



Delivering Sustainable Hot Water Solutions



# Product Overview

AP Evacuated Tube  
Solar Collector

## Product Overview

Apricus AP range of evacuated tube solar collectors are suitable for both residential and commercial applications. The design of the AP solar collector is a culmination of nearly 10 years of feedback from installers and solar professionals all over the world and aims to meet their requirements with the following key features:

- Modular “plug ‘n’ play” design (Manifold, frame and tubes in separate packages)
- Lightweight manifold design
- Choice of Stainless Steel or Anodized Aluminium mounting frames
- Extremely reliable header design due to only 4 or 6 brazing points (depending on configuration)
- Contoured header for turbulent flow even at low flow-rates
- All glass wool insulation for high temperature stability
- Patented heat transfer fin design for optimal heat transfer
- Extreme cold resilience (freeze protected heat pipes)
- Coastal region corrosion resistance (with optional anodized AL frame)
- UV stabilized components
- High wind load strength
- High snow load strength

## Product Range

AP collectors are available in 10, 20, 22 or 30 tube sizes and have a number of options depending on the local market requirements.

Model	AP-10	AP-20	AP-22	AP-30
Length	2005mm / 78.9"			
Height	136mm / 5.35" (not including mounting frame)			
Width	796mm / 31.34"	1496mm / 58.9"	1636mm / 64.4"	2196mm / 86.45"
Peak Output*	648W / 2,210Btu	1296W / 4,422Btu	1425W / 4,862Btu	1944W / 6,632Btu
Aperture Area	0.94m <sup>2</sup> / 10.1ft <sup>2</sup>	1.88m <sup>2</sup> / 20.23ft <sup>2</sup>	2.07m <sup>2</sup> / 22.3ft <sup>2</sup>	2.83m <sup>2</sup> / 30.46ft <sup>2</sup>
Gross Area	1.59m <sup>2</sup> / 16.95ft <sup>2</sup>	3m <sup>2</sup> / 32.3ft <sup>2</sup>	3.28m <sup>2</sup> / 35.29ft <sup>2</sup>	4.4m <sup>2</sup> / 47.4ft <sup>2</sup>
Gross Dry Weight	35kg / 77lbs	63.5kg / 139.8lbs	71.3kg / 156.8lbs	95kg / 209.5lbs
Fluid Capacity	310ml / 10.5fl oz	550ml / 18.6fl oz	600ml / 20.3fl oz	790ml / 26.7fl oz

\* Data from ITW report 09COL805. Calculated at midday (trans IAM = 1), G=1000W/m<sup>2</sup>, ΔT (tm-ta)=0

# How it Works

## Construction

The AP solar collector is comprised of four main parts:

### Evacuated Tube (ET)

Absorbs solar energy and converts it to usable heat. Vacuum between the two glass layers insulates against heat loss.

### Heat Pipe (HP)

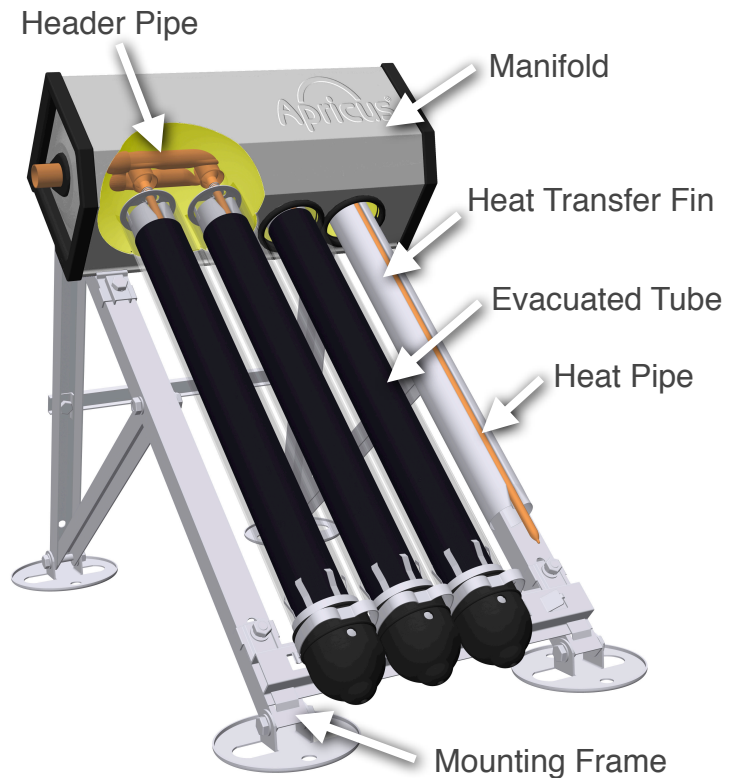
Copper vacuum pipe that transfers the heat from within the ET up to the manifold.

