December 2017

Apricus®
SOLAR HOT WATER

ETC SOLAR COLLECTOR

Installation & Operation Manual

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Contents

1. Important Information

⚠ WARNING

INDICATES IMPORTANT INFORMATION THAT MUST BE FOLLOWED TO AVOID POTENTIALLY HAZARDOUS SITUATIONS THAT COULD RESULT IN DEATH, SERIOUS INJURY, OR SUBSTANTIAL PROPERTY DAMAGE.

1.1. Scope of Manual

a) This manual pertains only to the installation and operation of the Apricus ETC evacuated tube solar collector. Details for the installation, operation and maintenance of the complete solar system components should be provided separately by their respective manufacturers.

b) This manual is primarily a reference document for installation officers, as the solar collector is not permitted to be installed by non-authorised persons.

1.2. Local Standards

a) Installation must be completed in accordance with all relevant local standards and regulations.

1.3. Authorised Person(s)

a) The term “authorised person(s)” used throughout this document refers to a suitably qualified professional, who holds relevant industry licenses or certificates required for the work completed during the installation process.

b) Installation may only be completed by authorised persons.

c) Unless otherwise specified in section 3, no part of the Apricus solar collector may be inspected, repaired or maintained by anybody other than an authorised person(s).

1.4. Component Materials

Component	Material Specifications
Evacuated Tubes	Material: Borosilicate 3.3 Tube style: Twin wall, All glass Dimensions: ⌀58mm outer tube; ⌀47mm inner tube; 1.8m length, 1.8mm outer tube wall thickness Absorber Material: Selective coating Absorptance: >92% (AM1.5); Emittance: <8% (80°C) Vacuum: P<5x10^{-3} Pa; Heat loss: <0.8W/(m^2 °C)
Heat Pipes	Material: High purity “oxygen free” copper (ASTM: C10200; DIN: OF-Cu) Working fluid: non-toxic liquid (Apricus’ proprietary mixture) Maximum heat transfer capacity: 220W Operating angle: 20-80° Startup temperature: ~30°C
Copper Header Pipe	Material: Copper (ASTM: C1100, DIN: ECu-58); Brazing rod material: BAg45CuZn (Potable water certified) Maximum pressure: 800kPa / 116psi Connection options: 3/4”M NPT; 3/4” SWEAT; 3/4”M BSP; 1/2”M BSP ELBOW
Heat Transfer Fins	Material: High purity aluminium
Rubber Components	Material: HTV Silicone Rubber (UV stabilized)
Mounting Frame	Material: 6005-T5 Aluminium Alloy with Anodized Finish (Stainless Steel frame available upon special request)
Tube Clips	Material: 316 Stainless Steel
Fasteners	Material: 316 Stainless Steel
Manifold Casing	Material: 3003 Aluminium with PVDF coating.
Manifold Insulation	Material: Glass Wool (<0.043W/mK) Thickness: Average >50mm

1.5. Collector Specifications

Not all models listed below are available in all markets.

ETC-10

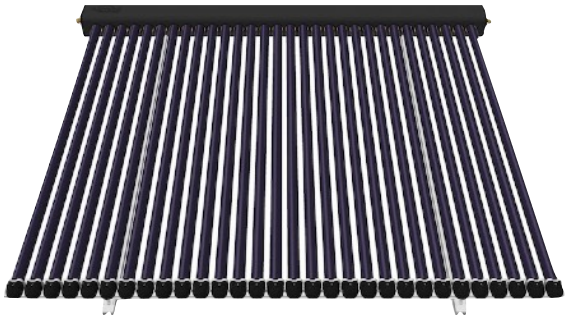
Dimensions (LxWxH) *	796x2005x136mm
Peak Output*	671W
Aperture Area	0.947m^2
Gross Area	1.59m^2
Gross Dry Weight	35kg
Fluid Capacity	310ml
Flow Rate	0.7Lpm (max 15Lpm)
Max Operating Pressure	800kPa / 116psi

ETC-20

Dimensions (LxWxH) *	1496x2005x136mm
Peak Output*	1342W
Aperture Area	1.89m^2
Gross Area	3m^2
Gross Dry Weight	63.5kg
Fluid Capacity	550ml
Flow Rate	1.4Lpm (max 15Lpm)

ETC-22

Dimensions (LxWxH) *	1636x2005x136mm
Peak Output **	1477W
Aperture Area	2.07m^2
Gross Area	3.28m^2
Gross Dry Weight	71.3kg
Fluid Capacity	600ml
Flow Rate	1.5Lpm (max 15Lpm)



ETC-30

Dimensions (LxWxH) *	2196x2005x136mm
Peak Output*	2014W
Aperture Area	2.84m^2
Gross Area	4.4m^2
Gross Dry Weight	95kg
Fluid Capacity	790ml
Flow Rate	2Lpm (max 15Lpm)

All Models

Installation Angle	20 ~ 80^o
Stagnation Temperature	228^{o}C
Max Operating Pressure	800kPa

2. Transport, Unpacking and Inspection

2.1. Safe Transportation

Evacuated tube and manifold boxes should be handled with care when transporting to avoid breakage.

a) If standing boxes on end, adhere to the direction arrows.

b) If lying boxes down, ensure the surface is flat.

c) Adhere to the markings on the number of boxes that may be stacked.

d) Do not stack any heavy or sharp objects on top of the boxes.

e) Always secure boxes in place to avoid bouncing or sliding around during transport.

