Solahart manufactures "solar thermal" systems. These are mainly used for generating hot water for any application.

"Solar Electric" or "Photovoltaic" (PV) systems are beyond the scope of this manual. For the benefit of the reader a brief performance comparison between "solar thermal" and "photovoltaic" systems is shown on Section 15-1.

There are two main categories in "solar thermal" systems:


### "PASSIVE " AND "ACTIVE"

A **"Passive"** system relies on a natural principle – "Thermosiphon". In these systems, the storage cylinder is always located higher than the collectors. As the sun's rays hit the surface of the collector, the temperature of the fluid in the collectors rises making it less dense or lighter. This hot and lighter fluid naturally moves to the top of the collector and via the pipe work into the storage cylinder, transferring the energy from the collectors to the storage cylinder. This makes the fluid colder and heavier and moves to the bottom of the collectors. This continuous displacement occurs naturally. These are often referred to as **"PASSIVE" OR "THERMOSIPHON" systems.**

An **"Active"** system uses a circulating pump, operated by an electronic controller, which circulates the closed circuit fluid or potable water, through the collectors. The energy in the collectors, normally located on the roof, is transferred to the closed circuit fluid or potable water and returned to a storage cylinder, normally located at ground level below the level of the collectors. These systems are also referred to as **"PUMPED" or "SPLIT" systems.**

A further classification in solar thermal systems is the **"Open Circuit"** system and the **"Closed Circuit"** system.

In an **"Open Circuit"** system the potable water flows through the collectors, whereas in a **"Closed Circuit"** system our unique *Hartgard* fluid flows through the collectors and a jacket that envelopes the main storage cylinder or a heat exchanger. The suitability and selection of an **"Open Circuit"** or a **"Closed Circuit"** system is discussed later in this manual.

### THE PRODUCT RANGE

- Residential Thermosiphon system
- Streamline Split system – 'open circuit' split system
- PowerPak – 'closed circuit' split system
- Non Residential system – 'closed circuit' split system
- Heat Pump
- Mounting Frames
- Gas Booster
- Accessories

## "PASSIVE" OR "THERMOSIPHON" SYSTEMS


This group of products is normally referred to as **"passive"** or **"thermosiphon"** systems and comprises

- A Storage Cylinder
- One to four Collectors

The Storage Cylinder is of three types

- 'J' Cylinder for "Closed Circuit" systems
- 'K' Cylinder for "Closed Circuit" systems
- 'L' Cylinder for "Open Circuit" systems


The 'J' Cylinder is constructed with a jacket enveloping the main Storage Cylinder, normally referred to as a mantle heat exchanger.
The 'K' Cylinder is similar in construction to the 'J' cylinder. There are additional features, such as a 33 mm anode and the ultra efficient insulation.
The 'L' cylinder is a standard cylinder without the jacket.

All the above cylinders are insulated with high density CFC free polyurethane foam and encased in aluminium.
Each type of cylinder is manufactured in several storage capacities

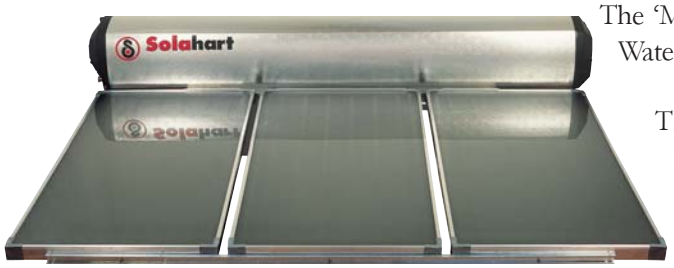
- 150 litres
- 180 litres
- 220 litres
- 300 litres
- 440 litres

All types of cylinders are suitable for mains pressure connection with a maximum inlet pressure of 850 kPa.


Collectors are manufactured and supplied to suit both the open circuit and closed circuit systems.

- 'F' Series – suitable for "Open Circuit" Systems only
- 'J' Series – suitable for "Closed Circuit" Systems only
- 'K' Series – suitable for "Closed Circuit" Systems only
- 'L' Series – suitable for "Open Circuit" Systems only
- 'B' Series – suitable for both "Open" & "Closed Circuit" Systems

The 'L' series collector is not suitable for "Frost Prone and Harsh Water Regions"




The 'M' series collector is not suitable for "Frost Prone and Harsh Water Regions" when used in an "open circuit" configuration.

The recommended combinations of storage cylinder and collector(s) to form complete systems is shown below:
151J 151K 151L
181J 181K 181Freeheat 181L 182J 182K 182Freeheat 182L
221J 221K 221L 222J 222K 222L
301J 301K 301Freeheat 301L 302J 302K 302Freeheat 302L 303J 303K 303Freeheat 303L
443J 443K 443Freeheat 443L 444J 444K 444Freeheat 444L

### EXAMPLES:

151J is a 150 litre 'J' Storage Cylinder with 1'J' series Collector
302K is a 300 litre 'J' Storage Cylinder with 2 'K' series Collectors
443L is a 440 litre 'L' Storage Cylinder with 3'L' series Collectors

These systems can be installed with the collectors on the roof or at an elevated location above the storage cylinder. The storagecylinder can be installed at ground level or at a location below the level of the collectors.

