

MODELS

System

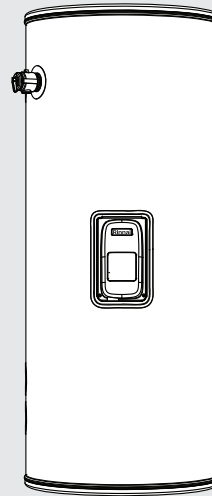
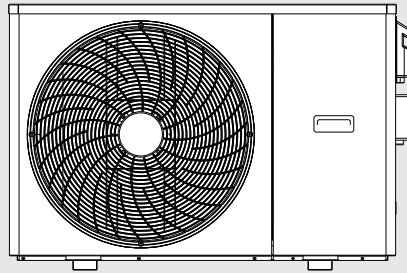
KSHP250M24L70
KSHP315M24L70
KSHP400M24L70
KSHP250M24L70H
KSHP315M24L70H
KSHP400M24L70H
KSHP250M24L70SS
KSHP315M24L70SS

Heat Pump

SHPL70

Tank

HPTB250VM24
HPTB315VM24
HPTB400VM24
HPTB250VM24H
HPTB315VM24H
HPTB400VM24H
HPTB250SSM24
HPTB315SSM24



Enviroflo Split - Electric Heat Pump Water Heaters

Operation & Installation Manual

Rinnai

This appliance must be installed in accordance with:

- Manufacturer's Installation Instructions
- Current AS/NZS 3500
- Plumbing Code of Australia (PCA) / NZ Building Code
- AS/NZS5149
- Local regulations, including local OH&S requirements, and Municipal Building Codes, including the National Construction Code (NCC).

These products comply with the lead-free requirements of the National Construction Code - Volume 3

This appliance must be installed, maintained and removed **ONLY** by an Authorised Person. Rinnai recommends that this appliance be serviced every 2 years.

NOT SUITABLE AS A POOL OR SPA HEATER

For continued safety of this appliance it must be installed and maintained in accordance with the manufacturer's instructions.



Standard: AS3498:2020
Licence Number: WMK26932
SAI Global



Standard: AS/NZS 2712:2007
Licence Number: SMK1849
SAI Global

Note: Models with codes ending in "H" and "S" are not available in New Zealand.

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WARNINGS AND IMPORTANT INFORMATION

SAFETY AND REGULATORY INFORMATION



DO NOT operate this system before reading the manufacturers instructions.

This appliance must be installed, commissioned and serviced by an authorised person in accordance with all applicable local rules and regulations.

Access covers of water heating system components will expose 240V wiring and **MUST** only be removed by an authorised person.

This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.

For continued safety of this appliance it must be installed, operated and maintained in accordance with the manufacturer's instructions.

Children should be supervised to ensure they **DO NOT** play with the appliance.

The unit is rated at 15 amps (2 core and earth) so the power mains supplying the unit **MUST** have a dedicated circuit breaker fitted, if the power supply cable is damaged, it **MUST** be replaced by an authorised person in order to avoid a hazard. Take care not to touch the power connections or plugs with wet hands.

Care should be taken not to touch the pipe work as it may be **HOT!**

DO NOT place articles on or against this appliance.

DO NOT store chemicals or flammable materials near this appliance.

DO NOT operate with collectors or covers removed from this appliance.

DO NOT activate heat pump unless cylinder is full of water.

NEVER use a flammable spray such as hair spray, paint, etc near this unit as this may cause a fire.



This appliance uses R290 (propane) refrigerant, which is a flammable gas class 3 according to AS/NZS5149 and **MUST** be handled by a refrigeration mechanic with the appropriate refrigerant handling licence. Refer to AS/NZS 60335.2.40 for flammable refrigerant handling requirements.

WARNING Risk of fire / flammable material. If the refrigerant is leaked, together with an external ignition source, there is a possibility of ignition.



MANDATORY INSPECTION PRIOR TO INSTALLATION

Immediately report any damage or discrepancies to the Supplier of the appliance. This appliance was inspected and tested at the time of manufacture and packaging, and released for transportation without known damage. Upon receipt, inspect the exterior for evidence of rough handling in shipment. Ensure that the appliance is labelled correctly for the electrical supply, and/or other services it is intended to be connected to.

For safety and warranty purposes, appliances that may be damaged or incorrect **MUST NOT** be installed or operated under any circumstances. Installation of damaged or incorrect appliances may contravene local government regulations. Rinnai disclaims any liability or responsibility whatsoever in relation to the installation or operation of damaged or incorrect appliances.

NOTICE TO VICTORIAN CONSUMERS

This appliance must be installed by a person licensed with the Victorian Building Authority.

Only a licensed person will have insurance protecting their workmanship.

So make sure you use a licensed person to install this appliance and ask for your Compliance Certificate.

For further information contact the Victorian Building Authority on 1300 815 127

TRANSPORT AND STORAGE OF APPLIANCE



The refrigerant used in the heat pump (R290 Propane) is a flammable gas.

The appliance(s) shall be stored and transported in an area without ignition sources (for example: open flames, an operating gas appliance or an operating electric heater)

DO NOT pierce or burn the appliance.

Be aware that refrigerants may not contain an odour.

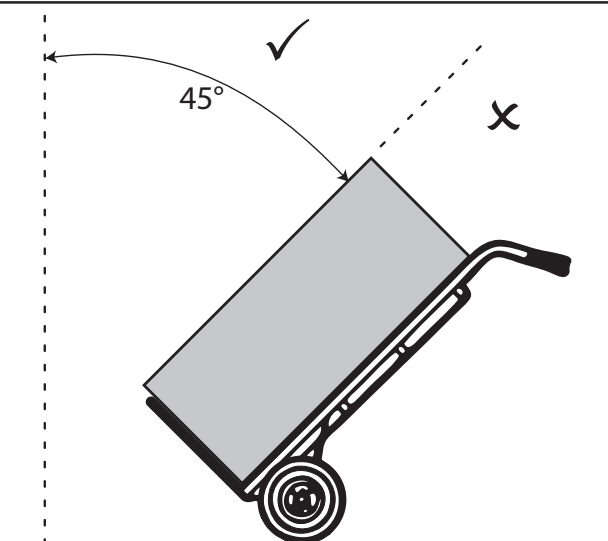
Compliance with AS/NZS 5149 **MUST** be observed while storing the appliance.



National and state regulations exist for storage, handling and transport of hazardous goods including flammable gasses. The maximum number of pieces of equipment or the configuration of the equipment, permitted to be transported or stored together will be determined by the applicable regulations.



**IMPORTANT
DO NOT TILT
MORE THAN 45°
FROM VERTICAL**



The Rinnai Electric Heat Pump must be transported at an angle no greater than 45° from vertical. If the heat pump is tilted at a greater angle than 45° from vertical, the lubrication oil within the compressor can run down into the mufflers. This will leave the compressor motor without sufficient lubrication and lead to premature failure of the compressor unit.

As a general good practice it is better to keep the compressor upright as much as possible to avoid any risks. Returning the Rinnai Electric Heat Pump to a vertical position will not allow the oil to properly flow back into the compressor motor.

Tilting the system beyond 45° from vertical will also place undue strain on compressor motor mounts and associated piping.



Do not use means to accelerate the defrosting process or to clean, other than those recommended by the manufacturer.

The appliance shall be stored in a room without continuously operating ignition sources. For example, open flames, an operating gas appliance or an operating electric heater.

Do not pierce or burn.

Be aware that refrigerants may not contain an odour.

SCALD HAZARDS



HOT WATER CAN CAUSE SCALDS.

CHILDREN, DISABLED, ELDERLY AND THE INFIRM ARE AT THE HIGHEST RISK OF BEING SCALDED.

FEEL WATER TEMPERATURE BEFORE BATHING OR SHOWERING.

SCALDS FROM HOT WATER TAPS CAN RESULT IN SEVERE INJURIES TO YOUNG CHILDREN.

SCALDS OCCUR WHEN CHILDREN ARE EXPOSED DIRECTLY TO HOT WATER WHEN THEY ARE PLACED INTO A BATH WHICH IS TOO HOT.

ALWAYS.....

Test the temperature of the water with your elbow before placing your child in the bath, also carefully feel water before bathing or showering yourself.

Supervise children whenever they are in the bathroom.

Make sure that the hot water tap is turned off tightly.

CONSIDER.....

Installing child proof tap covers or child resistant taps (both approaches will prevent a small hand being able to turn on the tap).

Installing tempering valves or thermostatic mixing valves which reduce the hot water temperature delivered to the taps. Your local plumbing authority may already require that these be fitted. Contact your installer or local plumbing authority if in doubt.

NEVER....

Leave a toddler in the care of another child. They may not understand the need to have the water temperature set at a safe level.

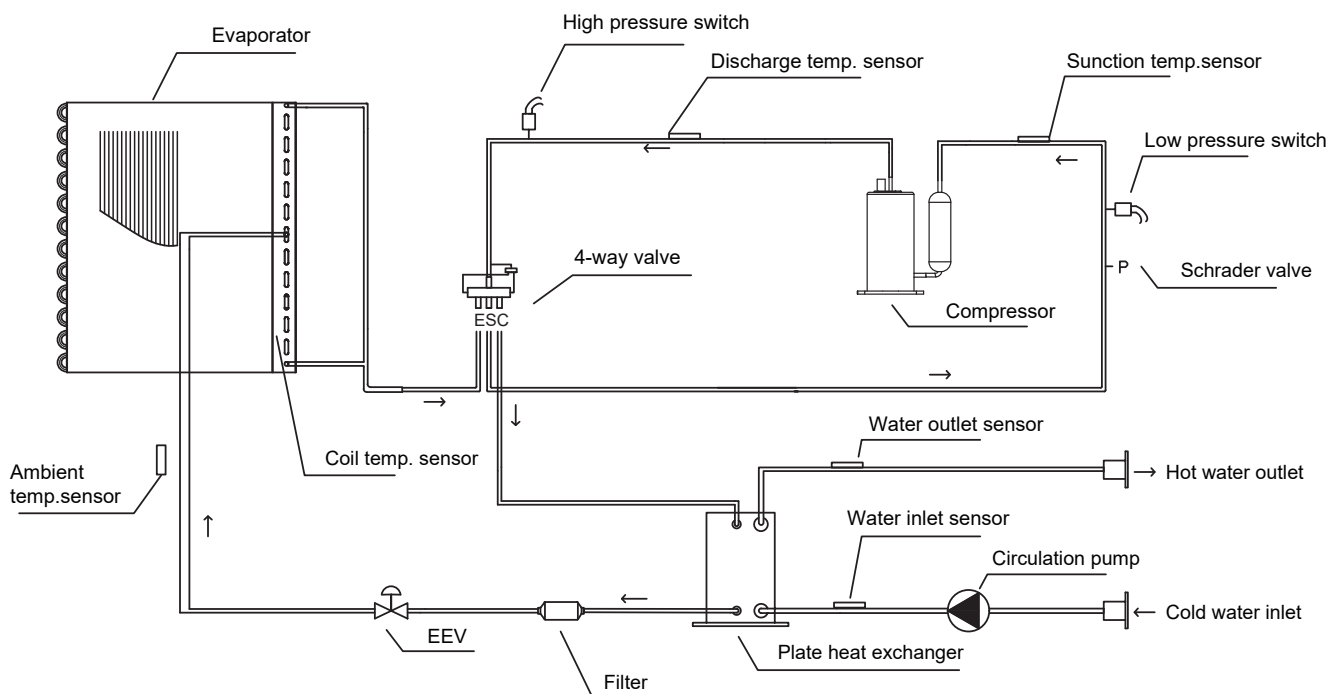
OPERATING PRINCIPLE

The operation of an electric heat pump is very similar to a refrigerator, but in reverse. A heat pump operates by transferring heat from the ambient outside air into the water. Electricity is just used to operate the system, but not to directly heat the water. Because of this energy consumption is significantly reduced as compared to an electric element hot water system. The warmer the climate in which the heat pump is installed, the more efficient the heat pump system will be at heating water.