### Manifold

Insulated box containing the copper header pipe. The header is a pair of contoured copper pipes with dry connect sockets that the heat pipes plug into.

### Mounting Frame

Strong and easy to install with various options to match different mounting methods.



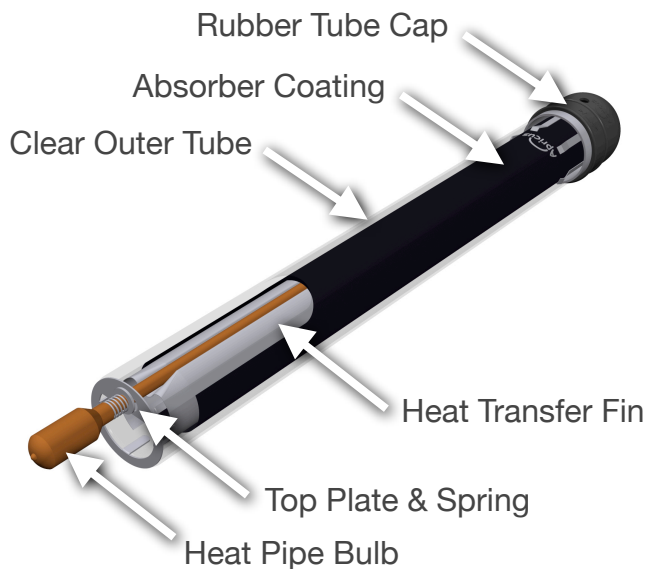
## Operation

**Step 1:** The absorber coating on the inner glass tube absorbs sunlight and converts it into heat.

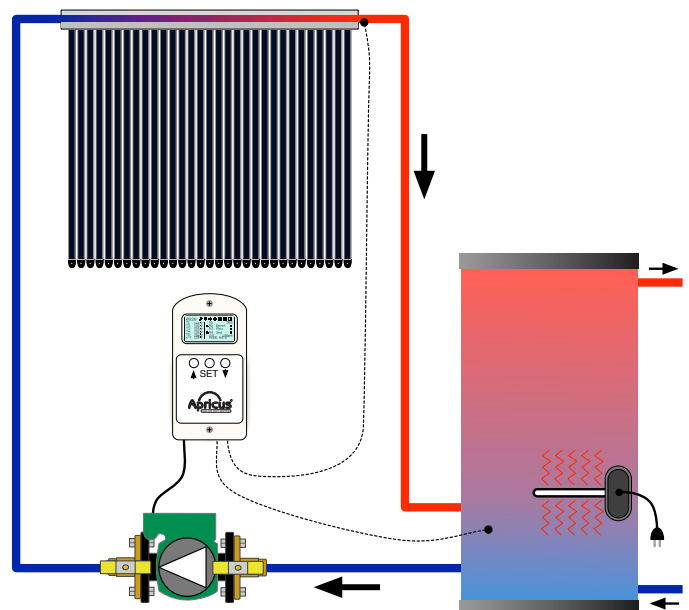
**Step 2:** Steam forms inside heat pipe which transfers heat rapidly up to the manifold.

**Step 3:** A pump circulates water or heat transfer fluid through the header pipe, carrying heat back to the storage tank. Gradually throughout the day the tank is heated up.