## "STREAMLINE" SYSTEMS

The Streamline series of split system water heaters can be utilised with either the 'L' collector for medium-high solar radiation, non-frost areas, or, the 'F' collector for low-high radiation, frost prone areas.

There are 4 tank capacities as follows;

- Electric Boost Systems - 270 litres, 340 litres & 430 litres, these Systems are supplied with 3.6 kW elements fitted in the Storage cylinders as standard.
- Gas Boost Systems - 260 litres

## "HEAT PUMP" SYSTEMS

The heat pump refrigeration technology used in this energy efficient Synergy hot water system, is widely used in Europe and the United States and is now available in Australia.

The Synergy uses an evaporator coil containing low pressure liquid refrigerant, a compressor and a heat exchanger to absorb the energy from the ambient air and transfers it to the water. The heat pump works on a similar principle to a refrigerator, except in reverse.

Synergy systems are available for residential.

- 275 litre Storage Cylinder

## "NON RESIDENTIAL (HEAT STORE)" SYSTEMS

Non Residential (Heat Store) systems are manufactured in three capacities and supplied as a package with the Heat Store and a predetermined number of 'M' Collectors.

- 2500J - 2500 litres and between 15 and 24 'M' collectors
- 3500J - 3500 litres and between 25 and 42 'M' collectors
- 6500J - 6500 litres and between 43 and 96 'M' collectors

Each size of Heat Store is fitted and supplied with the relevant circulating pump, necessary controls and different types of boosting. Boosting in available via optional, electric or gas or electric & gas or bio mass or coal or steam subject to client specifications.

| | Electric Gas | Electric & Gas |
|---|---|---|
| • 2500J | 19.2 kW275 MJ/hr | 19.2 kW & 275 MJ/hr |
| • 3500J | 33.6 kW345 MJ/hr | 33.6 kW & 345 MJ/hr |
| • 6500J | 48.0 kW420 MJ/hr | 48.0 kW & 420 MJ/hr |


## "POWERPAK" SYSTEMS

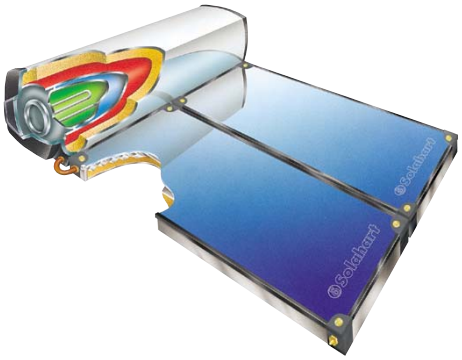
The PowerPak system is a "Solar Energy Transfer Module" and has a wide range of applications. These systems are specifically designed for, but not limited to, use in frost prone regions, ***hard water*** areas and for hot water demands ranging between 300 and 1,200 litres per day. The PowerPak systems are designed for connection to remote storage systems and are supplied as a 10 kW Module.

A 10 kW Module comprises a Heat Exchanger and an insulated drain back cylinder that has a capacity to be coupled with up to 8 Collectors.

## PASSIVE OR THERMOSIPHON SYSTEMS

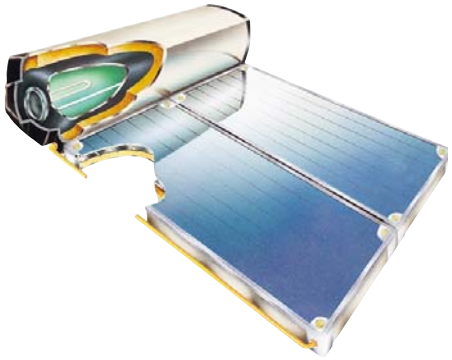
The Solahart "passive" solar hot water systems rely on the natural thermosiphon principle for circulation of the heated water or fluid in the collector to the storage cylinder or the jacket that envelopes the storage cylinder. As the solar radiation heats the water or fluid within the collector it becomes less dense and therefore lighter than the water or fluid stored above it in the storage cylinder or the jacket. This causes the cold (heavier) water or fluid to flow down to the collector and push the heated (lighter) water or fluid up into the storage cylinder or jacket.

The flow rate through the collector circuit is dependant upon the temperature difference between the storage cylinder or jacket and the collector. The greater the temperature difference, the higher the flow rate. As the sun leaves the collectors, the fluid begins to cool and becomes heavier than the fluid in the storage cylinder or jacket. This causes the thermosiphon circulation to stop. There is no heat loss from the storage cylinder or jacket to the collectors because the cold (heavy) fluid remains in the collectors and prevents recirculation of the hot (lighter) fluid.



### CLOSED CIRCUIT THERMOSIPHON FLOW PATTERN

The collector fluid hot return pipe to the jacket is located on the left side and the cold down pipe on the right. As the hot collector fluid is pushed into the jacket it rises along the outside of the main vessel wall whilst transferring the energy through the cylinder wall into the potable water. During this process the collector fluid gradually transfers heat (becoming heavier) and falls toward the cold down pipe connection on its way to the bottom of the collector. This process pushes the hotter (lighter) fluid back via the hot return pipe to the jacket. This movement of the fluid is a continuous process.



