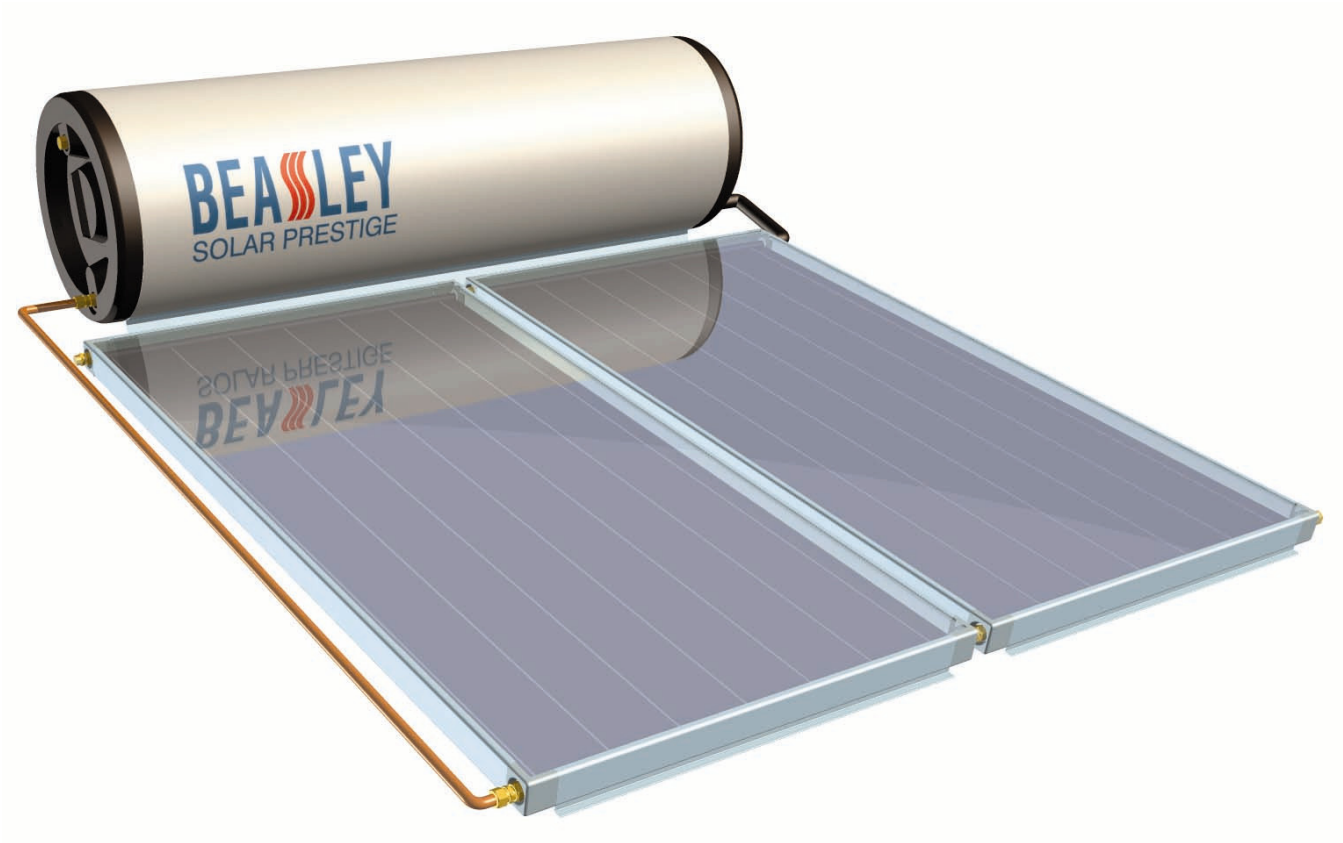
PRODUCT MANUAL

CLOSE COUPLED SYSTEMS



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HOW THE BEASLEY CLOSE COUPLED SYSTEM WORKS

THERMO-SYPHON PRINCIPLE

The Beasley close coupled solar hot water system operates on a natural thermo-syphon principle for the circulation of water. The system comprises a number of solar collectors (1 to 4) - located immediately below the storage cylinder. The collectors are connected to either side of the storage cylinder by a hot and cold pipe.

As water is heated by the sun, it becomes less dense and moves up through the riser tubes of the solar collectors to be replaced by colder (denser) water from the storage cylinder. The flow path is as shown in Figure 1. There is very little pressure differential between the hot and cold sides of the system (typically 0.1 kPa), so frictional losses within the pipe work must be kept to a minimum. The flow rates are self-adjusting according to the level of solar radiation. On a clear day the water will flow much faster through the system than on an overcast day when the solar gain might be very low. It is important that the hot pipe conveying water to the storage cylinder is well insulated, as any significant heat loss might interrupt the thermo-syphon process and prevent any hot water from reaching the storage cylinder.

DIRECTLY HEATED SYSTEM

A directly heated system as shown in Figure 1 is water directly heated by the sun within the solar collector. Water moves up the risers into the upper header tubes located at the top of the collectors. From there, it proceeds in an upward direction to the hot water storage cylinder. Cold water, displaced from the storage cylinder by the arrival of hot water, flows down the cold pipe into the lower header at the bottom of the collectors.

There are two methods employed to prevent water in the storage cylinder from overheating. Firstly by the location of a Thermo-Arrestor (TA) valve in the cold pipe, and secondly by asymmetrically positioning the storage cylinder within the outer case. The TA valve functions by shutting off the flow of colder water leaving the cylinder when it reaches 75 ºC. The asymmetric position of the storage cylinder within the outer case provides the system with an additional control by allowing surplus heat to be lost from the bottom of the horizontal storage cylinder.

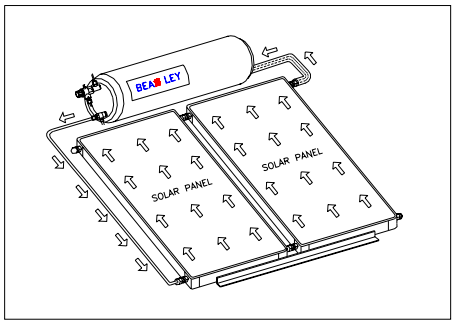


Figure 1. Directly Heated

INDIRECTLY HEATED SYSTEM

This system is employed in frost-prone areas and is designed to prevent the collectors from damage during freezing conditions. In an indirectly heated system as shown in Figure 2, the potable water is heated indirectly via a Heat Transfer Module (HTM). This unit is directly coupled to the solar collectors which are filled with the heat transfer fluid, ‘Glysol’. The ‘Glysol’ is heated in a similar manner to the directly heated system, except that instead of flowing up to the storage cylinder, it circulates through one side of the HTM and back to the collector. Potable water is heated by heat exchange with the ‘Glysol’ within the other side of the HTM and in turn thermo-syphons into the storage cylinder. An expansion tube is fitted to the collector circuit to prevent excessive pressure build-up.

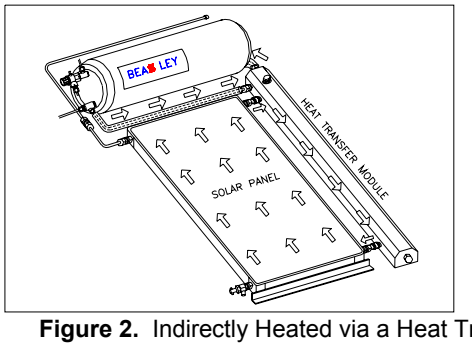


Figure 2. Indirectly Heated via a Heat Transfer Module

GETTING THE MOST FROM YOUR BEASLEY SOLAR HOT WATER SYSTEM

Installation must comply with all national and local electrical and plumbing codes

LOCATION

The performance of any solar hot water system can be significantly influenced by the way that the system is set up and used.

For maximum solar contribution:

- Solar collectors should be facing between north-east and north-west.
- Collectors should be inclined between 15° and 35°. For close coupled systems a limit of 30° is applied.
- There should be no shade over the collectors.

For optimum performance the storage cylinder should be installed to face the equator (south in the Northern Hemisphere, north in the Southern Hemisphere). Deviation from the equator up to 45° east or west has little effect on total annual solar contribution (approximately 4%). Should it not be possible to face the equator, the decision of either an EASTERLY or WESTERLY bias must be made:

- If major hot water draw is before 2 pm favour EASTERLY, or
- If major water draw is after 2 pm favour WESTERLY.

- The westerly direction is more commonly used. The storage cylinder should be installed on a roof of pitch or angle that is the same as the latitude angle of the site. Roof angles within 20° of the latitude angle will have little effect on the total annual solar contribution (4%). The minimum roof angle is 10% for with-pitch installations.

- If it is necessary to face the solar hot water storage cylinder 45° east or west to the equator, then a lower pitch (flatter) installation will give better performance. The addition of a third collector facing east or west is more aesthetically, economically and thermally beneficial than mounting the storage cylinder on roof brackets to face the equator. The storage cylinder is to be installed on an ADEQUATELY SUPPORTED AREA of the roof, as close as possible to the most frequently used hot water outlet or existing storage cylinder in retrofit installations. The storage cylinder must be installed in an area that is free of shade all year round. Check high trees for winter shade. All installations are to be made in accordance with the instructions detailed in this Owner's Manual. All storage cylinders installed in Australia must be installed in accordance with Australian Standard AS 3500.4.

KEY OPERATING CONSIDERATIONS

Solar cylinders differ from conventional cylinders in two fundamental ways. The first and most obvious is that much of the primary energy used to heat the water is provided free by the sun. The second difference is that input from the sun varies during the course of a day and from season to season. Annual variation often ranges from low levels of solar energy at times of greatest need to excessive levels at times of least need.

Not only does the level of solar energy vary during the day, it often varies widely from day to day. If the free solar energy component is to be maximised, the storage capacity of a solar cylinder needs to be optimised to accumulate residual energy from a previous good day to one for which the solar input may be insufficient.

With these principles in mind, the following operating recommendations should be followed to optimise the utilisation of free solar energy:

- The solar collectors should be suitably installed to achieve maximum solar energy input.

For maximum solar contribution:

- Correct orientation of the collectors relative to the location.
- Correct inclination of the collectors.
- No shade over the collectors.
- Glass on the collectors should be kept clean.
- The majority of the hot water should be used in the morning.

Solar collectors operate most efficiently when the inlet water is cold. Therefore the maximum solar contribution to the system will be achieved by starting each day with a tank of cold water, and letting the energy from the sun heat the water throughout the day. This is best achieved by ensuring that showering and the use of washing machines is performed early in the morning. This partially fills the tank with cold water, letting the sun work during the day to heat the whole tank, having only a small draw of water at night. This means that there will be only a small amount of supplementary electric heating required at night, and a tank full of hot water ready for use the next morning.

The action of auxiliary electric heating should be managed to permit the maximum possible solar contribution, with regard for patterns of hot water usage

Auxiliary heating for Beasley solar cylinders is provided by an incoloy sickle element that is controlled by an adjustable thermostat.

The element is located at the mid-point of the storage cylinder and is installed in the factory with the sickle curving downwards. This allows almost all of the water in the tank to be heated by the element. For instance a 3.6 kW element is capable of heating 330 litres of storage cylinder water from 25 °C to 60 °C in approximately 3.7 hours. This can be calculated using the following formula:

$$\text{Energy (kJ)} = \frac{\text{Volume (Litres)} \times \text{Change in Temperature (Deg. C)} \times \text{Specific Heat (kJ / kg Kelvin)}}{\text{3600 (seconds in 1 Hour)}}$$

Also $$\text{Time (Hours)} = \frac{\text{Energy (kJ)}}{\text{Element rating (kW)}}$$

Calculating the above example

$$\text{Energy} = \frac{330 \times 35 \times 4.18}{3600} = 13.41 \text{ kJ} \qquad \text{Hence} \qquad \text{Time} \frac{13.41}{3.6} = 3.7 \text{ Hours}$$

The operation of the element is controlled by an adjustable thermostat. The thermostat can be set to cut off at any temperature between 50 °C and 70 °C. The thermostat will cut in at a temperature 10 degrees below the temperature at which it is set. The thermostat is preset in the factory to cut off at 65 °C (and it will therefore cut in at 55 °C).

- Do not let the element operate during daylight hours.

If the element is allowed to operate in daylight hours, it will simply heat the water from the ambient temperature up to 60 °C, (in approximately 4.5 hours if starting with a cold tank) and leave the solar collectors to raise the heat of the water to a temperature above 60 °C. Solar collectors operate with declining efficiency as higher water temperatures are reached, this method of operation fails to utilise the free solar energy which is available to heat the water to 60 °C and attempts to inefficiently transfer some solar energy into hot water at the higher water temperatures.

The solution to this problem is to have a time switch connected to the element that permits only night time operation, or to have the element connected to night time tariff electricity. Many electricity utilities have reduced tariff electricity available in off peak periods at night, allowing auxiliary heating power for the solar system to be purchased at a lower rate.

If the majority of hot water usage has been restricted to the morning, and the system has most of the day available to heat the water using solar power, then there will be little need for auxiliary heating overnight. On days of high solar gain, the water in the tank will attain a temperature in excess of 65 °C. A Beasley solar cylinder located on the roof will generally suffer a heat loss of only 2 °C to 3 °C overnight. If the water has been allowed to heat all day using solar power, even the use of some water in the evening will not draw sufficient cold water into the tank to reduce the temperature to the 50 °C at which the thermostat will cut in, and there will be sufficient hot water remaining for major usage the following morning.

Thermostat Temperature Setting

The thermostat has been set so that if the temperature of the water falls below 50 °C, the water will always be reheated to a temperature of 60 °C. This setting is based upon the requirements of Australian Standards for water in all forms of hot cylinders to be stored at a temperature of not less than 60 °C. This is over the safety margin of approximately 55 °C which is thought to be sufficiently high to kill off any Legionella that might be present. The time required to heat the water in the tank from 50 °C to 60 °C using auxiliary power is approximately 1.1 hours. Each thermostat is subject to some variation in accuracy - if maximum solar contribution is sought, then the precise setting of the thermostat should be checked to ensure the thermostat cuts out at the minimum possible temperature.

Positioning of the Element

The element has been set at the factory with the sickle curving down to heat the maximum volume of water, heating and delivering close to the nominal volumetric capacity of the storage cylinder while operating as a purely electrical cylinder (if required). If operational experience on site shows that there is more than adequate supplies of hot water for the particular usage pattern, then the elements may be swivelled 90° so that the sickle is in the horizontal, rather than the vertical plane. In this configuration, the element can only heat the top half of the water in the tank, and the solar radiation has more scope to work on the cooler water in the bottom half of the tank. This will provide a more efficient solar contribution, but at the possible expense of reducing the amount of hot water that can be delivered in the morning following heating overnight by electricity.

Thermo-Arrestor Valve

The Thermo-Arrestor valve (TA valve) is fitted to Beasley solar cylinders to limit the water temperature in the storage cylinder to approximately 80 °C. The valve is located at the cold return to the collectors and closes automatically when water from the bottom of the tank passing through it reaches 65 °C. This prevents further thermo-syphoning taking place until the temperature in the storage cylinder reduces.

Usage Patterns

- Hot water usage patterns should be managed to the greatest extent possible.

Maximum solar contribution will be achieved by using most of the hot water in the morning and providing a cold storage cylinder of water for the sun to heat during the day. This usage pattern may be more difficult to implement when there are a large number of people using hot water. However, if high solar efficiency is sought, efforts should be made to encourage the use of hot water early in the morning.

If the building is to be left unoccupied for a time, the electricity supply to the auxiliary power should be switched off. The natural thermo-syphon flow will continue to heat the water up to the temperature of 75 °C limited by the action of the TA valve, and the temperature will be maintained at that level by the action of the thermo-syphon and TA valve. If there has been a period of low solar gain, the electricity should be switched on again prior to re-occupation to ensure that all the water has been heated to a useable temperature.

The average usage of hot water in a domestic household is normally taken to be 60 litres per person per day.

Load Calculations

Estimates of hot water requirement are at a stored water temperature of 60 °C. This complies with Australian Standard AS3500.4 to prevent the occurrence of the bacterium *Legionella pneumophila* which could lead to a disease normally referred to as *legionnaires' disease*. The hot water requirements for showers, hand washes, dish washing, laundry etc., are based on industry experience over the past fifty years.

HOT WATER REQUIREMENTS

Table 1 and Table 2 are a guide to hot water demand.

Table 1 Residential Dwelling - Household; Number of Persons - 4

Number of showers per person per day	2	
Total number of showers per day	8	
Hot water per shower @ 60 °C	18	litres
Total hot water for showers	**144**	**litres/day**
Hand washes per person per day	2	
Total number of hand washes	8	
Hot water per hand wash @ 60 °C	2	litres
Total hot water for hand wash	**16**	**litres/day**
Number of meals per day	3	
Hot water per dish wash @ 60 °C	10	litres
Total hot water for dish washing	**30**	**litres/day**
Hot water for laundry per person per day @ 60 °C	10	litres
Total hot water for laundry	**40**	**litres/day**
Total hot water requirement @ 60 °C	**230**	**litres/day**

Table 2 Residential Dwelling – Dual Occupancy; Number of Persons - 2

Number of showers per person per day	2	
Total number of showers per day	4	
Hot water per shower @ 60 °C	18	litres
Total hot water for showers	**72**	**litres/day**
Hand washes per person per day	2	
Total number of hand washes	4	
Hot water per hand wash @ 60 °C	2	litres
Total hot water for hand wash	**8**	litres/day
Number of meals per day	3	
Hot water per dish wash @ 60 °C	5	litres
Total hot water for dish washing	**15**	**litres/day**
Hot water for laundry per person per day @ 60 °C	10	litres
Total hot water for laundry	**20**	**litres/day**
Total hot water requirement @ 60 °C	**115**	**litres/day**

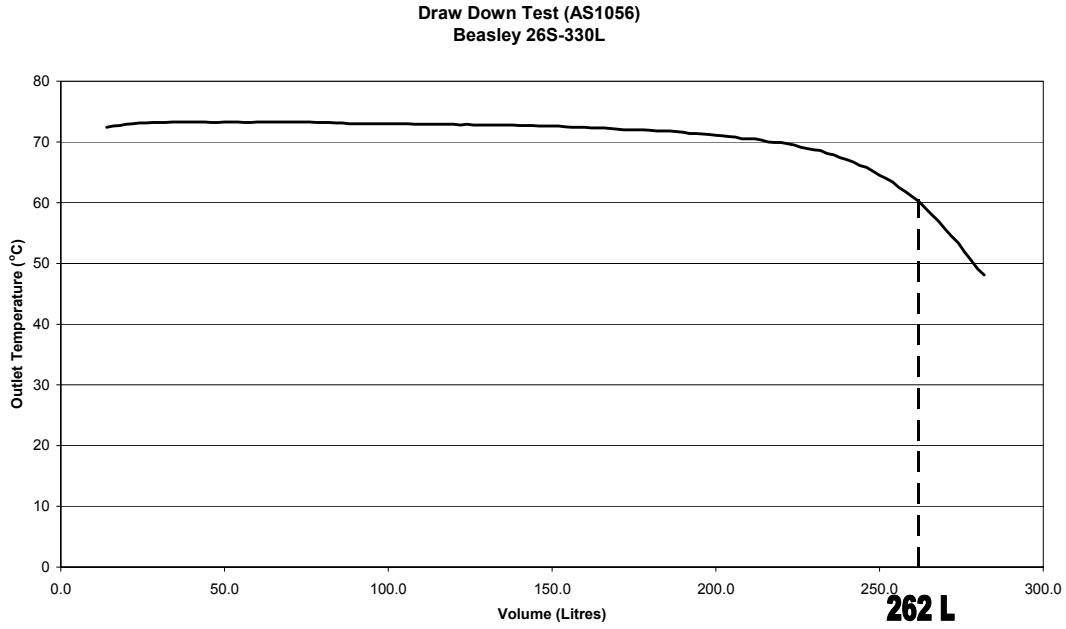
Manufacturer Terminology

Terminology can be confusing. Solar storage cylinders in Australia are manufactured with *nominal storage capacities* of 180 litres, 300 litres and 440 litres. Within most of these size ranges Beasley storage cylinders are up to 10% larger to provide additional deliverable capacity (i.e. 180 L, 330 L and 480 L). Most domestic sales of solar storage cylinders for a family home are of the 300 litre nominal capacity. However, the actual 'rated capacity' of a storage cylinder differs from its nominal capacity, and differs between manufacturers. The capacity of a storage cylinder to deliver hot water differs from its nominal storage capacity because of:

- The location of the inlet and outlet pipes in the storage cylinder, and
- The shape, size and location of the heating element.