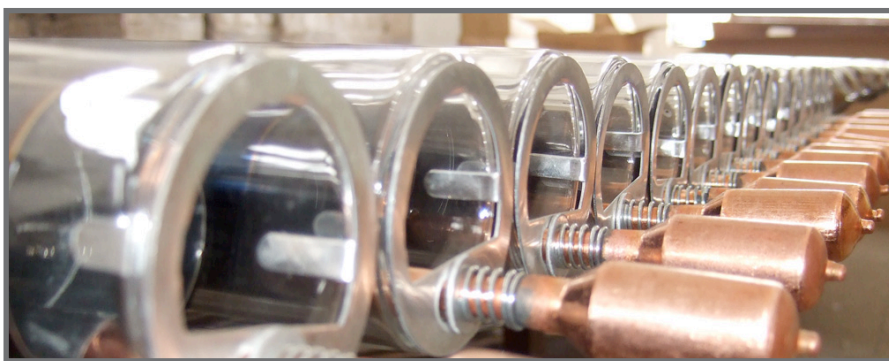
## Evacuated Tube Anatomy



## Basic System Diagram



## Main Component Specifications



Component	Materials & Specifications
Evacuated Tubes	<b>Material:</b> Borosilicate 3.3 <b>Tube style:</b> Twin wall all glass <b>Dimensions:</b> $\varnothing 58\text{mm}$ / 2.28" outer tube; $\varnothing 47\text{mm}$ / 1.85" inner tube; 1.8m / 71" length, 1.8mm / 0.07" outer tube wall thickness
Solar Absorber Coating	<b>Material:</b> Graded AL/N on AL <b>Absorptance:</b> >92% (AM1.5); <b>Emittance:</b> <8% (80°C / 176°F) <b>Vacuum:</b> $P < 5 \times 10^{-3}$ Pa; <b>Heat loss:</b> <0.8W/(m <sup>2</sup> °C) / 0.14Btu/hr/ft <sup>2</sup> /°F
Heat Pipes	<b>Material:</b> High purity "oxygen free" copper (ASTM: C10200; DIN: OF-Cu) <b>Heat transfer fluid:</b> distilled water <b>Maximum heat transfer capacity:</b> 220W / 750Btu <b>Operating angle:</b> 20-80° <b>Startup temperature:</b> ~30°C / 86°F
Copper Header Pipe	<b>Material:</b> Copper (ASTM: C1100, DIN: ECu-58); Potable water rated. <b>Brazing rod material:</b> BAg45CuZn <b>Maximum pressure:</b> 800kPa <b>Connection options:</b> 3/4" (7/8" OD) US copper; 19.1mm OD copper with DN20 flared nut (Australia); 22mm OD copper (Europe)
Heat Transfer Fins	<b>Material:</b> High purity aluminium
Rubber Components	<b>Material:</b> HTV Silicone Rubber (UV stabilized)
Mounting Frame	<b>Material:</b> 439 Stainless Steel or 6005-T5 Aluminium Alloy
Tube Clips	<b>Material:</b> 301 Stainless Steel
Fasteners	<b>Material:</b> 304 Stainless Steel
Manifold Casing	<b>Material:</b> 3A21 Aluminium with Anodized or Powder Coated Finish
Manifold Insulation	<b>Material:</b> Glass Wool (K = 0.043W/mK) <b>Thickness:</b> Average >50mm / 2"