### OPEN CIRCUIT THERMOSIPHON FLOW PATTERN

The potable water in the bottom of the tank flows down the cold down pipe at the left hand side of the collector and enters the bottom collector header pushing the heated water up within the collector. The heated water flows from the collector top header via the hot return pipe into the centre of the tank.

The location of the cold water inlet on the elbow of the collector cold down pipe enables the cold water to enter the tank without forcing cold water into the collector.

The use of open circuit systems is restricted to frost-free and good potable water quality areas. If used in areas where the potable water has a high mineral content, calcification of the collector riser tubes may reduce system performance.

### STORAGE CYLINDER

#### Special Features

All Solahart storage cylinders are suitable for mains pressure applications. The positive domed storage cylinder is fabricated from 2.5 mm hot-rolled, low-carbon steel sheet. The steel connection fittings are designed such that after enamelling, the vessel is free of bare steel surfaces.

The steel connection fittings are robot welded to the domes, the cylinder body is rolled and welded, and the completed domes welded to the cylinder body to form a storage cylinder. It is then filled with water and hydraulically pressurised to 2,100 kPa (300 psi) to ensure structural integrity of the weld seams. Finally, the storage tank is rapidly dried and placed into a shot blaster to prepare the internal surface for ceramic lining.

Note: A completely finished storage cylinder is chosen at random periodically and tested in a NATA accredited laboratory to achieve 250,000 pressure pulsations from 0 kPa to a maximum working pressure of 1,200 kPa to comply with Australian Standard AS1056.

## Ceramic Lining

The internal surface of the storage cylinder is lined with two coats of ceramic lining (also known as vitreous enamel). This is to protect the steel surface of the storage cylinder against corrosion. Ceramic lining is considered to be the best method of corrosion protection available for hot water cylinders. Solahart adopted this process for a number of reasons including:

- **resistance to corrosion**
- **resistance to permanent scale deposition**
- **resistance to high temperatures**

The Solahart Primaglaze® process incorporates two enamel formulations:
- **X-class Enamel:** high adherence at 75°C operating temperature, ground coat, blue colour, 0.16 mm thick. Designed to readily adhere to all exposed bare metal surfaces within the storage cylinder when fused at 860°C.
- **Y-class Enamel:** high temperature resistance, low solubility 95°C operating temperature, cover coat, green colour, 0.15 mm thick. Designed to adhere to the ground coat and provide exceptional coverage efficiency and long life at an operating temperature higher than 99°C after being fused at 860°C.

A total thickness of ceramic lining of approximately 0.3 mm. This is the result of two bonded coats and complies with Australian Standard AS4020.

## Anode

All storage cylinders are fitted with a replaceable magnesium anode (alternate aluminium alloy anodes are also available for exceedingly harsh water regions).

The purpose of the anode is to combat the impurities present in most water supplies. The anode also protects the electric element that is electrically isolated from the tank except for a single current path limited by a 560 Ohm "bleed resister". This allows the anode to provide a controlled level of protection to the booster element.

Essentially the life of the anode is determined by its natural solubility in the water in which it is immersed. For this reason, the life of the anode is quite variable. Due to this variation in actual life, it is recommend that as a matter of caution all anodes be replaced at the end of the warranty period of the system.

The recommended anode change period is listed in the Owner's Manual supplied with the Storage Cylinder.

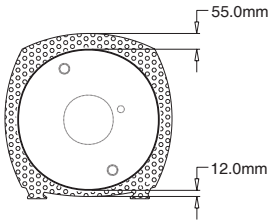
Aluminium anodes should only be used where the Total Dissolved Solids (TDS) content is greater than 1,000 ppm.

## Soft Flow Water Stratifier

The Soft Flow Water Stratifier prevents mixing of the cold water entering the storage cylinder with the hot water already contained therein. This promotes thermal stratification of the contents of the storage cylinder.

The water stratifier achieves this through a combination of its conical shape and inverted outlet slot. The stratifier reduces the velocity of the incoming water and thereby dissipates the inertia. The cold inlet water flows through the stratifier via the inverted outlet slot and lies on the bottom of the vessel. The temperature of the hot water already in the tank is therefore not diluted and as a result, the hot water delivery capacity of the system is enhanced.

The water stratifier is moulded from polypropylene (PPK 2032) which is inert, non toxic and approved for use in hot water systems as specified in Australian Standard AS 4020.




## Storage Cylinder Insulation

The storage cylinder is fully encased in pressure injected CFC free polyurethane foam. This has a very low thermal conductivity, (about half that of fibreglass – 40 mm of polyurethane has similar insulation properties as 70 mm of fibreglass).

All storage cylinders are designed to have thicker insulation at the top two thirds which is the hot section. The bottom third section of the storage cylinder has comparatively less insulation so that in summer, if the total water volume reaches 90°C, excess heat is dissipated through the bottom of the vessel.

The asymmetric insulation profile is very deliberate and arranged in a way that it is proportional to the normal, stratified temperature of the water volume. Heavier insulation over the upper sections of the storage cylinder ensures that the hot water is kept hot for extended periods. Lighter insulation over the lower sections of the storage cylinder allows a controlled level of heat rejection through the bottom section.

