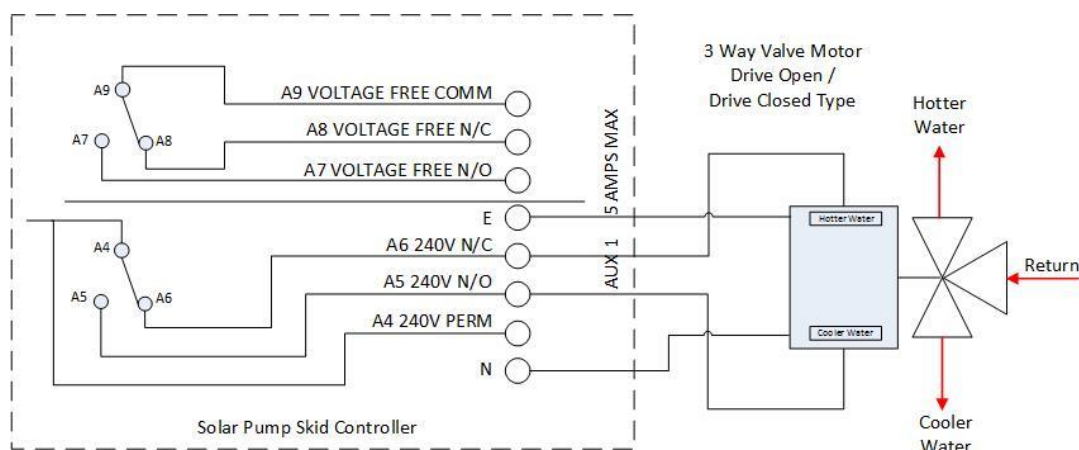


Set SHCX to divert return fluid to fitting A if cooler water is present, eg AHO = <40C and to divert to fitting C if hotter water is present eg AHF >45

See HS Series Manual for specific wiring of 3 way valve depending on the type of valve used



### 3 Way Motorised Valve with Internal Drive Relay



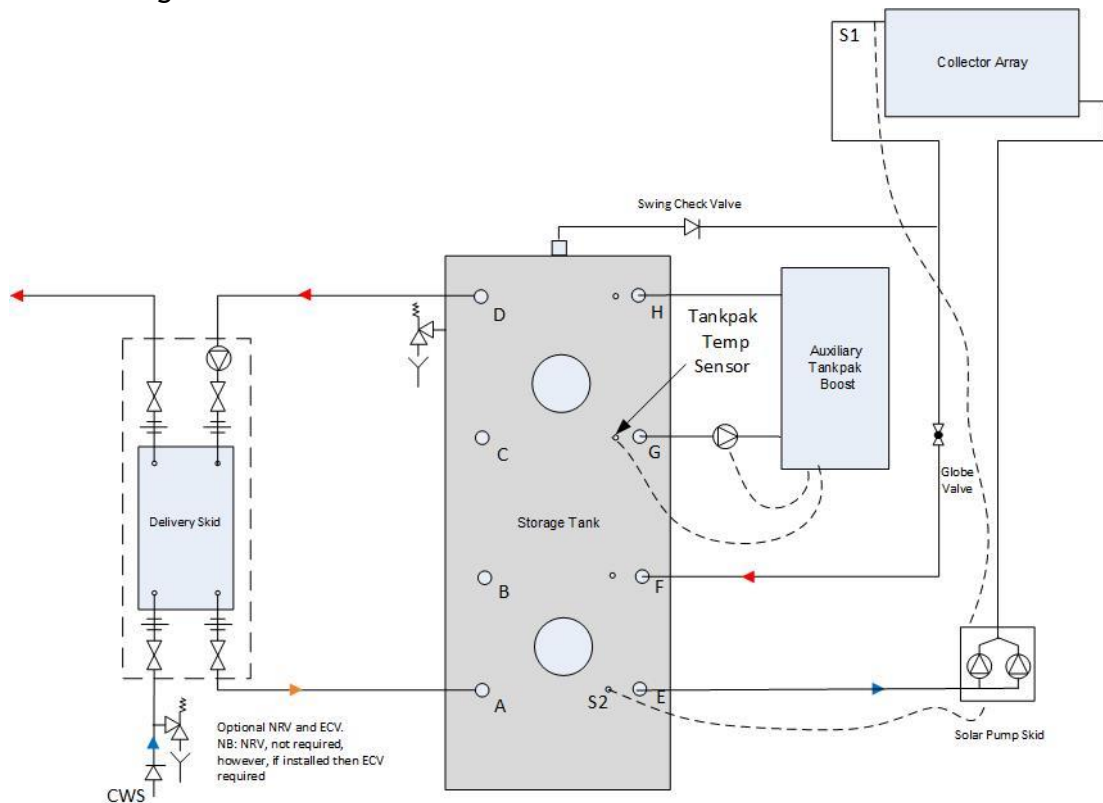
### 3 Way Motorised Valve – Drive Open / Drive Closed

#### Notes:

- The Raypak will maintain the top 1/3 of the tank at the temperature set on the remote tankstat.
- During building recirculation, the temperature rise across the delivery skid is small (eg 5°C) and the building flow rate is relatively low. The Delivery Skid return temperature will be 5°C lower than the supply temperature and the pump will also operate at a low speed. In smaller tanks, streaming may not occur as readily as in larger tanks, thus disturbing the stratification layer.
- Solar Pump Skid controller, sensor S3, is required to be fitted in the Delivery Skid return line at the position shown. Arrangement 3 to be selected on SHCX Controller.
- Valve to be wired such that non-potable (primary) return is diverted to fitting 'A' when cooler water is sensed at S3, eg  $AHO \leq 40^{\circ}\text{C}$  and to fitting 'C' when hotter water is sensed at S3 eg  $AHF \geq 45^{\circ}\text{C}$
- Refer to Solar Pump Skid wiring diagram for appropriate terminal locations depending on type of 3 way valve used.
- Raypak operation is totally independent of the Solar Pump Skid and Delivery Skid.
- Power for Raypak and primary circulating pump is supplied separately from the power for Solar Pump Skid.
- The tankstat should be set 5°C higher than the Delivery Skid desired outlet temperature.