## Instantaneous Efficiency

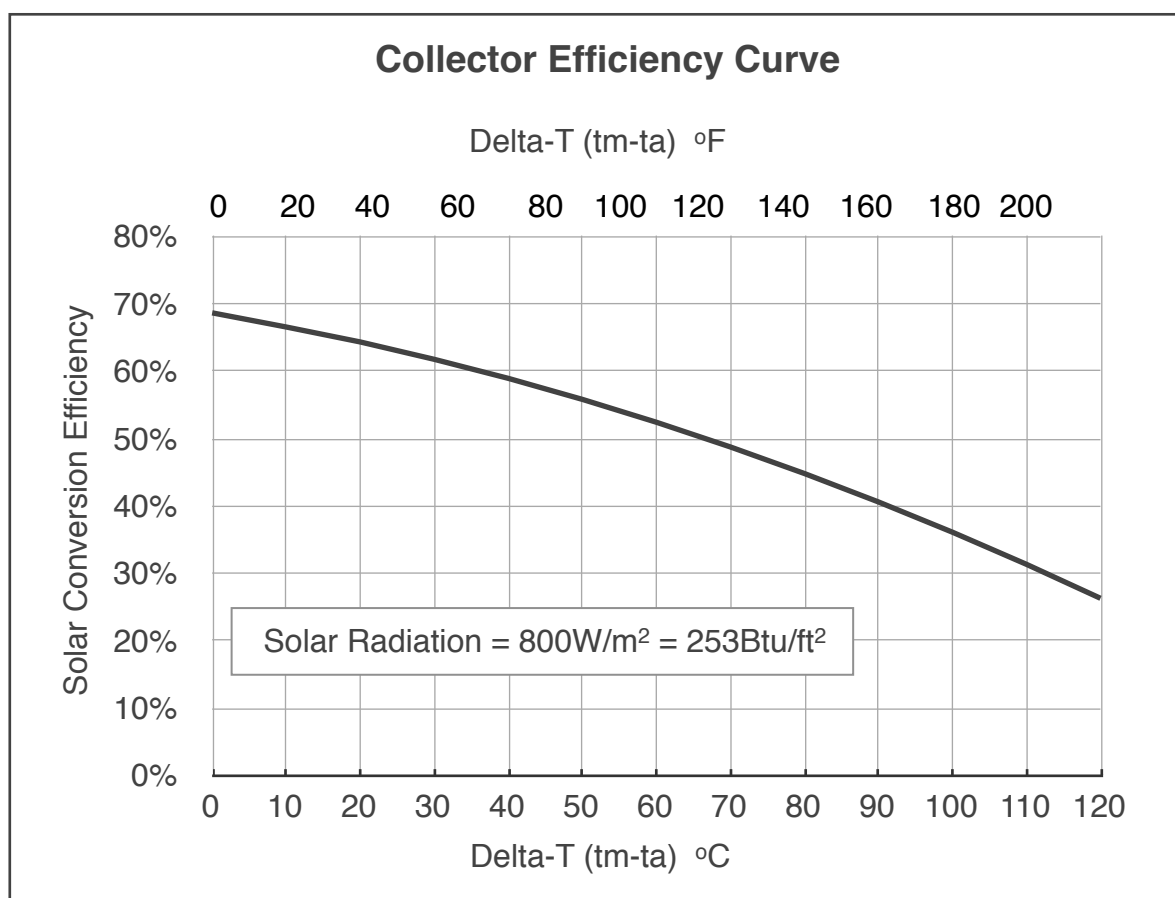
The instantaneous efficiency level depends on the surface area used for the calculation. It is important to use the same area (absorber, aperture or gross) when comparing collectors. Aperture is the standard area measurement for presenting efficiency values.

**AP Collector Performance Variables for Different Surface Areas**

Variable	Absorber	Aperture	Gross Area
AP-30 Area *	2.4 m <sup>2</sup> / 25.8 ft <sup>2</sup>	2.83 m <sup>2</sup> / 30.46ft <sup>2</sup>	4.4 m <sup>2</sup> / 47.4ft <sup>2</sup>
Eta0 ( $\eta_0$ )	0.81	0.687	0.442
a1	1.77	1.505	0.968
a2	0.0130	0.0111	0.0071

\* Surface area values differ slightly from Europe to North America due to difference in measuring methods.

The following is the AP solar collector performance curve based on the aperture area.



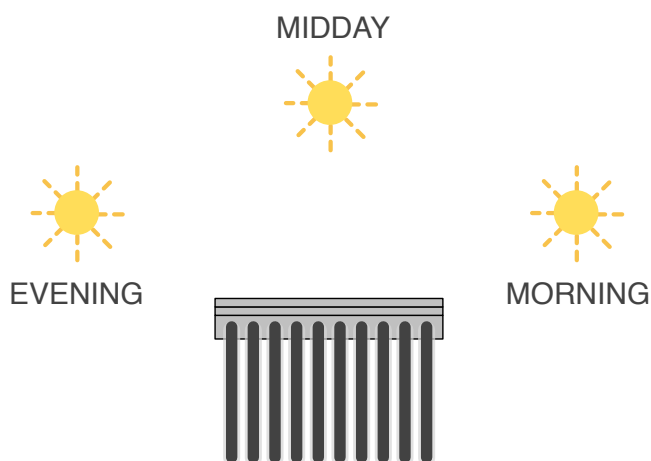
***It is important to consider BOTH efficiency conversion and IAM when looking at a collectors true daily or annual heat output.***