The 'rated delivery' of a storage cylinder is the amount of water delivered at the nominal thermostat temperature when only electrical heating is used.

The 'drawdown capacity' of a hot water system is defined as being the amount of water the system can deliver at a defined rate before the temperature of the water at the outlet drops 12 °C. Typically for the Beasley Solar Prestige 330 L storage cylinder, this is over 260 L (see Figure 3).



During manufacture Beasley storage cylinders have the elements installed to maximise the delivered capacity.

Figure 3. Delivery Graph for a 26S-330L Cylinder

Water Quality

Water quality cannot be defined by a single parameter as the suitability of water is defined by a number of parameters, some of which are incorporated in a measure called the *Saturation Index.* If this index lies between -0.8 and +1.0 then the water is considered suitable for direct use in hot water systems. The limits on some individual parameters include the *Total Dissolved Solids* content being less than 600 mg/l and *Total Hardness*, expressed as Calcium Carbonate ($CaCO_3$) being less than 200 mg/l. Measurements for chlorides and pH also apply. It is recommended that where calcium hardness ($CaCO_3$) and the alkalinity of water supplies are in excess of 200 mg/l, the water should be treated by a softening process prior to use. Refer to the Warranty section for specific details.

General Rules

- Water from bore wells is generally unsuitable for hot water systems without treatment and should be analysed prior to use.
- It is not recommended that water from any hot water system be used for drinking or cooking.

Known Locations of Harsh Water Quality:

- Central region of Australia – Alice Springs, Ayers Rock
- Pilbara region of Western Australia
- Kimberley region of Western Australia
- Mining towns in North Queensland

PRODUCT SPECIFICATIONS

Table 3 Storage Tank Specifications

Storage tank		180 L	330 L	480 L
Storage cylinder capacity (litres)		180 L	330 L	480 L
Electric rated capacity (litres)		125 L	250 L	315 L
Hot water relief pressure		850 kPa	850 kPa	850 kPa
Number of collectors (std)		1	2	3
Collector area (std)		2.0 m^2	4.0 m^2	6.0 m^2
Number of collectors (max.)		2	3	4
Storage cylinder (nominal)	length (mm)	1258	2133	3033
		550	550	550
		560	560	560
Collector bank (nom)	length (mm)	1937	1937	1937
		1075	2160	3245
		80	80	80
Assembled unit (nom)	length (mm)	2450	2450	2450
		1075	2160	3245
		560	560	560
Weight empty (kg)		80	150	215
Weight full (kg)		265	485	700
Supply voltage		240 V	240 V	240 V
		Single phase	Single phase	Single phase
Element type	Sickle	Immersion	Immersion	Immersion
Thermostat type		Contact	Contact	Contact
Adjustable therm/setting		50-70 °C	50-70 °C	50-70 °C
Over temp cut-out setting		75 °C	75 °C	75 °C
Materials				
‘Prestige’ Inner cylinder		316 SS	316 SS	316 SS
‘Plus’ Inner cylinder		316 SS	316 SS	----------
‘Prestige’ Outer case		Colorbond	Colorbond	Colorbond
‘Plus’ Outer case		Aluminium	Aluminium	----------

Table 4 Solar Collector Specifications

Item	Characteristic	Details
Collector	Type Construction Absorber material Surface treatment Sheet to tube bond Header tubes Riser tubes Number of risers Nominal area Water volume Max. operating pressure Absorptance Emittance Stagnation temperature (at 1200W/m² & 40 °C ambient)	Flat plate Tube on sheet Copper 0.2 mm thick AMCRO selective surface 30/70 solder 19.1 mm diameter 12.7 mm diameter 7 2.0 m^2 1.81 litres 850 kPa 0.90 – 0.92 9 – 11 % 182 °C
Glazing	No. of glass covers Thickness Type Transmittance Dimensions of aperture	1 3.2 mm Low iron tempered glass 91-92% 1930 mm x 1015 mm
Insulation	Base insulation type Base insulation thickness	Rockwool batt 25 mm
Outer case SP200	Walls Base Corner blocks	Grade 6060/T591 aluminium mill finish Grade 5052/H34 aluminium mill finish Glass filled polypropylene with silicone seals
Collector assembly	Weight Overall dimensions	36 kg 1937 x 1025 x 80 mm
Mounting	Type	Aluminium angles bolted to panel ends
Outer case SP201	Case material Grommet material	Grade 5052/H34 aluminium mill finish. Silicone

Table 5 Heat Transfer Module Specifications

Item	Details
Outer case	Colorbond
Shell and tubes	Copper tube
Insulation	Polyurethane foam
Glysol fluid	Glycol Propylene, Tolytriazole and coloured with blue food dye
Length (mm)	2257
Width (mm)	164
Weight (empty) (kg)	16
Weight (full) (kg)	21
Connections	3/4 Compression

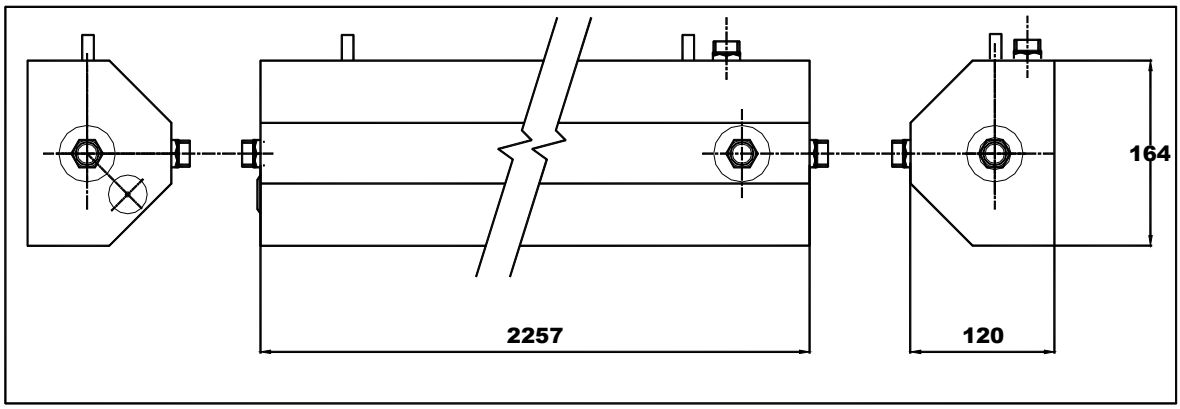


Figure 4. Heat Transfer Module (external dimensions)

INSTALLATION INSTRUCTIONS

The method of mounting the storage cylinder and collectors is a critical factor in the satisfactory operation of the system.

The installation must be in accordance with these instructions, in conjunction with Australian Standard AS3500.4, and in accordance with all relevant local electrical, water supply and building regulations.

Considerations Before Starting the Installation

It is essential, in order to ensure a safe and satisfactory final installation, that the roof structure is suitable for the equipment supplied, and the loads applied. It is the installation contractors' responsibility to visually check the roof, and if there is any damage that requires attention, to inform the owner. If this affects the safe installation of any part of the new system, installation should not proceed until the damage has been rectified.

Other points which should be assessed at this stage are :

Will any trees cause a shadow to pass over the collectors during the course of the day? It should be taken into account that at different times of the year shadow patterns will vary. If shadows are a problem, the owner should be advised so that they can arrange to have the trees pruned.

The new solar system should be installed as close as possible to the hot water outlet with the maximum usage. If the bathroom is at the opposite end of the house to the kitchen, the system should be placed closer to the bathroom. Some water authorities specify a maximum distance from storage cylinder to the principal hot water outlet.

If the property is situated in a cyclone area, or an area where wind loadings or other adverse weather conditions exist, additional consideration may need to be given to the methods used during installation.

Will the location be subject to frost? If so will it be necessary to install a frost protection system.

Safety Considerations During Installation

The installation contractor must ensure that correct handling procedures are adopted at all times, particularly when lifting heavy assemblies onto the roof. All personnel should be trained for working at heights, and it is recommended that harnesses etc. be used to minimise the risk of a fall. This should be considered essential for multi-story buildings.

Consideration should be given at all times to prevent property damage during the installation. Protect gutter and facia board surfaces from damage caused by ladders etc.; this can be achieved by placing a protective material under the ladder (a piece of heavy material or old carpet), but at no time should ladder safety be compromised.

All storage cylinder and collector mounting straps must be securely fixed to the roof structure with the correct type of fixings or the straps may become detached and cause the system to be unsafe.

It is important to ensure the safety of all occupants of the property during installation. Children are especially attracted to any unusual activity, and it is essential that they are kept at a safe distance at all times, especially from falling items which can occur when working overhead. Ask the property owner to assist in keeping children safe, and also advise them of any inconvenience which will be caused by turning off water, electric, or gas supplies. They may wish to fill a jug with water prior to installation, or make a cup of tea/coffee etc.

If the installation is being carried out during a high solar radiation period, it is wise to cover the collectors during installation until they have been filled with water.

Water Supply Quality

Refer to the Warranty section of this manual for acceptable water quality.

- Bore water usually exceeds these limits.

Location of Collectors and Storage Cylinder

Refer to page 6 of this manual for information on choosing the best system installation configuration for the property. AS3500.4 has a very useful 'Midwinter Solar Altitude Sight' in Appendix I and graphs that quantify the effects of orientation and inclination in Appendix J.

System Orientation and Frame Options

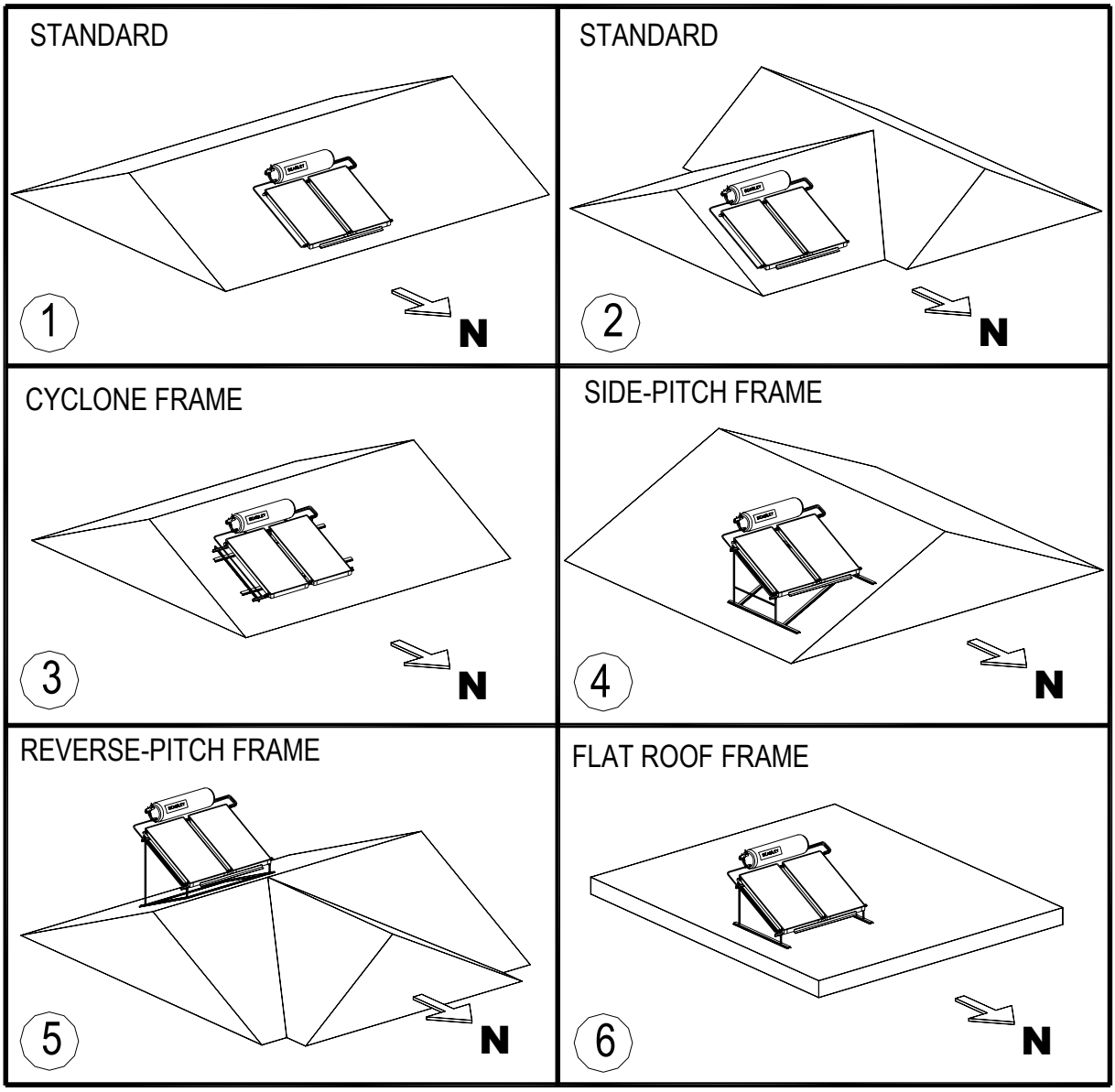


Figure 5. System Mounting Options

Figure 5 illustrates various options available to enable the solar collectors to be installed at the correct angle on various types of roof, whilst enabling the storage cylinder to be mounted horizontally.

Careful consideration must be given to ensure that a shadow will not fall over the collectors during the day due to other sections of roofing, such as example 2 above, when the roof line may be high and cause shadowing in the afternoon.

For special installation requirements, e.g. in cyclone prone areas where the standard cyclone frame may not be used, consult your nearest BEASLEY representative.

Storage Tank and Collector Options

The following illustrations show a selection of the possible combinations of storage cylinder size associated with the number of collectors installed with the system.