## 4. Auxiliary Boosting with Tankpak

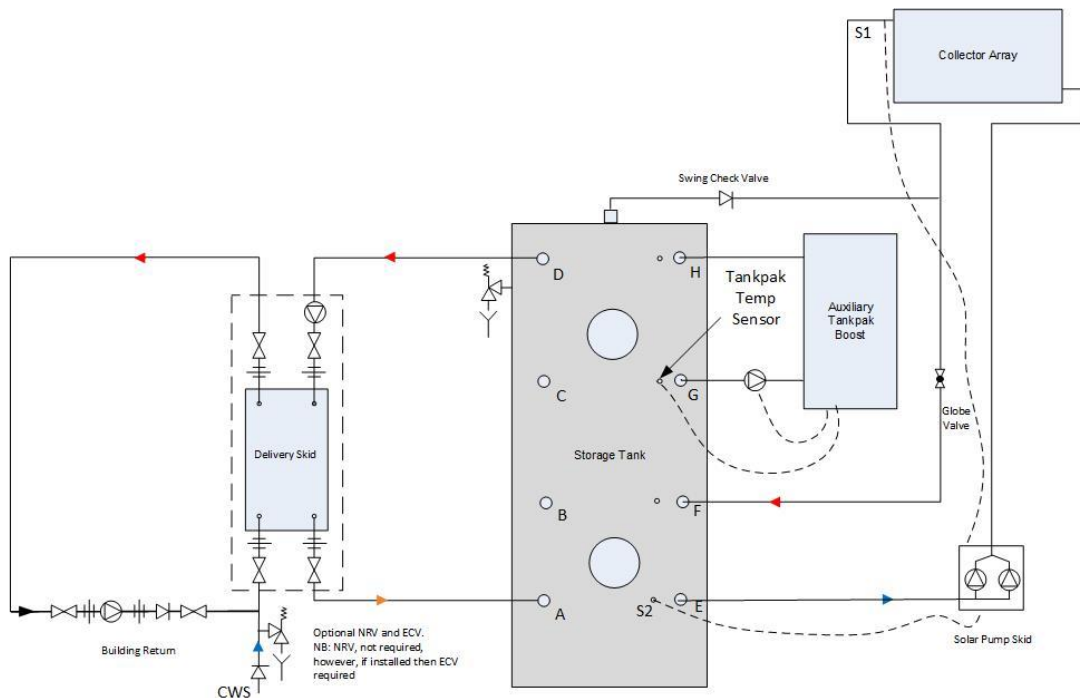
### a. Dead leg with or without timer control



#### Notes:

- The auxiliary Tankpak water heater will maintain the top 1/3 of the tank at the temperature set on the Tankpak controller.
- If timer control of Tankpak boost is required, use Tankpak timers.
  - Both timers must be set identically
  - Multiple On/OFF times may be set
- Time control of the Tankpak heater is best used when water usage peak period is of a known nature, eg shower blocks. This maximises solar input potential.
- Arrangement 1 to be selected on SHCX Controller.
- Power for Tankpak and primary circulating pump is supplied separately from the power for Solar Pump Skid.
- The Tankpak thermostat should be set 5°C higher than the Delivery Skid desired outlet temperature, eg Off = 70°C / On = 65°C.

b. Secondary flow and return circuit without diverter valve

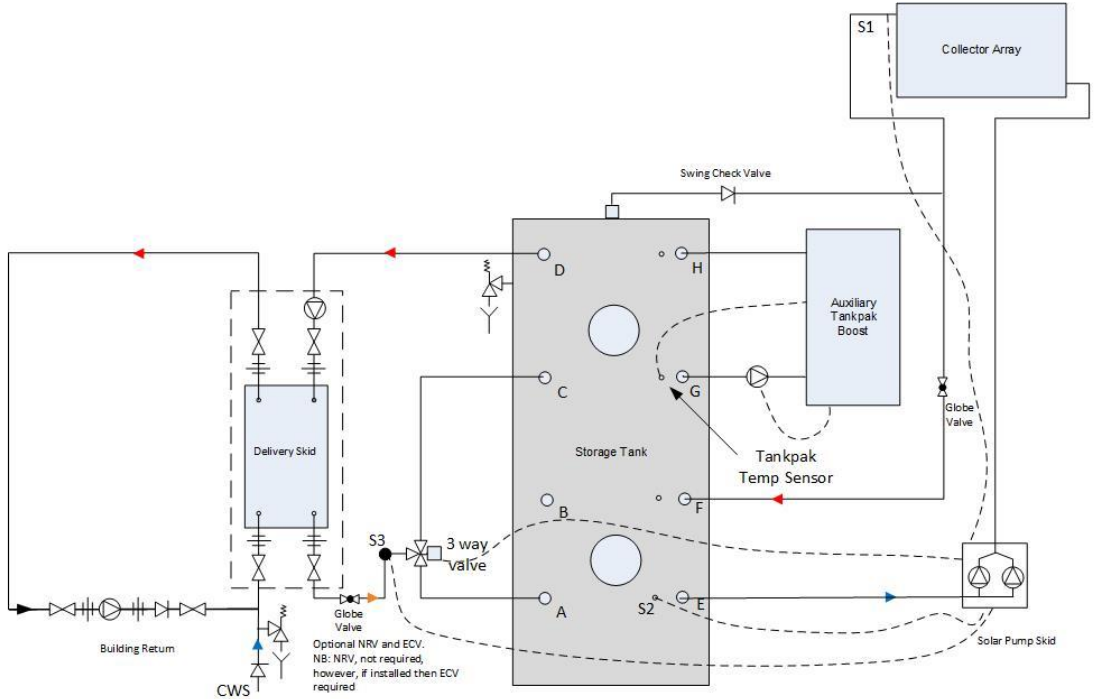


Note: If Tankpak booster is timer controlled, building return pump should also be timed or secondary side should be on a dead leg.

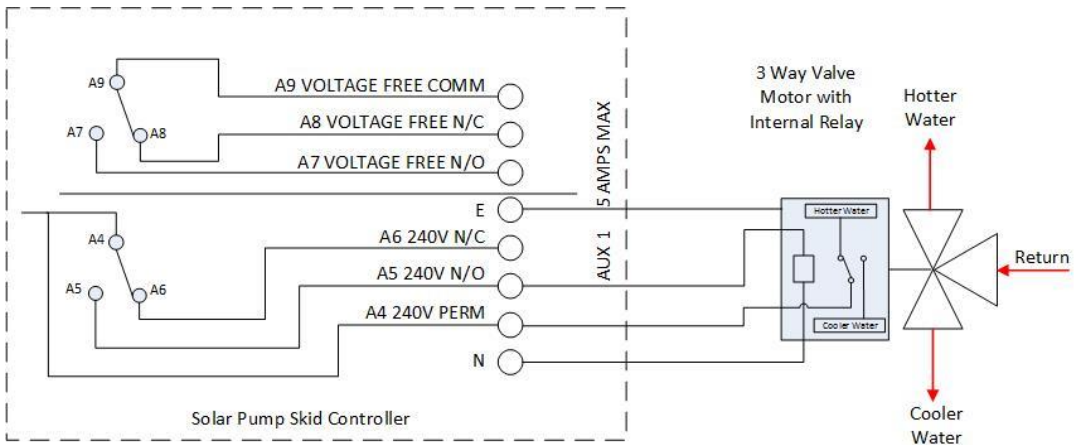
**Notes:**

- The auxiliary Tankpak will maintain the top 1/3 of the tank at the temperature set on the Tankpak controller.
- During building recirculation, the temperature rise across the delivery skid is small (eg 5°C) and the building flow rate is relatively low. The Delivery Skid return temperature will be 5°C lower than the supply temperature and the pump will also operate at a low speed. In larger tanks, the returning primary side hot water will stream to the hot zone at the top of the tank and not blend with the potentially cooler solar zone.
- Operation is totally independent of the Solar Pump Skid and Delivery Skid.
- Power for Tankpak and primary circulating pump is supplied separately from the power for Solar Pump Skid.
- The Tankpak thermostat should be set 5°C higher than the Delivery Skid desired outlet temperature, eg Off = 70°C / On = 65°C.