2.2. Component Lists

a) Review the components lists included in the component boxes. If any components are missing, or additional parts are required, contact the local supplier.

2.3. Tube & Heat Pipe Unpacking & Inspection

a) Open the tube box(es), which contain the evacuated tubes with heat pipes inserted. Check to make sure the evacuated tubes are all intact, and the bottom of each tube is still a silver colour. If a tube has a white or clear bottom, it is damaged and should be replaced. The heat pipe should be removed from the damaged tube and inserted into a replacement tube. Replacement tubes are available from your local Apricus dealer who supplied the solar collector.

b) Heat pipes are bright and shiny copper colour when newly manufactured, but will dull and may form dark-grey surface discolouration over time. This is due to mild surface oxidation (when exposed to air), which is normal and does not affect the integrity of the heat pipe.

c) Do not remove and/or expose the tubes to sunlight until ready to install, otherwise the heat pipe tip will become very hot, and may cause serious skin burns. The outer glass surface will not become hot.

d) Apricus does not warrant the tube or heat pipes against failure as a result of damage incurred during transport or installation.

⚠ WARNING

- NEVER TOUCH THE INSIDE OF THE EVACUATED TUBE OR HEAT PIPE TIP AFTER EXPOSURE TO SUNLIGHT.
- WEAR THICK LEATHER GLOVES IF HANDLING A HOT HEAT PIPE.
- WEAR SAFETY GLASSES AT ALL TIMES WHEN HANDLING THE GLASS TUBES

2.4. Frame Unpacking & Inspection

a) Unpack the standard frame that is provided together with the manifold. If an angled frame kit is being used, those components will be packed separately from the manifold. See section 4 for standard frame diagram.

b) Depending on the roof surface, rubber pads, roof attachment straps, round feet, roof rails or U feet may be used to attach the standard frame to the roof. These components are supplied separately from the standard frame.

3. System Design

3.1. System Design

a) System design should be completed prior to commencing installation.

b) Solar collectors need to be installed correctly to ensure high efficiency, and most importantly, safe and reliable operation.

c) Seek professional advice for the design and installation of the solar heating system.

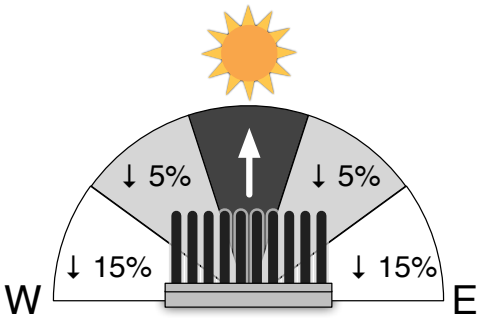
d) Only authorised installers are permitted to install the solar collector.

e) Apricus does not provide warranty coverage and will not be held liable for any damage to person or property that results from solar collectors that are installed by unauthorised persons.

3.2. Collector Direction

a) The collector should face the equator, which if in the northern hemisphere is due South, and southern hemisphere is due North.

b) The collector will still work even facing at angles East or West of the equator direction but a reduction in output will result (depending on location and system configuration). The diagram to the right provides a rough guide.

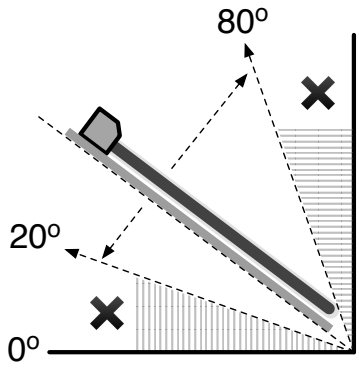


3.3. Installation Angle

a) For optimal annual solar output, install the collector at an angle equal to the location's latitude. An angle of +/- 10º is acceptable, and will not greatly effect output.

b) If the system is likely to exceed demand in the summer, install the collector at an angle 15-20º greater than the latitude of the location which will help reduce summer output and maximise winter output. E.g. Latitude of 30º, install at 45-50º.