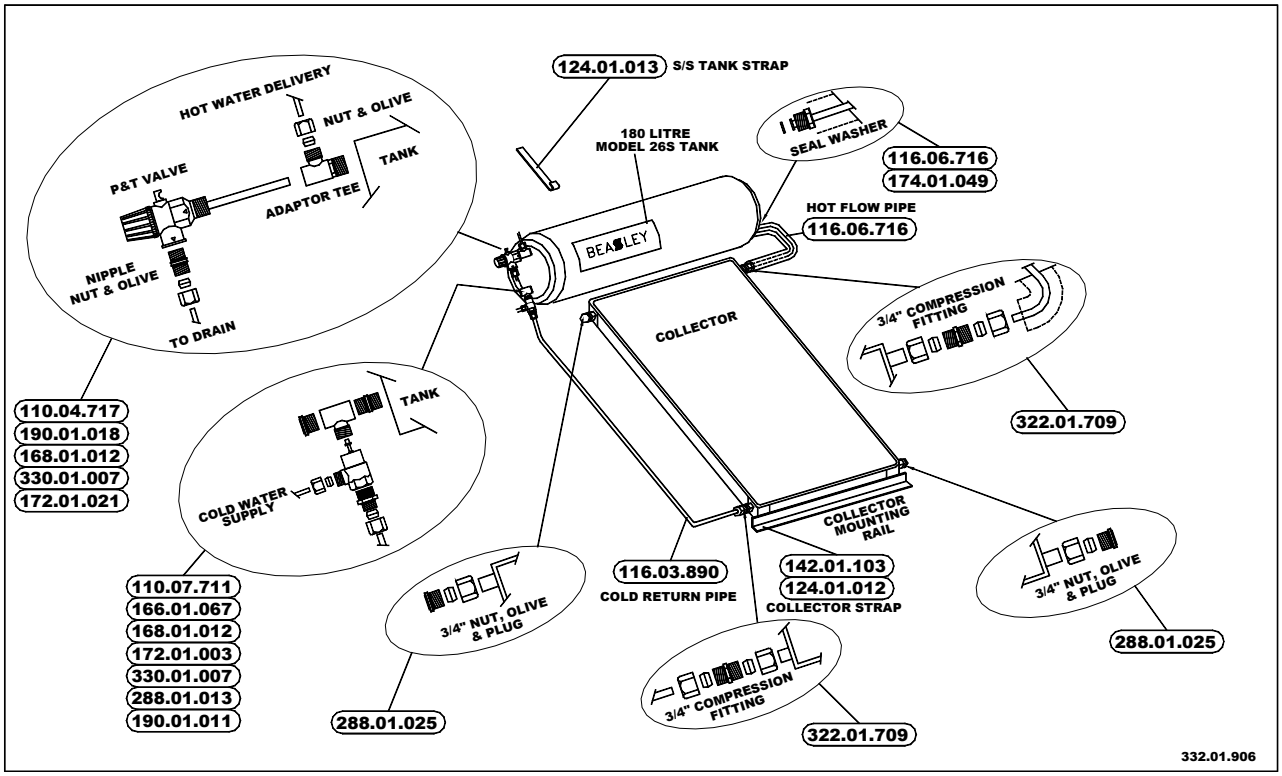


Figure 6. 180 Litre Single Panel Close Coupled System

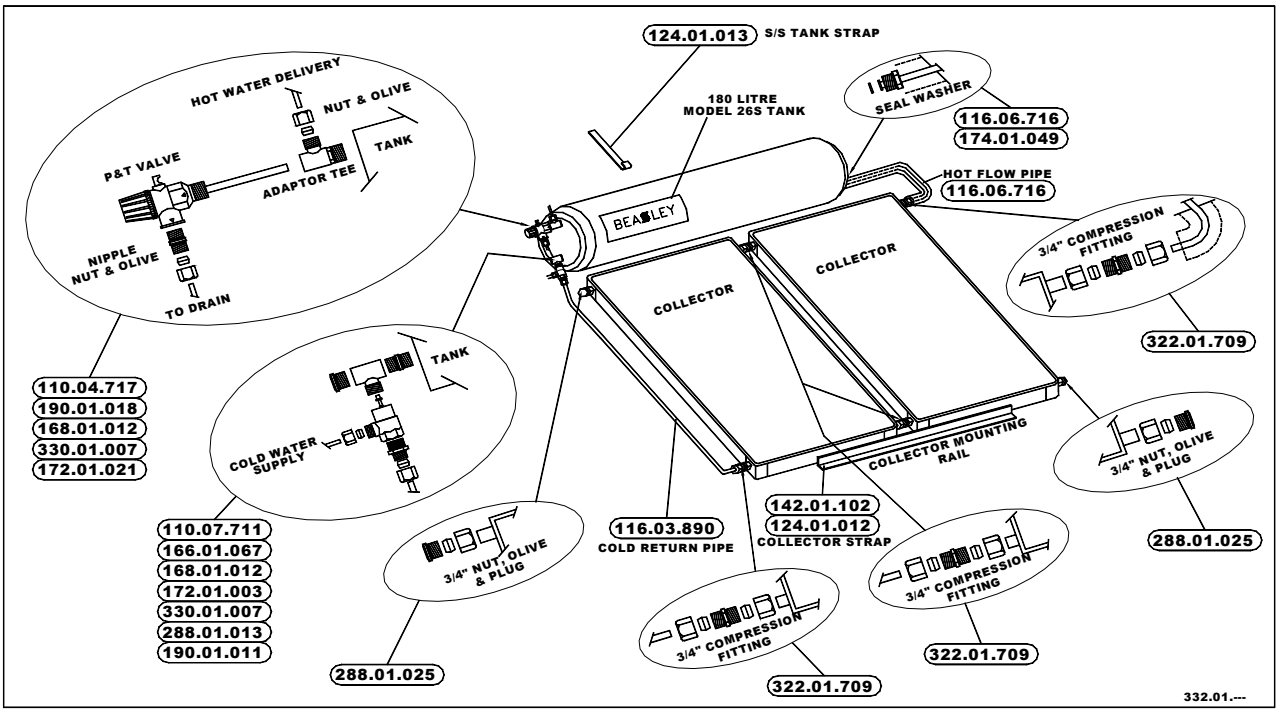


Figure 7. 180 Litre Two Collector System

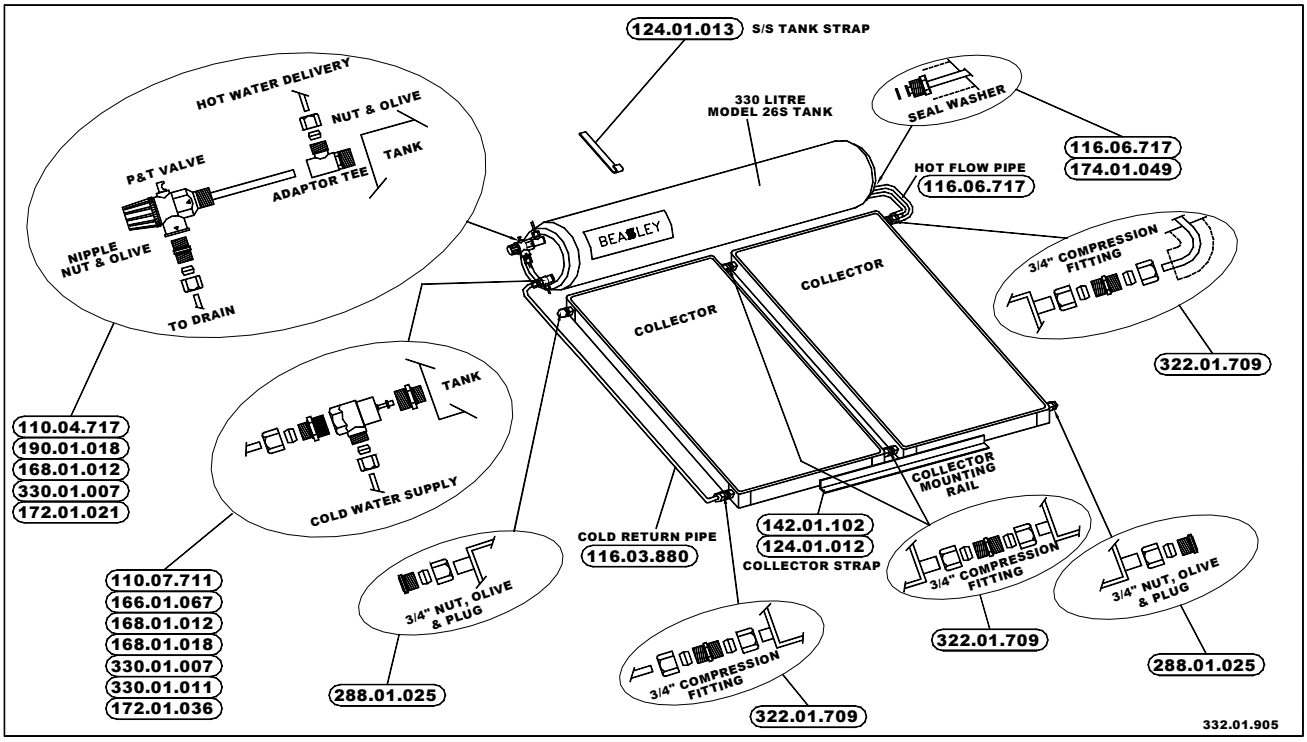


Figure 8. 330 Litre Two Collector System

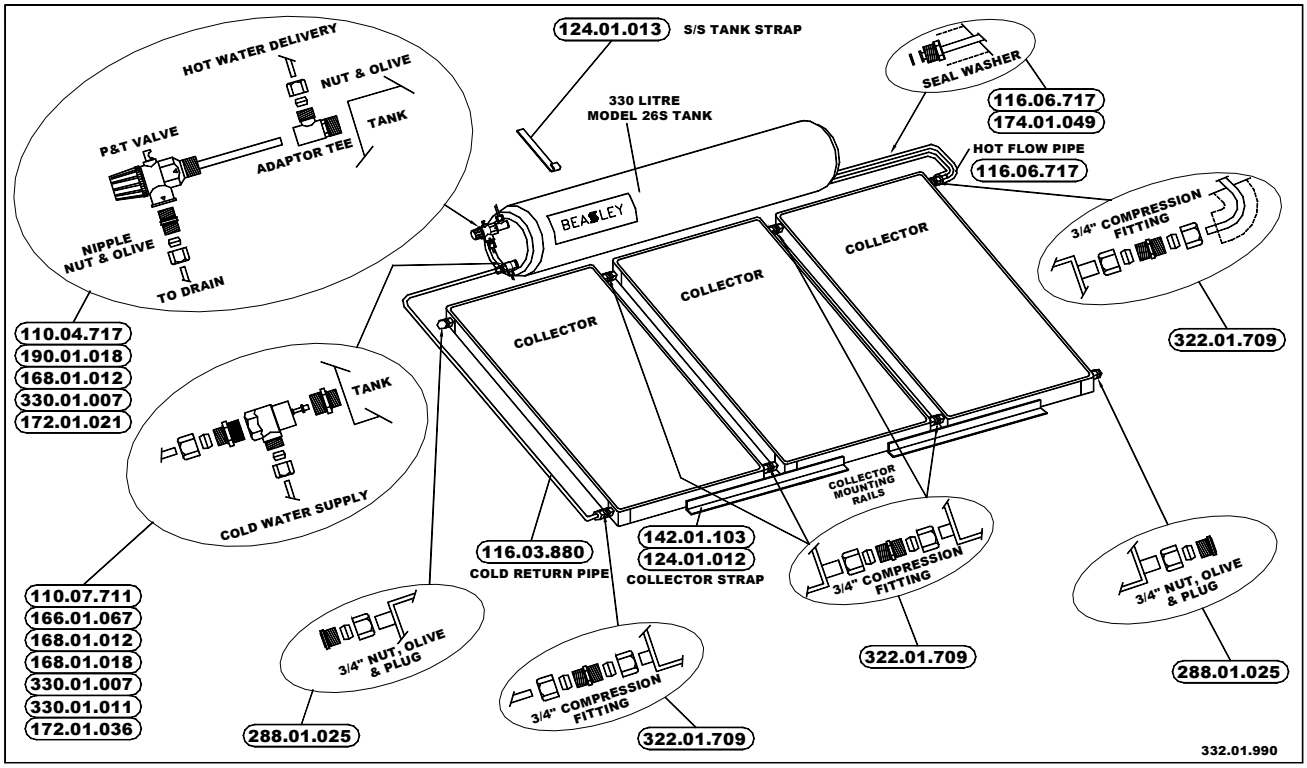


Figure 9. 330 Litre Three Collector System

CLOSE COUPLED SOLAR HOT WATER SYSTEM

	PART No.	DESCRIPTION	QTY 180L 1 COLL	QTY 180L 2 COLL	QTY 330L 2 COLL	QTY 330L 3 COLL	QTY 480L 3 COLL	QTY 480L 4 COLL
	KIT PART No		332.01.906	332.02.005	332.01.905	332.01.990	332.01.907	332.02.006
+	110.04.717	VALVE P&T RELIEF HT 55 850 kPa	1	1	1	1	-	-
+	110.04.781	VALVE P&T RELIEF HT 575 850 kPa	-	-	-	-	1	1
+	110.07.711	THERMOSYPHON ARRESTOR TA100VT	1	1	1	1	1	1
+	190.01.018	TEE REDUCTION RMC 1A046	1	1	1	1	-	-
+	166.01.046	ADAPTOR P&T VALVE RMC T-75	-	-	-	-	1	1
+	288.01.025	PLUG 3/4" COMPRESSION	2	2	2	2	2	2
+	322.01.709	UNION COMPRESSION ASSY. 3/4" CU-3/4" CU BRASS	2	4	4	6	6	8
+	322.01.713	UNION COMPRESSION ASSY. 3/4" BSP-3/4" CU BRASS	-	-	-	-	2	2
+	166.01.067	ADAPTOR M33 TO 3/4" CU COMP	1	1	1	1	1	1
+	168.01.012	NUT BRASS 1/2" BSP COMPRESSION	3	3	3	3	-	-
+	168.01.018	NUT BRASS 3/4" BSP COMPRESSION	1	1	1	2	2	2
+	330.01.007	OLIVE NYLON COMPRESSION 1/2" BSP	3	3	3	3	-	-
+	330.01.011	OLIVE COPPER COMPRESSION 3/4" BSP	1	1	1	1	2	2
+	172.01.021	NIPPLE 1/2" BSP	1	1	1	1	-	-
+	172.01.003	NIPPLE 3/4" BSP	1	1	-	-	1	1
+	172.01.036	NIPPLE REDUCING 1" BSP x 3/4" BSP	1	1	1	1	1	1
+	160.01.003	CAP 1/2" BSP BRASS	-	-	-	-	1	1
+	190.01.011	TEE - 3/4" BSP BRASS	1	1	-	-	1	1
+	288.01.013	PLUG 3/4" BSP BRASS	1	1	-	-	-	-
+	174.01.049	SEAL WASHER	1	1	1	1	1	1
	116.03.890	TUBE COLD RETURN ASSY. 26S-180L	1	1	-	-	-	-
	116.03.880	TUBE COLD RETURN ASSY. 26S-330	-	-	1	1	-	-
	116.03.881	TUBE COLD RETURN ASSY. 26S-480L	-	-	-	-	1	1
	116.06.716	TUBE/INSULATION ASSY. : HOT FLOW 180L	1	1	-	-	-	-
	116.06.717	TUBE/INSULATION ASSY. : HOT FLOW 330L	-	-	1	1	-	-
	116.06.718	TUBE/INSULATION ASSY. : HOT FLOW 480L	-	-	-	-	1	1
	142.01.102	SUPPORT BAR – COLLECTOR 330L	-	2	2	-	-	4
	142.01.103	SUPPORT BAR – COLLECTOR 180L & 480L	2	-	-	4	4	-
	124.01.013	S/S CYLINDER STRAP	2	2	2	2	4	4
	124.01.012	MOUNTING STRAP - COLLECTOR	2	4	4	6	6	8

NOTES.

1. + These components packed on a skin wrapped backing sheet.

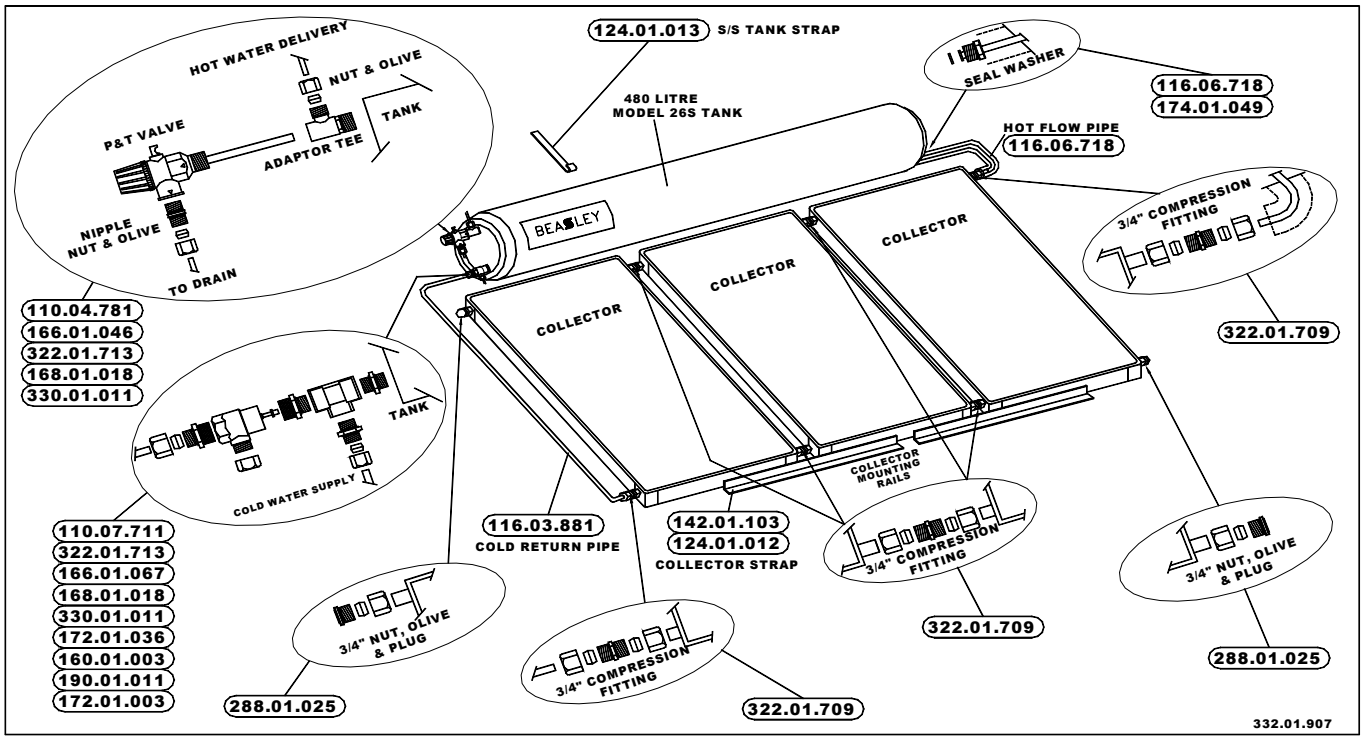


Figure 10.480 Litre Three Collector System

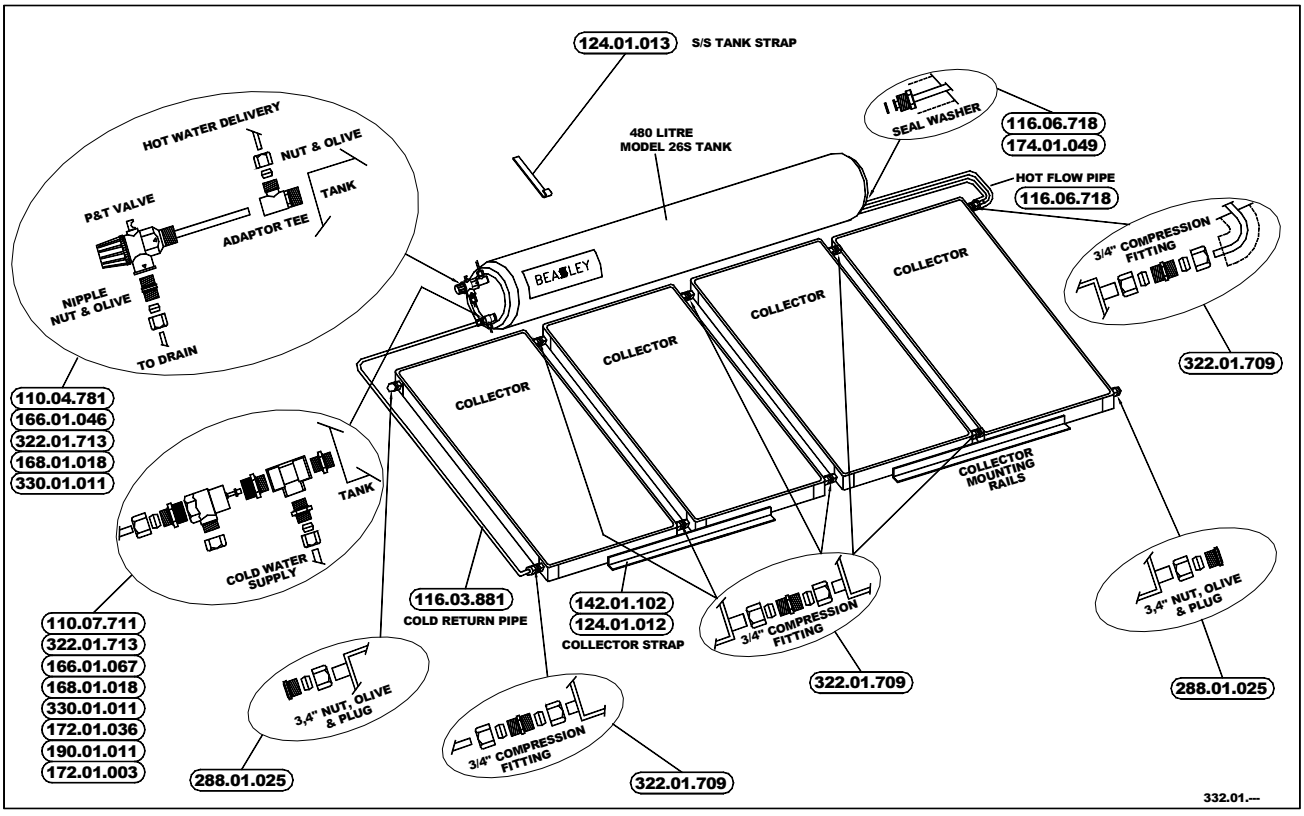


Figure 11.480 Litre Four Collector System

INSTALLATION INSTRUCTIONS FLAT ROOF MOUNTING FRAME

- This frame is not suitable for installation in cyclone prone areas. For the correct frame for use in cyclone areas, contact your local Beasley distributor.