The heat pump unit includes a circulation pump which draws water from the bottom of the storage tank and returns it to the tank at a higher temperature. A temperature sensor in the tank is used to control the heat pump operation to achieve suitable tank temperature.

During the occasional times when the ambient weather conditions are not suitable for the heat pump to operate, the electric element will provide heating to ensure a supply of hot water.

SYSTEM SCHEMATIC



ACCESSORIES

Please check that the following items are included in the heat pump unit. The installer needs to provide other parts for installation, including but not limited to the strainer.

No.	Description		Quantity
1	Rubber pad		4
2	Drainage adaptor		1
3	Drain hose		1
4	Operation & Installation Manual		1
5	Warranty Booklet		1

SAFETY DEVICES

The water heating system is supplied with various safety devices including temperature sensors, overheat sensors and switches and a Pressure & Temperature Relief (PTR) valve. These devices must not be tampered with or removed. The water heating system must not be operated unless each of these devices is fitted and is in working order.



DO NOT tamper with or remove safety devices.

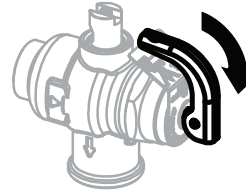
DO NOT operate the water heater unless all safety devices are fitted and in working order.

DO NOT block or seal the PTR Valve and drain pipe.

Pressure & Temperature Relief (PTR) Valve

This valve is located near the top of the water heater and is essential for safe operation. It is normal for the valve to release a small quantity of water through the drain line during heating.

However, continuous leakage of water from the valve and its drain line may indicate a problem with the water heater.



Lift lever until water flows from drain line (Lower lever gently!)



NEVER block the outlet of the PTR valve or its drain line for any reason. The easing gear **MUST** be operated at least every 6 months to remove lime deposits and verify that it is not blocked. Failure to do this may result in the water heater failing.

If the valve does not discharge water when the easing gear lever is opened, or does not seal again when the easing gear is closed, attendance by an authorised person **MUST** be arranged without delay. The PTR valve is not serviceable.

EXCESSIVE DISCHARGE FROM SAFETY DEVICES**Pressure & Temperature Relief (PTR) Valve**

It is normal and desirable that this valve allows a small quantity of water to be discharged during the heating cycle. If it discharges more than a bucket of water during a 24 hour period or discharges continuously there may be another problem.

If the valve dribbles continuously, try easing the valve gear for a few seconds as described above. This may dislodge any foreign matter and alleviate the problem.

If the valve discharges at high flows, especially at night, it may be as a result of the water pressure exceeding the design pressure of the water heater. Ask your installer to fit a Pressure Limiting Valve (PLV).



NEVER replace the PTR valve with one which has a higher pressure rating than is specified for your water heater.

Expansion Control Valve (ECV) - if required

It is normal that this valve allows a small quantity of water to be discharged during the heating cycle. If it discharges more than a bucket of water during a 24 hour period or discharges continuously there may be another problem.

If the valve leaks continuously, try easing the valve gear for a few seconds. This may dislodge any foreign matter which may be causing the problem. If this does not fix the issue, contact Rinnai.

Operate the easing gear regularly to remove any lime deposits and to verify that it is not blocked.

HYDROGEN GAS

If the hot water unit is not used for two weeks or more, a quantity of hydrogen gas, which is highly flammable, may accumulate in the water heater. To dissipate this safely, it is recommended that a non electrically operated hot tap be turned on for two minutes at a sink, basin, or bath, but not a dishwasher or other appliance. During this procedure there must be no smoking, open flame or any electrical appliance operating nearby. If hydrogen is discharged through the tap, it will probably make a sound like air escaping.

ANODES

The water heater Vitreous Enamel Tank is fitted with sacrificial anodes to extend its life. They will slowly dissipate whilst protecting the cylinder. The life of the water heater may be extended by arranging for an authorised person to inspect the anodes and replace them as required. It is recommended that the anodes be inspected at least every 5 years. The factory-fitted Rinnai anodes are Magnesium based. These anodes are suited to conditions where the total dissolved solids (TDS) content in the water supply does not exceed 600 mg/L, (which is the case in most areas). In areas where the total dissolved solids (TDS) content in the water supply exceeds 600 mg/L Rinnai aluminium based anodes are required.

TURNING OFF THE WATER HEATING SYSTEM

If you plan to be away for only a few nights, we suggest you leave the water heating system switched on. If it is necessary to switch off the water heater, do so as outlined below:



DO NOT turn power off to the heat pump unit if snow or frost conditions are expected as components in the system may be damaged by freezing. If power needs to be turned off or power failure occurs and freezing conditions are expected, the water needs to be drained from the heat pump unit. Follow the procedure described below in the section 'Draining and Filling'.

TURNING ON THE WATER HEATING SYSTEM

Switch on the electric supply to the heat pump unit. Water heating will now occur as required. It may take a number of hours before hot water is available.

DRAINING AND FILLING

Draining or filling of the complete system normally only occurs during installation or servicing and must be carried out by an authorised person.

Draining water from the heat pump unit is necessary if the power will be shut off to the unit and snow or frost conditions are expected. **Arrange for an authorised person to carry out this task.**

To drain the heat pump:

1. Turn off power to the heat pump.
2. Close the cold water mains supply stop cock.
3. Open a hot tap to relieve pressure.
4. Disconnect the hot outlet near the top of the storage cylinder.
5. Disconnect the cold inlet near the bottom of the storage cylinder.
6. The system will now drain completely.

MAINTENANCE AND REGULAR CARE

Operate the easing gear of the PTR and the ECV if fitted as described in the section 'Safety Devices' on page 8. The overflow tray (supplied by installer) and drain underneath the storage cylinder (if fitted) should be periodically checked to ensure there are no blockages.



DO NOT screw into the tank with a screw longer than 16mm. Penetrating the outer skin of the tank may damage the inner cylinder. Rinnai's warranty will not cover any resultant faults.

SAVE A SERVICE CALL

Rinnai's servicing network personnel are fully trained and equipped to give the best service on your Rinnai appliance. If your appliance needs service, ring one of the service contact numbers on the back of this booklet.

The pressure and temperature relief valve and expansion control valve (if fitted) must be replaced by an authorised person at intervals not exceeding 5 years or more frequently in areas where the water is classified as scaling water.

If the power supply cable to the Heat Pump unit is damaged, it must be replaced by a licensed electrician or an authorised, qualified person to avoid potential hazards.

Use the following guide to avoid the need for an unnecessary service call.

INSUFFICIENT OR NO HOT WATER	
Heat Pump Unit Not Powered	Check to ensure the electric isolating switch at the switchboard (usually marked "Hot water" or "Water heater" is turned on. (note that the compressor will not start up for 2 minutes after power is turned on).
Excessive hot water consumption	Often end users are surprised at the amount of hot water used, especially when showering. If the amount of hot water used during the day exceeds the storage capacity of the cylinder, it is likely there will be insufficient hot water.
Pressure & Temperature Relief (PTR) Valve continually discharging water	It is normal and desirable that this valve allows a small quantity of water to be discharged during the heating cycle. If it discharges more than a bucket of water during a 24 hour period or discharges continuously there may be another problem. If the valve dribbles continuously, try easing the valve gear for a few seconds as described in the section 'Excessive Discharge from Safety Devices' on page 8. This may dislodge any foreign matter and alleviate the problem. If the valve discharges at high flows, especially at night, it may be as a result of the water pressure exceeding the design pressure of the water heater. Ask your installer to fit a Pressure Limiting Valve (PLV).
Expansion Control Valve (ECV) continually discharging water	It is normal and desirable that this valve allows a small quantity of water to be discharged during the heating cycle. If it discharges more than a bucket of water during a 24 hour period or discharges continuously there may be another problem. If the valve leaks continuously, try easing the valve gear for a few seconds as described in the section 'Excessive Discharge from Safety Devices' on page 8. This may dislodge any foreign matter and alleviate the problem. If this does not alleviate the problem contact Rinnai.
Ambient conditions too hot	To protect the components of the heat pump unit it may not operate when the ambient temperature is higher than 45°C. Please switch to ELECTRIC mode if water heating is required.
Ambient conditions too cold	To protect the components of the heat pump unit it may not operate when the ambient temperature is less than -10°C. Please switch to ELECTRIC mode if water heating is required.
NO WATER FROM THE TAP	
Restriction in the hot tap or failure of the cold water supply to the water heater	Check for water flow at the other taps and that the cold water isolation valve is fully open.

HIGH ELECTRICITY BILLS	
Excessive hot water consumption	See entry under the heading 'Insufficient or no hot water'
High Electricity Tariffs	The electricity tariff will determine the running costs of the system. It is important the end user is aware of the applicable tariffs. Contact your electricity supplier to confirm what these tariffs are.
Higher Element Usage	In extremely cold conditions the element may be operating more than normal.
WATER FLOW FLUCTUATIONS	
One or more hot taps opened at the same time	More than one or two hot taps in use at the same time may cause a decrease in the hot water flow from the taps. Is there more than one or two hot taps open, or are appliances such as a dishwasher or washing machine, in use at the same time? Ensure only one or two hot taps are on at one time.
WATER HAMMER	
Hot and cold water plumbing in the premises	Have a plumber check clipping of hot and cold water pipe work and install a pressure limiting valve and water hammer arrestor as required.
HEAT PUMP ICES UP	
Defrosting function	The heat pump has a built in reversing valve defrosting function which may operate and remove any ice.

HEAT PUMP ERROR INDICATOR*

Error	Error Description	Possible Causes
LP SW Err	Low pressure switch protection	Pressure switch is broken/Connection is loose/EEV fault/Refrigeration system is blocked/Refrigerant is less.
HP SW Err	High pressure switch protection	Pressure switch is broken/Connection is loose/EEV fault/Refrigeration system is blocked/Water pump is broken
Coil Temp Err	Coil temperature sensor fault	Sensor fault/Connection is loose
Discharge Temp Err	Discharge temperature sensor fault	Sensor fault/Connection is loose
Suction Temp Err	Suction temperature sensor fault	Sensor fault/Connection is loose
Tank Temp Err	Tank temperature sensor fault	Sensor fault/Connection is loose
Ambient Temp Err	Ambient temperature sensor fault	Sensor fault/Connection is loose
Outlet Temp Err	Water outlet temperature sensor fault	Sensor fault/Connection is loose
Inlet Temp Err	Water inlet temperature sensor fault	Sensor fault/Connection is loose
DC Fan Err	DC Fan motor fault	DC Fan motor fault is broken/Connection is loose
High Discharge temp	Discharge temperature too high	Lack of refrigerant/system leak
Invertor Err	Compressor Invertor fault	Main PCB fault/Compressor connection is loose/Compressor fault

* If an error code is displayed on the control unit please contact Rinnai Customer Care Immediately.