A fully foam-encapsulated storage cylinder ensures that there is no direct heat flow path through the foam. The foam adheres to both the outer case and the surface of the storage cylinder, thereby forming a vapour-tight skin. The skin ensures the polyurethane foam retains its high insulating qualities.

## Storage Cylinder Outer Casing

**"Passive"** or **"Thermosiphon"** Systems: The external case of the storage cylinders are made from two sheets of aluminium that are lock seamed together. The top section is 0.4 mm thick with a stucco finish and the base is 0.7 mm thick and has a brush finish.

The polypropylene end covers ensure weather sealing to the case edges and the fittings. Concealed hand grips built into the end covers ensure ease of carrying. The case body and end covers derive considerable strength and rigidity from the high density CFC free polyurethane foam insulation that adheres to all internal surfaces including the polypropylene end covers.

The material used for the end covers is polypropylene utilising the most effective combination of chemical stabilisers and finely ground carbon black. This gives excellent stability under prolonged exposure to ultra-violet radiation, and high temperatures. Field experience and 18 years of in-house tests prove that the material is stable and inert. It will retain its toughness and flexibility without cracking in sunlight and is durable over a wide range of temperatures.

"Active" Systems: The outer casing of these storage cylinders as well as the base are made from 0.45 mm thick colorbond, manufactured by BHP. The top cover is made from UV stabilised ABS. This allows the storage cylinder to be installed outside while still being protected from the vagaries of the environment.

## Pressure & Temperature Relief Valve

From a statutory compliance and safety perspective, this is the most important valve in the system. It must be fitted to all un-vented systems. Only systems that are permanently open vented do not require this valve.The valve is located in the hot water outlet connection to the storage cylinder through the tee adaptor. The valve probe extends through the tee adaptor and into the vessel.

The P & T valve is designed to relieve water at a pressure of 1,000 kPa or a water temperature of 99° C.

## Combination Inlet Valve

This valve assembly comprises:

- An isolating valve to turn off the water supply to the system should it be necessary at the time of service.
- An in-line water strainer to prevent any solid particles from entering the storage cylinder.
- An in-line water check (non return) valve. In addition to complying with local regulations it is installed to ensure that the flow of water is unidirectional and also to prevent the water in the storage cylinder from draining out.
- A cold water relief valve to relieve water from the storage cylinder should it be subjected to any back pressure in excess of 850 kPa.

## Heat Dissipation System

This patented design dissipates excess energy in the storage cylinder to the outside atmosphere. In installations where there is low consumption of water or no consumption of water for prolonged periods (eg. summer vacation), energy tends to build up in the storage cylinder. Any energy above 75° C in the middle of the storage cylinder is dissipated through the heat dissipator to the outside atmosphere.

The Heat Dissipation Pipe should be installed with systems with 'K' collectors or 'J' collectors in areas of high solar radiation, such as Northern Australia, Hawaii and Malaysia.


## HARTGARD

Hartgard is a special fluid developed by Solahart to prevent solar hot water systems from freezing and to protect against corrosion. Hartgard is used only in closed circuit, "thermosiphon" and "pump"systems.

Hartgard is made up of four components and all of them are food-grade chemicals approved by the US Food and Drug Administration for use in food manufacture:

• Propylene Glycol is the main component (90% v/v) and is a food-grade, anti-freeze substance which is used in a range of foods including ice-cream. Its role is to prevent the water in the closed circuit system from freezing.

• DiPotassium mono hydrogen phosphate is a corrosion inhibitor which acts by raising the alkalinity of the water to a pH level of 8.5 to 9.0, making the water "softer" and less corrosive.

• Edicol blue dye is a food colouring dye and is added to give the "closed circuit" a light blue colour to distinguish it from the colour of water.

• Distilled water is used to mix all the above chemicals.

***Anti-Freeze Property:*** The mixture in the "closed circuit", of water and Hartgard will remain in a liquid state and continue to circulate through the collector until the water temperature drops to -10° C. Water begins to crystalise at this temperature. The thermosiphon action will stop when the temperature reaches -15° C. However, it will remain stable and not expand until the temperature falls to -40° C. In areas where temperatures are likely to fall below -40° C, the quantity of Hartgard is doubled to further lower the freezing point.

***Anti-Corrosion Property:*** The presence of DiPotassiun mono hydrogen phosphate in Hartgard helps to raise the pH level of the mixture to between 8.5 and 9.0, making the mixture "softer". Potable water at a pH of 7.0 is neutral. At a pH below 7.0 water is acidic and a pH above 7.0 water is alkaline. The alkalinity inhibits corrosion.

Some households and establishments depend on rain for their water supply. Rain water is normally collected via the gutters of the building into a holding tank. Care should be taken at the time of commissioning so as not to spill the Hartgard on the roof. Gutters should be blocked to isolate the rain water holding tank and any spilt Hartgard should be mopped up so it does not flow into the tank.

Although the "closed circuit" mixture of Hartgard and water is safe for human consumption, it upsets the bacteriological balance by settling on the water surface and depriving the bacteria of oxygen. This kills the bacteria which results in a foul odour. The water is fit for consumption but the strong foul odour makes it distasteful. The water in the rain water holding tank should be emptied and refilled.