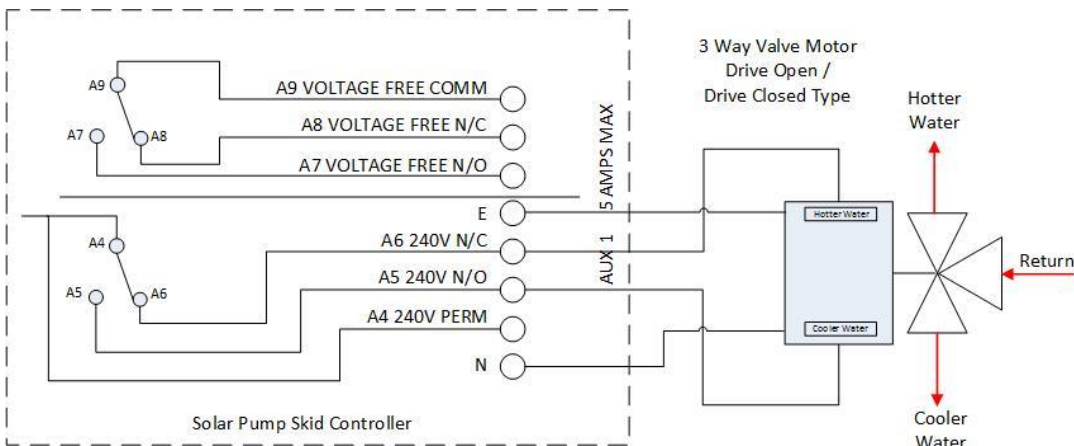
c. Secondary flow and return circuit with diverter valve



Note: If Tankpak booster is timer controlled, building return pump should also be timed or secondary side should be on a dead leg.



**3 Way Motorised Valve with Internal Drive Relay**



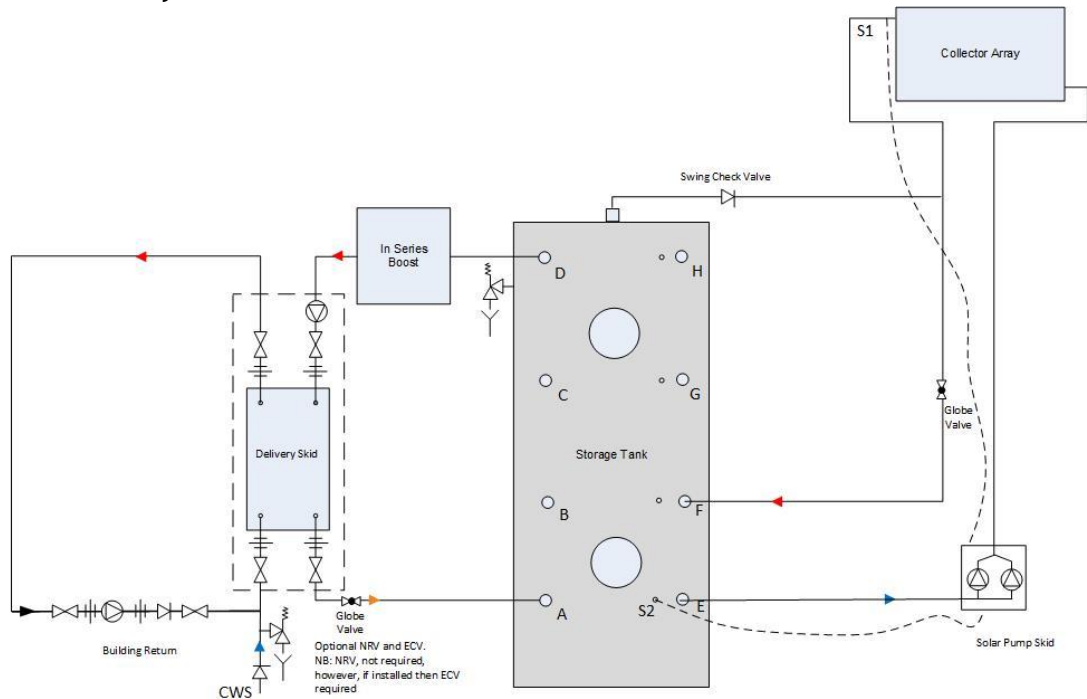
**3 Way Motorised Valve – Drive Open / Drive Closed**

**Notes:**

- The auxiliary Tankpak will maintain the top 1/3 of the tank at the temperature set on the Tankpak controller.
- During building recirculation, the temperature rise across the delivery skid is small (eg 5°C) and the building flow rate is relatively low. The Delivery Skid return temperature will be 5°C lower than the supply temperature and the pump will also operate at a low speed. In smaller tanks, streaming may not occur as readily as in larger tanks, thus disturbing the stratification layer.
- Solar Pump Skid controller, sensor S3, is required to be fitted in the Delivery Skid return line at the position shown. Arrangement 3 to be selected on SHCX Controller.
- Valve to be wired such that non-potable (primary) return is diverted to fitting 'A' when cooler water is sensed at S3, eg AHO  $\leq 40^{\circ}\text{C}$  and to fitting 'C' when hotter water is sensed at S3 eg AHF  $\geq 45^{\circ}\text{C}$
- Refer to Solar Pump Skid wiring diagram for appropriate terminal locations depending on type of 3 way valve used.
- Tankpak operation is totally independent of the Solar Pump Skid and Delivery Skid.
- Power for Tankpak and primary circulating pump is supplied separately from the power for Solar Pump Skid.
- The Tankpak thermostat should be set 5°C higher than the Delivery Skid desired outlet temperature, eg Off = 70°C / On = 65°C.