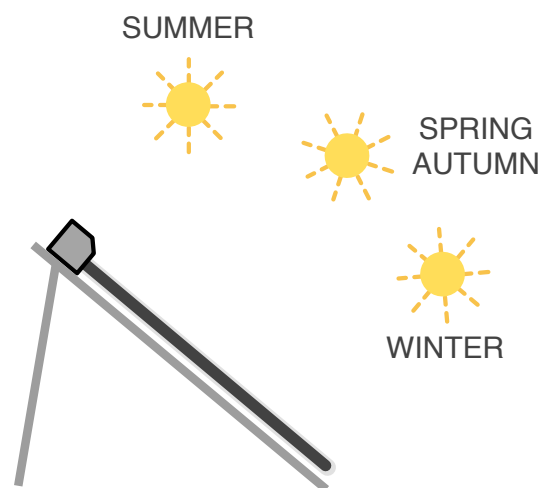
## Instantaneous Efficiency

IAM is a measure of the change in collector performance as the angle with the sun changes. This is measured in two planes, longitudinal which represents sun's path over the collector throughout the year and transversal which represents the sun's path over the collector each day.

### TRANSVERSAL IAM



### LONGITUDINAL IAM



The following table provides the IAM values for Apricus AP Solar Collectors (same for all sizes). A value of 1.00 is when the sun is perpendicular to the collectors surface; so midday for transversal, and mid spring/autumn for longitudinal if the collector is installed at the same angle as the location's latitude.

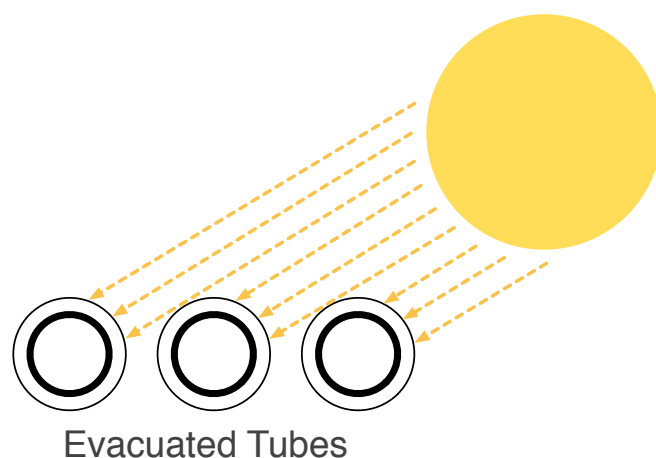
Angle	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
Longitudinal	1.00	1.00	1.00	0.99	0.97	0.92	0.84	0.70	0.45	0.00
Transversal	1.00	1.02	1.08	1.18	1.35	1.47	1.39	1.57	0.95	0.00

The longitudinal IAM is the same for most flat plate and evacuated tube collectors. Transversal IAM, however, can vary greatly between solar collectors, and even amongst different evacuated tube designs. It is often referred to as the “passive tracking” as it provides a performance adjustment factor for how well the absorber of the collectors “tracks” or “faces” the sun throughout the day.

Apricus AP collectors have an excellent IAM curve as the tubes facing the sun for most of the day and only shade each other at extreme angles. The result is fairly stable output from 9am - 3pm.

Any daily or annual collector output calculations MUST consider IAM properly in order to provide realistic results.