SPECIFICATIONS

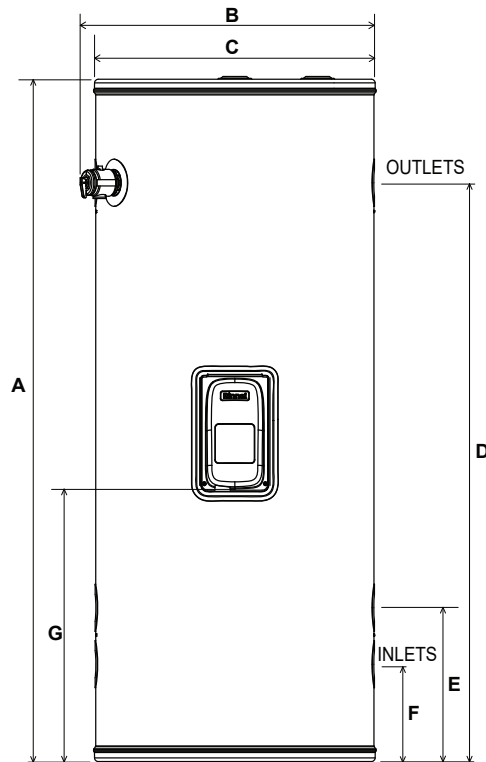
HEAT PUMP SPECIFICATIONS

Model		SHPL70
Net Weight		66kg
Dimensions (LxDxW)		1047x375x690mm
Ambient Temperature Limits (for heat pump operation - element will operate beyond these limits)		-10°C to 45°C
Ingress Protection		IPX4
Heat pump - Hot Outlet and Cold inlet Connections		ISO 7.1 ¾" RC
Storage Cylinder - PTR Valve Connection		ISO 7.1 ½" Rp
Pressure & Temperature Relief (PTR) Valve (Supplied) Setting / Rating		1000 kPa / 10kW
ECV Pressure Rating		850 kPa.
ECV Fitted	Fit PLV if mains pressure exceeds	680 kPa
	Recommended PLV pressure rating	500 kPa
ECV Not Fitted	Fit PLV if mains pressure exceeds	800 kPa
	Recommended PLV pressure rating	500 kPa
Rated Input Electric Element (Factory Wired)		2.4 kW
Maximum Input Refrigeration Module (Factory Wired)		2.0 kW
Total Maximum Input		2.4 kW
Maximum Energy Output (Use to size PTR)		7.8 kW
Power Supply		220V-240V AC/50Hz
Switchboard Power Circuit		In accordance with AS/NZS 3000 and local regulations
Maximum Current		11.5 Amps (15 Amps rating power supply)
Sound Pressure Level*		45 ~ 52 dB(A)
Refrigerant Type / Mass		R290 / 510 g
Refrigerant Circuit Maximum Pressure		3200 kPa
Coefficient Of Performance (COP)	32.6°C Ambient 21.1°C cold water inlet	9.2
Heat Output	32.6°C Ambient 21.1°C cold water inlet	7.0kW

*Sound Pressure Level @1.5m. Sound Levels on installations can be higher due to noise reflections from nearby surfaces and structures.

DIMENSIONS (mm)

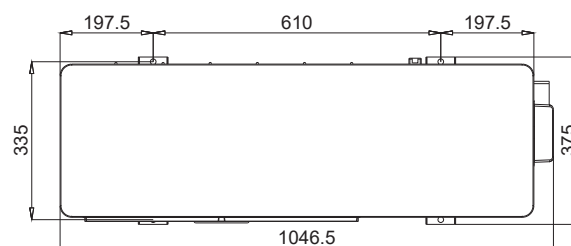
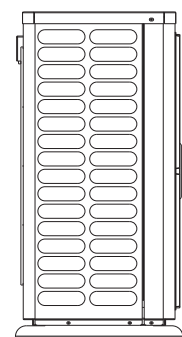
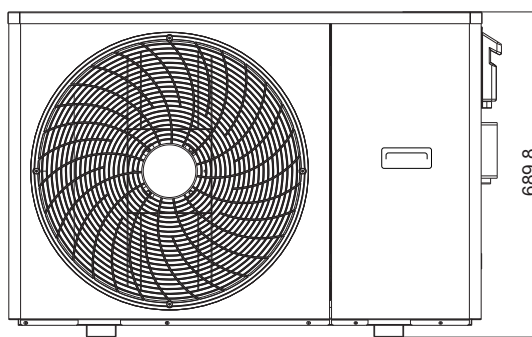
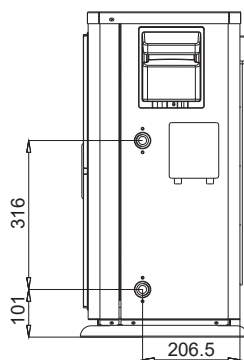
Tank



No	Dimension(mm)	Tank Model		
		HPTB250	HPTB315	HPTB400
A	Tank Height	1477 1700*	1770 2090*	1840
B	Width	674 750*	674 750*	744
C	Tank Diameter	605 605*	605 605*	675
D	Hot Water Outlet	1248 1490*	1541 1880*	1587
E	Heat Pump Hot Flow	332 300*	332 300*	359
F	Cold Water Inlet	210 210*	210 210*	237
G	Electric Cover	593 692*	754 748*	793
Tank Weights (kg)				
Net Weight (kg)		66 45*	77 56*	90
Filled Weight(kg)		341 303*	413 382*	514

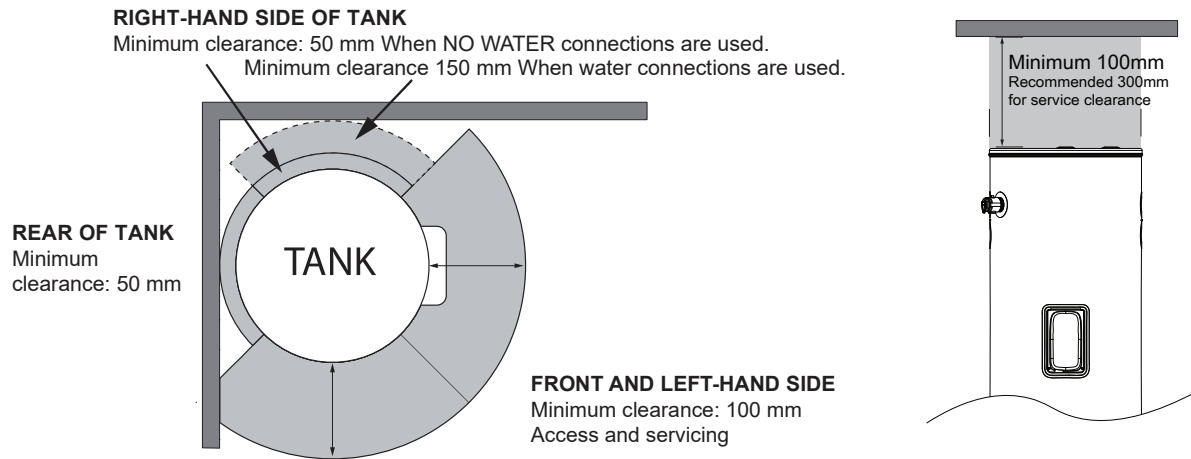
*Denotes dimensions for stainless steel tanks

Heat Pump



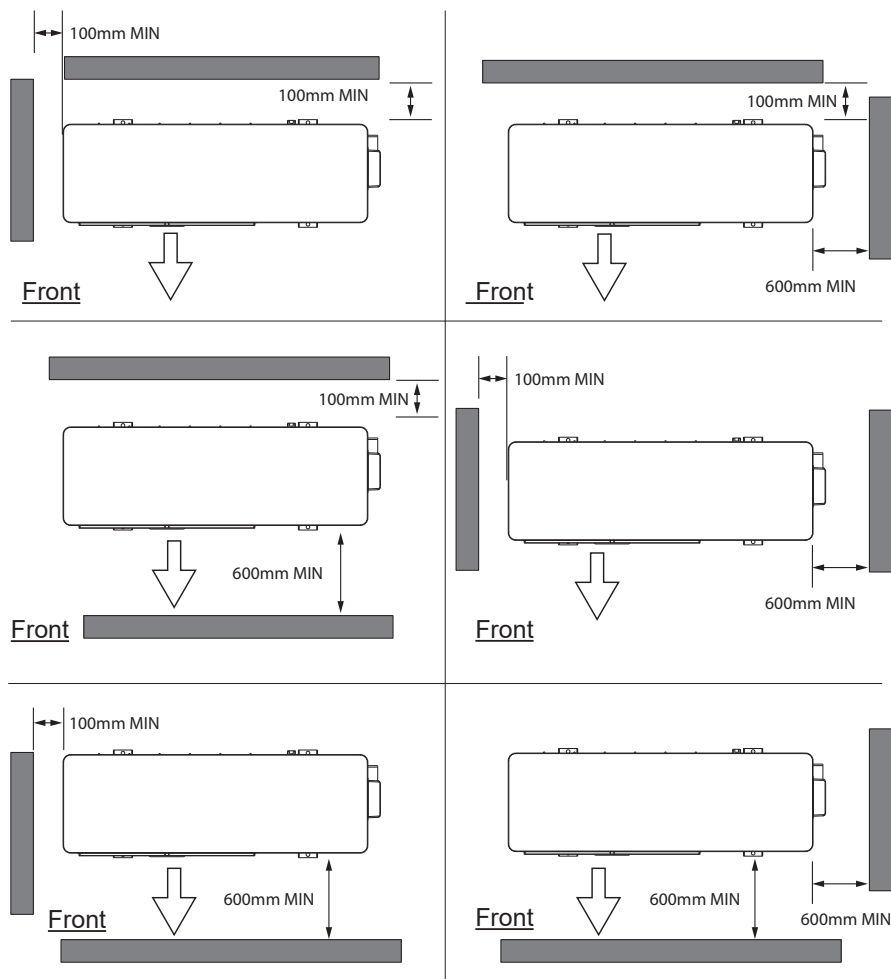
CLEARANCES

Tank



Heat Pump

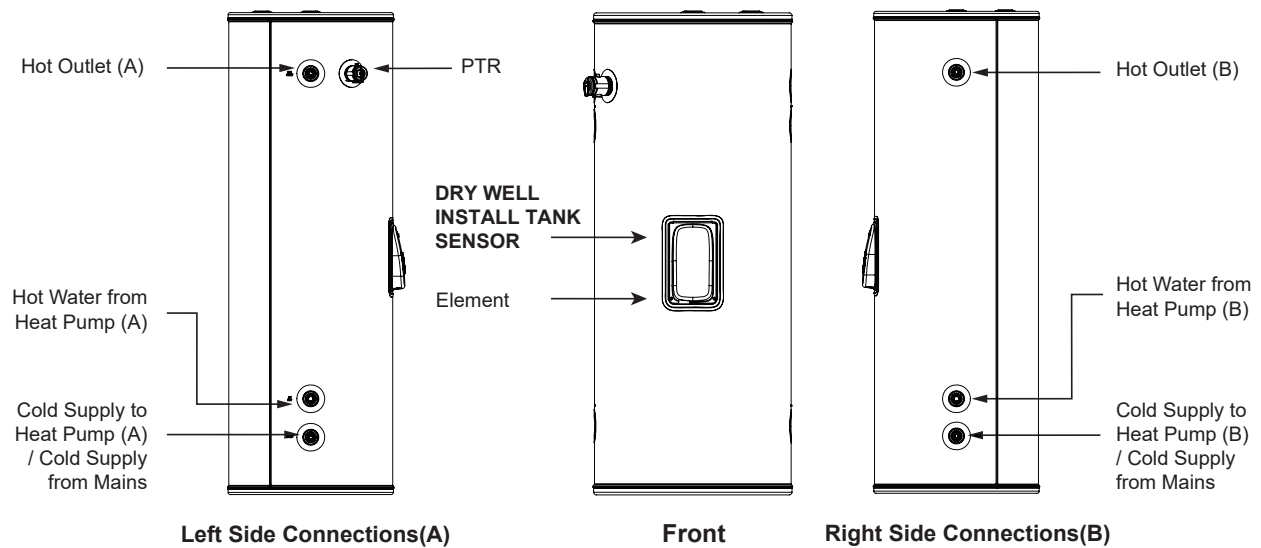
Allow 600mm on the fan discharge side and 100 mm clearance on the fan suction side to allow for sufficient air flow through the fan. All measurements outlined below are minimums.



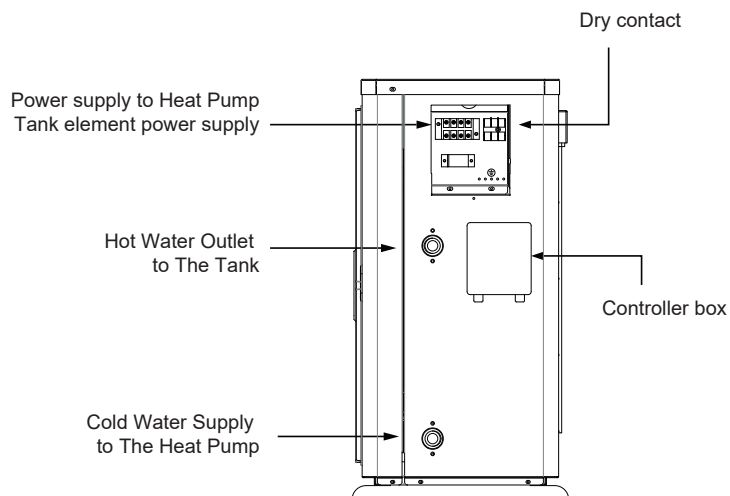
CONNECTIONS

The Tank is supplied with duplicate connections on either side so that the Heat Pump unit can be located on the Left (A) or Right (B) side of the tank more easily as required.