b. Secondary flow and return circuit without diverter valve

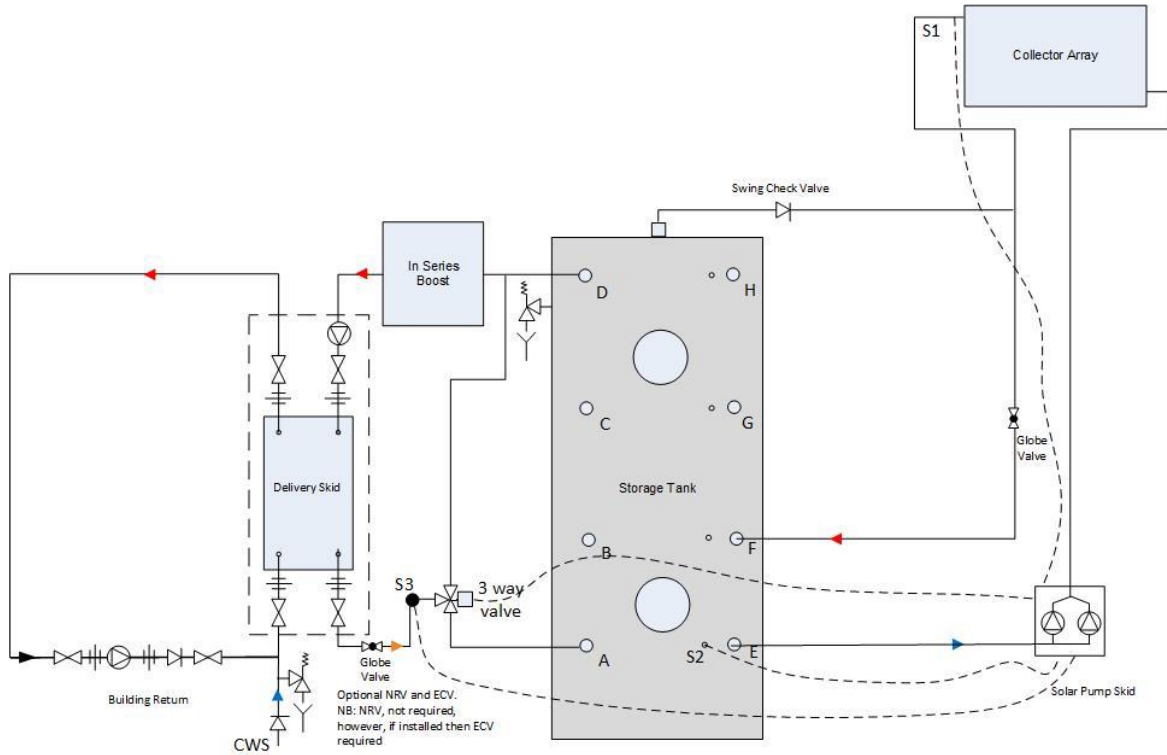


**Notes:**

- In-series boost plant is located between the solar storage and the Delivery Skid, on the non-potable (primary) side.
- The in-series boost plant must be able to meet the peak demands of the application in terms of temperature at required flow rate.
- During building recirculation, the temperature rise across the delivery skid is small (eg 5°C) and the building flow rate is relatively low. The Delivery Skid return temperature will be 5°C lower than the supply temperature and the pump will also operate at a low speed. In larger tanks, the returning primary side hot water will stream to the hot zone at the top of the tank and not blend with the potentially cooler solar zone.
- Operation of the in-series boost plant is totally independent of the Solar Pump Skid and Delivery Skid.
- The in-series boost plant thermostat should be set 5°C higher than the Delivery Skid desired outlet temperature, eg Off = 70°C / On = 65°C.



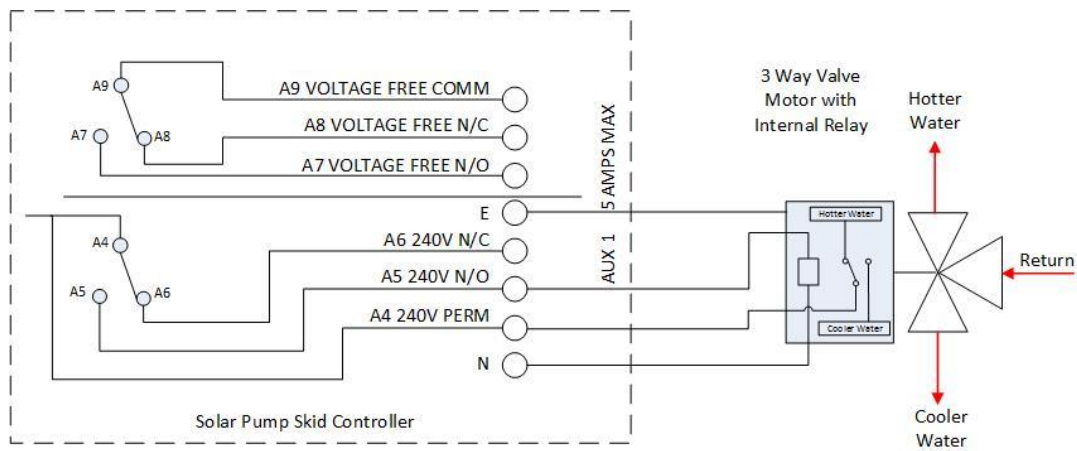
c. Secondary flow and return circuit with diverter valve



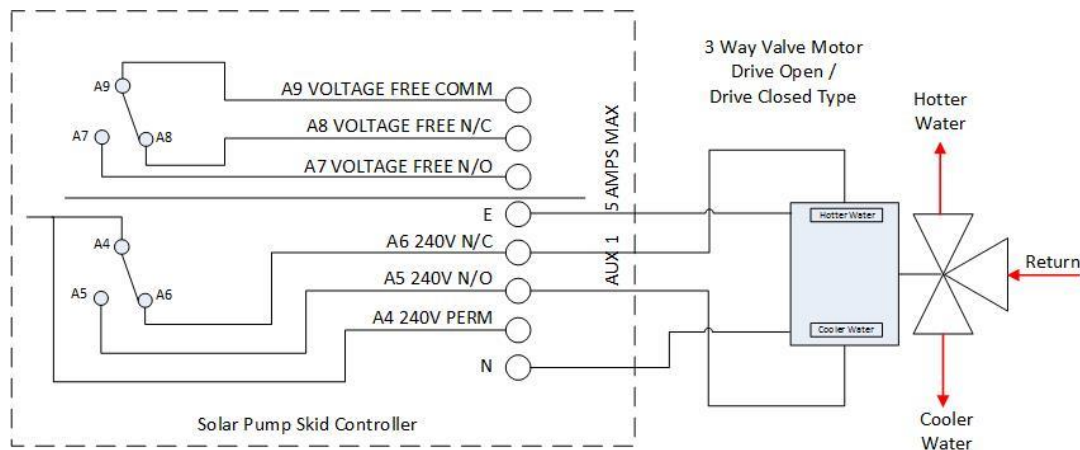
Note: If Heat Pump booster is timer controlled, building return pump should also be timed or secondary side should be on a dead leg.

Set SHCX to divert return fluid to fitting A if cooler water is present, eg AHO = <40C and to divert to boost plant inlet if hotter water is present eg AHF >45

See HS Series Manual for specific wiring of 3 way valve depending on the type of valve used