### PASSIVE TRACKING



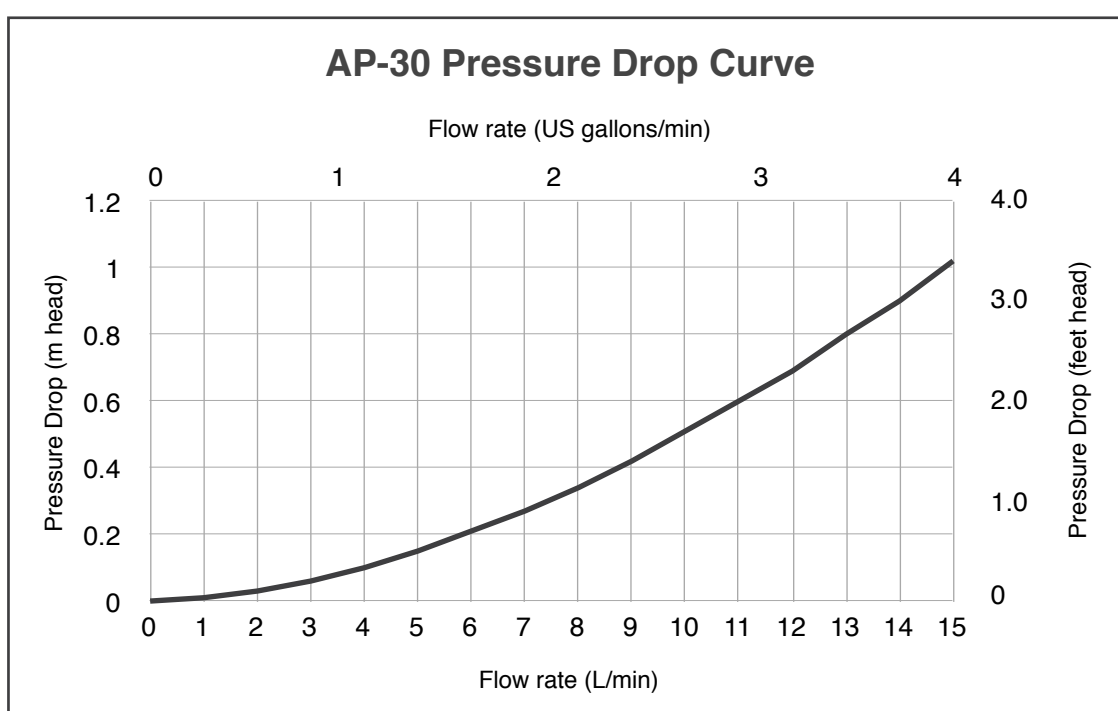
## Flow Rates

The liquid flow rate through the collector depends on the desired temperature rise. In most cases a variable speed controlled pump is recommended so a target temperature rise is maintained. The following calculations are based on water as the circulating liquid, with collector operating at the maximum rated midday output. Please note that either side of midday output can exceed these levels by up to 15% due to the IAM angle adjustment factor. Values will differ slightly for other heat transfer fluids.

Flowrate (L/min)	Temp Rise (°C)			
	AP-10	AP-20	AP-22	AP-30
1	9.3	18.6	20.4	27.8
2	4.6	9.3	10.2	13.9
3	3.1	6.2	6.8	9.3
4	2.3	4.6	5.1	7
5	1.9	3.7	4.1	5.6

For most domestic hot water applications, if not using a variable speed pump, choose a flow rate from the above table that corresponds to around a 10°C / 18°F temperature rise. That will provide a good balance between preventing excessive rise in the summer and also preventing short cycling of the pump during periods of poorer solar radiation. Apricus offers a simple calculator to determine the above values for other flow rates or temperature rises.

The following curves provides the pressure drop values for an AP-30 collectors. This can be used to help determine pump sizing when installing a number of collectors in series.



## Snow & Wind Loading

AP solar collectors are rated for up to 295kg/m<sup>2</sup> / 60lbs/ft<sup>2</sup> snow loading. The roof and attachment points must also be suitably rated.

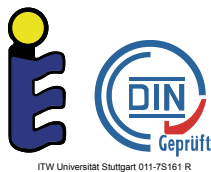
Mounting frames are available for the AP solar collector that can withstand category C cyclonic winds (249km/h / 155mph). For such conditions there are specific requirements that must be observed.



## Certification

The AP range of solar collectors have obtaining the following certifications:

Standard	Report No.	Region
OG-100	100-2007033A	USA
FSEC	00442N	USA (Florida)
IAPMO USEC	S-5995	USA (California)
NSF-61 Tested	17248	North America
CSA	2375921	Canada
Solar Keymark	011-7S161 R	Europe
AS/NZS 2712:2007	100633	Australia & New Zealand
Watermark	40107	Australia & New Zealand





## Choice of Materials

Choice of material is extremely important for a collector that is going to be exposed to the elements 24/7 and expected to last for many years, and so great consideration has gone into the selection of materials for the AP solar collector. Following is a summary of some of the key material choices that may differ from other products on the market.

### *Silicone Rubber*

HTV Silicone rubber is used for the manifold seals and tube caps as this material does not become brittle during freezing conditions and does not crack or powder with extended UV exposure.

### *Tube Attachment*

Plastic caps that clip into the frame can be used to secure the tubes in place but over time they become brittle and degrade in UV radiation. Instead, AP solar collectors use a high tensile stainless steel clip that ensures the tubes are held firm long term even during extreme wind loads.