Tank

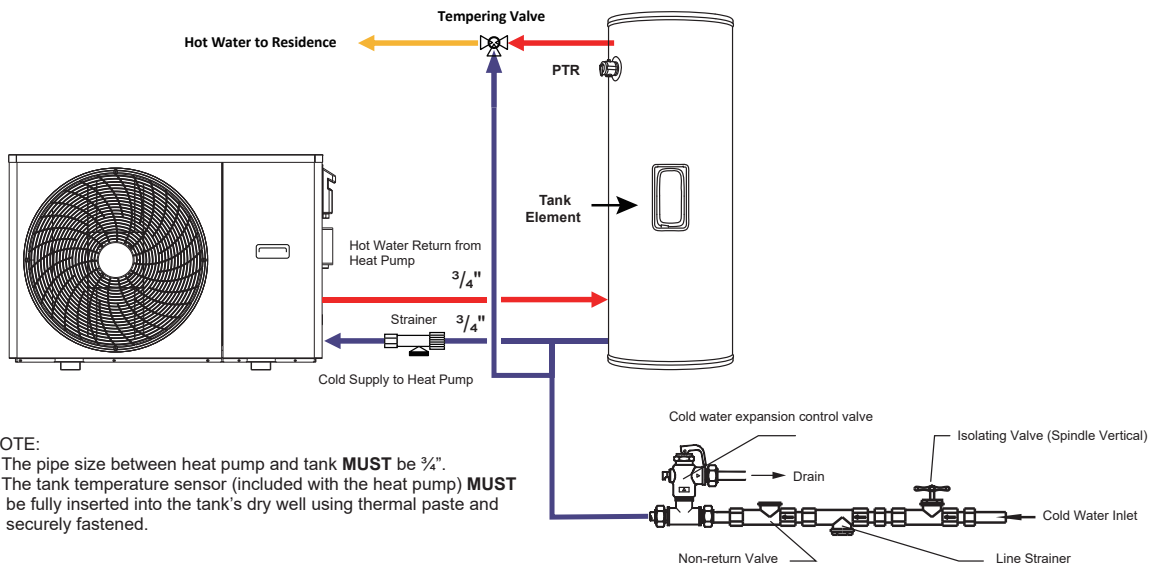


Heat Pump



SYSTEM SCHEMATIC

Typical Example 1



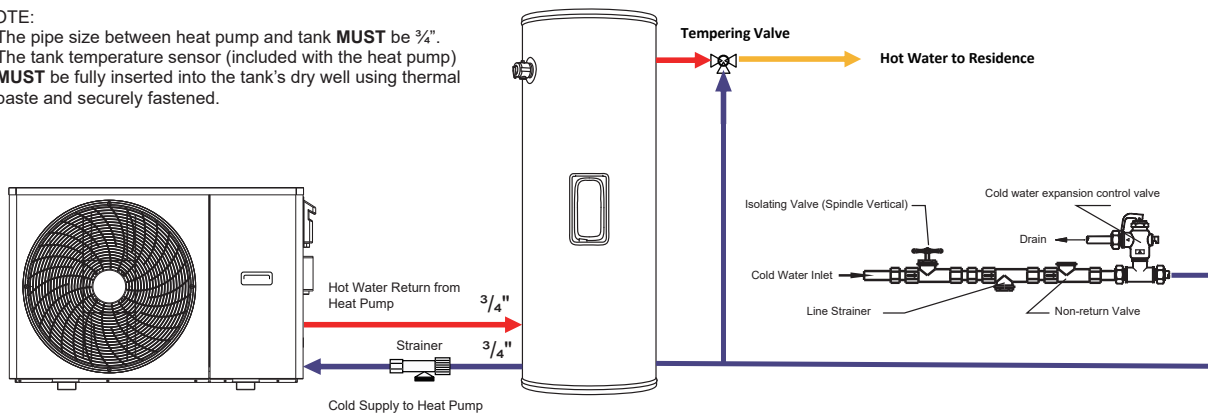
NOTE:

1. The pipe size between heat pump and tank **MUST** be 3/4".
2. The tank temperature sensor (included with the heat pump) **MUST** be fully inserted into the tank's dry well using thermal paste and securely fastened.

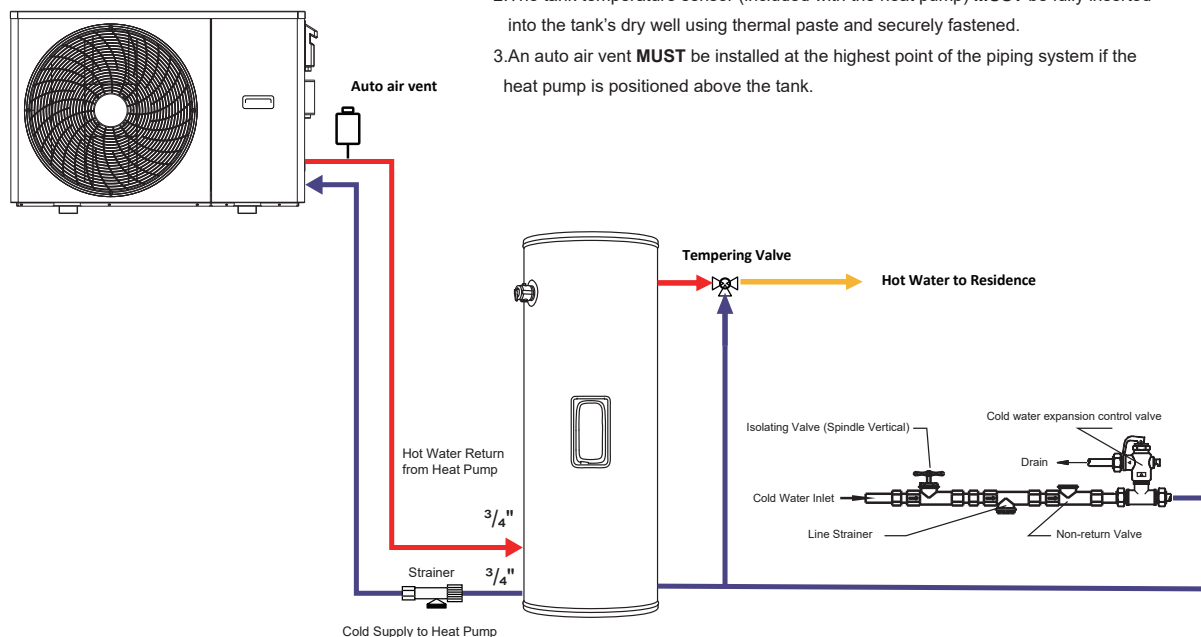
Typical Example 2

NOTE:

1. The pipe size between heat pump and tank **MUST** be 3/4".
2. The tank temperature sensor (included with the heat pump) **MUST** be fully inserted into the tank's dry well using thermal paste and securely fastened.



Typical Example 3



NOTE:

1. The pipe size between heat pump and tank **MUST** be 3/4".
2. The tank temperature sensor (included with the heat pump) **MUST** be fully inserted into the tank's dry well using thermal paste and securely fastened.
3. An auto air vent **MUST** be installed at the highest point of the piping system if the heat pump is positioned above the tank.

NOTE:

1. The maximum pipe length between the tank and the heat pump must not exceed 5 meters.
2. The heat pump can be under or above the tank for a distance up to 3.5 meters.
3. An auto air vent must be installed at the highest point of the piping system if the heat pump is positioned above the tank.
4. Pipework must have no more than 6 bends in total between the tank and the heat pump.
5. **MUST** install a strainer at the water inlet pipe (not supplied with the unit) of the heat pump. Recommend 3/4" Y brass strainer with 40 mesh filter.
6. The tank temperature sensor (included with the heat pump) **MUST** be fully inserted into the tank's dry well using thermal paste and securely fastened.
7. Above item 1 and 2 are based on the requirements for energy efficiency rebate eligibility related to product registration. If the customer does not intend to apply for such rebates, the maximum pipe length can be extended to 10 meters, and the allowable height difference can be increased to 5 meters.

INSTALLATION

REGULATIONS AND OCCUPATION HEALTH AND SAFETY (OH&S)



Installation and commissioning **MUST** be performed by authorised persons.

The heat pump **MUST** be installed in accordance with these instructions and all regulatory requirements which exist in your area including those in relation to manual lifting.

Applicable publications and regulations may include:

- AS/NZS 3500 National Plumbing and Drainage
- AS/NZS 3000 Wiring Rules
- Building Codes of Australia (BCA) / NZ Building Code
- Local Occupational Health and Safety (OH&S) regulations

This appliance is not suitable for use as a domestic spa pool or swimming pool heater.

Electric Heat pumps are heavy and bulky items. Australian States and Territories, and New Zealand have a Principal Occupational Health and Safety (OH&S) Act which contains requirements relating to the handling of large, bulky or awkward items. Persons installing heat pump systems **MUST** be aware of their responsibilities and be adequately trained and qualified, in accordance with local OH &S requirements.

LOCATION

The electric heat pump can be installed externally or internally.

The electric heat pump should be placed as close as practicable to the most frequently used hot water outlet point or points to minimise the delay time for hot water delivery. This will usually be the kitchen tap. For installations where the distance between the heat pump and the outlets is considerable, a flow and return system can be used which minimise the waiting time for hot water delivery. We recommend not to install the unit close to where operational sound levels may cause occupant disturbances, such as bedrooms.

It is recommended that all components are installed at ground or floor level with consideration for easy service, repair or replacement access. The heat pump **MUST** be installed in a vertically upright position.



Ensure the location complies with the requirements of AS/NZS 60335.2.40 & AS/NZS 5149.

The air inlet and outlet of the heat pump module **MUST** be away from areas with strong wind and **MUST** be provided with sufficient clearances as per those shown in the section 'Clearances' on page 14.

The heat pump **MUST** be connected to an independent AC 240 V, 50 Hz power supply, Dedicated Safety Switch Circuit Breaker and Weatherproof Isolating Switch

Ensure the pressure and temperature pressure relief (PTR) valve and any access covers have sufficient clearances and are accessible for service and removal. The information on the rating plates **MUST** also be readable.

The heat pump **MUST** be installed free-standing on a level and stable base. The cylinder should be mounted on a concrete base at least 50mm thick or on well-seasoned, evenly spread hardwood slats with a thickness of at least 25mm. Where property damage can occur as a result of water leakage, the storage cylinder **MUST** be installed with a safe tray (overflow tray) and drain in accordance with AS/NZS 3500.4. Ensure the storage cylinder **DOES NOT** stand on wet surfaces.

Internal Installation

For internal installations the area **MUST** meet the following requirements:

- Minimum room volume of 75m³ per unit.
- Good Ventilation (i.e minimum 500 L/s per unit)
- Away from any ignition sources or corrosive environments.

If the heat pump is installed internally careful consideration should be taken in regards to positioning and limiting the effect of unit noise and reverberation during operation, which may cause noise disturbances otherwise.

Condensation

As this heat pump is highly efficient, the surrounding air temperature could be cooled by up to 4°C and condensate will be produced, the condensate outlet will need to be plumbed to a suitable drain.

Drainage

Where property damage can occur as a result of water leakage, the water heater **MUST** be installed with a safe tray (overflow tray) and drain. Construction, installation and draining of the safe tray **MUST** comply with local regulatory requirements and. AS/NZS 3500.4 also requires the use of a safe tray for particular situations.

WATER SUPPLY

This appliance is intended to be permanently connected to the water mains and not to be connected by a hose set.

The maximum water pressure is listed on page 12. An approved pressure limiting valve may be required if the maximum rated water supply pressure is exceeded.