## STREAMLINE

The Streamline is an "active" or "pumped" system where the collectors are installed above the storage cylinder. An "open circuit" system, it is designed to:

- Provide the flexibility to design the home with the collectors on the roof and the storage cylinder at a lower level than the collectors.
- Provide a solar option where aethestics are important, eg. a north facing frontage.
- Limited roof area, where a "thermosiphon" system cannot be installed.
- Roofs with limited structural strength to support the total weight of a "thermosiphon" system.

### HOW DOES IT WORK:

The system is fitted with a sensor at the collector outlet and another located on the storage tank. A temperature difference of 8°C between the two sensors activates a circulating pump that moves the water from the bottom of the storage cylinder to the collectors. The solar energy from the collectors is absorbed by the water and returned to the storage cylinder. The pump continues to circulate the water until the temperature difference falls to 4°C. This system is designed to be used with either 'L', for areas of medium-high solar gain without frost, or, 'F' collectors, for areas of low-high solar gain where the temperature does not fall below 10° C.

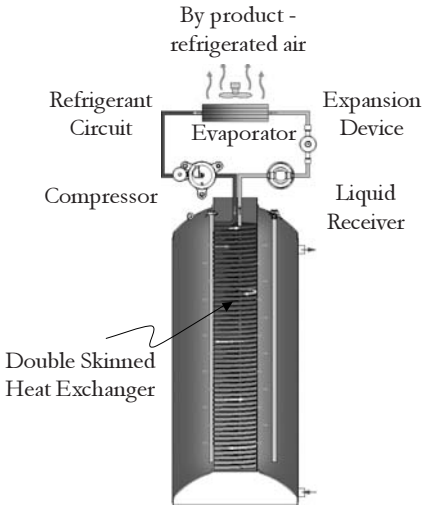

***Electric Boost:*** The storage cylinder comes fitted as standard with a 3.6 kW element, however elements ratings from 1.8kw through to 6.0kw are available. The system is available in 3 tank sizes; 270 litres, 340 litres & 430 litres.

***Gas Boost:*** Gas boosting is available for Natural, Propane and Butane gas types. The gas booster is controlled by a 7-day programmable timer that allows the owner to boost automatically or manually. The system is available in 260 litres.

## SYNERGY

The Synergy Heat Pump has the following features;

- Temperate climatic regions, with optimum performance in tropical or dry climate zones.
- It operates day or night 24 hours a day.
- It can be installed in direct sunlight or no sunlight.
- Has an inbuilt automatic electric booster.
- The unit can be located in any convenient outdoor location.




### HOW DOES IT WORK:

This innovative and efficient system of energy collection and transfer from ambient air to the potable water uses the simple principle of a refrigerator. There are very few mechanisms which have the ability to transfer energy from one state (air) to another state (water), while consuming less energy than that transferred to the new medium (water).

The operation of a Heat Pump is based on the fact that ambient air (even cold air) contains energy. The Synergy uses an evaporator coil containing low pressure liquid refrigerant which is cooler than the ambient air, to absorb heat from the warmer ambient air. This heated refrigerant moves to the compressor where it is becomes superheated before passing through the internal heat exchanger, emersed in the water, releasing its heat energy to the water. The cycle now begins again when the refrigerant, now liquid is pumped back to the evaporator coil.

### APPLICATIONS:

The Synergy can be used in domestic households, hotels, motels, restaurants, bars, rest rooms, health clinics and similar establishments. For greater hot water demands, multiples of these systems can be used.

The Synergy is available in a 275 litre storage capacity.

## PowerPak


The PowerPak, an "active", "closed circuit" system is versatile in its application. The collectors must be installed at a higher level than the storage cylinder. The system can be coupled to either 'M' or 'B' copper collectors that allows it to be used in varying conditions as described below:

- Cold climate or frost prone regions. As an example, a system is currently operating successfully at the Davis station in the Antarctic.
- Poor water quality areas, where the mineral content and the Total Dissolved Solids (TDS) content is high.
- Limited roof area and structural strength.
- Gives the architect the flexibility to install the collectors on the roof and the storage cylinder at a convenient location at a lower level.
- Caters to varying hot water demands, from 300 to 1,200 litres per day.
- Allows for continued use of existing storage cylinders.

### WHAT IS A POWERPAK:

It is a solar energy transfer module that is made up of the following components:

- A fully insulated "drain back" cylinder.
- A highly efficient flat plate "heat exchanger".
- Two circulating pumps – one each for the "closed" and "potable" circuits.
- A minimum of 2 to a maximum of 8 collectors.

The PowerPak is designed to be coupled with a external storage cylinder.

### HOW DOES IT WORK:

The circulating pumps are controlled by a combination of "User Selectable" functions and an overriding "Temperature Comparator" system. The user has the opportunity to select between "OFF", "MANUAL" and "AUTOMATIC". The "Temperature Comparator" system monitors the collector array temperature and the temperature of the potable water storage system. The circulating pumps commence circulation of both "closed" and "potable" circuits when useful energy is available and required. The circulation continues until the "Temperature Comparator" determines that there is insufficient energy to be collected. For normal operation the customer should select "AUTOMATIC".