**3 Way Motorised Valve with Internal Drive Relay**



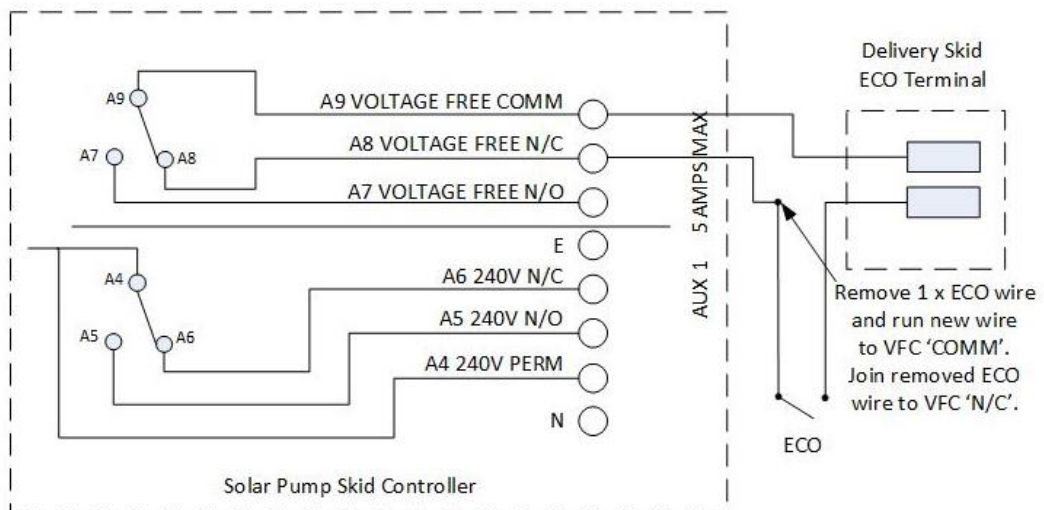
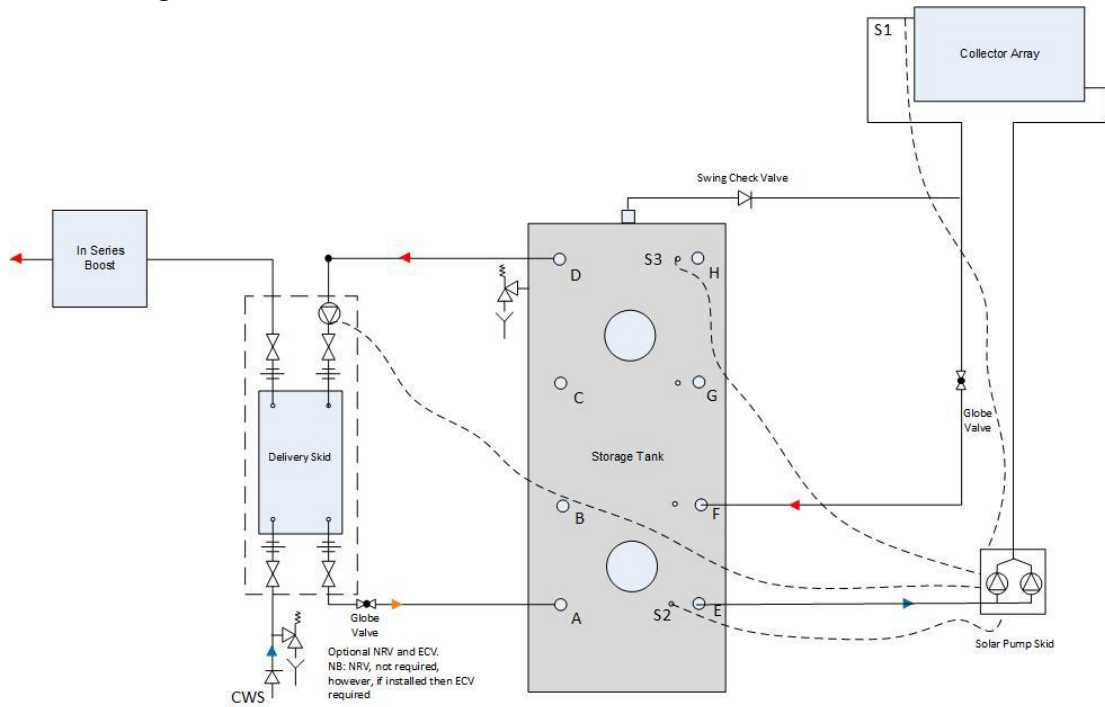
### 3 Way Motorised Valve – Drive Open / Drive Closed

#### Notes:

- In-series boost plant is located between the solar storage and the Delivery Skid, on the non-potable (primary) side.
- The in-series boost plant must be able to meet the peak demands of the application in terms of temperature at required flow rate.
- During building recirculation, the temperature rise across the delivery skid is small (eg 5°C) and the building flow rate is relatively low. The Delivery Skid return temperature will be 5°C lower than the supply temperature and the pump will also operate at a low speed. In smaller tanks, streaming may not occur as readily as in larger tanks, thus disturbing the stratification layer.
- Solar Pump Skid controller, sensor S3, is required to be fitted in the Delivery Skid return line at the position shown. Arrangement 3 to be selected on SHCX Controller.
- Valve to be wired such that non-potable (primary) return is diverted to fitting 'A' when cooler water is sensed at S3, eg AHO  $\leq$  40°C and to fitting 'C' when hotter water is sensed at S3 eg AHF  $\geq$  45°C
- Refer to Solar Pump Skid wiring diagram for appropriate terminal locations depending on type of 3 way valve used.
- In-series boost plant operation is totally independent of the Solar Pump Skid and Delivery Skid.
- The in-series boost plant thermostat should be set 5°C higher than the Delivery Skid desired outlet temperature, eg Off = 70°C / On = 65°C.

## 6. In-Series Boosting Potable (secondary) Side

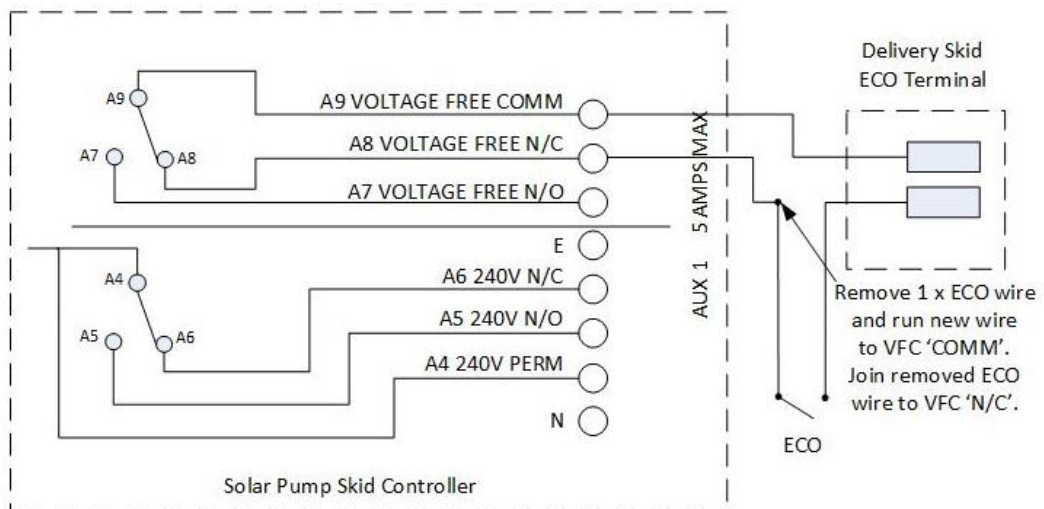
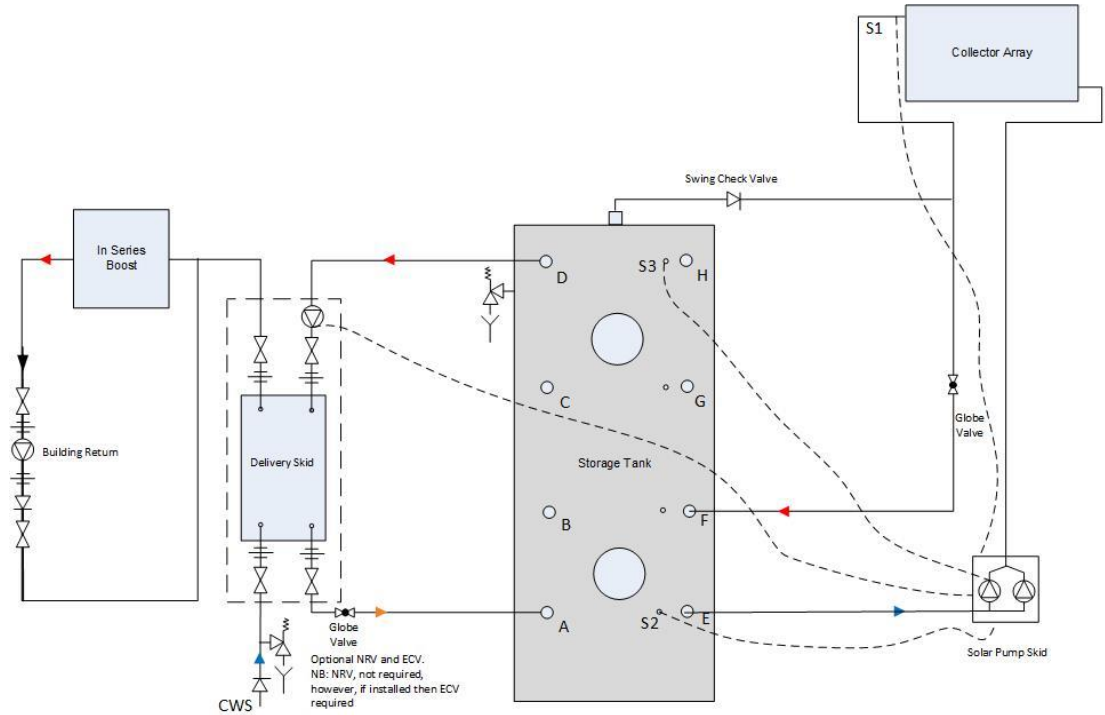
### a. Dead leg