### *High Purity Copper*

Heat pipes used to transfer heat from within the evacuated tube up to the header are produced by Apricus in house using high purity C10200 grade copper. The choice of material and manufacturing process is extremely important to ensure longevity. Using a lower purity grade copper such as C12200 reduces the cost of the heat pipes considerably but can reduce the longevity as impurities in the copper leach out over time (3-5 years) to form an air pocket in the bulb, compromising the heat transfer operation.

### *Folded Aluminium Manifold Casing*

Rather than using extruded aluminium for the manifold casing, the AP collector uses folded 0.8mm thick high tensile aluminium alloy sheet. This provides a very strong, rigid casing that provides a total assembled manifold weight of only 9.2kg / 20.25lbs for AP-30, half that of most other designs. That extra weight makes a huge difference to an installer when carrying the manifold up a ladder. Prototypes of a revised AP solar collector casing design were even developed in 2008, but rejected by installers in field trials simply due to the extra weight it added.

### *Evacuated Tubes*

Apricus uses the AL/N on AL coating that is an extremely mature and reliable technology able to achieve 92% absorptance of solar radiation and conversion to heat.

### *End of Life Recyclability*

Ease of recycling was a key consideration when selecting the materials for the AP solar collector, so ensuring minimal end of life environmental impact.



# Packing

## Packing Design

10 years of shipping experience have provided many valuable lessons and helped develop packing methods that provide the best balance between cost, weight and safety. Regardless of if the packages are shipped air freight, palletized for LCL sea freight or in a full shipping container, the very best efforts are made to ensure it arrives safely.

## Packing Format

Box Type	Contents	Container Packing
Manifold Box	<b>Standard:</b> Manifold, heat transfer paste, tube clips <b>Optional:</b> Basic mounting frame, brass fittings	Loose
Tube Box	Box of 10/10 ET/HP (15 boxes/pallet) <b>STANDARD</b> Box of 12/10 ET/HP (12 boxes/pallet) <b>OPTIONAL</b>	Wooden pallet with steel bracing or Loose (customer's choice)
Frame	Standard frame provided together in manifold. Angle frame kits bundled together and packed in boxes.	Loose

*Example:*

AP-30 collector would require:

- 1 x AP-30 Manifold Box (including standard frame)
- 3 x Boxes of 10 ET/HP

Refer to the product catalogue for complete details of all product and box options.

## Container Packing

**20' FCL:**

- 10-12 x Pallets of ET/HP
- 50 x AP-30 collectors (adjust to match pallets of ET/HP)
- Frame kits and auxiliary components

**40' FCL:**

- 22-24 x Pallets of ET/HP
- 100 x AP-30 collectors (adjust to match pallets of ET/HP)
- Frame kits and auxiliary components

Exact loading capacity depends on the components ordered, but in most cases container space usage exceeds 95%.



## More Information

For more information about other Apricus products or to make contact with your local Apricus office please visit [www.apricus.com](http://www.apricus.com). On the Apricus website, register for access to the Apricus Tech Centre for technical files, product certificates, test reports, collector sizing tools, installation case studies and much more.

# Manufacturer Limited Warranty

## AP Solar Collector

### LIMIT OF LIABILITY

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WITH RESPECT TO ANY END-USER OTHER THAN A CONSUMER END-USER WHICH PURCHASES APRICUS PRODUCTS FOR COMMERCIAL, INSTITUTIONAL, INDUSTRIAL OR OTHER NON-RESIDENTIAL PURPOSES, APRICUS DISCLAIMS ANY IMPLIED WARRANTY OF MERCHANTABILITY OR IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE AND FURTHER DISCLAIMS ANY LIABILITY FOR SPECIAL, INDIRECT, SECONDARY, INCIDENTAL, OR CONSEQUENTIAL DAMAGES ARISING FROM OWNERSHIP OR USE OF THESE PRODUCTS, INCLUDING PERSONAL INJURY, INCONVENIENCE, LOSS OF USE OR LOSS OF INCOME.

Apricus assumes no responsibility under this Limited Warranty for any damage to the Products caused after they have left the control of Apricus, including but not limited to damages caused by any trades people or visitors on the job site, or damage caused as a result of post-installation work. This Limited Warranty shall be invalidated by any abuse, misuse, misapplication or improper installation of the Products.