The kit contains:

- Truss assemblies.
- Rear diagonal brace.
- Solar collector support bars.
- Nuts and bolts.
- 'Top hat' sections for installations parallel to roofing material ridges.
- Bolts to connect the frame to the roof are not included because requirements differ between building authorities.

Assembly Instructions

Each of the truss assemblies comes loosely bolted. Lay the medium sized member of one of the trusses on the roof, lift the long member, rotate the short member upwards to the vertical and bolt it to the long member. Tighten all the bolts.

Repeat for the other trusses.

Position the truss assemblies on the roof as shown in the diagram (Ref Figure 12 and Figure 13), and secure the trusses together by bolting the rear diagonal brace to the marked holes on each of the rear members. If required, mount the top-hat sections beneath the frame.

Attach one solar collector support bar to the bottom hole in each of the trusses as per the diagram, and semi-tighten the bolts to hold in position (the second to bottom hole in the trusses is for use only with the SP201 collectors).

Cradle the solar collectors within the bottom support bar, using the bar as a straight edge, and centralise the collectors on the bottom bar.

Loosely fit all the interconnector assemblies and seals to the solar collector joins (refer Collector installation instructions).

Lay the top support bar on the solar collectors and loosely bolt to the trusses.

Using a spirit level, check that the solar collectors have the correct rise (as specified in Collector installation instructions), and when correct tighten all interconnector assemblies and all bolts on to the frame assembly.

Secure the frame to the roof in accordance with local building authority regulations.

Lift the cylinder on to the frame above the solar collectors, ensuring that the Beasley sticker is facing towards the collectors.

Attach the cylinder to the frame by bolting through the cylinder support bars into the holes provided in the truss assemblies.

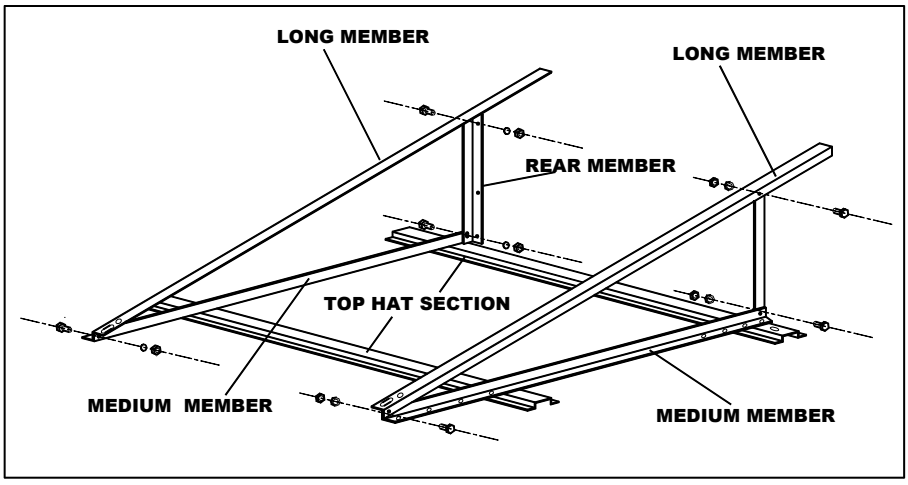


Figure 12. Frame Members

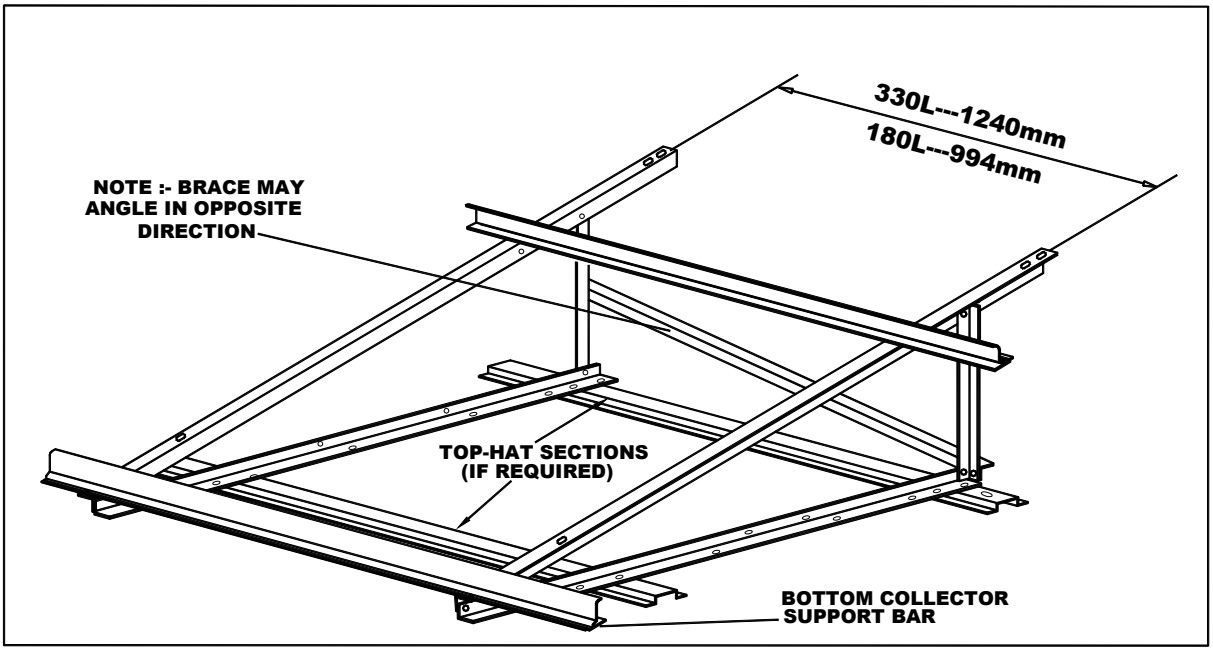


Figure 13. Frame Dimensions

Table 6 Component List for the Flat Roof Mounting Frame

Part No.	Description	Quantity
142.01.106	Bar HTM flat roof mounting frame 2644 mm long	1
142.01.107	Bar HTM flat roof mounting frame 2317 mm long	2
142.01.108	Bar HTM flat roof mounting frame 665 mm long	2
142.01.089	Bar rear cross brace 1320 mm long	2
142.01.083	Support bar aluminium	1
174.01.058	Washer 3/8” BSW zinc plated	2
168.01.056	Nut 3/8” BSW zinc plated	14
226.01.066	Screw 3/8” BSW x 3/4” long zinc plated	14
33201835	1 Collector 180 litre kit	14
33201820	2 Collector 330 litre kit	
33201875	3 Collector 480 litre kit	

- All nuts, bolts and washers to be attached with installation instructions to a skin wrapped backing card.
- All parts to be packed into a frame carton sleeve (Pt. No. 202.01.125).
- Frame Part Number : 332.01.935.

INSTALLATION OF CYCLONE MOUNTING FRAME FOR CLOSE COUPLED SYSTEM

Preface

Before commencing the installation, check that all components are included as shown in the kit list on page 23 of this manual. No components are supplied for mounting the frame to the roof.

Location

Choose the mounting location with a direction in mind that will allow the frame to be centrally located over three rafters (two for 180 L) and to provide the top hat sections with suitable fixing battens as shown in these instructions. Locate the system towards the centre of the roof if possible.

To install the solar collectors 'Clear of the roof'

- This method of installation must be used on tiled roofs

Lay the two top hat sections parallel on the roof, with their centres to suit the particular roof configuration. Attach the two C-section support bars to the top hat sections using 3/8" BSW nuts and bolts (see Figure 14 and Figure 15).

Square up the frames by equalising the diagonals and then tighten the nuts. Use the assembled frame as a template to mark the position of the mounting rods onto the roof tiles. The frames use one rod on the outside of each C-section and one rod at the mid-span of the top hat section.

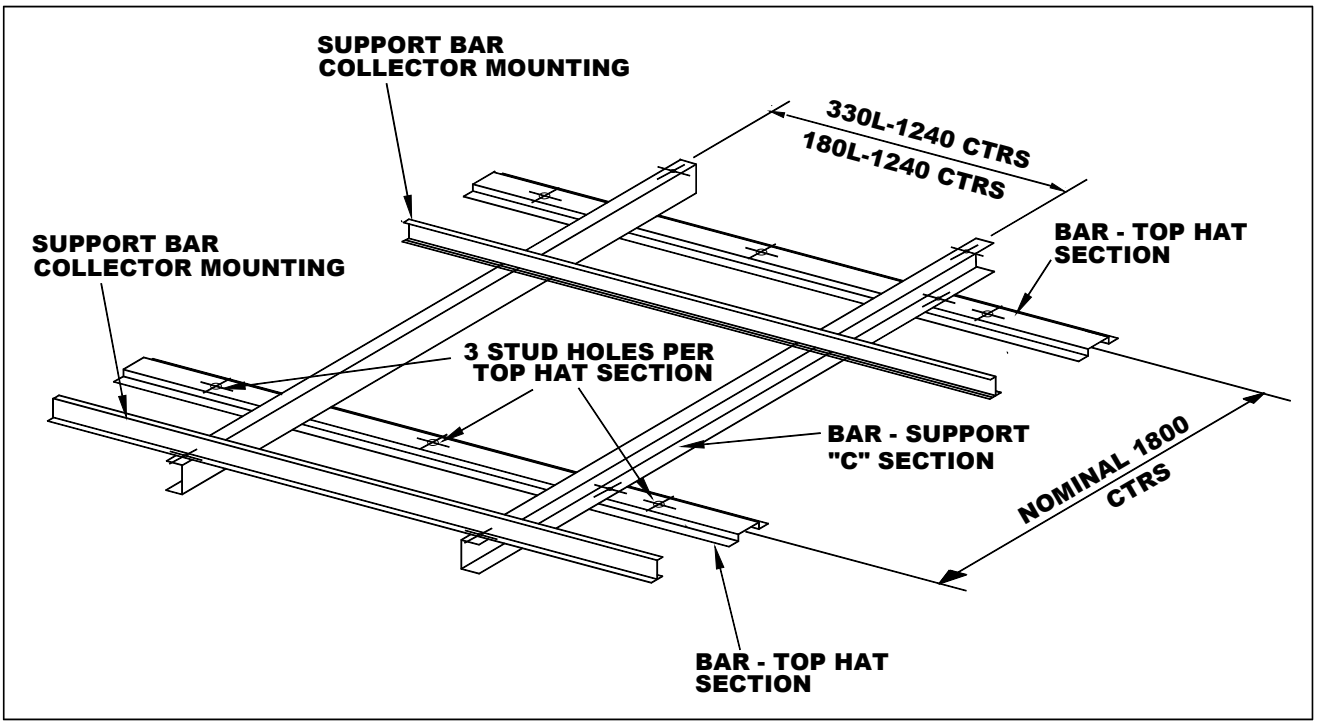


Figure 14.180 and 330 Litre Frame

This frame is suitable for :

- 180 litre one or two collector system.
- 330 litre two or three collector system.

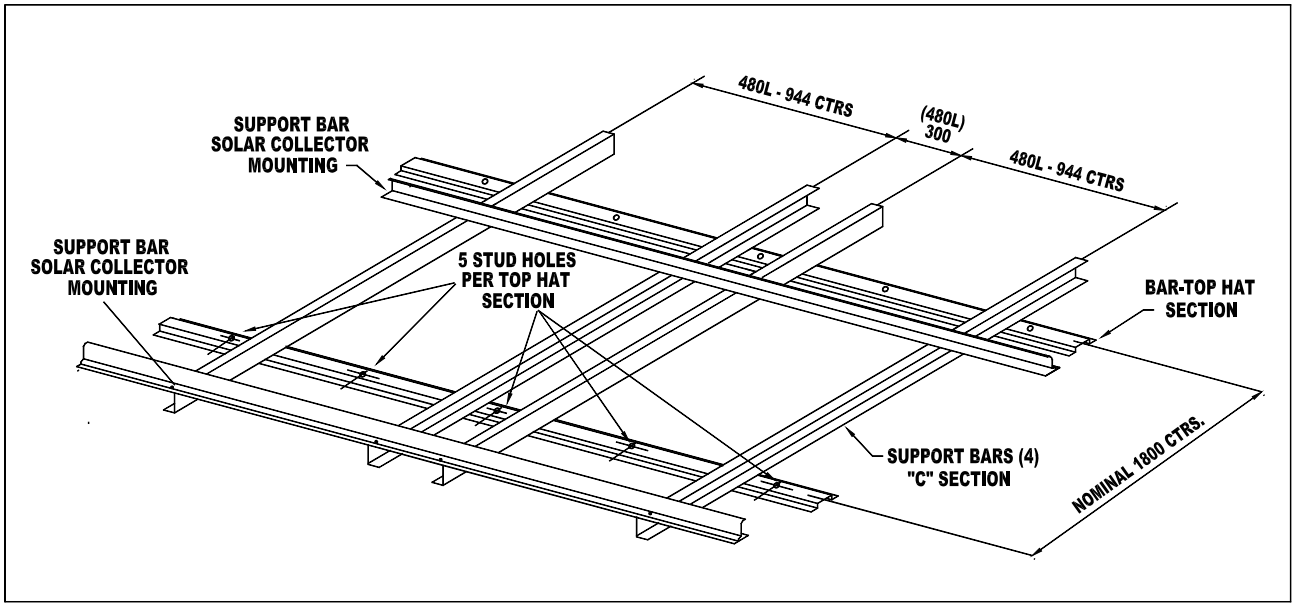


Figure 15.480 Litre Frame

This frame is suitable for :

- 480 litre three or four collector system.

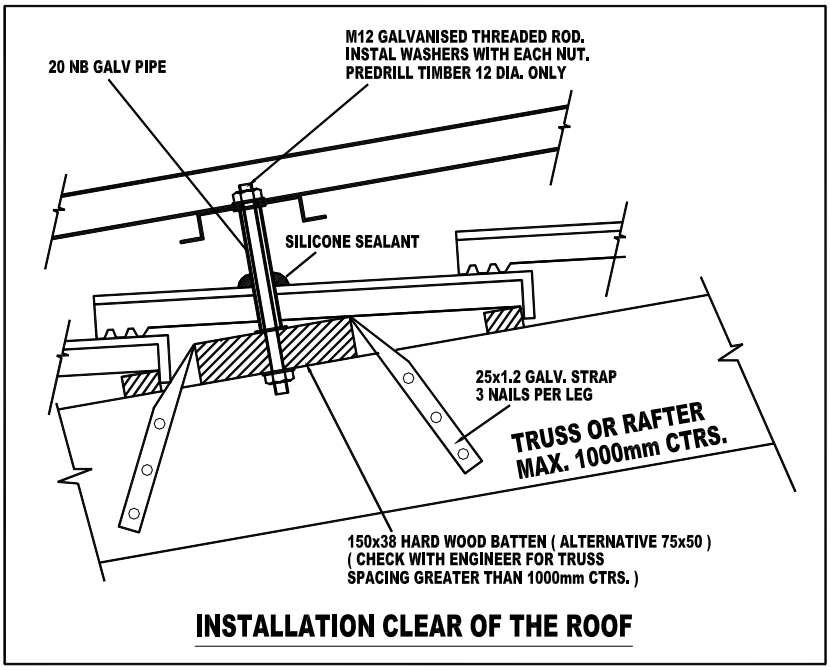


Figure 16. Installation of Solar Panels Clear of the Roof

Pre-drill the hardwood battens with a 12 mm drill using hole positions to suit the particular frame. Three holes must be drilled in each batten for the 180 Litre and 480 Litre frames. Attach the hardwood battens to the roof trusses or rafters using a galvanised iron strap and nails.

Position tiles over the battens and mark the hole centres onto them. Remove tiles and carefully drill a suitable clearance hole through the tile at the marked points. Before replacing the tiles, attach the galvanised screwed rods to the hardwood battens, using nuts and washers to secure.

Replace the tiles over the battens, allowing the threaded rods to protrude through them (note: the rod should be a maximum of 175 mm above the roof support). Fit washers and galvanised pipes over the threaded rods and seal around the tile with a suitable silicon sealant. Fit a washer on each of the threaded rod supports.

Place the frame over the mounting supports, aligning the bolts with the pre-drilled holes in the top hat sections, and secure with galvanised nuts and washers. Loosely fasten the frame to the supports and recheck the squareness of the frame by measuring its diagonals. When the two dimensions are within 5 mm tighten all the nuts and bolts on both the frame and the mounting supports.

On an Iron Clad Roof

Lay the two top hat sections parallel on the roof, with their centres to suit the roof configuration. Attach the top C-section support bars to the top hat sections with 3/8" BSW nuts and bolts. Check that the side rail centres are as per Figure 14 or Figure 15.

Square up the frames by equalising the diagonals and tighten the bolts.

Position the hardwood battens under each top hat section. Fasten the lower top hat section to the batten with a TEK screw through its centre, using the slotted holes provided. Before this is tightened, check the alignment of the frame for an efficient thermo-syphon angle, and screw in the remaining TEK screws for both the upper and lower top hat sections (Ref Figure 17).

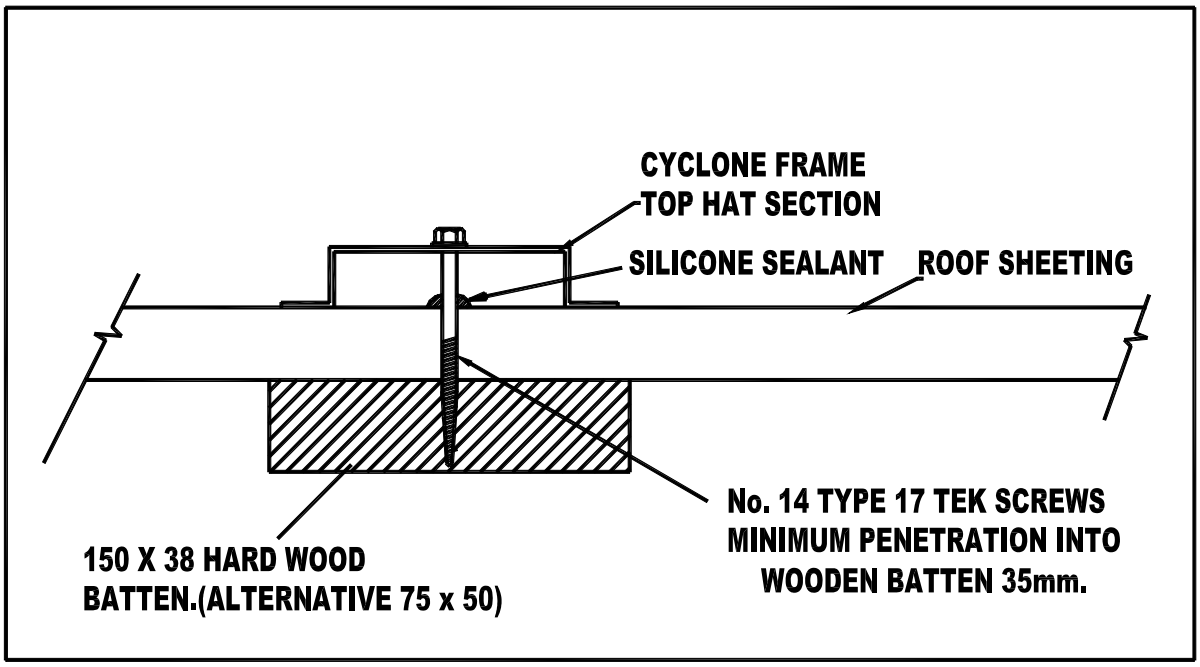


Figure 17.TEK Screw Installation

Installation of Collectors

Connect the bottom collector mounting rail to the C-section using two of the 3/8" BSW nuts and bolts provided through the slots that are 65 mm from the end of the C-Section. Remove the 3-off 6 mm setscrews from both ends of the collectors. Place the two collectors on the frame, using the bottom collector mounting rail to support the collectors. Fit the compression unions to the centre collector joints. Note that it is very important to have the union olives fully seated on the pipes before the collector is installed.