Water chemistry and impurity limits are detailed in the separate warranty document. Most metropolitan water supplies fall within these requirements. If you are unsure about water quality and suitability, contact your water authority.

If sludge or foreign matter is present in the water supply, a suitable strainer filter should be incorporated in the water supply to the system.

In a scaling water supply, calcium carbonate and possibly other compounds are deposited out of the water onto any hot metallic surface and form a scale. Scaling water may cause scale deposits to form onto the metallic surfaces of the PTR valve and may prevent it from operating properly. To prevent this, an expansion control valve (ECV) **MUST** be fitted on the cold water line after the non-return valve in areas of scaling water. ECVs' **MUST** be fitted in South Australia and Western Australia to comply with local regulations.

STORAGE TEMPERATURE

If the tank water temperature is set below 60°C, the system will automatically override this setting once a week to activate the disinfection cycle, heating the water to 60°C to meet regulatory requirements. This setting can not be altered.

HOT WATER DELIVERY TEMPERATURE

This appliance may deliver water at high temperature. Refer to the respective plumbing codes of Australia / New Zealand, local requirements and installation instructions to determine if additional delivery temperature control is required.

The PCA, local regulations and the requirements of AS/NZS 3500.4 **MUST** be considered regarding the temperature limitations of hot water supplied to areas used primarily for personal hygiene.

The temperature of water to certain areas is limited to different temperatures according to purpose, for e.g. early childhood centres, primary and secondary schools and nursing homes or similar facilities for young, aged, sick or people with disabilities and for all other buildings. To comply with these requirements, a temperature limiting device, such as a thermostatic mixing or tempering valve, will be required on hot water systems.

VALVES AND FITTINGS



A 10 kW capacity, combined Pressure and Temperature Relief (PTR) valve is supplied with the Heat Pump hot water system. This valve is fitted at the top of the storage cylinder. The PTR valve is a safety device and it is mandatory that it is fitted by the installer in all installations.

The following valves & fittings are to be supplied by the installer:

- A cold water expansion control valve (ECV). An ECV **MUST** be fitted in Western Australia and South Australia to the cold water supply to the storage cylinder to comply with local regulations. An ECV is recommended in all other geographical areas where the water supply has a tendency to cause scaling. This will reduce hot water discharge from the pressure and temperature relief (PTR) valve which minimises wear on this valve.
- A stop cock, non return valve and combination valves incorporating two or more of these functions (such as 'Trio' valves) are suitable. These are fitted to the cold water supply to the storage cylinder by the installer.
- Cold water supply and hot water discharge pipework to and from the storage cylinder. This pipework **MUST** be insulated as specified in AS/NZS 3500.4
- An approved pressure limiting valve (supplied with some systems) is required if the maximum rated water supply pressure on page 12 is exceeded.
- Tempering valve(s) or thermostatic mixing valve

TRANSPORT AND HANDLING



When moving the unit, it **MUST** be close to vertical at all times.

When using a trolley to move the unit, ensure it is not tilted more than 45° from the vertical.

Non compliance will void warranty and severely affect product performance and operation

The Rinnai Electric Heat Pump **MUST** be transported at an angle no greater than 45° from vertical.

It is essential that the tank remains in an upright position at all times during transportation. Transporting the tank while lying flat may cause internal components, particularly the anode, to become damaged. The anode plays a critical role in protecting the tank from corrosion, and any damage to it could compromise the performance and longevity of the unit. Always ensure the tank is securely positioned upright to maintain product integrity.

POSITIONING THE HEAT PUMP

Arrive at site and conduct a safety audit. Safety audits can also be known as Work Method Statements (WMS) or Job Site Analysis (JSA).

Park your vehicle as close as allowable to your installation. Unload all materials in a safe manner.

Position all materials in a convenient position near the work area.

Where the requirements for internal installation can't be met, the heatpump **MUST** be installed outdoors.

The location **MUST** consider noise impact on living areas. Avoid positioning near bedrooms or neighbours' bedrooms. Although the running noise level is very low it can be expected that the heat pump will run during the night.

Adequate access **MUST** be available to the relief valve and anodes.

Safely position the new unit on a level surface in accordance with all plumbing and building regulations.

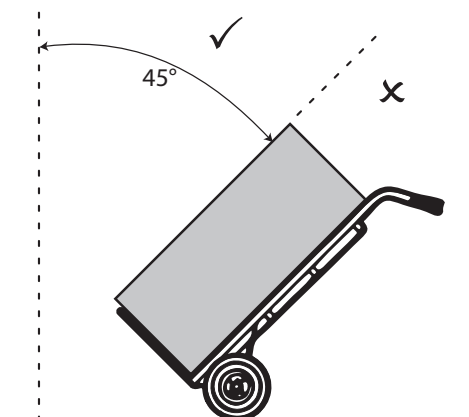
A properly drained overflow tray **MUST** be used where property damage could occur from water spillage. (See AS/NZS 3500.4.2 for further details.)



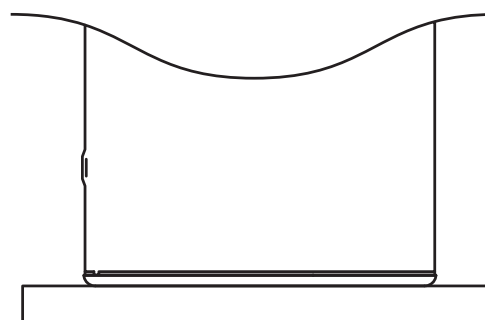
DO NOT drain on to grass or garden beds.

DO NOT commence a job where the risks cannot be controlled.

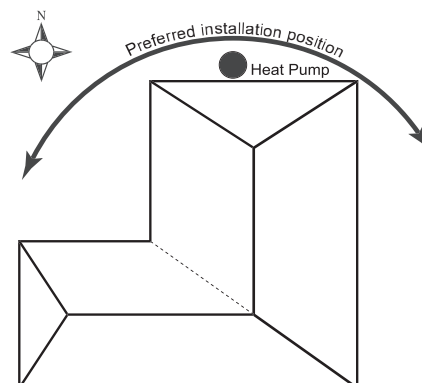
Allow 200m³ of free space surrounding the unit. This provides clear ambient airflow assisting the product's performance. Ensure the clearance requirements specified in the section 'Dimensions' on page 14 are complied with. The area **MUST** also be clear of debris such as leaves and tree branches.



Never tilt unit more than 45° from vertical



Install a plinth under the heat pump where it is subjected to wet conditions



Optimum installation location is on the warmest side of house.

CONNECT THE PTR VALVE

Connect the PTR valve to the uppermost fitting of the storage cylinder. See the diagram in the section 'Dimensions' on page 13.

The PTR pressure rating **MUST** be suited for the cylinder and adequate for the thermal loading applied to the storage cylinder, as specified in the table on page 12. The supplied PTR valve input rating is 10 kW. The PTR valve rating **MUST EXCEED** the total input from the heat pump (see the table on page 12). As this is less than 10 kW, the supplied PTR valve is of sufficient capacity.

Use PTFE (Teflon) thread tape on the valve, never use hemp or other sealing materials. Ensure the tape does not protrude past the end of the thread, which could result in it hanging over the end of the thread and blocking the water passage through the valve.

Connect the supplied PTR valve into the top socket marked "Relief Valve" Leave the valve outlet pointing down. Tighten the valve using the spanner flats - never use the valve. Discharge according to plumbing regulations. PTR Valves for the unit are rated at 1000 kpa.

The drain line from this valve **MUST** run in a continuously downward direction with the discharge end left permanently open to atmosphere.

PLUMBING CONNECTIONS

Refer to the diagram on page 13 for detailed information on position of plumbing.

An approved isolating valve, non return valve, and union **MUST** be fitted between the supply main and the RP $\frac{3}{4}$ socket in the water heater. All fittings **MUST** be approved by the relevant installation Authority.

An ECV **MUST** be fitted in Western Australia and South Australia to the cold water supply to the storage cylinder to comply with local regulations. For New Zealand, it needs to be installed as per guidance in G12 AS1 table 6.

An ECV is recommended in all other geographical areas where the water supply has a tendency to cause scaling.

This will reduce hot water discharge from the Pressure and Temperature Relief (PTR) valve which minimises wear on this valve.

This water heater is designed for direct connection to water supply pressures of no greater than those specified on page 12. Where the mains pressure can exceed or fluctuate beyond this, a pressure limiting (PLV) device (complying with AS1357 or AS/NZS3500.4.) **MUST** be fitted. For New Zealand, it needs to be installed as per guidance in G12 AS1 table 6.

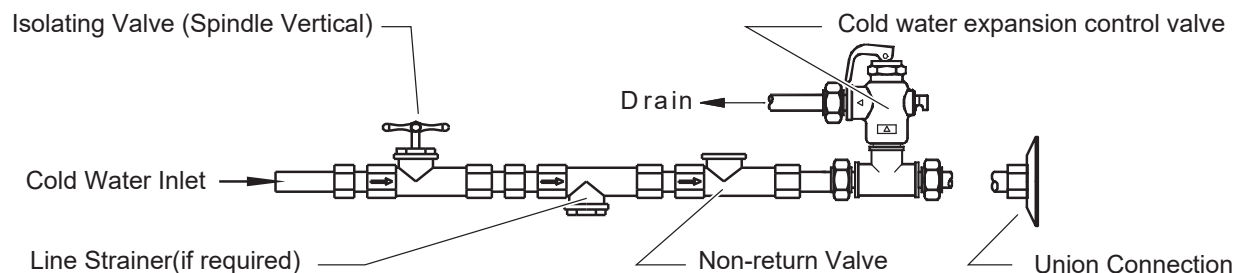
CONNECT COLD / HOT WATER SUPPLY

Connect cold water supply, Pressure Limiting Valve (PLV) and or Expansion Control Valve (ECV).

Connect cold water supply to the storage tank (refer to Diagram BELOW).

A stop cock, and non return valve **MUST** be fitted.

If sludge or foreign matter is present in the water supply, a suitable strainer filter should be incorporated in the water supply to the system.



Connect the pipe work supplying hot water to the premises to the hot water outlet on the tank.

A temperature limiting device may be required as detailed in the section the section 'Hot Water Delivery Temperature' on page 19.

The cold water supply line to the water heater and the hot water outlet line must be insulated in accordance with AS/NZS 3500.4 requirements. It is recommended that all hot water lines are insulated using weatherproof and UV resistant insulation, in Australia 13 mm closed cell insulation in Climate Region A, and 25 mm insulation in Climate Regions B and C.

CONNECT CONDENSATE DRAIN LINE

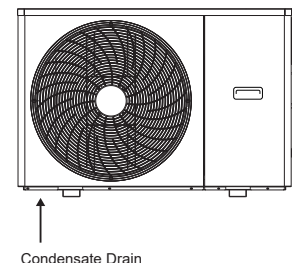
A condensation drain line is required to be fitted to carry discharge clear of the water heater. The condensate drain line should not be connected to the PTR drain line but can exit to the same point.

The diagram shows the condensate drain location on the heat pump. Use the supplied drain hose to connect to the condensate outlet.

Independent 15mm copper pipes **MUST** be fitted to the PTR and ECV drain outlets.

Each pipe **MUST** be open to atmosphere and run with a continual downward grade in a frost free environment to a visible discharge point.

Drain lines **MUST NOT** exceed 9 meters in length. Valves or other restrictions **MUST NOT** be placed in the relief valve drain outlet line.



ELECTRICAL TESTS

DO NOT turn on the power supply to the appliance until it has been filled with water and a satisfactory insulation (Megger) test has been performed.

Conducting Insulation (Megger) Tests

When conducting an insulation test using a Megger on this appliance, observe the following:



This appliance contains electronic components, when performing insulation tests (500 Volts) this **MUST ONLY** be conducted the across active terminal to earth and then across the neutral terminal to earth.

Tests between the active to neutral terminals **MUST NOT** be performed as this **WILL** damage the electronic components.

Insulation test results of between **100 kΩ** and **660 kΩ** are normal for this appliance.