**Notes:**

- In-series boost plant is located after the Delivery Skid, on the potable (secondary) side.
- The in-series boost plant must be able to meet the peak demands of the application in terms of temperature at required flow rate.
- During a demand situation, the in-series boost plant will deliver a constant temperature to the user points and cooler water will return to the bottom of the storage tank, in an identical fashion to in-tank or auxiliary boosting.
- During periods of no consumption, the Delivery Skid may call for heat in which case the Delivery Skid pump will activate and draw energy from the solar storage. If solar storage is not up to temperature the Delivery Skid will continue to operate, and the pump will increase speed attempting to meet the set point. This will have the effect of upsetting the stratification layer, if any, within the storage tank.
- If the system is designed such that solar is predominantly pre-heat only, either, the set point of the Delivery Skid should be lowered to prevent the above from occurring or S3 should be fitted at fitting as shown above in the storage tank and SHCX set to, say AHO  $\leq$  40, AHF  $\geq$  45.
- The Delivery Skid ECO signal is interrupted by the VFC contacts within the Solar Pump Skid as shown above and will prevent the Delivery Skid pump from operating if the tank temperature is below set point.

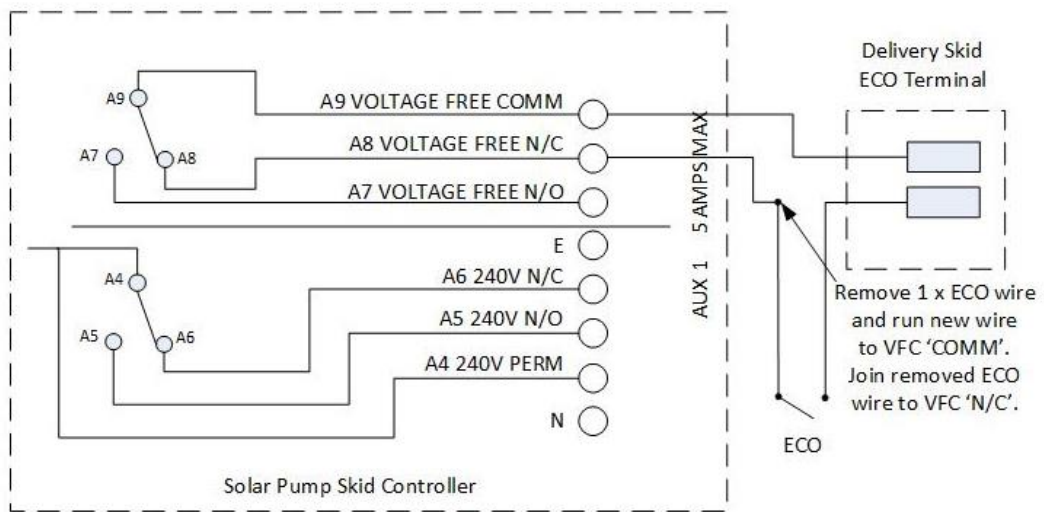
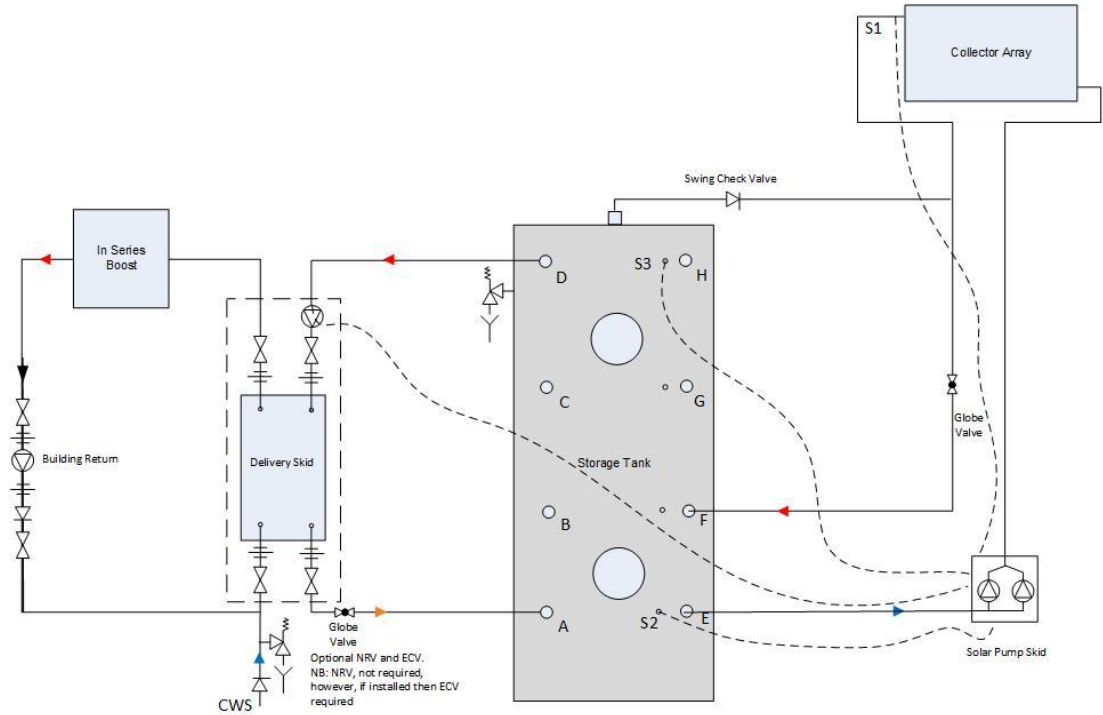
b. Secondary flow and return with recirculation to boost