For an efficient thermo-syphon operation, the right-hand side of the collectors need to be slightly higher than the left-hand side. Set the bottom support bar to achieve this incline and tighten the nuts and bolts. Once the compression unions have been installed and tightened, position the collector bank centrally on the bottom support bar. Attach the top collector support bar to retain the top of the collector bank and fasten to the side rails using two 3/8" BSW bolts and nuts.

Installation of Storage Cylinder

The Beasley close coupled system comes complete with cylinder support bars attached to the main cylinder. Lift the storage cylinder on to the frame with the cylinder lower side support bar located under the lip of the top collector support.

Align the cylinder upper support bar with the mounting slots in the C-section. Secure the cylinder to the upper ends of the C-sections using 3/8" BSW nuts and bolts.

Finishing the Installation

Once the cylinder and collectors are attached to the cyclone mounting frame, the connection of flow and return pipes, valves and all associated plumbing work can be completed.

Table 7 Component List for Cyclone Mounting Frame

Part No.	Description	180 Litre	330 Litre	480 Litre
142.01.091	Bar top hat section 180 L	2	-	-
142.01.078	Bar top hat section 330 L	-	2	-
142.01.079	Bar support C-section	2	2	4
304.01.705	Support bar collector mounting 26 S-180 L	2	-	-
304.01.706	Support bar collector mounting 26 S-330 L	-	2	-
304.01.710	Support bar collector mounting 26 S-480 L	-	-	2
226.01.066	Bolt 3/8" BSW x 3/4" long zinc plated	10	10	20
168.01.056	Nut 3/8" BSW zinc plated	6	6	12
174.01.058	Washer 3/8" BSW zinc plated	10	10	20

- All components packed in a kit carton Pt. No. 202.01.125
- Kit Part Numbers: 180 L - 332.01.933; 330 L - 332.01.934; 480 L – 332.01.966;

INSTALLATION OF SIDE-PITCH ROOF FRAME FOR CLOSED COUPLED SYSTEM

Preface

Before installation, check that all the components are included in the kits including both the flat roof and the separate side-pitch frame kit.

Read these instructions carefully and fully BEFORE proceeding with installation

- Side-pitch frame kits are not available for the 480 Litre model.

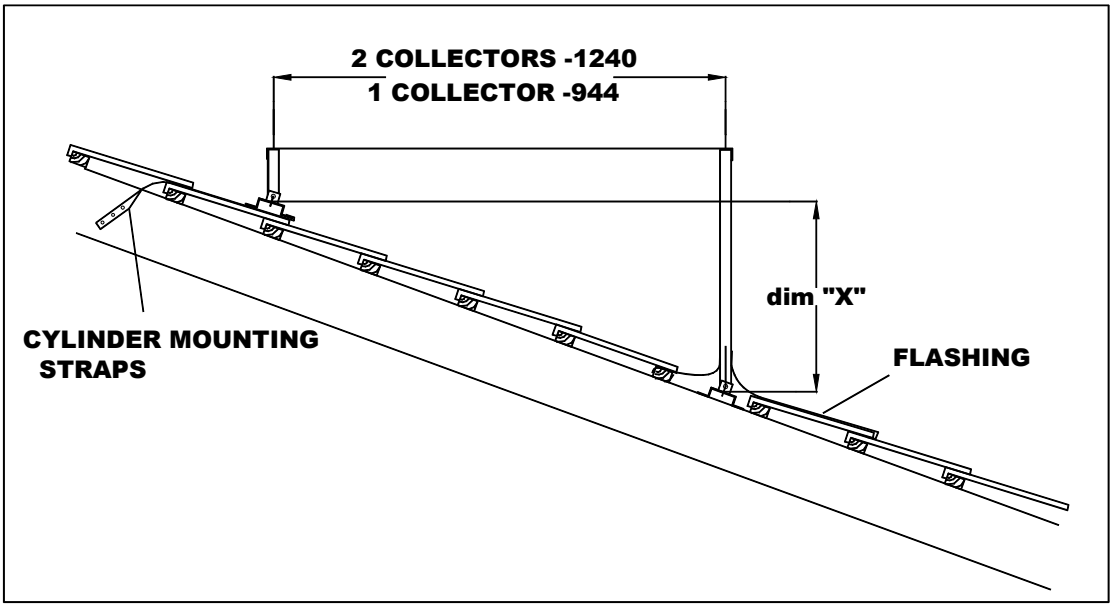


Figure 18. Frame Dimensions

Locating the Frame

The base rail (top hat section) that supports the short legs must be located on the nose of the tiles.

The legs at the high end of the frame must be located directly above a roof rafter. Ref Figure 19.

Modifying the Frame to Suit the Roof Pitch

Position the upper top hat section on the tile nose. Remove the roof tiles from the position of the lower top hat section, lay it in position, and measure the vertical distance between them (dim 'X' in Figure 18). Add 324 to this dimension and cut the plain end off the long extensions to make them this length (e.g. vertical dimension 'X' is 200, cut the long legs 524 long). Drill an 11 mm diameter hole through the long extensions 20 mm from the plain end to match the hole in the angle cleat.

- This frame is not suitable for installation in cyclone prone areas. For further details, contact your local Beasley distributor.

Assembling the Frame

Assemble the left and right-hand triangular frames as shown in Figure 19. Note that the installation instruction supplied with the Flat Roof Kit shows the lower angle with its 'toes in' but for this installation toes need to be out.

Bolt the long extensions to the triangular frame that will be installed on the lower part of the roof.

Bolt the short extension supports to the triangular frame that will be installed on the higher part of the roof. Attach the cross braces and collector support rails.

Bolt the angle cleats to the top hat sections and then loosely attach the frame to the cleats.

Put the frame into position and secure the lower top hat section to each rafter that it crosses with 8 mm coach screws.

Hook the two cylinder mounting straps to the upper top hat section and nail them onto roof rafters under the tiles.

Tighten all frame nuts and bolts.

Replace tiles and flash around the long legs.

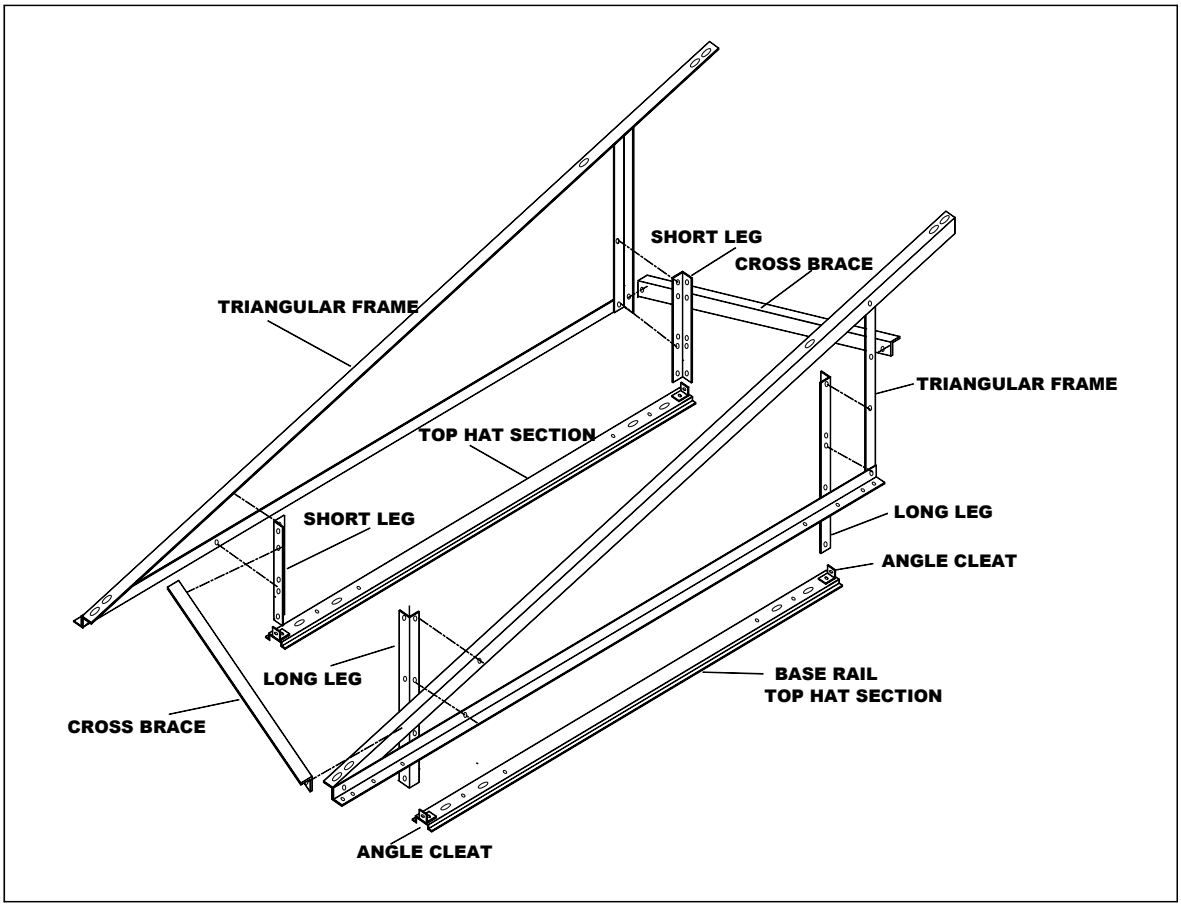


Figure 19. Frame Construction Members

INSTALLATION OF REVERSE-PITCH ROOF FRAME FOR CLOSE COUPLED SYSTEM

- This frame is not suitable for installation in cyclone prone areas. For further details, contact your local Beasley distributor.
- Reverse-pitch frame kits are not available for the 480 Litre model.

Preface

Ensure all components are included in the kit. Refer to Table 7.

INSTALLATION INSTRUCTIONS:

Locating the Frame

The Base Rail top hat section that supports the end of the triangular frame is to be located on the nose of the tiles. The legs at the high end of the frame are to be equally spaced across roof rafters.

Modifying the Frame to Suit the Roof Pitch

Position the upper top hat section equally across three rafters with the lower edge of the top hat section on a tile nose. Hook the two cylinder mounting straps onto the top hat section and nail the cylinder mounting strap to the roof rafters. To ensure the correct thermo-syphon action will be achieved, the left hand end of the frame (looking up the roof) must be approximately 12 mm higher than the right hand end of the frame. Remove the roof tiles from the area where the lower top hat section is to be installed. Position the lower top hat section with the U brackets in place and measure the vertical distance between the holes in the two brackets (Dim. 'X' in Figure 21). Mark this position on the two right hand side sections and drill 11 mm diameter holes. Cut off the surplus top hat section 15 mm below the centre line of the drilled holes.

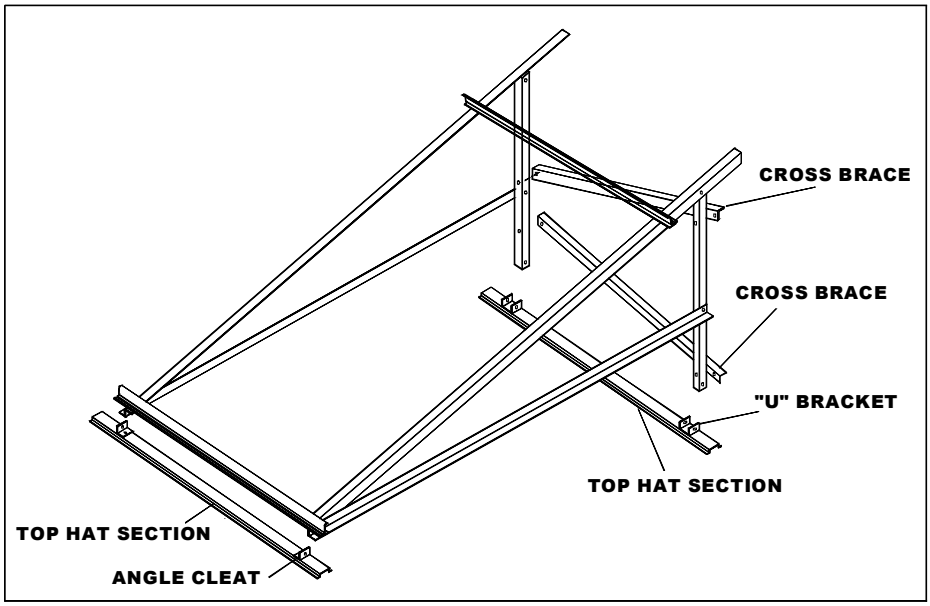


Figure 20. Frame Construction

Assembling the Frame

Assemble the Frame as shown in Figure 20 and Figure 21. Note the sloping angle iron has a toe in and the horizontal angle iron has a toe out. This allows the angle cleat to be bolted to the lower end of the frame with its toe in.

Assemble the cross braces to the support legs and bolt the lower collector support extrusion to the sloping angle iron using holes nearest the end. The braces may slope in the opposite direction to that shown in the diagram. Loosely attach the upper collector extension.

Secure the lower top hat section to each rafter that it crosses using 8 mm coach screws.

Replace tile and flash around each leg.

Mounting the Collectors and Cylinder

Place the cylinder in position and temporarily fix it in the highest possible position.

Sit the collectors in the lower support extrusion.

Interconnect the collectors with Din 20 compression fittings.

Position the upper support extrusion over the collector and secure the mounting screws.

Position the cylinder by fitting the lower support rail into the recess in the collector extrusions. Connect the collector piping and secure the cylinder in place.

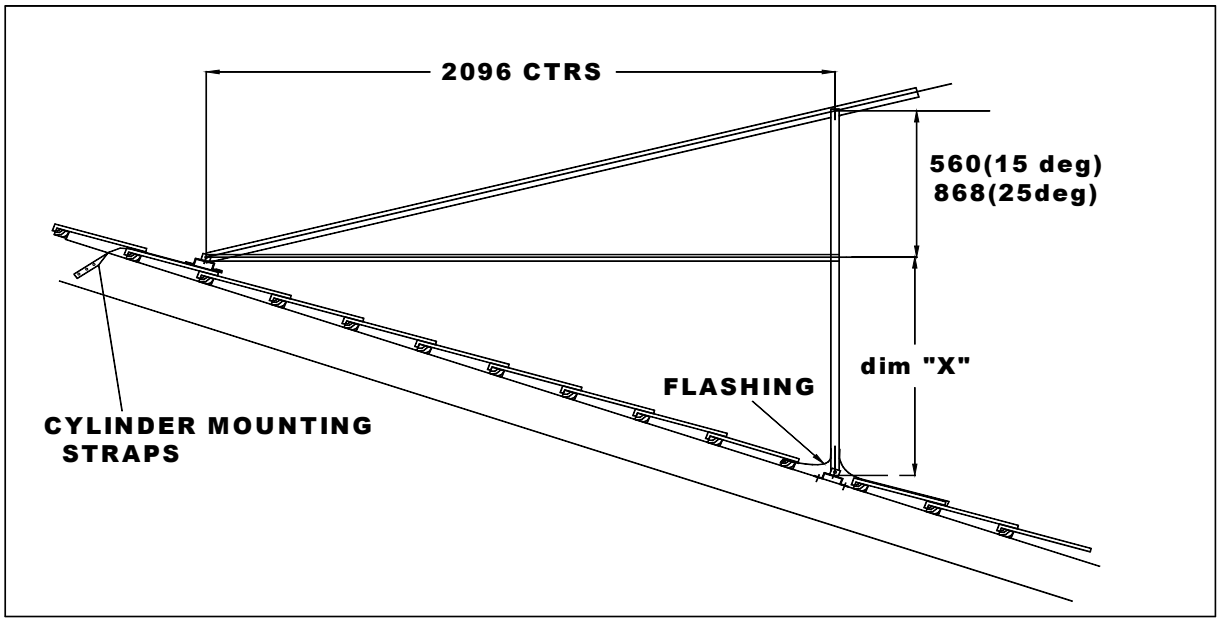


Figure 21. Frame Dimensions

Table 8 Component list for reverse-pitch mounting frame

Part No.	Description	1 Collector	2 Collector
142.01.089	Bar diagonal bracing	-	2
142.01.090	Bar diagonal bracing	2	-
142.01.087	Base rail	2	2
142.01.086	Angle rail	2	2
142.01.113	Angle cleat	2	2
142.01.126	'U' bracket	2	2
142.01.091	Top hat section 180 L	2	-
142.01.078	Top hat section 330 L	-	2
142.01.127	Support leg R.H.	1	1
142.01.128	Support leg L.H.	1	1
304.01.705	Support bar mounting 26S-180- SP201	2	-
304.01.706	Support bar mounting 26S-330- SP201	-	2
174.01.058	Washer 3/8" BSW zinc plated	20	20
168.01.056	Nut 3/8" BSW zinc plated	16	16
226.01.066	Screw 3/8" BSW x 3/4" lg Z/P Hex Hd.	10	10
226.01.076	Screw 3/8" BSW x 2½" lg Z/P Hex Hd.	10	10

- 2 Collector Kit Part No. 332.01.994, 1 Collector Kit Part No. 332.01.995
- All parts to be packed into a frame carton sleeve (Pt. No. 202.01.125)

INSTALLATION OF SOLAR COLLECTORS

- The method of mounting the collectors is the most important factor in the satisfactory operation of the system

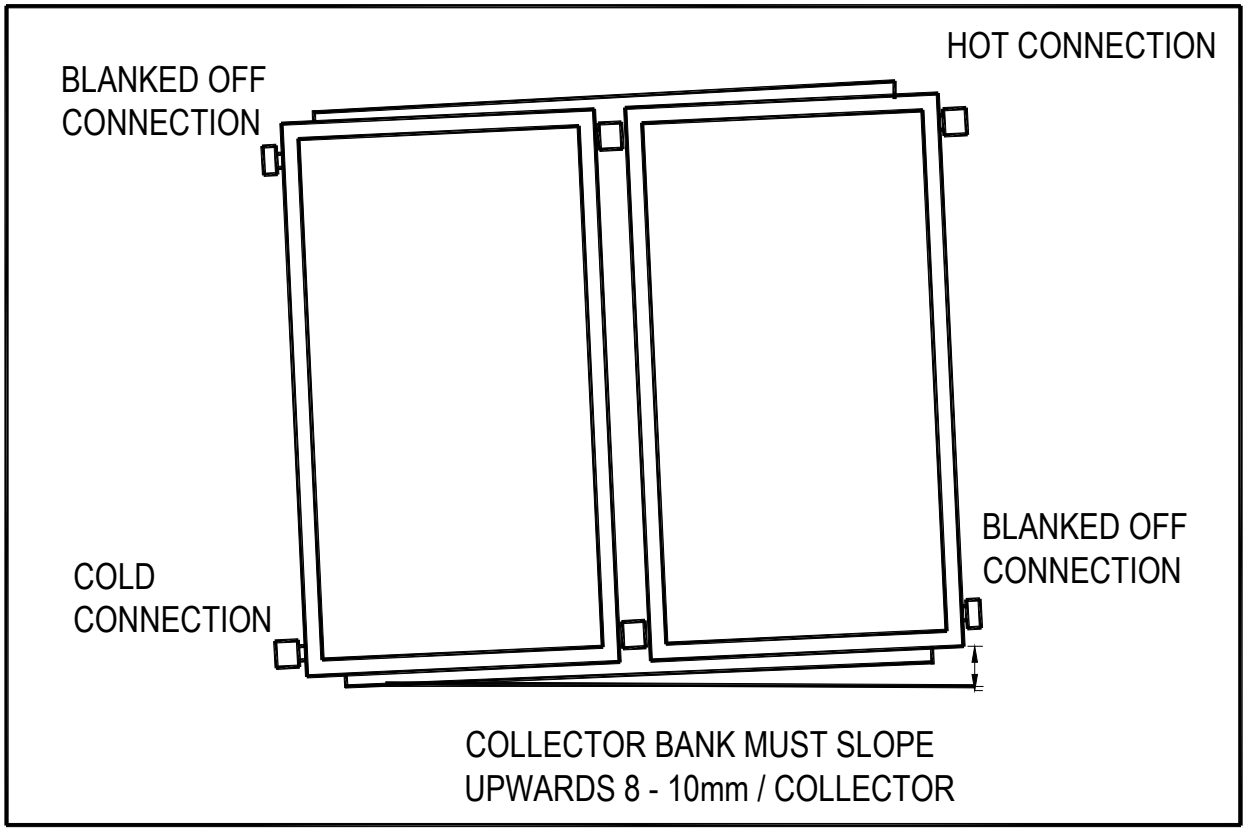


Figure 22. Collector Bank Slope

Marking a Tiled Roof with the Location of Collector Mounting Straps

- This process should be carried out **BEFORE** hauling the collectors up onto the roof.