In accordance with AS/NZS 3000 an insulation test with a result less than **1 MΩ** is permitted where the appliance is approved to a Standard applicable to that class of appliance.

This appliance is categorised and certified as a 'stationary Class 1 motor operated appliance' and therefore satisfies the requirements of AS/NZS 60335.2.40 for leakage current and electric strength. As such, this appliance complies with the insulation resistance requirements of AS/NZS 3000.

ELECTRICAL CONNECTIONS



The power supply to the heat pump module **MUST NOT** be activated until the system is filled with water.

The premises wiring to the heater **MUST** be capable of withstanding the appliance load. Refer to specification table for load details.

All electrical connections and wiring **MUST** be installed, maintained and removed by authorised persons in accordance with AS/NZS 3000, and all other relevant local regulations and municipal building codes including OH&S requirements.



The Heat Pump is NOT equipped with a power cord and plug and **MUST** be hard-wired to an isolating switch with dedicated circuit as per the wiring rules. The supply terminals **MUST** be connected to an independent AC 240V 50Hz power supply with a safety switch. The isolator **MUST** effectively isolate all active supply conductors from the circuit. A method for disconnection **MUST** be incorporated into the fixed wiring in accordance with the relevant wiring rules and regulations.

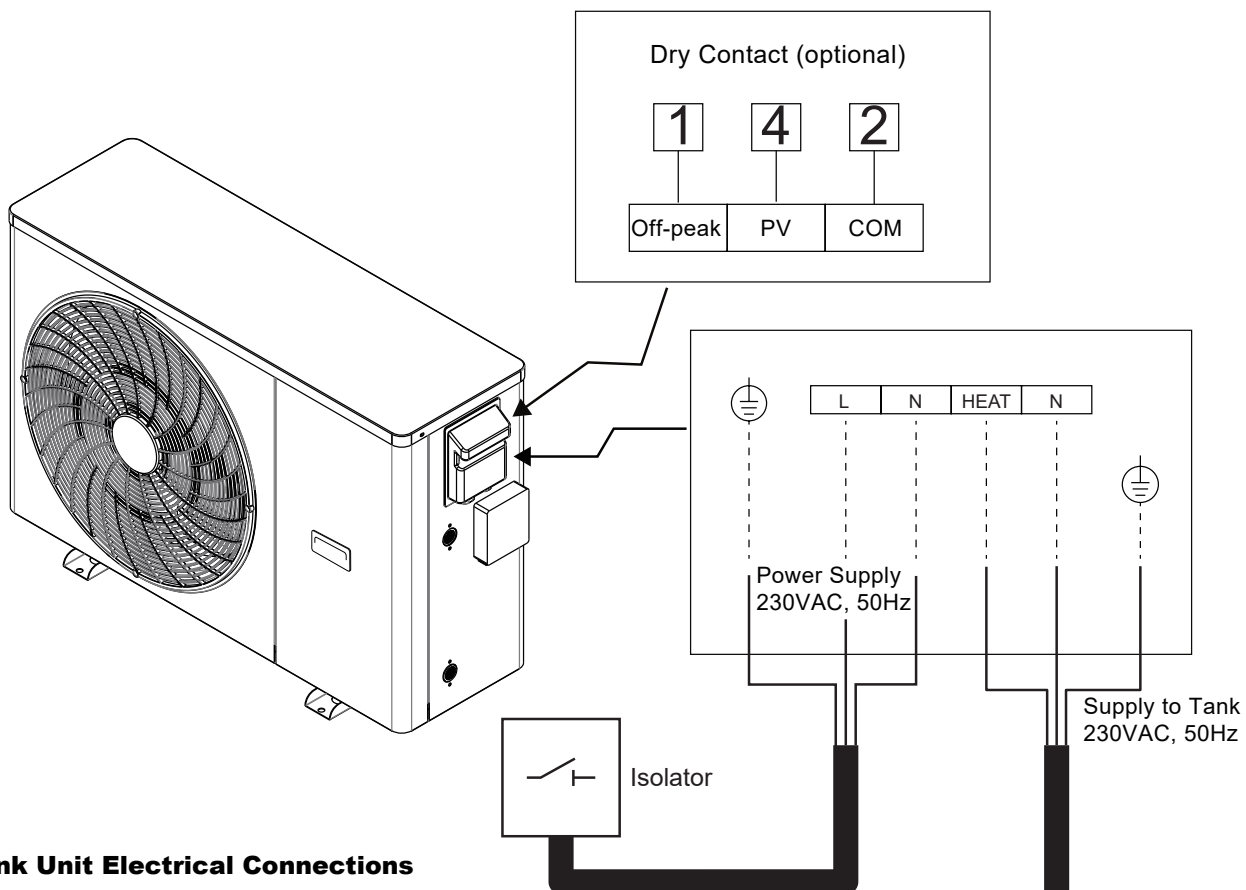
In Australia, a Residual Current Circuit Breaker (RCD) must be installed to the power supply for this appliance.



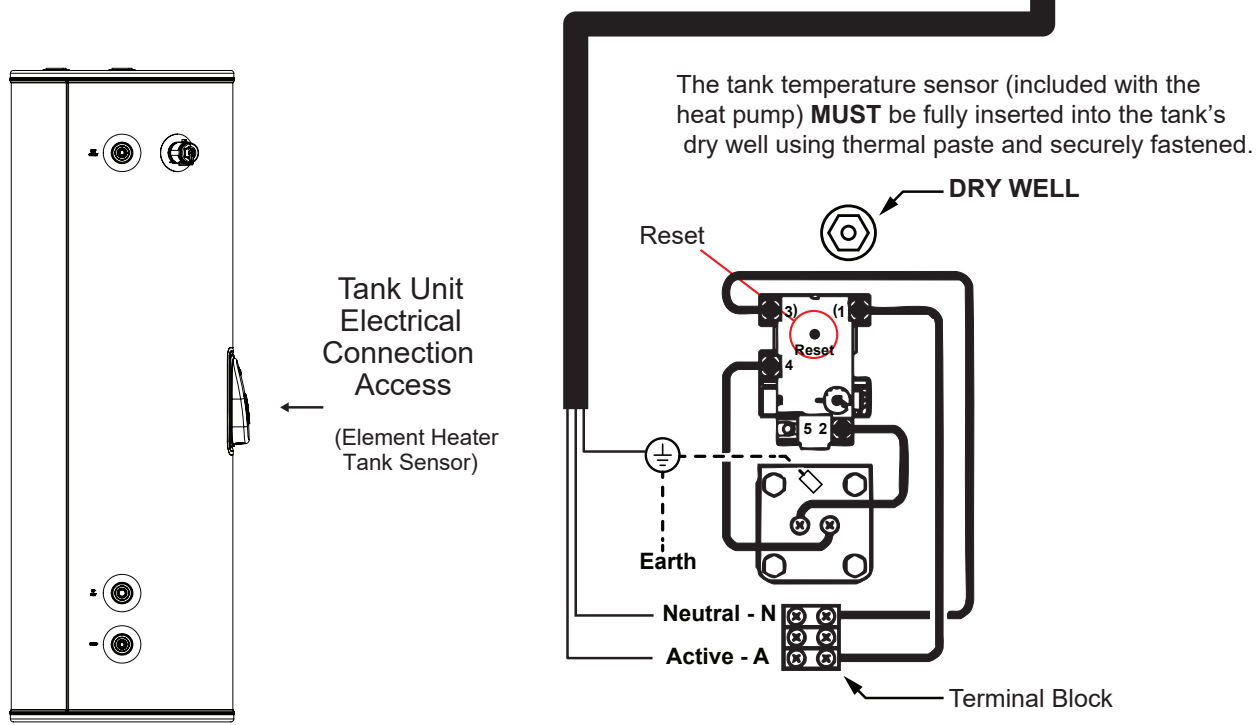
Disconnect all power prior to installation and commissioning.

This appliance is designed for single phase 240 Volts, AC mains electrical operation.

Heat Pump Electrical Connections

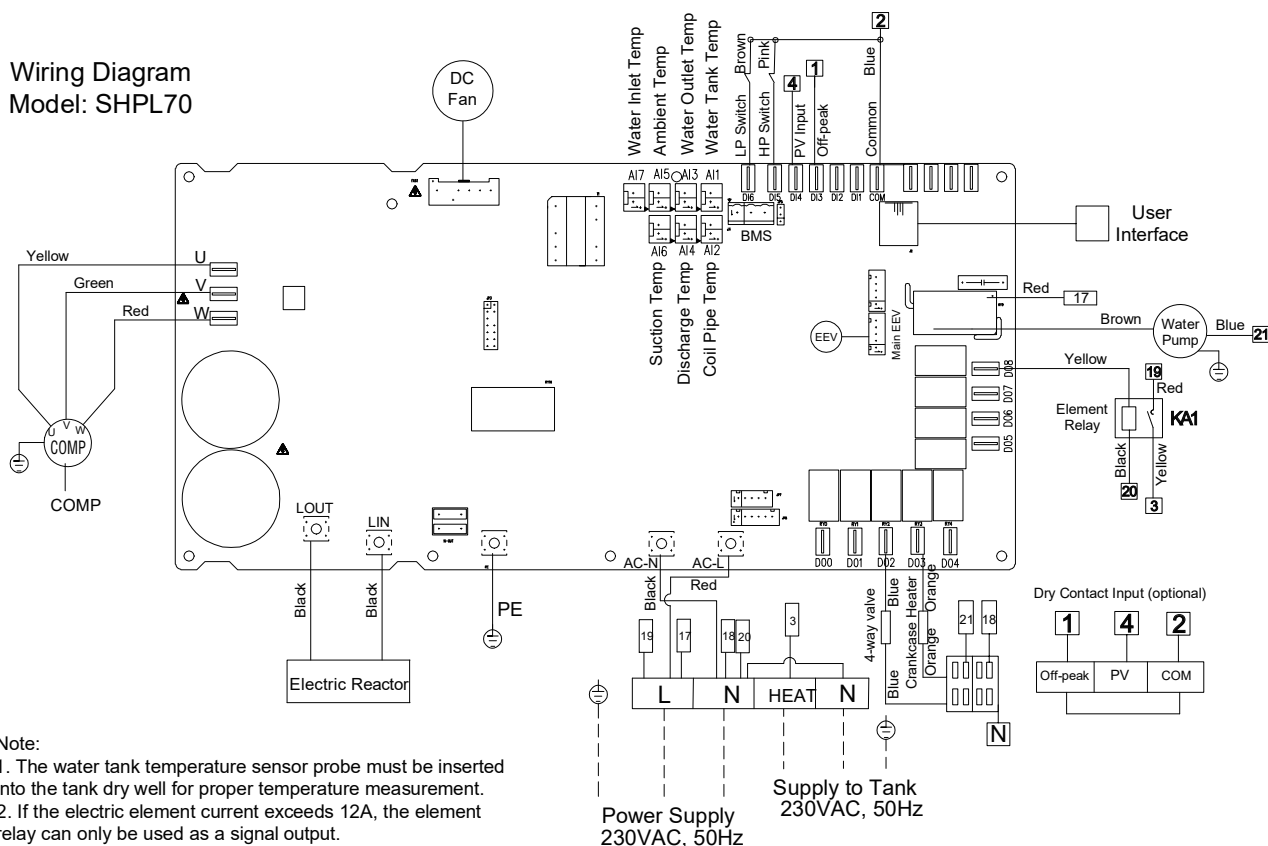


Tank Unit Electrical Connections



WIRING DIAGRAM

Wiring Diagram
Model: SHPL70



FILLING THE SYSTEM

Open hot water tap at sink.

Open the stop cock in the cold water main supply line. Allow the system to fill and the air to bleed through the tap.

Turn off the hot tap at the sink when water flows freely without any air bubbles or air bursts. If leaks are detected, repair any leaks and repeat the filling process to remove any air.

If no leaks are detected water heating can commence.

COMMISSIONING AND FINISHING THE INSTALLATION



Please confirm the followings before commissioning:

- Piping and electrical wiring are all correct and Earthing wire is installed properly.
- Pipe insulation is completed
- Tank is filled
- Supply Voltage complies with rated voltage
- Air intake and discharge are not obstructed

Turn on the heat pump unit and wait a few minutes for the system to start. Change operation mode or water temperature setting if required (it is recommended to retain default setting).