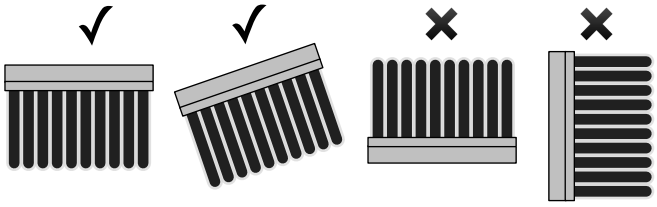
c) The collector must be installed within the range of 20-80º to ensure optimal operation of the heat pipes.



3.4. Collector Plane

a) The collector manifold is normally installed on the flat horizontal plane, but may be installed at an angle such as when installed sideways on a pitched roof.

b) The collector must not be installed up-side-down (tubes pointing upwards) or with tubes lying horizontally, as the heat pipes will not function.



3.5. Avoid Shade

a) Collectors should be located so that shading does not occur between 9am - 3pm.

b) Partial shading, due to small objects such antennas and small flues/chimney, will not significantly reduce heat output.

3.6. Collector and Tank Location

a) The collector should be positioned as close as possible to the storage tank to avoid long pipe runs.

b) The storage tank should be located as close as possible to the most frequent hot water draw off points in the building.

3.8. Heat Transfer Fluids

a) In regions where freeze protection is not a concern, water is the most appropriate heat transfer fluid. Water must be potable rated (suitable for drinking) if the system is direct flow.

b) In all cases the water or other type of heat transfer fluid must meet the following quality requirements:

i)	Total dissolved solids	< 600 p.p.m.
ii)	Total hardness	< 200 p.p.m.
iii)	Chloride	< 250 p.p.m.
iv)	Free Chlorine	< 5 p.p.m
v)	Magnesium	< 10 p.p.m.
vi)	Sodium	< 150 p.p.m
vii)	Electrical conductivity	< 850 µS/cm
viii)	pH	6.5 - 8.5

c) When a direct flow system is used in an area with hard water (high mineral content), scale may gradually form in the solar collector loop causing the following issues:

i) Gradual reduction in performance
ii) Increased pressure drop
iii) Eventual flow blockage.

d) In regions with hard water a water treatment system should be installed, which either removes the scale forming minerals, or prevents formation of scale.

e) In regions where freeze protection is required, it is advisable to use a closed loop system with a non-toxic grade polypropylene glycol (or equivalent) as the heat transfer liquid. This liquid should be used directly (if already mixed), or mixed with water as per the manufactures instructions.

f) Maximum allowed concentration of heat transfer liquids is 50% mixed with water.

g) Periodic inspection of the heat transfer fluid should be completed (annually), and replaced if necessary to ensure that the liquid meets the requirements outlined in (b) above. Please refer to the guidelines provided by the heat transfer fluid manufacturer regarding fluid inspection and replacement.

h) Check with local regulations regarding the use of heat transfer fluids as some regions require precautions such as dual wall heat exchangers, back-flow preventers or specific solar system pressure operating levels in order to prevent drinking water contamination.

3.9. Solar Controller Settings

a) For solar controllers the following solar ON/OFF settings are usually appropriate:

i) Delta-T ON = 8°C
ii) Delta-T OFF = 2°C
iii) Delta-T TARGET (for variable speed pump control) = 8°C

b) These settings may need to be altered slightly according to the location and system design.

c) Refer to the controller installation manual for more information.

3.10. Correct System Sizing

a) The solar collector should normally be sized to provide 90-95% of hot water requirements during summer period.

b) Depending on the location this will provide 60-80% annual contribution to domestic hot water supply.

3.11. Stagnation and Overheating

a) Stagnation refers to the condition that occurs when the pump stops running, due to pump failure, power blackout, or as a result of a high tank temperature protection feature built into the controller, which turns the pump off.

b) If the system is designed to allow stagnation as a means of preventing tank overheating, the collector and plumbing in close proximity may reach temperatures of >200°C; therefore components that may be exposed to the high temperatures such as valves, plumbing or insulation, should be suitably rated.

c) Temperature relief valves or auto air vent should NOT be installed on the collector outlet, as high temperature may damage the valve, and scale formation can rapidly block the vent hole.

d) In direct systems, the pressure and temperature relief valve on the tank may open to release pressure or heat as required. Under such conditions the collector manifold will normally reach a maximum temperature of approximately 160°C. Any heat returning from the collector is generally not enough to cause a continued increase in tank temperatures (i.e. heat input is less than tank heat losses). A crackling noise may be heard in the solar flow and return lines when hot water is used, as the pressure in the system drops and steam

forms, this is normal.

e) In closed system dumping of liquid from the pressure and temperature relief valve is an indication of undersized expansion tank or incorrect system pressure settings.