Obtain a heavy crayon or chalk marking the tiles with the required location of the ends of the collector mounting straps, and obtain a long straight edge (such as a piece of timber or tube).

Lay the collectors together on a flat surface, with the straight edge along the bottom edge. Place all olives, nuts and nipples used for connecting the collectors together on the pipes and hand tighten. Ensure that the pipes are fully entered into the fittings. Once this has been established, tighten the compression fittings that join the collectors together until the olives are sealed on to the pipe.

Mark the centres of the mounting strap holes and the mid point of the collector bank onto the straight edge. Note that it is normally the extreme mounting strap positions that are used together with intermediates as required. Undo the compression fittings, leaving the nuts and olives on the collectors.

Marking the Location for the Lower Collector Mounting Straps

Select the cylinder location. The lowermost cylinder mounting bracket must rest directly over a tile batten at a minimum of 2100 mm above the edge of the roof, as shown in Figure 23. Mark the centre position of the cylinder lower mounting bracket.

From this mark, measure 2035 mm down the roof. Position the marked straight edge with the collector banks mid-point to coincide with this centre line.

After ensuring that the straight edge slopes up the roof about 8 mm/collector from inlet to outlet, clearly mark the location of the selected mounting strap hole positions.

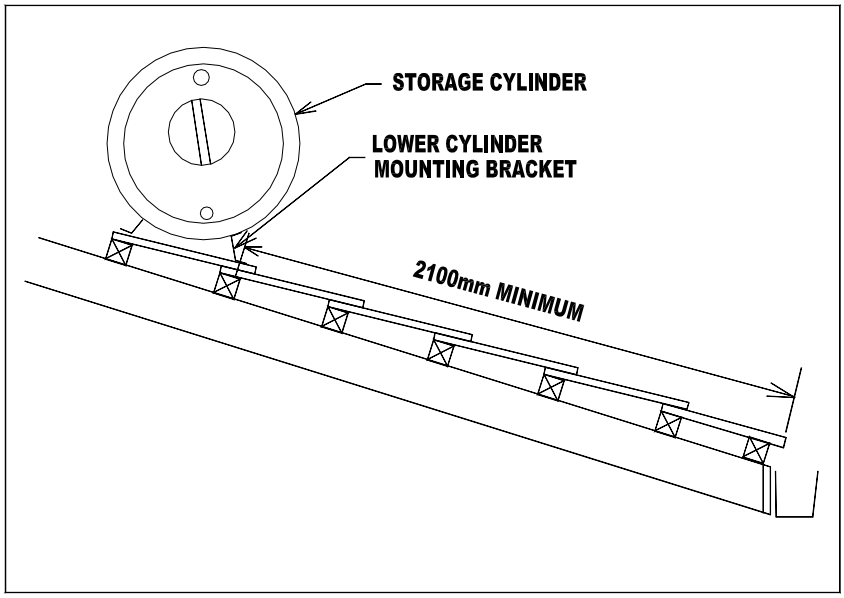


Figure 23. Lower Cylinder Mounting Bracket

Attachment of Collector Mounting Straps on a Tiled Roof

Remove 2 or 3 tiles above each of the marked positions and nail collector mounting straps to the tile battens, so that the holes at the end of the straps are at the marks on the roof, as shown in Figure 24. Pilot drilling the holes for the clouts is recommended. For maximum strength it is wise to wrap the strap around the batten. Replace the tiles.

Positioning of Collectors on a Tiled Roof

Carefully lift the collectors onto the roof. If more than one collector is being installed, connect the collectors together with their compression fittings after placing on the roof. If the roof is distorted it may be necessary to pack up the corners of the collector to achieve alignment.

Attach the mounting straps to the collectors using the screws supplied. A small amount of silicone sealant should be applied to both the screws and the threaded holes prior to inserting the screws into the collector.

Check with a spirit level to ensure the collectors are on the correct slope up towards the outlet as shown in Figure 22.

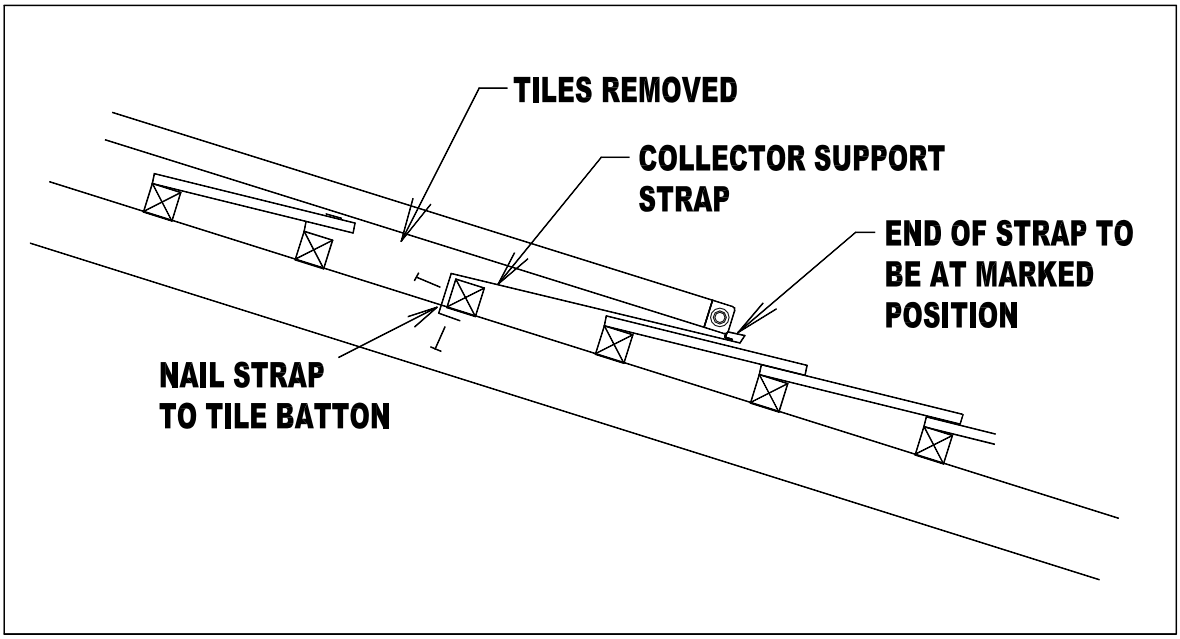


Figure 24. Collector Support Strap Fixing

Installation of Upper Collector Mounting Straps on a Tiled Roof

Once the collectors are in position, remove tiles from above the collectors and fit the upper mounting straps as per the lower ones. Replace the tiles.

Installation of Collectors on an Inclined Iron Roof

Special care must be taken to check that the roof structure is capable of bearing the load imposed by the hot water solar system (see AS 3500.4).

Determine the position of the roof purlins (usually by the line of nails). Drill through the purlins, apply silicone sealant down the hole to ensure no water leakage is possible and secure with 5/16 galvanised coach screws.

Mount the collectors on the roof. Join the collectors using the supplied brass interconnecting unions. Attach the mounting straps to the collectors using the supplied screws. A small amount of silicone sealant should be applied to the screws and around the threaded holes prior to inserting the screws into the collector.

Adjust the position of the collectors to achieve the 8 mm/collector rise as per Figure 22. The collectors will look slightly askew on the roof. If necessary drill through the support straps and secure the collectors with 1/4 galvanised coach screws.

Installation of the Storage Cylinder (roof pitch less than 30°)

Lift the storage cylinder onto the roof and locate it above the collector bank. If the installation is 180 L/1 collector,

330 L/2 collector, or 480 L/3 collector, the cylinder is central across the collectors. If additional collectors are used, the cylinder's position should be as central as possible to the collector bank. Loosely attach the hot flow and cold return pipe assemblies to the collector and storage cylinder. The use of a teflon based sealing cream (Loctite 567 or Unasco) applied to the end of the pipe prior to sliding on the olives will ensure that a leak free joint is made.

- The large 'Beasley' sticker should face the collector bank.

Remove a row of tiles one row up from the storage cylinder. Slide the two cylinder support straps into the slots located in the uppermost cylinder support bracket so that the straps are in line with the rafters or as close as possible to them. Apply tension to the straps and attach them to the rafters using roofing nails or similar (as shown in Figure 25). Replace the tiles.

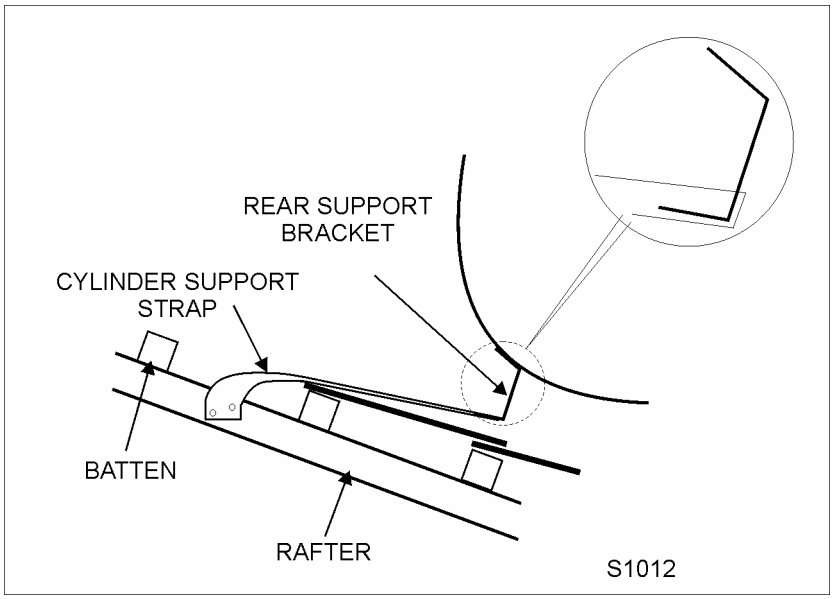


Figure 25. Cylinder Support Strap Location (Roof Pitch < 30 Degrees)

- Ensure the connecting pipes are not stressed, and that connectors on the cylinder and collectors are aligned correctly. Tighten connectors and fittings.

WARNING: Do not secure cylinder support straps to tile battens. If rafters are not in suitable locations, additional timbers should be secured into position.

Installation of the Storage Cylinder (roof pitch less than 30°)

If the roof pitch is greater than 30° and the standard cylinder strap shown in Figure 25 is used, excessive load will be applied to the standard cylinder support strap. For this reason a special rafter bracket and a cylinder wraparound strap should be installed as shown in Figure 26.

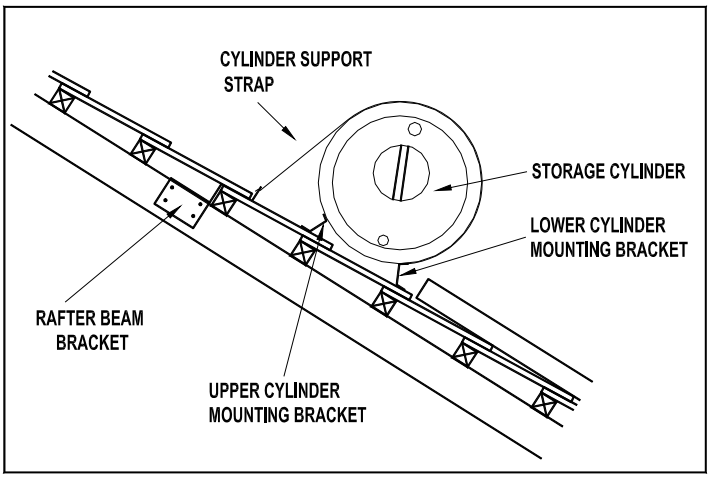


Figure 26. Cylinder Support Strap Location (Roof Pitch > 30 Degrees)

The rafter beam bracket is securely bolted to the rafter with M10 coach bolts. To install the cylinder support strap after installing the rafter bracket, fix the cylinder support strap at the lower end, and lift the tank upward, fitting the top end of the cylinder support strap through the slot in the rafter beam bracket. When the lifting pressure is removed from the cylinder and the cylinder support strap is tensioned, the cylinder should be in its correct position.

Hot and Cold water Connection

To reduce the risk of scalding, it is recommended that a tempering valve is fitted for all hot water systems.

Hot Water Connection

Assemble the Pressure and Temperature Relief (PTR) valve and adapter tee into the hot water outlet.

Connect a copper tube to the drain provision of the PTR valve.

- DN15 mm tube for 180 and 330 Litre cylinders, and DN20 mm tube for 480 Litre cylinders.

Run the relief drain lines with a continuous downward grade to a visible discharge point over a drain or gully.

Connect a copper tube to the tee in the hot water outlet.

Run the copper tube to the hot water outlet points.

- The hot water outlet pipe must be insulated a minimum of 1 metre from the outlet point of the PTR valve.

Cold Water Connection

Connect the cold supply line to the branch of the tee on 480 L models or to the branch on the TA valve on 180 L & 330 L models.

ELECTRICAL WIRING CONNECTION

Electrical installation must be carried out by a licensed electrician in accordance with AS3000 wiring rules (in Australia – or the associated legislation for the country of installation) and all local electrical and building regulations

A separate circuit breaker or fuse should be assigned to the water heater in the main fuse board of the property, and wiring to the element in the storage tank on the roof should be carried out by a licensed electrician using weather-proof conduit. A 20 mm diameter conduit entry accommodates a standard screwed straight weather–proof connection. All cables must be rated for maximum current consumption in accordance with AS 3000. A 'Utilux' earth tab is attached to the tank alongside the terminal block.

- 15A for elements up to 3600 W; 20A for 4800 W elements.

If the new installation replaces an existing unit, the existing fuse/circuit breaker and/or wiring may be reused, providing the new current rating is either less or equal to the rating of the removed unit, and is in serviceable condition.

Thermostat

The thermostat installed in the storage tank has been pre-wired at the Beasley factory. The thermostat must not be set below 60 °C. The normal setting temperature is 65 °C.

Electrical Cover

The cover is attached by a bayonet fitting secured by a screw for easy access to the electrical components.

Auxiliary Switches

For convenience, a switch may be installed in the wiring to the storage tank, enabling the property owner to switch off the auxiliary heating element if required. This may be during a vacation etc. A time clock may also be installed to prevent heater operation during the day, although a short period of electric heating may be advantageous in the late afternoon, especially in the winter months. A 'One Shot' boost switch should be considered. By pushing the button, this switch will cause the element to heat the water to temperature, then cut out.

- Ensure that the cylinder is completely filled with water before turning on the power supply. Failure to adopt this procedure can cause extensive damage and will void the warranty.

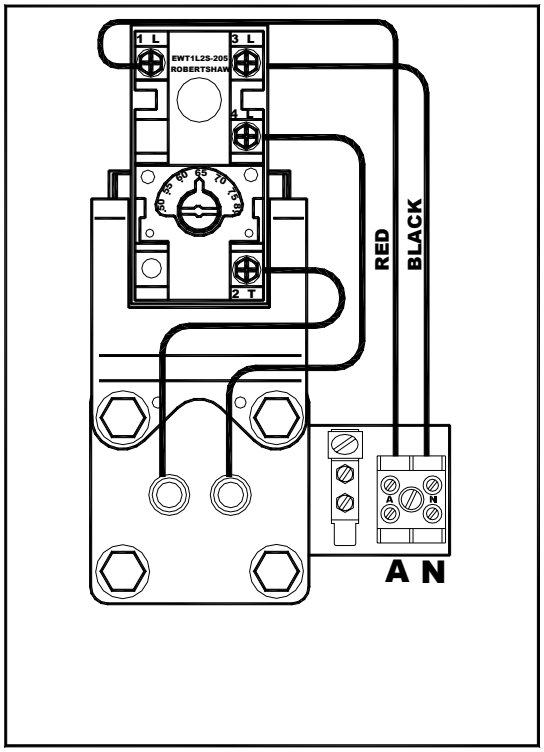


Figure 27. Wiring Diagram

Table 9 Standard Booster Element Current Ratings

Model	Element rating	Full load current
All models	3600 watt standard	15 amps at 240 volts AC

Table 10 Alternative Optional Booster Element Current Ratings

All models	1800 watt	7.5 amps at 240 volts AC
All models	2400 watt	10 amps at 240 volts AC
330 litre & 480 litre	4800 watt	20 amps at 240 volts AC

Finishing the Installation

Check and replace any tiles that may have been damaged during installation.