**Notes:**

- In-series boost plant is located after the Delivery Skid, on the potable (secondary) side.
- The in-series boost plant must be able to meet the peak demands of the application in terms of temperature at required flow rate.
- During a demand situation, the in-series boost plant will deliver a constant temperature to the user points and cooler water will return to the bottom of the storage tank, in an identical fashion to in-tank or auxiliary boosting.
- Recirculation is totally handled by the in-series boost plant.
- During periods of no consumption, the Delivery Skid may call for heat in which case the Delivery Skid pump will activate and draw energy from the solar storage. If solar storage is not up to temperature the Delivery Skid will continue to operate, and the pump will increase speed attempting to meet the set point. This will have the effect of upsetting the stratification layer, if any, within the storage tank.
- If the system is designed such that solar is predominantly pre-heat only, either, the set point of the Delivery Skid should be lowered to prevent the above from occurring or S3 should be fitted at fitting as shown above in the storage tank and SHCX set to, say AHO  $\leq$  40, AHF  $\geq$  45.
- The Delivery Skid ECO signal is interrupted by the VFC contacts within the Solar Pump Skid as shown above and will prevent the Delivery Skid pump from operating if the tank temperature is below set point.

c. Secondary flow and return circuit without diverter valve

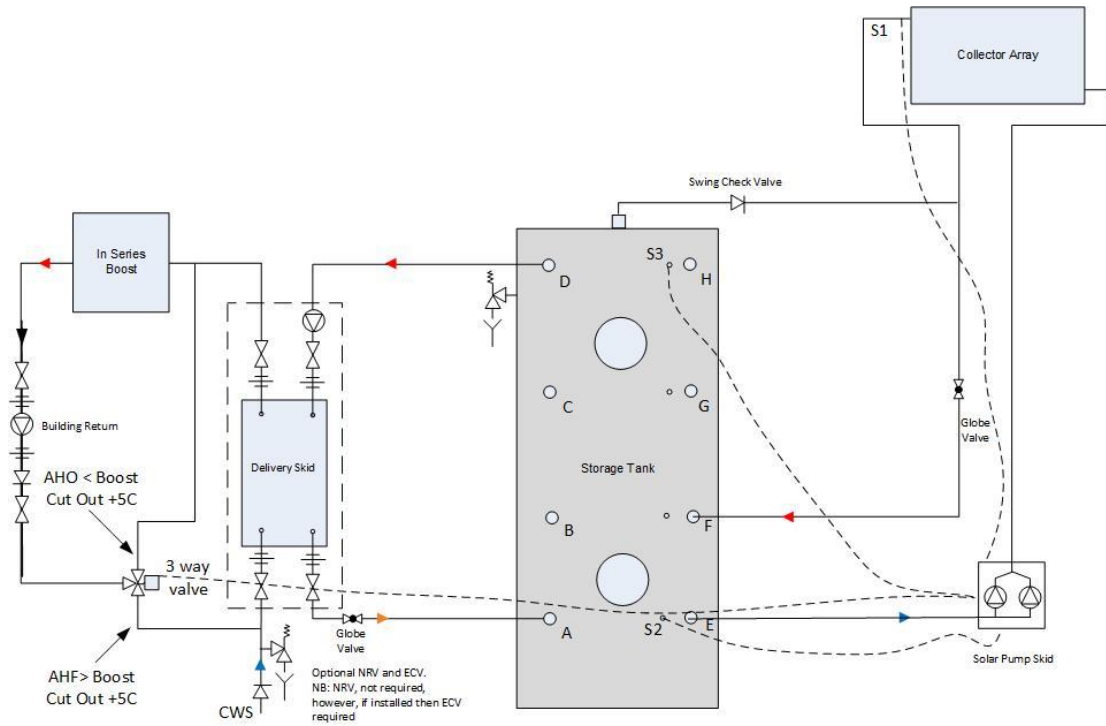


**Notes:**

- In-series boost plant is located after the Delivery Skid, on the potable (secondary) side.
- The in-series boost plant must be able to meet the peak demands of the application in terms of temperature at required flow rate.
- During a demand situation, the in-series boost plant will deliver a constant temperature to the user points and cooler water will return to the bottom of the storage tank, in an identical fashion to in-tank or auxiliary boosting.
- During periods of no consumption, the Delivery Skid may call for heat in which case the Delivery Skid pump will activate and draw energy from the solar storage. If solar storage is not up to temperature the Delivery Skid will continue to operate, and the pump will increase speed attempting to meet the set point. Energy will be transferred from the secondary side back into the primary side and the solar storage will be heated by the in-series boost plant.
- **THIS SET UP IS NOT RECOMMENDED**
- If the system is designed such that solar is predominantly pre-heat only, either, the set point of the Delivery Skid should be lowered to prevent the above from occurring or S3 should be fitted in the primary flow line to the Delivery Skid and SHCX set to, say, AHO  $\leq$  Building Return Temperature, AHF  $\geq$  Building Return Temperature +5°C.
- The Delivery Skid ECO signal is interrupted by the VFC contacts within the Solar Pump Skid as shown above and will prevent the Delivery Skid pump from operating if the tank temperature is below set point.



d. Secondary flow and return circuit with diverter valve



Set SHCX to divert return water to Delivery Skid (AHF) if solar tank is hotter than in series booster cut out temperature + 5C and to divert return water to In Series Booster (AHO) if solar tank is less than building return water temperature +5C.