### *Drain Back Principle:*

When there is insufficient energy to collect, the circulating pumps stop. This allows the "closed circuit" fluid to return to the "drain back" cylinder preventing high stagnation temperatures that are detrimental to the system. Another distinct feature of the "Drain Back" principle is that the "closed circuit" which is a mixture of "Hartgard" and water continues to retain its freeze protection properties. This makes the PowerPak system suitable for installation in frost prone regions.

### APPLICATIONS:

The PowerPak is varied in its application, some are listed below;

- A typical domestic household where the customer wishes to incorporate solar energy to the existing hot water service.
- Room heating, either via Hydronic heating or radiators.
- Hotels, Motels, Restaurants and Caravan Parks
- Small to medium health clinics, surgeries and similar establishments.
- Multiple Modules of PowerPak systems can be installed for hot water demands in excess of 1,200 litres per day.

The PowerPak is available in a 10 kW Module with up to 8 'M' or 'B' collectors.

The Non Residential Systems are large, "active", "closed circuit" systems to cater for hot water demands in excess of 2,500 litres per day. These systems use a "drain back" principle and hence the collectors must be installed at a higher level than the heat store. The 'M' or 'B' collectors and the "drain back" principle make these systems suitable for any situation:

- Cold climate or frost prone regions. Many systems are currently operating success fully in Europe and other colder regions.
- Poor water quality areas. A number of these systems are successfully operating in Alice Springs where the water quality is known to be very hard.
- Large varying hot water demands ranging from 2,500 litres to 10,000 litres per day.

### WHAT IS A NON RESIDENTIAL SYSTEM:

It is a large solar hot water system made up of:

- A fully insulated Heat Store that is built with both the "closed" and "potable" circuits in one integral unit.
- The Heat Store is fitted with a circulating pump for the "closed" circuit to pump the fluid through the collector array.
- A gas boosted system is fitted with another circulating pump to circulate the "closed" circuit fluid through a separate stand alone gas package.
- An electric boosted system is fitted with electric elements to heat the "potable" circuit in the Heat store.
- The Heat Store is connected to a set of 'M' collectors ranging from 16 to 96 depending on the size of the Heat Store.

### HOW DOES IT WORK:

***Closed Circuit:*** The system is fitted with a sensor in the Collector Array to measure the hottest point and a sensor in the bottom of the Heat Store to measure the coldest point in the system. A temperature difference of 5°C between the two sensors activates the circulating pump that moves the "closed circuit" fluid in the Heat Store to the collectors. The solar energy from the collectors is absorbed by the fluid and returned to the Heat Store. The energy is transferred to the "potable" circuit via the cylinder wall of the potable cylinders. The pump continues to circulate the fluid until the temperature difference falls to 2°C.

***Potable Circuit System:*** The ceramic lined cylinders that form the potable circuit are arranged in multiple layers. A parallel-series arrangement of the potable cylinders ensures that the full potable volume is ready for use at the design temperature of 60°C and at the maximum draw off rate possible.

***Drain Back Principle:*** When there is insufficient energy to collect or when the system has reached the set temperature, the circulating pump stops. This allows the "closed circuit" fluid to return to the Heat Store. The energy is now stored in the Heat Store. Returning the "closed circuit" fluid to the Heat Store prevents high stagnation temperatures in the collector array, that are detrimental to the system.

### APPLICATIONS

Non Residential Systems are suitable for facilities where large volumes of hot water are required, such as Hotels, Hospitals, Caravan Parks, Prisons, Factories including process water, industrial heating, large messes or kitchens and similar establishments.

The Non Residential Systems are available in three capacities:

- 2500J Heat Store with 15 to 24 'M' Collectors
- 3500J Heat Store with 25 to 42 'M' Collectors
- 6500J Heat Store with 43 to 96 'M' Collectors

Electric or Gas Boosting or both Electric and Gas Boosting options are available.

## COLLECTORS

All collectors conform to Australian Standard AS2712. Casing and Glass specifications are common to all collectors.

• **Glass:** The collector glass is 3.2 mm thick and has a very low iron content of 0.04%. The glass is tempered to conform to Australian Standard AS2208-1975. It has a minimum solar radiation transmittance of 94% and weighs 16 kg.

• **Insulation:** The bottom insulation is a 40 mm thick grey polyester batt. The inside perimeter of the collector tray is insulated with 13 mm thick polyester. The insulation is rated R0.61 with a Thermal Conductivity of 0.059 W/m.°C @ 23°C.

• **Casing:** The collector tray or casing is made from 0.7 mm thick marine grade Aluminium alloy H3004 Temper H32.

### 'KF' COLLECTORS

This highly efficient collector is designed for use with "closed circuit" systems only.
**Application:** This collector is suitable for "closed circuit" systems only of both the "Thermosiphon" and "Pump" type.
**Products:** "Thermosiphon" systems – 151K, 181K, 182K, 221K, 222K, 301K, 302K, 303K, 443K, 444K and all Free Heat & Black Chrome XII systems.
**Products:** "Pumped" systems – PowerPak and EnergyPak.
**Construction:** The absorber is made from two sheets of 0.6 mm thick pressed steel forming 25 mm headers and 35 risers. The two sheets are spot welded and seam welded to create a sealed collector. This multiflow construction ensures a high surface area for absorption, thereby transmitting a large amount of energy to the "closed circuit" fluid.
**Surface Finish:** The absorber is nickel plated on both sides and then plated with Black Chrome to have an Absorptivity factor of 0.95and an Emittance factor of 0.10.
**Connections:** The collector sockets are 20 mm (3/4" BSP) steel and complemented with teflon coated cones to provide a perfect water tight seal. A torque arrester prevents the sockets from being subjected to extreme force.
**Weight:** The completed collector weighs 40 kg empty and 43.8 kg full.