Advise the customer of the recommended operating and maintenance procedures and complete the 'Warranty Certificate' at the end of this manual.

Draining Instructions

The power supply to the element must be switched off and the fuses removed.

Close the stop cock in cold water mains supply line.

Open a hot water tap to relieve pressure in the cylinder and collectors.

Remove hot water outlet fitting or open the pressure relief valve, so that the cylinder can vent during draining.

Remove brass plug from the bottom left-hand end of the collector bank and allow unit to drain.

WARNING: Water in collectors may exceed 90 °C so extreme care should be exercised during the draining operation. In clear sunshine, partially drained collectors can easily generate steam which will flow from a hot water outlet point.

Pre-commissioning Checklist

- Are all bolts tight on the roof framework?
- Are all cylinder and solar collector straps fitted and correctly anchored to the roof structure?
- Are all pipe connections fitted correctly and tightened?
- Are the solar panels and pipe work installed with the correct slope to ensure the thermo-syphon flow of hot water can take place efficiently?
- Is the installation finished neatly with the roof made good, all tiles and flashings in place?
- If a HTM is fitted, has this been correctly filled with ‘Glysol’ and checked for leaks?
- Has the electrical installation been completed correctly; are all connections tightened and conduit entries sealed from the weather?

Filling Instructions

Open the taps at all hot water outlet points. Special attention is necessary if the installation has multi-level hot water outlets, to ensure that no air is trapped in the hot water pipe work. Open stop cock in the cold water mains supply line.

Close hot water taps when water flows freely and all air has been expelled.

Commissioning the New System

When the new hot water system is full and no air is apparent at the hot water taps, the entire system should be checked for leaks. Pay particular attention to fittings in inaccessible positions, such as on the solar panels and the storage tank on the roof. If any leaks are detected the system must be drained and the leaks repaired before the system is refilled. If this is necessary, cover the solar collectors to prevent them from excessively heating any water still in them.

Check that the thermostat is set between 50 °C and 65 °C, replace the cover correctly and switch on the electrical circuit breaker (or install the fuse). Check the operation of the PTR valve; after a period of time, check that the element in the storage tank is heating the water correctly.

WARNING : Ensure that the system is full of water before switching on the heating element

The new hot water system is now ready for use.

MAINTENANCE

Pressure and Temperature Relief Valve

At six monthly intervals the PTR valve and temperature valve should be checked; at twelve monthly intervals the whole system should be checked for general condition with specific emphasis on the following details:

Gently turn knob to check that water discharges through the drain and that the valve then reseals after the knob has been released. Take care that you are not in the path of the discharging water because it will be very hot. It is recommended that the PTR valve be replaced at intervals not exceeding 5 years.

Tempering valve: Confirm that the temperature of the water issuing from the hot taps is below the safety setting.

Pipe joints: Ensure that there are no leaks from any of the pipe joints or collector connectors.

Collector glass: Confirm that all the collector glass is unbroken and clean off any accumulated dirt. This will ensure that the collectors continue to operate at their maximum efficiency. Check the condition of the seal around the glass.

Electrical: Ensure that the power supply is isolated. Remove the electrical door from the cylinder end cap and check for any signs of arcing or water seepage.

Installation site: Confirm that no changes have occurred in the vicinity of the system to cause shading of the collectors.

Installation of Heat Transfer Module (HTM)

The Beasley Heat Transfer Module (HTM) is for use in conjunction with solar collectors in areas prone to frost. The unit operates with a Propylene Glycol-based heat transfer fluid that contains a corrosion inhibitor, that is balanced for the system and dye. Only Beasley 'Glysol' can be used as the base for filling the HTM and collectors.

- Propylene Glycol is rated as a food quality product but it is not recommended to be ingested in significant quantities.

If the collector system is installed on a roof that is used as a rainwater catchment, precautions should be taken to prevent any leaking Glysol from entering the gutter system. If a spillage occurs contact Beasley Industries Pty Limited.

If the user should notice a blue tinge in the hot water supply, it is possible that Glysol has leaked into the water circuit. Even though Glysol does not pose any significant threat to health, the HTM must be isolated and serviced.

- The HTM and collector connections are made with copper olives. The mounting of the collectors shown in the diagram is indicative only and may vary slightly in the way in which the support rail(s) is attached.

Attach the croxed stub pipe and flexible couplings with the hose clamps to the two right-hand collector header tubes and attach croxed tubes to the HTM connections. Slide the HTM towards the collector to fully insert connecting tubes into the flexible connectors. Tighten the hose clamps.

For the 330 and 480 Litre systems, take the cold return pipe from the collector kit and cut the longer tail off, leaving the long leg 2000 mm long. Braze the supplied extension pipe to this to make an overall length to suit the system.

For the 180 Litre system reduce the long leg of the cold pipe to 1355 mm. Slide the supplied insulation onto the pipe. Loosely attach this pipe to the fitting on the side of the HTM.

Position the cylinder above the collectors and connect the hot pipe between the cylinder and the HTM. Adjust the cylinder to a horizontal position along the roof and attach as described in the non-HTM instructions.

Connect the long and short expansion pipes together. Attach the short expansion pipe to the top left-hand collector stub pipe and lay the long pipe along the upper support foot on the cylinder. Ensure that the long pipe is slightly higher at the plug end than the collector end.

Tighten all pipe connections. Seal the lower end of the HTM with the 3/4" cap. Do not install the 1/2" plug in the vent connection at this stage. Attach the drain cock using the compression plug, copper olive and compression nut to the lower left collector header tube

- Use a drain cock fitted with special 'O' rings supplied by Beasley Water Systems.

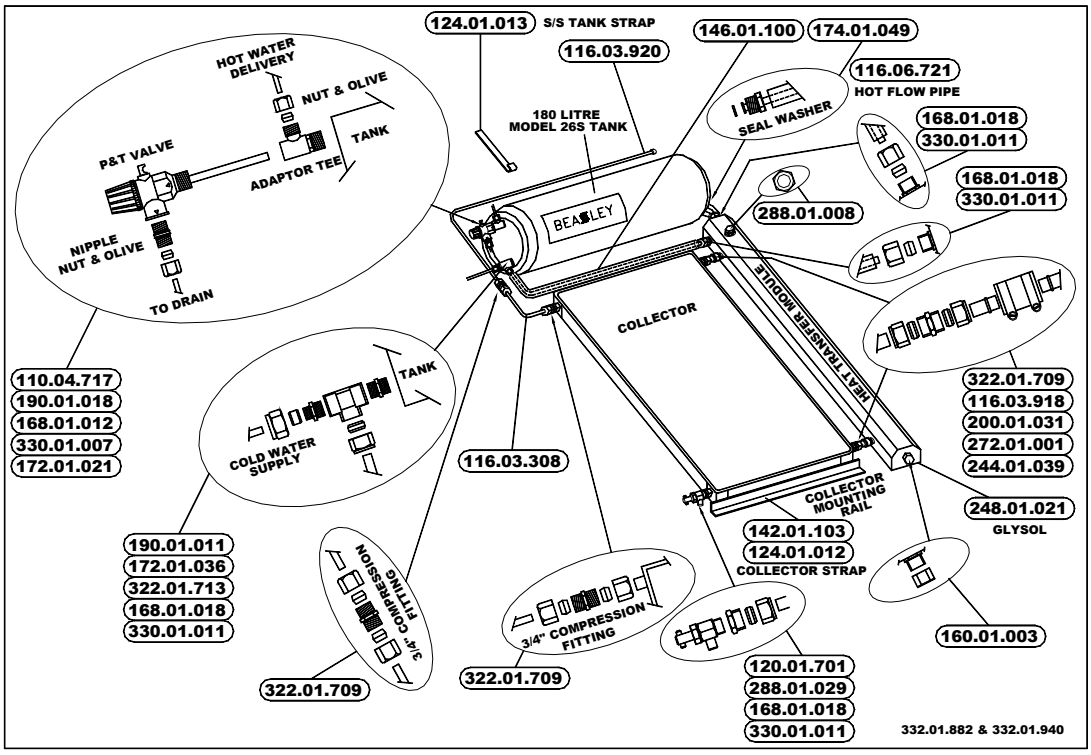


Figure 28. 180 Litre One Collector System fitted with HTM

Filling Instructions

With the 1/2" vent plug removed from the heat transfer module (HTM), connect a length of 1/2" hose to the drain cock outlet. Fully open the drain cock tap. Hold the hose higher than the HTM vent and slowly pour the Glysol fluid into the hose and top up the system with clean (preferably demineralised) water until the fluid starts to overflow from the vent. Fit the 1/2" plug in the vent, then close the drain cock tap and remove the hose. If any fluid escapes from the drain cock, remove the 1/2" plug and add water to the HTM through the vent until it overflows. Fit the 1/2" plug to the vent.

Table 11 Fluid Volumes

SP 2000 collectors	Glysol litres	Water litres
1	2.5	4.3
2	3.5	6.2
3	4.5	8
4	5.5	10

Slide the two covers over the flexible connectors and press in their open ends to fasten them in place.

- **IMPORTANT:** Failure to remove all air from the system may result in excessive pressure build-up and subsequent detachment of the HTM from the collector.

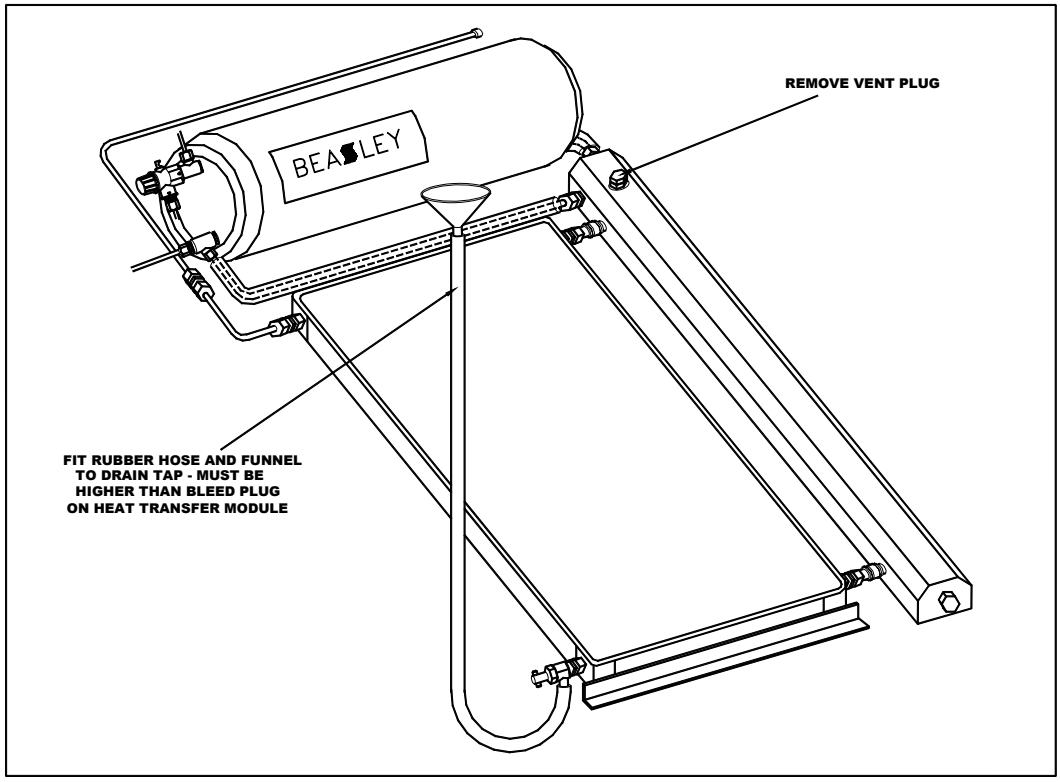


Figure 29.. Filling a HTM system

HTM System Service Precautions

IMPORTANT – If there is a rain water tank:

- When draining or refilling the system make sure that Glysol does not spill onto the roof where it can run into the rain water tank. If any spillage occurs refer to Beasley Hot Water Solutions.
- Maintain a minimum 35% Glysol content when refilling the closed circuit.
- Hot water in the collectors may be under pressure. Caution should be taken when removing bleed plug.
- Always ensure that drain cock is fully closed and a leak tight seal when replacing the vent plug. Any leakage will reduce the thermo-syphon efficiency of the system.

CLOSE COUPLED SOLAR HOT WATER SYSTEM WITH HTM

	PART No.	DESCRIPTION	QTY 180L 1COLL	QTY 180L 2COLL	QTY 330L 2COLL	QTY 330L 3COLL	QTY 480L 3COLL	QTY 480L 4COLL
	KIT PART No		332.01. 940	332.02. 007	332.01. 937	332.02. 008	332.01. 986	332.02.0 09
+	168.01.018	NUT BRASS 3/4" BSP COMPRESSION	1	1	1	1	1	1
+	330.01.011	OLIVE COPPER COMPRESSION 3/4" BSP	1	1	1	1	1	1
+	190.01.011	TEE – 3/4" BSP BRASS	1	1	1	1	1	1
+	120.01.701	DRAIN COCK	1	1	1	1	1	1
+	288.01.029	PLUG BRASS 3/4" BSP x 1/2" BSP	1	1	1	1	1	1
	288.01.008	PLUG 1/2" BSP	1	1	1	1	1	1
+	322.01.709	UNION COMPRESSION ASSY 3/4" CU-3/4" CU BRASS	2	2	2	2	2	2
+	200.01.031	HOSE - INTERCONNECTOR HTM / COLLECTOR	2	2	2	2	2	2
+	272.01.001	HOSE CLAMP 3/4" TO 1½" ST. ST.	4	4	4	4	4	4
+	116.03.915	STUB PIPES 50 LG.	-	2	2	2	2	2
+	116.03.918	STUB PIPES 100 LG.	2	-	-	-	-	-
	248.01.021	GLYSOL 2.5L - 1 COLLECTOR	1	-	-	-	-	-
	248.01.022	GLYSOL 3.5L - 2 COLLECTOR	-	1	1	-	-	-
	248.01.023	GLYSOL 4.5L - 3 COLLECTOR	-	-	-	1	1	-
	248.01.---	GLYSOL 5.5L - 4 COLLECTOR	-	-	-	-	-	1
	116.06.721	TUBE & INSUL. ASSY - HTM TO 180 L CYL.HOT	1	1	-	-	-	-
	116.06.723	TUBE & INSUL. ASSY - HTM TO 330 L CYL.HOT	-	-	1	1	-	-
	116.06.724	TUBE & INSUL. ASSY - HTM TO 480 L CYL.HOT	-	-	-	-	1	1
	116.03.916	TUBE CYL TO HTM - 330L COLD EXT. DN20x300	-	-	-	1	-	-
	116.03.917	TUBE CYL TO HTM - 480L COLD EXT. DN20x1350	-	-	-	-	1	1
	116.03.920	TUBE ASSY HTM EXPANSION LONG	1	1	1	1	1	1
	116.03.308	TUBE ASSY EXPANSION SHORT	1	1	1	1	1	1
	146.01.099	INSULATION 19 I/D x 13 WALL x 2 m Lg.	-	1	1	1	1	1
	146.01.100	INSULATION 19 I/D x 13 WALL x 325 mm Lg.	1	-	-	1	1	1
	146.01.101	INSULATION 19 I/D x 13 WALL x 1.5 m Lg.	-	1	1	-	-	-
	244.01.039	COVER-HTM CONNECTORS	2	2	2	2	2	2
NOTES								
1. + These components packed on a skin wrapped backing sheet.								

Draining the HTM and Collectors

To prevent Glysol flowing into the roof gutters, carefully loosen the 1/2" plug to relieve the pressure (if the collectors are hot there will be pressure in them) and then re-tighten it. Attach a hose on the drain cock outlet pipe.

Put the other end of the hose into a container before removing the 1/2" vent plug and opening the drain cock tap.

To drain the water out of the HTM remove the cap at the bottom of the HTM.

WARNING: Fluid in collectors may exceed 90 °C so extreme care should be exercised during the draining operation. In clear sunshine partially drained 'Beasley solar collectors' can easily generate steam which will flow from any outlet point.

INSTALLATION OF A CLOSE COUPLED SOLAR GAS SYSTEM

The installation must be in accordance with these instructions, in conjunction with AS 3500.4, and in accordance with relevant local electrical, gas, water supply and building regulations.

The instantaneous gas hot water booster unit must be installed in a location that complies with the limitations shown in the instructions supplied with the unit. All installation must be carried out by suitably qualified personnel in accordance with the manufacturer's instructions.

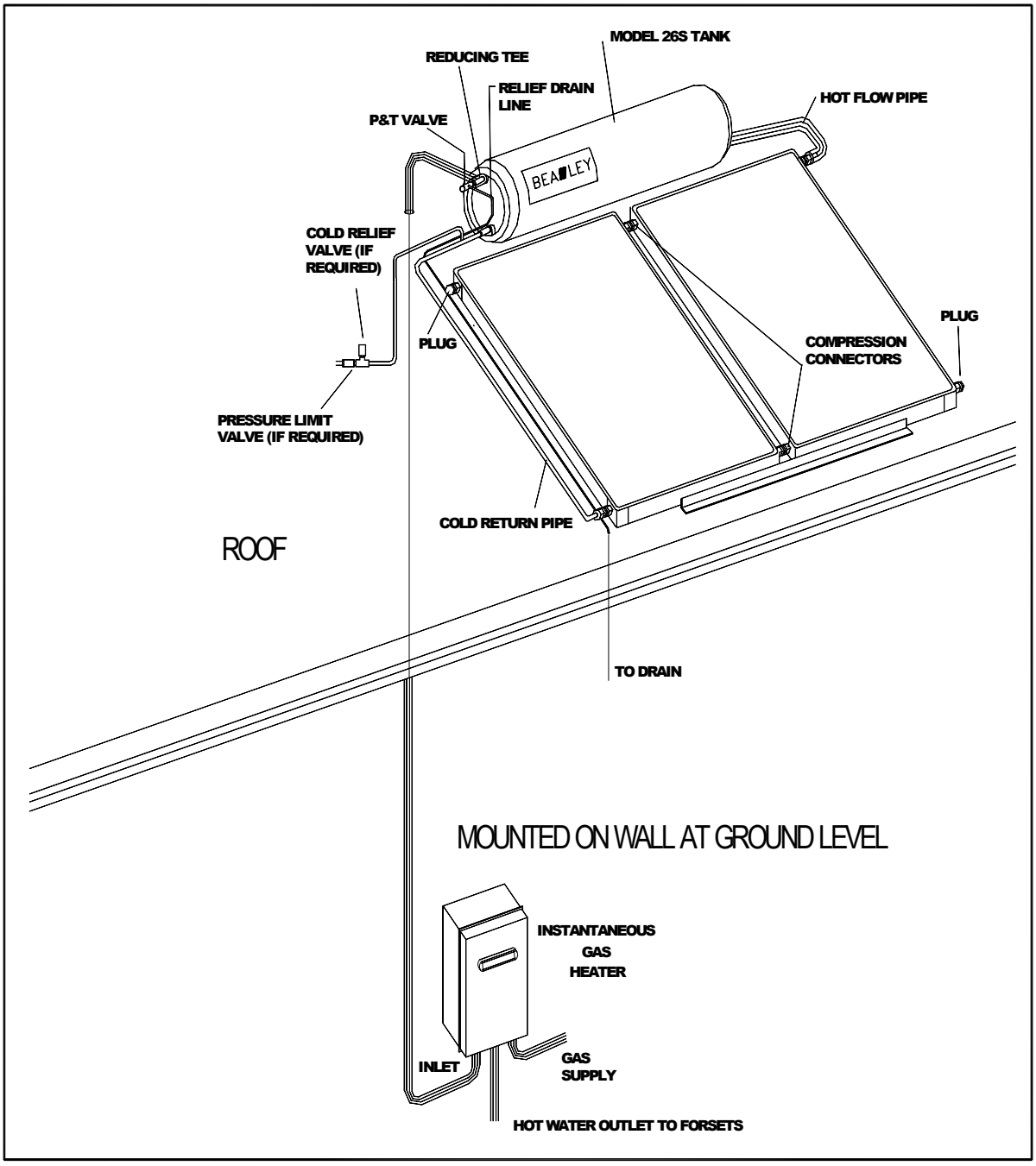


Figure 30. Typical Installation of Close Coupled Solar Gas System

TROUBLESHOOTING

GENERAL

This section should be used as a guide to assist in the quick location and correction of system faults to ensure Beasley systems retain their position of high performance, quality and service.