eg Boost

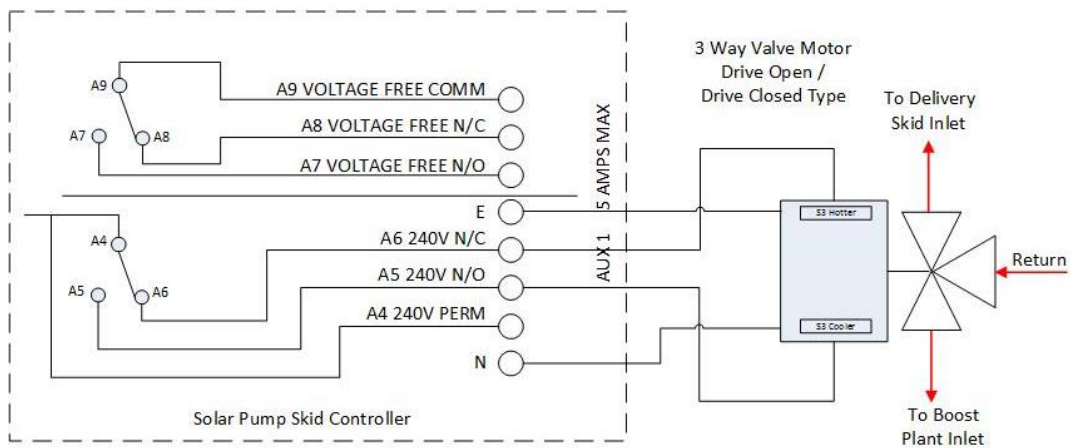
cut out = 65C

Bld Retn = 60C

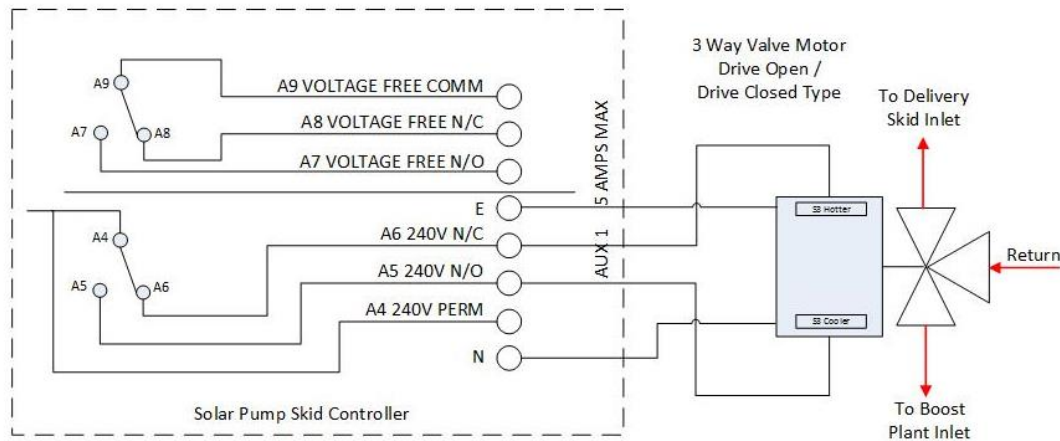
set SHCX

AHF = 65 + 5 = 70C

AHO = 60 + 5 = 65C



**3 Way Motorised Valve with Internal Drive Relay**

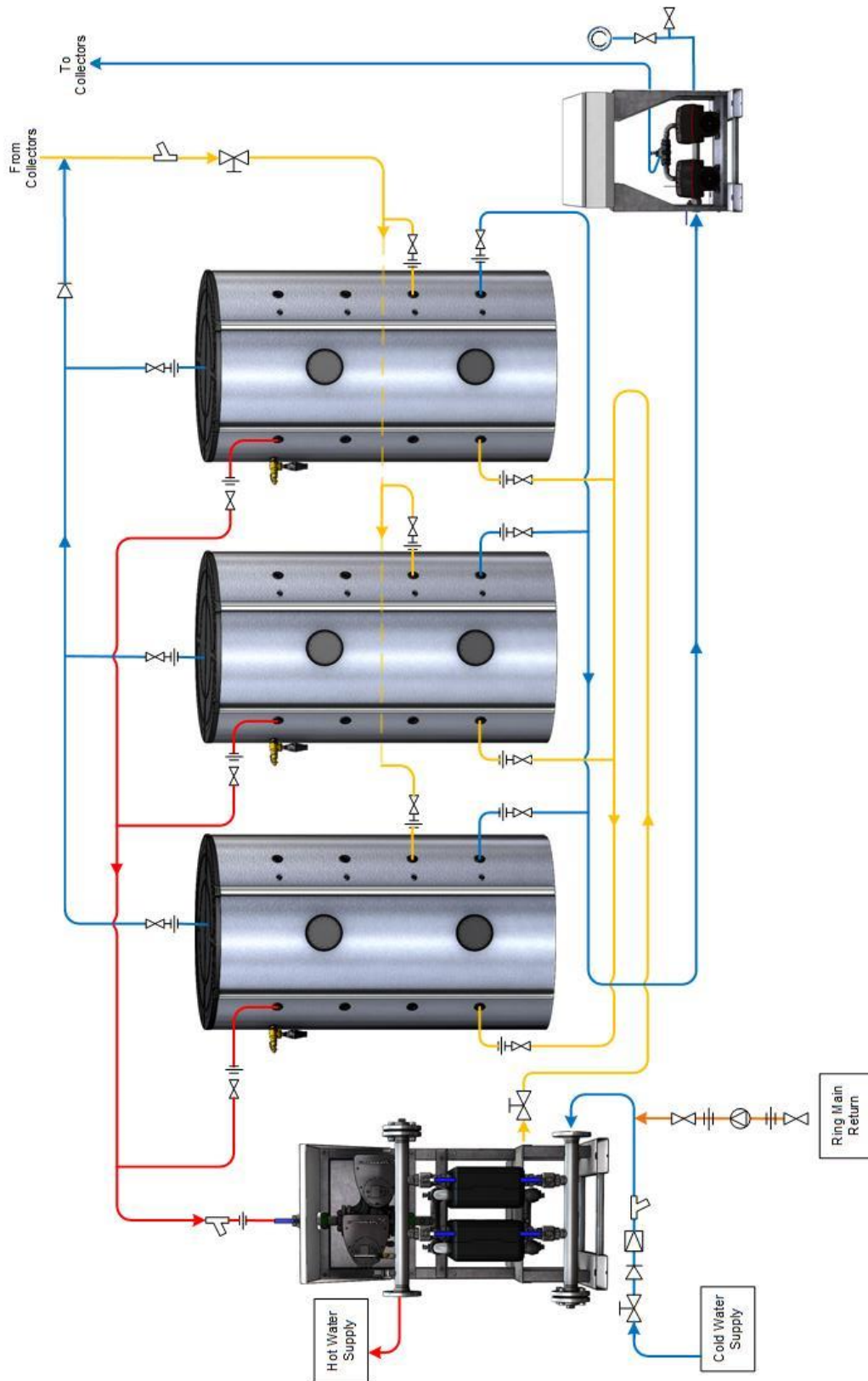


### 3 Way Motorised Valve – Drive Open / Drive Closed

#### Notes:

- In-series boost plant is located after the Delivery Skid, on the potable (secondary) side.
- The in-series boost plant must be able to meet the peak demands of the application in terms of temperature at required flow rate.
- During a demand situation, the in-series boost plant will deliver a constant temperature to the user points and cooler water will return to the bottom of the storage tank, in an identical fashion to in-tank or auxiliary boosting.
- The temperature in the top of the solar storage is monitored by S3. Valve to be wired such that building return water is diverted to the cold water inlet to the Delivery Skid when the solar storage tank is hotter than the in series boost plant cut out temperature + 5°C (AHF), and to divert building return water to the in-series booster when the solar storage tank temperature is less than the building return water temperature + 5°C (AHO).
- Solar Pump Skid controller, sensor S3, is required to be fitted in the solar storage tank at the position shown. Arrangement 3 to be selected on SHCX Controller.
- Refer to Solar Pump Skid wiring diagram for appropriate terminal locations depending on type of 3 way valve used.
- In-series boost plant operation is totally independent of the Solar Pump Skid and Delivery Skid.

## 7. Multiple Tank Installations



**Notes:**

- Equaflo or Tichelmann principles must be adhered to for the following plumbing connections when manifolding multiple tanks:
- The direction of flow in the manifold header must be in the same direction for the solar cold line to Solar Pump Skid and solar hot line from collectors. A reverse return should be included in the solar cold line as shown in the diagram above.
- The direction of flow in the manifold header must be in the same direction for the primary hot water flow to the Delivery Skid and the primary hot water return from the Delivery Skid. A reverse return should be included in the primary hot water return as shown above.
- The drain back vent line does not need to be in the same direction of flow as the solar cold and hot manifolds. Install the supplied check valve in the direction shown between the solar hot line from the collectors and the first tank, as shown.
- Install the globe valve in the solar hot line from the collectors as shown before the first tank.