### GENERAL

Apricus warrants its Solar Collectors and Accessories (the "Products") to be free from defects in workmanship under normal usage for the applicable Warranty Period from the date of installation. This Limited Warranty extends to the End-User of the product at the original installation location, and is not transferable.

In the event of a defect, malfunction or other failure of the Products occurring within the applicable Warranty Period which is not caused by any misuse or damage to the Product while in the possession of the End-User, Apricus will remedy the failure or defect within a reasonable amount of time. The remedy will consist of repair or replacement of the Products, or refund of the purchase price, in Apricus's sole discretion. However, Apricus will not elect to refund the purchase price unless it is unable to provide a replacement, and repair is not commercially practical and cannot be made within a reasonable timeframe. After a reasonable number of attempts by Apricus to remedy any defects or malfunction, the End-User will be entitled to either a refund or replacement of the product or its component parts. The remedies stated herein are the sole remedies for defects within the applicable warranty period.

### WARRANTY PERIOD

The "Effective Date" of warranty coverage is the installation date as recorded on the installation record form, purchase invoice date, or, if neither are available, the date of manufacture plus sixty (60) days.

Component	Coverage
Manifold Casing	Ten years parts
Copper heat transfer header	Fifteen years parts
Evacuated Tubes and Heat Pipes	Ten years parts
Mounting Frame	Fifteen years parts

### WARRANTY EXCLUSIONS

This warranty shall be void and shall have no effect if:

- (a) The design or structure of the Products are attempted to be modified or altered in any way, including by not limited to attaching non-Apricus approved appliances or equipment;
- (b) The Products are not installed or repaired in accordance with applicable local codes;
- (c) The Products are not installed by qualified, suitably licensed persons;
- (d) The installer had not received Product installation training by an authorized Apricus distribution partner;
- (e) The installation was not completed in line with the guidelines of the then current Apricus installation manual;
- (f) System is exposed to excessive system pressure;
- (g) Solar collector is exposed to flow rates in excess of 15Lpm / 4gpm;
- (h) Any system component is damaged due to freezing;
- (i) Any system component leaks due to corrosion;
- (j) Water quality is not within specified limits, and/or non-approved heat transfer liquids are used;
- (k) Damage to the collector header is caused due to heat buckling;
- (l) Failure is due to wind, hail, storms or other acts of God;
- (m) Failure or loss of efficiency is due to lime-scale formation;
- (n) Product serial tag or other identification is defaced or removed;
- (o) Product is relocated from its original point of installation;
- (p) Collector is not commissioned and is left to dry stagnate for a period exceeding 14 consecutive days;
- (q) Any operation exceeds the documented design limits of the system components or materials.

### END USER OBLIGATIONS

In order to obtain performance of any obligation under this warranty, the End-User must:

- (a) Firstly determine if the Product is within the applicable Warranty Periods. This can be determined by referring to the installation record form, or alternatively the original purchase invoice. If neither documents are available, the serial number and manufacturing date will need to be read off the Product serial tag. Some Products may be installed in a location that is not accessible to the End-User and so the information may only be obtained by a qualified service technician.
- (b) Contact the company who installed the original Product, or, if unknown or unable to be contacted, contact Apricus directly.

The following information may be required to determine if the Product issue is eligible for coverage under the terms of this Limited Warranty.

- (i) Information related to the manner in which the Product(s) were installed.
- (ii) The history of operation.
- (iii) Any repairs that may have been made.
- (iv) Evidence that the Product(s) were installed by a qualified, licensed contractor.
- (v) Evidence that the Product(s) were installed in accordance with the applicable Products Installation Manuals and any special written design or installation guidelines by Apricus for this project.
- (vi) Evidence that the Product(s) were installed in accordance with all applicable local building, plumbing and electrical codes.

### CUSTOMER SATISFACTION

We believe you will be fully satisfied by the service you receive from the local Apricus representatives and from Apricus. However, because our aim is your complete and lasting satisfaction, Apricus adds another feature to your warranty's protection. In the unlikely event that you feel our response to a warranty service request is not satisfactory, Apricus offers you an opportunity to air your complaint in an impartial Mediation process.

The opportunity to mediate any complaint made by an End-User is hereby extended to all End-Users. If you are a Consumer End-User, the provisions of the federal Magnuson-Moss Warranty Act provide that you may not file suit against Apricus until your claim has been submitted to Mediation for an informal dispute settlement and a decision has been reached.