### 'J' COLLECTORS

This collector is designed for use with "closed circuit" systems and is suitable for installation where radiation levels are high. This collector is most suitable for areas with high solar radiation, such as Alice Springs, North West Australia, .
**Application:** This collector is recommended for use with "closed circuit" systems of the "Thermosiphon" type.
**Products:** "Thermosiphon" systems – 151J, 181J, 182J, 221J, 222J, 301J, 302J, 303J, 443J, 444J and all J Free Heat & AS XII systems.
**Construction:** The absorber is made from two sheets of 0.6 mm thick pressed steel forming 25 mm headers and 35 risers. The two sheets are spot welded and seam welded to create a sealed collector. This multiflow construction ensures a high surface area for absorption, thereby transmitting a large amount of energy to the "closed circuit" fluid.
**Surface Finish:** The absorber is finished with a black polyester powdercoat. This finish ensures stable performance in high solar radiation conditions. The collector performance drops at elevated temperatures.
**Connections:** The collector sockets are 20 mm (3/4" BSP) steel and complemented with teflon coated cones to provide a perfect water tight seal. A torque arrester prevents the sockets from being subjected to extreme force.
**Weight:** The completed collector weighs 40 kg empty and 43.8 kg full.

### 'L' COLLECTORS

This collector is designed for use with all "open circuit" systems and is suitable for installation at all levels of radiation. This collector is not suitable for installation at locations where the water is very high in mineral content and very high in Total Dissolved Solids and the location is subject to frost.
**Application:** This collector is suitable for "open circuit" systems only of both the "Thermosiphon" and "Pump" type.

## 'L' Collectors Cont...

**Products:** "Thermosiphon" systems – 151L, 181L, 182L, 221L, 222L, 301L, 302L, 303L, 443L and 444L. "Pump" systems – Streamline.
**Construction:** The skeleton of the absorber is made from two 25.4 mm, type C copper header pipes with 6 risers that are made from 12.7mm Type C Copper. The riser tubes are mechanically bonded by stitching to the absorber plate with a roll formed backing strip with thermal paste that fuses on the riser pipes when baked in the oven with black polyester powdercoat.
**Surface Finish:** The absorber is made from 0.8 mm thick Aluminium alloy 5005 Temper H34 and is finished with black polyester powdercoat.
**Connections:** The collector sockets are made from 38 mm DR brass Hex bar with a recess for the 'O' ring to provide a perfect water tight seal. A torque arrester prevents the sockets from being subjected to extreme force.
**Weight:** The completed collector weighs 31.5 kg empty and 34.5 kg full.

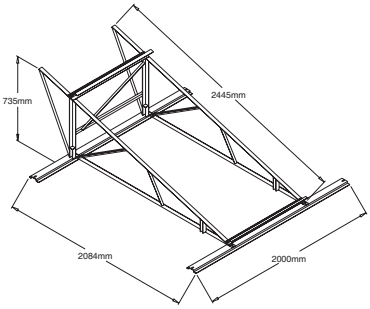
## 'F' Collectors

The 'F' collector is specially designed for use in areas that are prone to light frosts. It is manufactured with unique tapered risers that control the way water freezes during periods of low temperature. It doesn't stop the water in the rises from freezing, rather, it allows the water to freeze in a controlled way - from the middle outwards. This means the pressure build up caused by the expanding water can be relieved safely back into the tank.

The ABS couplings provide a secondary safety mechanism to help prevent frost damage to the collector. They are munufactured with a special sacrificial disc designed to give way before damage is suffered by the collector. In this way in the event of bad frosts, or a system failure, the relatively inexpensive coupling is sacrificed to protect the collector.
**Application:** This collector is suitable for areas of low to high solar radiation, subject to mild frosts with good potable water quality.
**Products:** Streamline
**Construction:** The absorber is made from 0.2 mm copper sheet, 32mm header pipes with 6 sequential copper risers, that are mechanically bonded to the absorber plate and finished with Black Chrome.
**Connections:** crox fittings, with ABS couplings.
**Weight:** The completed collector weighs 32 kg empty.