INSUFFICIENT HOT WATER (SOLAR*)*

This can often be the result of the owner's reluctance to turn on the booster during periods of low solar radiation or high hot water usage. It is essential to establish the facts regarding usage patterns before any investigative work is conducted. Owners may not be aware of issues that can lead to perceived system inefficiency under solar only input conditions.

The situations for consideration are:
Use of hot water is above the system's capacity.

- High hot water usage at night.
- Current weather conditions.
- Household plumbing condition.
- The owner's understanding of booster usage.
- The owner's expectations of system performance.

Having determined that these conditions are not responsible for poor performance, the following checklist may be used to identify the cause.

TROUBLESHOOTING CHECK LIST

Orientation of solar hot water system and the effect of any shading.

Airlock in collector:

- Raise top right-hand corner on system.
- Ensure that tank connections are higher than the collector connections.

Slow leak from system or household pipes:

- Check water meter for movement.
- Pressure test pipes in the house.

Blockage in connecting pipes.

Collector blocked with sediment.

HTM SYSTEMS ONLY

Closed circuit not filled with Glysol.

Check for joint leakage.

Check expansion tube (if fitted) has an upward slope.

Refill HTM during cool part of day; pressure test and ensure that all joints and fill plug are watertight.

Ensure correct mix of Glysol is maintained (35%).

More Detailed Investigation

If the above checklist items do not reveal any faults a draw-off test may be performed to demonstrate that the system is performing correctly (see draw off procedure below).

Should the solar hot water system be shown to be performing correctly it is possible that household consumption is greater than expected. To demonstrate this to the owner, a water meter should be placed on the cold supply to the solar hot water system and daily recordings should be made for one month to establish average usage requirements.

Water restriction devices may need to be considered if high usage is the reason for perceived poor performance. Fitting restrictors to shower heads and using cold clothes washing methods are the most successful ways to reduce hot water usage without affecting the owner's comfort levels.

Draw-off Test Procedure (solar boosting)

Before 9 am draw-off all hot water from the storage tank, and turn off cold water and booster supplies to the solar hot water system. If the day has been clear, return to the system after 4 pm and turn on the cold water supply. Note the supply water meter reading before drawing off the entire tank contents into the laundry trough. The water should be drawn one trough at a time with a record made of the temperature and water meter reading after each trough load. The

first temperature measured should be approximately twice the daily maximum temperature and at least 75% of the tank volume should be drawn before the temperature falls by 12 °C from the starting temperature.

Insufficient Hot Water (auxiliary boosting)

- Power supply or booster switch off.
- Blown fuse.
- Circuit breaker tripped.
- Thermostat failure.
- Remove the thermostat and replace with new EWT1L2S thermostat. This thermostat has no 'RESET' button.
- Thermostat setting too low.
- Thermostat faulty (will not switch on).
- Electric element faulty.

Check element circuit continuity.

For OFF-PEAK supply systems the electric sickle element should be fitted in the downward position. If this is not the case, the element must be rotated until it is in the sickle down position to maximise the boosting capacity. Have the time clock checked to ensure the auxiliary boost is being activated at the correct time.

If the above check-list items do not reveal the fault, a draw-off test may be performed to demonstrate that the system is performing correctly (see draw-off procedure below).

When connected to an off-peak electricity supply, the quantity of hot water used must be less than the storage volume or the system will run out of hot water. Methods of hot water usage reduction need to be considered to overcome this problem - a day rate change-over switch can be fitted to the installation for use during high usage, low solar radiation periods.

Draw-off Test Procedure (auxiliary boosting)

Turn off cold water supply, and allow the tank to boost for a minimum of 5 hours on electric (i.e. one thermostat cycle). Turn off the booster supply. Note the supply water meter reading before drawing off the entire tank contents into the laundry trough. The water should be drawn one trough at a time with a record made of the temperature and water meter reading after each trough load. The first temperature measured should be approximately 60 °C and at least 60% of the tank volume should be drawn before the temperature falls by 12 °C from the starting temperature.

Auxiliary Booster Water Volume

Standard electric auxiliary cylinders will heat the top 2/3 of the storage tank so that there is sufficient hot water to meet demands without seriously affecting the solar energy collection ability. Consequently, the night stabilisation effect will be more pronounced when the only source of input energy is the electric or gas booster. This is because the tank bottom 1/3 is filled with cold water that can only be heated by solar energy.

Off-peak Electricity Supply

Most OFF-PEAK supplies are available during the night (no daytime boost) therefore the tank can be without any boost energy input from 7 am to 9 pm (i.e. 14 hours). During periods of low solar radiation a significant run-down will occur after early morning hot water usage. It is advisable to install the electric element sickle down to increase the boosted volume in off-peak installations.

Overnight Temperature Stabilisation

Overnight there is a reduction in the tank hot water outlet temperature. This is caused by heat dissipation into the cooler water stored lower in the tank near the inlet position. The magnitude of this effect is proportional to the amount of water drawn overnight (the more hot water used the greater the temperature drop). The outlet heat energy is not lost from the system but is stored in the cooler water lower in the tank. On some occasions it may be necessary to use the electric booster to heat the water in the top of the tank to a useable morning temperature.

If hot water is not used from a 330 litre storage tank during the night, the heat loss (temperature drop) under average conditions is approximately 5 °C (with the tank storage temperature at 70 °C).

As an example, if 60 litres of hot water is used during the night, the morning tank temperature will be 61.5 °C or a reduction of 8.5 °C (5 °C heat loss and 3.5 °C of temperature stabilisation). If 160 litres of hot water were used during the night, the morning tank temperature will be 50 °C or a reduction of 20 °C (5 °C heat loss plus 15 °C temperature stabilisation).

Direct Heat Loss

Close coupled thermo-syphon solar cylinders have the tank positioned above the collectors and therefore do not circulate water between the collectors and tank at night.

Since water in the storage cylinder is warmer than that in the collectors, and as hot water always rises, the hot water will remain in the storage tank. As a result there is no night recirculation of hot water from tank to collectors.

Water Hammer

If water hammer does exist the following points should be checked:

- All pipes must be solidly clipped down.
- Check tap washers at laundry, kitchen and basin taps; rubber washers can help reduce water hammer.

'Flip top' style mixer taps and washing machine solenoid valves are primary causes of water hammer. This is due to the severe nature of the valve mechanism that opens and closes very rapidly. These are most effectively remedied using a water hammer arrester valve.

Water Discharge from the Cold Relief Valve

The cold relief valve is designed to release water from the system if the pressure rises above 700 kPa. Water discharge from the cold relief valve is normal when the water is being heated; a volume between 5 and 30 litres a day is quite common. If the discharge is greater than this volume the valve operation should be checked as follows:

- Lift the valve hand lever to open and reseat the valve.
- Inspect the valve seat for pitting or calcium build-up.
- Check mains pressure and fit a pressure limiting valve if excessive.
- Check that pressure is not feeding back from another device connected to the hot reticulation circuit. Particular attention should be given to dishwashers, washing machines and single lever taps.
- Replace the valve only if discharge continues and the pressure is below the specification settings.

Water Discharge from the Pressure and Temperature Relief (PTR) valve

If a cold relief valve is fitted, water should not discharge automatically from the pressure & temperature relief valve unless the hot water temperature is at 93 °C or the pressure is greater than 850 kPa. If water is being discharged from the valve, the following checks should be made:

- Lift the valve hand lever to open and reseat the valve.
- Confirm the thermostat operation and replace thermostat if faulty.
- Inspect the valve seat for pitting or calcium build-up.
- Check the tank water temperature.
- Replace the valve only if discharge continues and the pressure and temperature are below the specification settings.
- If no cold relief valve is fitted then the pressure & temperature relief valve will drip during every heating cycle, either solar or electrical boost.

Insufficient Pressure

The pressure control valve of the combination inlet valve is designed to limit the maximum supply water pressure to 450 kPa at a flow rate of up 15 litres per minute. If the pressure at the solar hot water system is less than 450 kPa and the flow rate is less than 15 litres per minute the following checks should be made:

- Combination inlet valve water strainer blocked or restricted.
- Pressure control valve restricted with mineral deposits.
- Supply pipe work to unit or hot outlet line pinched, blocked or under-sized.
- Mains supply pressure below 450 kPa, - this will require installation modification by the user or supply authority.
- Pressure control valve flow insufficient for the user's requirements. This may be addressed by installing a larger valve or by fitting two limiting valves in parallel.

Thermostat Safety Cut-out Activated

The thermostat safety cut-out is designed to disconnect the booster device from the supply if the temperature of the potable water rises above 87 °C when the booster is operating. The potable water temperature can, however, regularly reach in excess of 87 °C from solar collection when low usage rates are experienced, - under these conditions the safety device will automatically reset when the temperature falls to below 72 °C. If the high temperature is a result of booster operation the safety device will trip and cannot be reset. When this occurs the thermostat is not repairable and must be replaced with the EWT1L2S thermostat.

General Condition Report

A general condition inspection can be conducted by your plumber which should cover the following items:

- Collector condition, leaking unions, dirty or broken glass, damaged water seals etc.
- Tank water tightness, condition of outer cover, tank ends, fittings etc.
- Check auxiliary power connections.
- Inspect booster and safety devices.
- Check shading of collectors.
- Check relief and drain lines from pressure & temperature relief valve or combination inlet valves.

MATERIAL SAFETY DATA SHEET

GLYSOL

- Not classified as hazardous according to the criteria of Work Safe Australia

Chemical characterization	A liquid mixture containing glycol ether and dye
Form	Liquid
Colour	Blue
Odour	Mild pleasant
Concentration	Propylene Glycol – 60 - 85% Blue dye - 1% Tolytriazole - 10%

PHYSICAL AND SAFETY DATA

Change in physical state	
Density	0.94
Bulk density	N/A
Vapour pressure	N/A
Viscosity	N/A
Solubility	Completely soluble in water
pH value	N/A
Flash point	32 °C for 100% liquid
Ignition temperature	N/A
Explosion temperature	N/A
Thermal decomposition	
Hazardous thermal	
Decomposition products	Carbon Monoxide
Hazardous reactions	
Further information	Ingredients not considered hazardous by Work Safety Australia by 100%

TRANSPORT

UN No: 3092
PG:III
Haz: 2Y
IMDG Code Class 3
Shipping name: As commercial name

REGULATIONS

Risk phrases:	Irritating to eyes, skin and mucous membranes. Symptoms may include: nausea, vomiting and diarrhoea
Safety phrases:	Contact with skin wash immediately with plenty of water
Air contamination limits:	N/A

STORAGE, HANDLING AND PROTECTIVE MEASURES

Storage	Store in the original container
Handling	Wear protective equipment when handling or dispensing
Respiratory protection	If airborne concentration is high or unknown
Eye protection	Goggles
Hand protection	Rubber or PVC gloves
Disposal	Dispose as per general solvents in accordance with local regulations

MEASURES IN CASE OF ACCIDENTS OR FIRES

Extinguishing media	Above flash points, vapour air mixtures are explosive Use foam, CO_2 or dry chemical powder extinguisher
First Aid	Eyes – irrigate with water for 15 minutes – seek medical aid Skin – irrigate with water Inhaled – ensure airways are clear, administer oxygen if required seek medical aid
Further information	Obtain medical attention Ingestion – if conscious give quantities of water to drink and seek medical advice immediately

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TOXICOLOGY ORAL LD50 5660 MG/KG

Skin 13000 mg/Kg

Ecological Effects When released to soil or water, material may biodegrade to a moderate extent Not expected to bio-accumulate.

Further Information. The material is an industrial preparation and must be used only for industrial purposes in accordance with the technical sheet for the process to which it refers

WARRANTY CONDITIONS

AUSTRALIA & NEW ZEALAND

Consumer laws in each state and territory provide the owner under certain circumstances with remedies in the event that a Product fails due to defective materials or workmanship In addition to these remedies Beasley Hot Water Solutions.

(ABN 37 074 929 883) makes the following promise: We will repair, or if necessary, replace a defective Beasley water heater on the following terms and conditions.

INSTALLATION IN SINGLE FAMILY DOMESTIC DWELLINGS

MODEL	WARRANTY PERIOD FROM DATE OF INSTALLATION	WARRANTY
ALL MODELS	1 YEAR	Repair or replace all failed* components free of charge including labour costs.
Solar Plus Direct & HTM systems with SP201 or SP151 Solar Collectors.	5 YEAR	Repair or replace, with removal, installation, transport and labour costs being the responsibility of the owner.
Roofmaster Plus Model 9A, 13 & 7.	6 YEARS	
Solar Prestige Direct and HTM systems with SP200 Solar Collectors or SP2000 Collectors.	7 YEARS	
Centurion 12S Tanks Roofmaster Prestige Storage tanks. Roofmaster Plus 10 Storage tanks.	10 YEARS	

INSTALLATION IN OTHER THAN SINGLE FAMILY DOMESTIC DWELLINGS

MODEL	WARRANTY PERIOD FROM DATE OF INSTALLATION	WARRANTY
ALL MODELS	1 YEAR	Repair or replace all failed* components free of charge, including labour costs.
DEMAND DUO	5 YEARS WITH TEMPERATURE < 75 °C	Repair or replace, with removal, installation, transport and labour costs being the responsibility of the owner.
ALL OTHER MODELS	3 YEARS	Repair or replace, with removal, installation, transport and labour costs being the responsibility of the owner.

* Refer to item 3 of warranty conditions.

WARRANTY CONDITIONS

1. The water heater must be installed by a licenced plumber / electrician in accordance with the Beasley Water Heater Installation instructions supplied with the water heater, and in accordance with all relevant statutory and local requirements of the State in which the water heater is installed.

2. Where a failed component or water heater is replaced under Warranty, the balance of the original warranty period will remain effective. The replaced part or water heater does not carry a new warranty.

3. Where the water heater is installed outside the boundaries of a metropolitan area as defined by Beasley or further than 25 km from a regional Beasley Water Heater branch office, or Accredited Service Agent, the cost of transport, insurance and travelling costs between the nearest Beasley Water Heaters Accredited Service Agent's premises and the installed site shall be the owners responsibility.

4. The warranty only applies to the water heater and original or genuine Beasley supplied component replacement parts and therefore does not cover any plumbing or electrical parts supplied by the installer and not an integral part of the water heater, e.g. pressure limiting valve, stop cock, non-return valve, electrical switches, pumps, or fuses.

5. The water heater must be sized to supply the hot water demand in accordance with industry guidelines.

6. The quality of water used in Beasley Water Heaters must conform to the following requirements for the warranty to be valid. Operation of the water heater with water having contaminants outside the allowable levels outlined below, even for short periods will void the warranty.

Model	Saturation Index Max./Min.	Chlorides Mg/L	Total Solids Mg/L	Total Hardness Mg / (CaCO3) / L	Magnesium Mg/L	pH maximum
All models & Solar Collectors	0.8 / -1.0	< 300	< 600	< 200	< 10	9.5 / 6.5

Beasley reserves the right to transfer fully functional components from the defective water heater to the replacement water heater if they are suitable.

WARRANTY EXCLUSIONS

REPAIR AND REPLACEMENT WORK WILL BE CARRIED OUT AS SET OUT IN THE BEASLEY WATER HEATER WARRANTY ABOVE, BUT THE FOLLOWING EXCLUSIONS MAY CAUSE THE WATER HEATER WARRANTY TO BECOME VOID, AND MAY INCUR A SERVICE CHARGE AND COST OF PARTS (IF NECESSARY).

1. Accidental damage, Acts of God, failure due to misuse: incorrect installation; attempts to repair the water heater other than by a Beasley Accredited Service Agent, or the Beasley Water Heater Service Department.

2. Where it is found there is nothing wrong with the water heater, where the complaint is related to excessive discharge from the temperature and pressure relief valve due to high water pressure, high temperature due to solar contribution, where there is no flow of hot water due to faulty plumbing, where water leaks are related to plumbing and not the water heater or water heater components, where there is a failure of gas, electricity or water supplies.

3. Where the water heater or water heater component has failed directly or indirectly as a result of excessive water pressure, temperature and / or thermal input or corrosive atmosphere.

4. Where the water heater is located in a position that does not comply with the Beasley water heater installation instructions or relevant statutory requirements, causing the need for major dismantling or removal of cupboards, doors, or walls or use of special equipment to bring the water heater to floor level.

5. Subject to any statutory provisions to the contrary, claims for damage to furniture, carpets, walls, foundations or any other consequential loss either directly or indirectly due to leakage from the water heater.

6. Repairs to the water heater due to scale formation in the waterways when the heater has been connected to a harmful water supply as outlined herein.

7. Interruption or malfunction of inlet and outlet controls and safety valves, ball float valves, pressure limiting or reducing devices or valves etc., arising from foreign matter introduced externally or through the water supply.

8. Electrolytic corrosion occasioned by electric currents originating from earthing systems attached to any reticulated pipe work associated with the water heating appliance or any other appliance in the building or installation.

9. Glass breakage for any reason is excluded from warranty on solar collectors. (This should be included in the home owners insurance policy).

10. Beasley does not warrant solar collectors against frost damage unless fitted with a Beasley Heat Transfer Module (HTM). Warranty period against bursting or leaking collectors, when fitted with a HTM as a part of the original system, is the same period of warranty as the system.

11. Repair or replacement accepted by Beasley only after return to the Beasley factory for examination and identification of the cause of failure.

For service or warranty claim under warranty contact the manufacturers :-

Beasley Industries Pty Ltd

Bolton Avenue, Devon Park,

South Australia, 5008

ABN 37 074 929 883

Phone (08) 8340 2299

Fax (08) 8340 0829

- Every care has been taken to ensure accuracy in preparation of this publication. No Liability can be accepted for any consequence which may arise as a result of it's publication.