After testing is completed demonstrate the functions and operation of heat pump water heater components to the householder. Explain the need to drain the heat pump if freezing conditions are likely and when power may be shut off for an extended time.

Also explain the importance of performing maintenance in accordance with this manual. Leave the manual with the householder.

OPERATION OF CONTROLLER

When the heat pump turns on, the control system initiates and will check the unit's operating parameters. The controller will check on all sensors and pressure switches. If conditions are suitable (i.e all reading within the reasonable range) and there is enough energy available in the surrounding air, the fan and compressor will turn on.

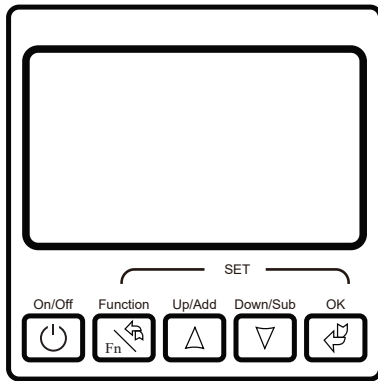
There will be 3 minutes delay from the time the heat pump is switched on before the fan and compressor begin operating.

The unit is self-regulating so there are no internal adjustments to be made during commissioning. When the unit is operated for the first time, it runs through an initial heat up cycle, allow time for the initial heat up cycle. Depending on the ambient conditions this can take several hours.

If for any reason the unit does not start, the water is cold and the controller unit is not displaying any LED lights, an electrician should test that power is available to the heat pump.

CONTROLLER LAYOUT AND KEYS

All major functions are controlled by the Control Panel situated in the enclosure on the right of the unit.



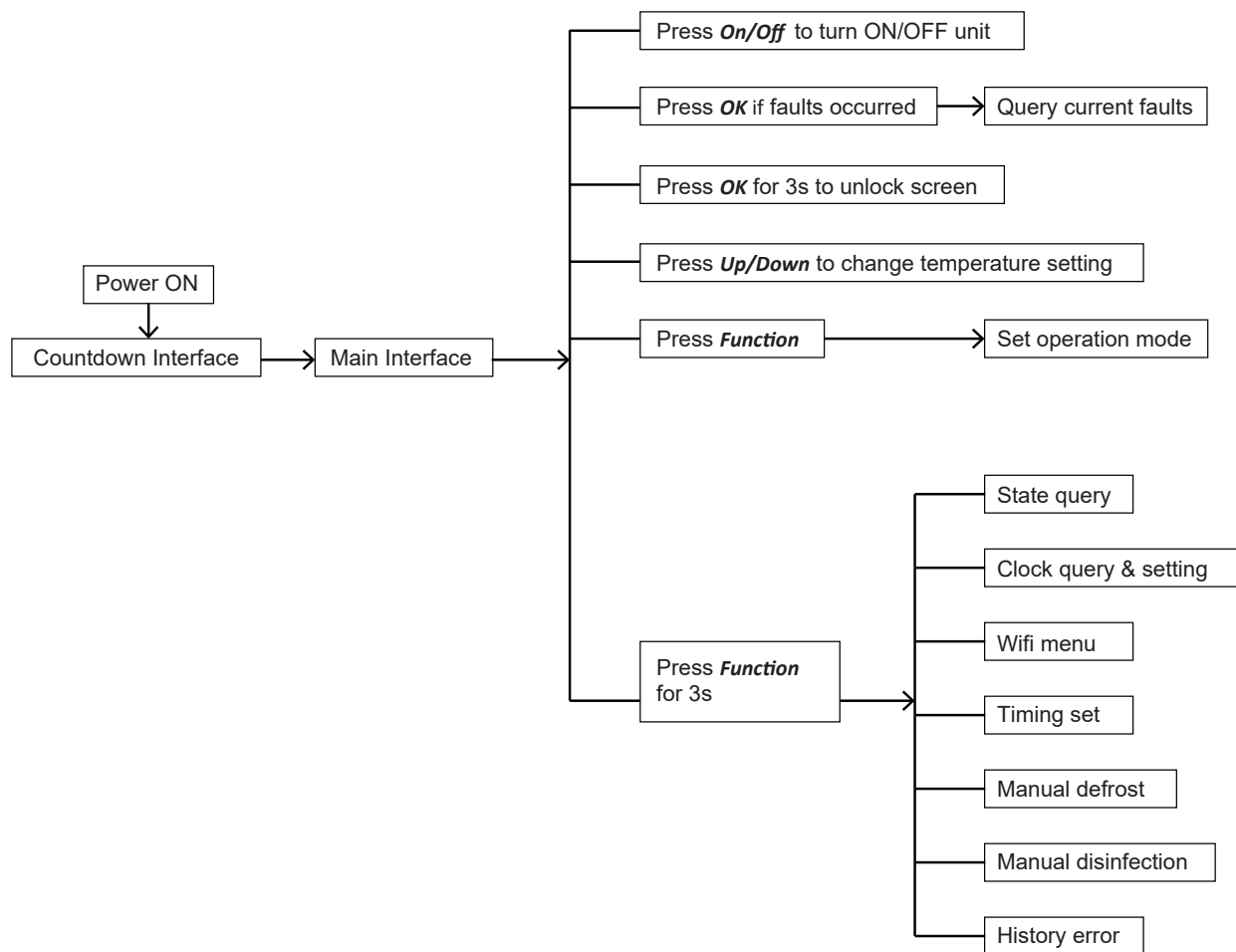
Note: Carefully flip up the weatherproof cover. To close, gently press it until the locking tabs at the bottom lock in place.

Key Primary Functions

The following table describes the primary function of each key on the controller.

Key	Icon	Primary Functions
Up/Add	△	Indicates that you can page up, select parameters and increase numerical values
Down/Sub	▽	It means that you can page down, select parameters and decrease numerical values
Function	Fn ↗	Represents function key icon, which is only used for menu, cancel, return and shift.
OK	↵	Represents confirm key icon, which is only used to enter, confirm, reset and unlock.
On/Off	⏻	ON/OFF switch key icon, only used to start and stop the unit.

Controller Operation Flow



CONTROLLER FUNCTIONS AND OPERATION

1. Turn ON/OFF the heat pump

When the unit is the first-time powered on, the display starts countdown interface. It enters main interface in 5 seconds automatically. Press 'On/Off' key to turn on the heat pump by following the prompt. Wait a few minutes for the unit to start heating. If the screen was locked, press 'OK' key for 3 seconds to unlock first.

When the unit is turned off, it will not operate, and the interface will display 'OFF' in the top left-hand corner.

The unit will enter the operation mode and setting it was in prior to shutdown (or factory default setting if it is the first-time powered on).

2. Unlock the screen

If there is no key operation for 60 seconds, the screen will lock automatically. Press any key to light the screen, and press 'OK' key for 3 seconds to unlock the screen.

3. Operation mode selection

Press 'Function' key to enter operation mode selection: ECO → STND → VACA → ELEC → HYBD. Press 'Up' or 'Down' to select and press 'OK' to confirm.

Note: the system default mode is ECO. When the unit is switched on for the first time, the system will operate under ECO mode. Subsequently, the unit will start in the mode setting it was in prior to shutdown.

Operation in the factory default ECO mode is assumed for energy saving calculations and is recommended for normal domestic hot water demand.

Operation in Standard, Hybrid or Electric mode is recommended during periods of higher than normal hot water demand and will increase purchased energy consumption.

No.	Symbol	Mode	Set Point - Factory Default (°C)	Restart Differential (°C)	Set Point Range (°C)
1	STND	Standard	60	5	45~60
2	ECO (Factory default)	Economy	55	12	45~60
3	HYBD	Hybrid	65	10	45~70
4	ELEC	Electric	70	8	45~70
5	VACA	Vacation	20	12	15~60

STANDARD Mode:

The user should select this mode for use in the commercial application. In this mode, the water heating is done by the compression system.

ECO Mode:

This is the default mode as the heat pumps leave the factory. In this mode, the water heating is done by the compression system.

HYBRID Mode:

In this mode, when the water temperature is below 60°C, water heating is carried out by the compression system. When the water is greater than 60°C, water heating is carried out by the resistive heating element.

ELECTRIC Mode:

In this mode, water heating is done by the resistive heating element.

VACATION Mode:

In this mode, water heating is done by the compression system. This mode is to be used when there is no need for hot water for an extended period of time

4. Water temperature setting

Press the 'Up' or 'Down' key to increase or decrease the water temperature setting value. The value changes by 1°C. It is recommended not to alter the factory default temperature setting.

5. Clock query & setting

Press 'Function' key for 3 seconds then press 'Up' or 'Down' to select 'Clock query', and press 'OK' key to enter the clock query & setting interface.

Press 'Up' or 'Down' to cycle the value and press 'Function' key to select year, month, day, hour, minute and second setting, then press 'OK' key to save the setting.

6. Timer setting

Press 'Function' key for 3 seconds then press 'Up' or 'Down' to select 'Timing set', and press 'OK' key to enter the timer setting interface.

The factory default timer is set to disabled. Once the timer is enabled, the 'Start time' and 'Stop time' will need to be set.

If the timer function is enabled, ensure the heat pump is scheduled to operate for at least 6 hours in warm climates and at least 8 hours in cold climates to ensure the water tank is adequately heated.

7. Operation state query

Press 'Function' key for 3 seconds then press 'Up' or 'Down' to select 'State query', and press 'OK' key to enter, then select 'System state query' to enter the operation status interface. See the following table for data query.

Item	Description	Unit	Note
1	EEV	step	Electronic expansion valve opening
2	Coil temp	°C	Coil evaporator temperature
3	Discharge temp	°C	Compressor discharge pipe temperature
4	Suction temp	°C	Compressor suction pipe temperature
5	EEV SV	°C	EEV superheat setting
6	EEV PV	°C	EEV current superheat
7	No frost EWD	°C	N/A
8	Frequency need	rpm	Compressor speed demand
9	Frequency now	rpm	Compressor current speed
10	Inverter volt	V	Inverter output volt (for reference)
11	Inverter curr	A	Inverter output current (for reference)
12	Inverter temp	°C	Inverter temperature
13	Inverter info	-	N/A
14	Invt.in.Curr	A	Inverter input current
15	Invt.Out.Power	-	Inverter output Power (for reference)
16	Fan 1 Set Speed	rpm	Fan speed demand
17	Fan1 Now Speed	rpm	Fan current speed
18	Invt.In.volt	V	Inverter input volt
19	Water in	°C	Water inlet temperature
20	Water out	°C	Water outlet temperature
21	Ambient temp	°C	Ambient temperature
22	CM FOUR	-	N/A
23	FAN_H CRANK	-	N/A

8. Manual defrost

Press 'Function' key for 3 seconds then press 'Up' or 'Down' to select 'Manual dfrst', and press 'OK' key to activate manual defrost operation. The unit performs manual defrost if certain conditions are satisfied.

9. Auto disinfection

If the water temperature setting is $< 60^{\circ}\text{C}$ cumulatively over a 7-day period, the heat pump will start disinfection automatically. After completion, it will re-clock. During disinfection, "Heat" and "Disin" flash alternatively on the display panel and the water will be heated up to 60°C .

If the water temperature setting is $\geq 60^{\circ}\text{C}$, then disinfection will not be commenced.

10. Manual disinfection

Press 'Function' key for 3 seconds then press 'Up' or 'Down' to select 'Manual disinf', and press 'OK' key to activate manual disinfection operation.

11. History error query

Press 'Function' key for 3 seconds then press 'Up' or 'Down' to select 'History err', and press 'OK' key to query historical errors.

CONNECTION OF EXTERNAL SIGNALS (OPTIONAL)



This type of connection **MUST** only be carried out by a qualified electrician.