## 'B' Collectors

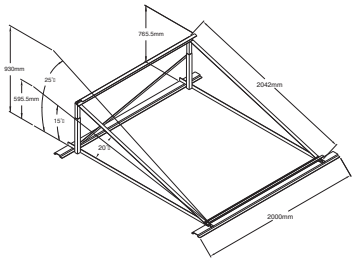
This collector is for use with Non Residential Systems only which function on a "drain back" principle and is suitable for installation at all locations irrespective of radiation levels, water quality and frost conditions. Its robust construction allows it to be left without fluid even at high radiation levels.
**Application:** This collector is suitable for installation with "Non Residential Systems" only. As these systems function on a "drain back" principle, the collectors are free of fluid when the system is idle. Due to this particular feature, the collector can be installed for all levels of radiation and water quality and also in frost prone regions.
**Construction:** The skeleton of the absorber is made from two 25.4 mm, type C copper header pipes with 7 risers that are made from 10.0mm Type C Copper. The riser tubes are soldered to the absorber plate.
**Surface Finish:** The absorber is made from 0.2mm thick copper coated with a Blue Selective Surface
**Connections:** The collector sockets are 20 mm (3/4" BSP) of DR brass and complemented with teflon coated cones to provide a perfect water tight seal. A torque arrester prevents the sockets from being subjected to extreme force.
**Weight:** The completed collector weighs 40.0 kg empty and 44.0 kg full.




## Fixed-Pitch Frame

These frames are manufactured and supplied with a fixed angle of 17.5° for mounting "thermosiphon" systems and can be used in the following situations:

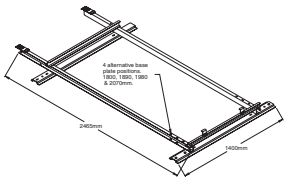
- On flat roofs.
- To face the equator on pitched roofs where the roof is sloping east or west.
- To face the equator where the roof faces directly away from the equator.
- Side and reverse pitch installations are not recommended in cyclone prone areas.
- All fixed-pitch frames are rated for Region C Cyclones.




## Variable-Pitch Frame

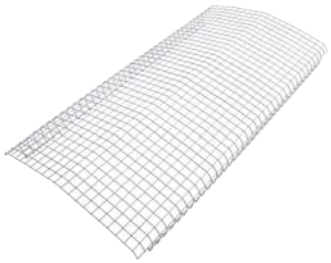
Frames for mounting collectors only of "active" systems can be adjusted to three angles – 15°, 20° & 25° and can be used in the following situations:

- On flat roofs.
- To face the equator on pitched roofs where the roof is sloping east or west.
- To face the equator where the roof faces directly away from the equator.
- Side and reverse pitch installations are not recommended in cyclone prone areas.




## Cyclone Frame

These Frames are designed for mounting "thermosiphon" systems in cyclone prone regions. They have been tested and rated to Australian Cyclone Terrain Region D and can withstand wind velocities up to 57 m/sec which is equivalent to 205 kilometres per hour.



## Stone Guard

A robust protective steel mesh is available to serve as a guard to protect the collector glass from vandalism The stone guard clips onto the collector without the use of any additional hardware. The aperture area of the collector is marginally reduced when fitted with a stone guard.


## Gas Booster

All storage cylinders are fitted as standard with an electric element of the desired kilowatt rating. The Gas Booster is designed to fit as an integral part of the storage cylinder:

- FD15-12 for "thermosiphon" systems

## Heat Dissipation System

This system dissipates any excess energy in the storage cylinder to the outside atmosphere in a controlled process. The Heat Dissipation Pipe should be installed with systems with 'K' collectors or 'J' collectors in areas of high solar radiation, such as Northern Australia, Hawaii and Malaysia.

## Time Clock

Boosting will become necessary during periods of inclement weather or when hot water is consumed in larger quantities than the capacity of the storage cylinder. A seven day timer is available to effectively control the power required for boosting. Power supply to the thermostat, which in turn activates the electric element in the storage cylinder, can be controlled by setting this timer to match with the hot water consumption pattern. For example:

- To boost between 3.00 am and 6.00 am to meet morning demand.
- To boost between 5.00 pm and 8.00 pm to meet evening demand.

The seven day timer can also be set to operate the thermostat during off peak power supply or night rate only.


## Energy Management Switch

The Energy Management Switch is an efficient way to manage the extent of gas consumption in a gas boosted solar hot water system, via architrave plate fitted with an "ON/OFF" switch, a "RED" neon and a "GREEN" neon.

- When the "RED" neon is on, it indicates that boosting is required.
- The selector switch can be switched to "ON"
- The "GREEN" neon will come on indicating that boosting is in progress.
- Once boosting is complete, both "RED" and "GREEN" neons will switch off.
- The selector switch can be switched to the "OFF" position.

The above is typical of a "BOOST AS REQUIRED" scenario. However, by leaving the selector switch in the "ON" position a continuous supply of hot water can be guaranteed.

## Bobbin Element (hard water)

Water quality varies from location to location. Hard water or water that is high in mineral content like calcium, can gradually drop the performance as well as the life of the electric element. A special element is available on request for use in these regions. This is a bobbin type element.

A ceramic lined steel sheath has been designed to house a bobbin element. This complete bobbin element assembly is designed to fit as an integral part of the storage cylinder in place of the standard sickle element. It avoids the direct contact between the hard water and the heating element while still transferring energy efficiently to the water in the storage cylinder.

The bobbin element is available in either a 2.5kW or 4.8kW rating. The design ensures uninterrupted water supply should the bobbin element need replacement.

## Coloured Tank Skins

A complete kit is now available made in Colorbond to match the outer skin of the tank and the collectors with the colour of the roof on the house.