1. Solar photovoltaic system

A solar photovoltaic signal can be integrated via the built-in dry contact input 'PV' on the terminal block. When the heat pump receives 'closed' signal from the solar PV system and the signal lasts for 30 seconds, the restart differential will temporarily change to 2°C for at least 10 minutes to take advantage of electricity generated on site to produce more hot water.

2. Off-peak electricity

Off-peak tariff signal can be integrated via the built-in dry contact input 'OP' on the terminal block. The terminals are pre-wired to bridge. Remove the bridge and connect off-peak signal if required. The unit will be only operating at receiving 'closed' signal. This feature accesses the heat pump to utilize off-peak electricity.



The unit can not be connected to OFF PEAK meters.

In this case the system will be OFF (No power when connected to this meter) causing, the disinfection timer to stop counting down.

If the water temperature drops below the required level for an extended period, there is a risk of legionella developing in the hot water system.

Wi-Fi Connection

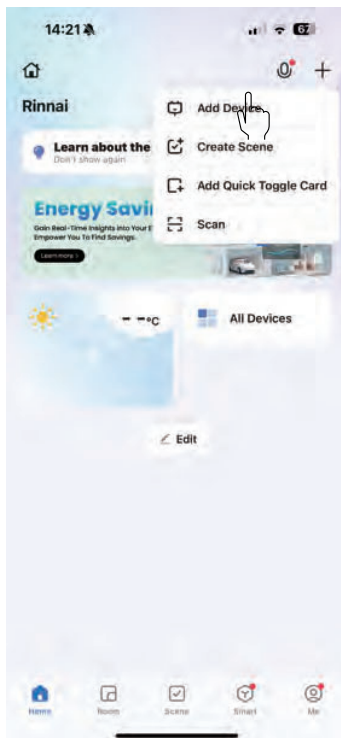
Please follow below steps to set up and operate Wi-Fi functions.

1. Prepare a Wi-Fi wireless router that can access the Internet, The Wi-Fi frequency band must be 2.4 GHz and should be placed within 10 meters of the water heater to ensure that a strong Wi-Fi signal is available.
2. Turn on Wi-Fi and Bluetooth on your device. After the connection is successful, you can turn off Bluetooth and operation will not be affected.
3. Scan the QR code below or search in the app market to download and install the 'Smart Life' App.
 - * iOS users – please download from App Store
 - * Android users – please download from Google Play

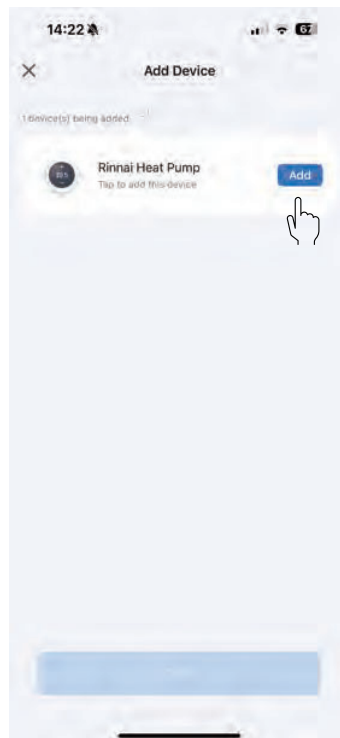


4. After completing the installation, open the App, register an account and log in according to the App prompt.

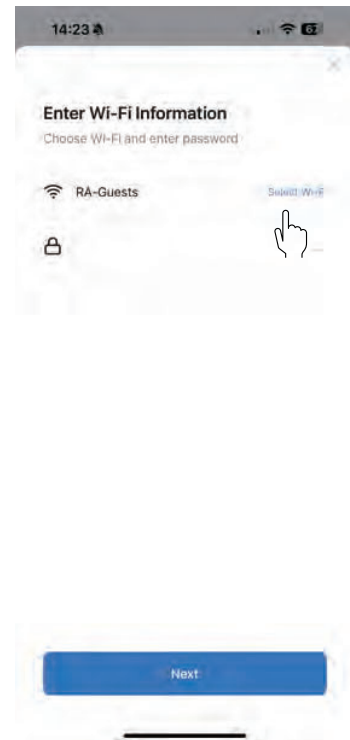
5. Connect to the SmartLife App as follows:



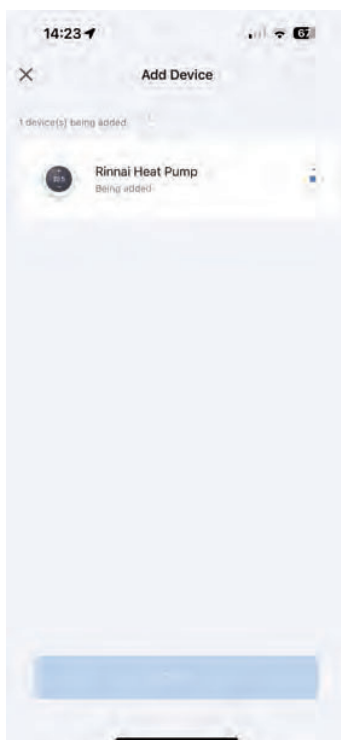
I) Search for Device



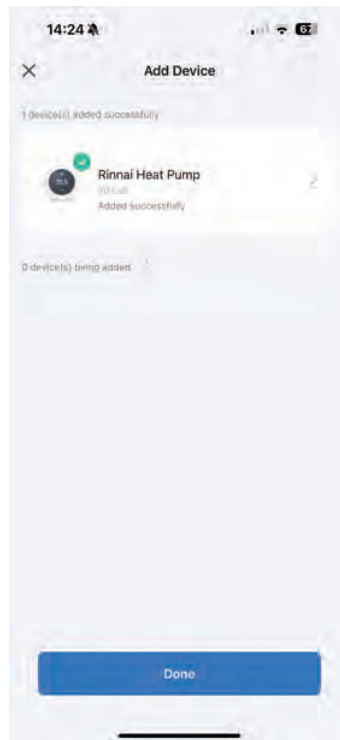
II) Add Found Device



III) Connect to Wi-Fi



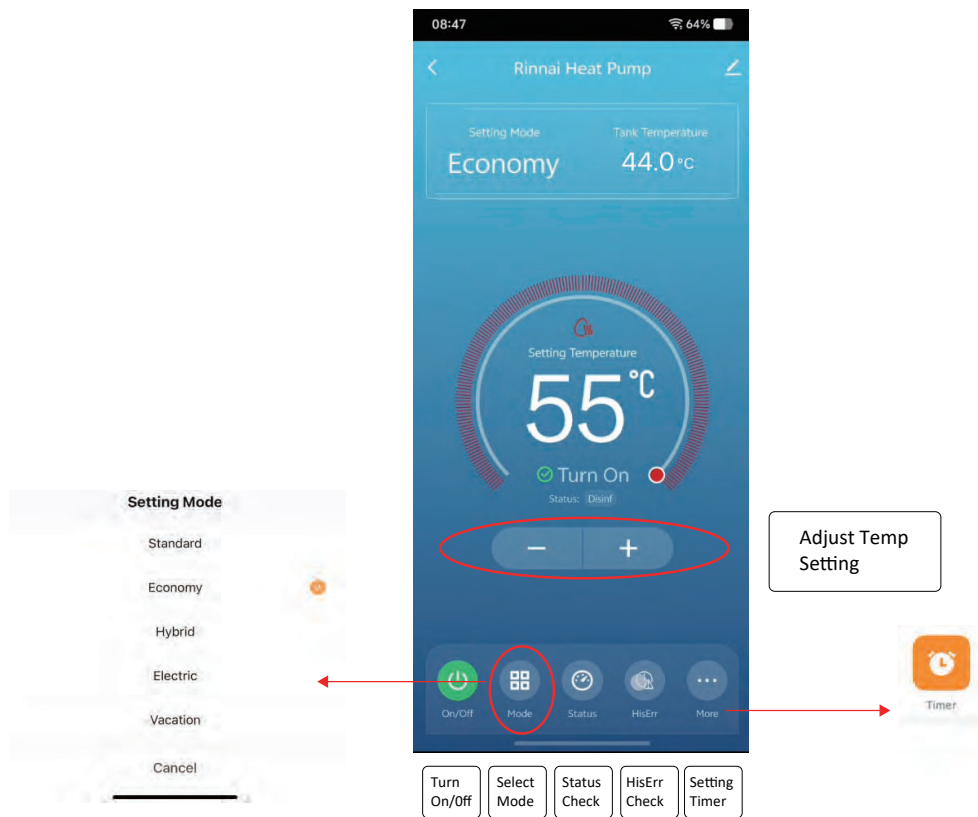
IV) Wait to Connect



V) Complete

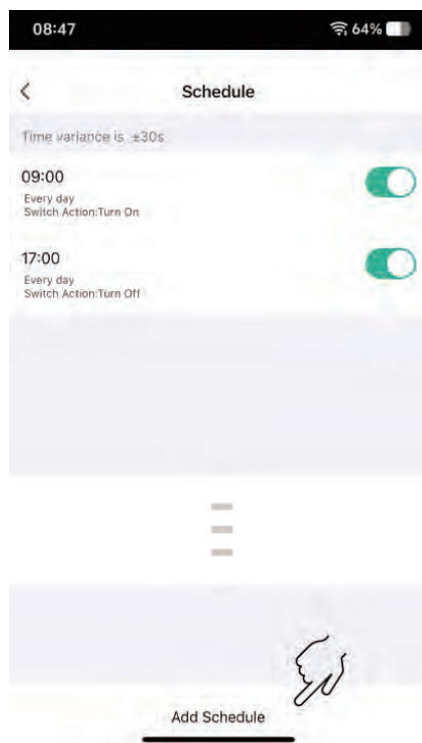
6. Control the Heat Pump with the App

The main controls for the App are laid out as follows on the App.



7. Set timer from the App

If the timer function is enabled, ensure the heat pump is scheduled to operate for at least 6 hours in warm climates and at least 8 hours in cold climates to ensure the water tank is adequately heated.



WI-FI TROUBLESHOOTING

Issue	Potential Cause
Configuration cannot be completed	Check that you are only connected to the 2.4 GHz WIFI frequency. You may be required to temporarily turn off you 5.0 GHz WIFI frequency at the modem during the configuration process.
	Check your WIFI signal strength at the hot water unit. You will require a minimum of 3 bars WIFI signal to be connected.
	Check you have the correct app downloaded.
	Check you have the minimum requirements as stated at the beginning of this manual.

COMMISSIONING CHECKLIST

Installer to complete and return to householder to retain for reference.

Item	Description	Complete (Yes/No)	Notes
1	Plumbing completed.		
2	$\frac{3}{4}$ " copper used for hot and cold water connections to the heat pump.		
3	Strainer installed on the cold water inlet line to the heat pump.		
4	Wiring completed.		
5	Heating element cable securely run & connected between tank and Heat pump unit.		
6	Tank sensor inserted to tank dry well with thermal paste, and sensor cable securely connected.		
7	Tank filled up with water and system is purged by PTR valve and taps.		
8	Make sure there is no leakage of water from any connection.		
9	Heat Pump is plugged in.		
10	Turn on the system from the display panel on the right side of the heat pump. The heat pump will start within 5 minutes.		
11	Touch water connections; top connection should feel warmer than the bottom connection.		
12	Perform site cleanup after installation.		
Signed			
Date			

Rinnai Australia Pty Ltd

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Tel: (03) 9271 6625

Customer Support

Tel: 1300 555 545*
Monday to Friday, 8.00 am to 5.00 pm EST.

After Hours Hot Water Service Line

Tel: 1800 000 340*

*Cost of a local call may be higher from a mobile phone.
(National calls from public phones in Australia are free.)

For further information visit www.rinnai.com.au
or email enquiry@rinnai.com.au

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www.rinnai.co.nz
youtube.com/rinnainz
facebook.com/rinnainz
or email info@rinnai.co.nz

Rinnai has a Service and Spare Parts network with personnel who are fully trained and equipped to give the best service on your Rinnai appliance. If your appliance requires service, please call our Customer Support. Rinnai recommends that this appliance be serviced every 2 years.

With our policy of continuous improvement, we reserve the right to change, or discontinue at any time, specifications or designs without notice.