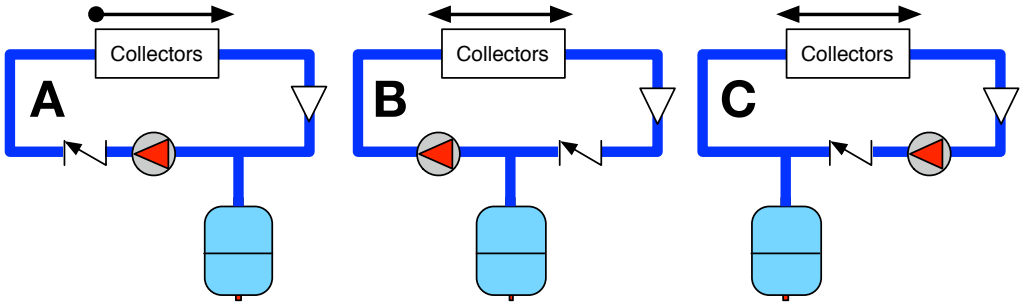
f) To allow the system to stagnate and form steam without over-pressurisation or hot line heat migration issues, installation of a suitably sized expansion tank AFTER the pump and check valve on the supply line (cold line to solar) is recommended. This format is commonly referred to as “steam back” and allows steam to form in a controlled way. Apricus ETC solar collectors ideal for steam back operation. Commercial systems with complicated piping layout may not allow steam back to occur properly, please consulting with Apricus for assistance with system design.

g) The diagrams below show the various configurations for expansion tank, pump and check valve position:

i) Option A = WORST. Expansion tank on inlet side of pump, before check valve. Solar expansion only in one direction, so not steam back compatible.

ii) Option B = BEST. Expansion tank between pump and check valve. Steam expansion able to occur in both directions (steam back), and optimal circulation pump operation.

iii) Option C = OK. Expansion tank after pump and check valve. Steam expansion able to occur in both directions (steam back), Not good for low pressure (<200kPa) systems or when >10m high pump head is required. This is because the position of the expansion tank after the pump drops inlet pressure to pump by pump head value which can fall under pump NPSH requirements causing cavitation.



3.12. Pressure and Temperature Control and Relief

a) For direct flow systems, the normal operating pressure should be limited to <500kPa / 72.5psi via use of a pressure limiting (pressure reduction) valve on the mains cold supply line.

b) For closed loop systems, the recommended system pressure setting is 4 bar filling pressure, with expansion tank sized to allow maximum pressure of 5bar during stagnation. Use the Apricus toolkit to help correctly size the expansions tank.

c) Any system design must provide pressure relief at no more than 850kPa, using a pressure and/or pressure and temperature relief valve (PTRV), in accordance with local regulations. THE RELIEF VALVE OR DRAIN TUBE MUST NOT BE SEALED OR BLOCKED. This valve must not be located in close proximity to the solar collector field.

d) If installed inside a building a safe-tray must be installed beneath the hot water tank to safely collect any water expelled from the pressure and temperature relief valve.

3.13. Freeze protection

Freeze protection must be implemented in any regions that experience freezing conditions at any time throughout the year.

a) For areas with temperature not falling below –5°C, simple low temp controller based freeze protection may be used. (i.e. Pump circulates if the manifold temperature approaches freezing). If possible, backup protection in the form of uninterrupted power supply (UPS) or drip valve (which opens to allow water to dribble out if power supply is cut) should also be installed. It is also important that the tank is heated at least once daily (to the bottom) to ensure there is heat to keep the solar loop from freezing.

b) For areas with temperatures below –5°C there are two main freeze protection options:

i) A closed loop filled with an anti-freeze mix can be used to provide freeze protection. Please refer to heat transfer fluid manufacturer’s specifications about the temperature ranges the liquid can withstand. See also 1.4 regarding water quality requirements. Heat transfer liquids are normally required to be potable water grade; please check with local regulations.

ii) Drain back systems allows the solar collector to drain empty of water each time the pump stops circulating. A drain back tank is required and system piping must be sloped enough to allow proper drainage.

c) In any system that may be exposed to temperature close to freezing, insulation of at least 20mm thickness must be used on all exposed outdoor piping. Insulation must be run right up to the end plates of the collector manifold and sealed with silicone sealant to prevent water ingress.

d) Evacuated tubes are not susceptible to damage in cold weather, and Apricus heat pipes are protected against damage that could result from the freezing of the water inside.

e) Apricus does not warrant the solar collector against freeze related damage.

3.14. Wind Loading

a) When installing the collector, wind loading must be considered.

b) The standard frame and angle frame kits are designed to withstand wind speeds of up to 208km/h without damage for installation angles of 45° or less. This wind speed corresponds to the mid range of Category 2 cyclones (US Saffir-Simpson Scale).

c) Roof strength and any non Apricus supplied attachment components must be reviewed and approved by structural engineer and approved in accordance with local code where applicable.

d) Refer to section 4 for specific roof attachment details for various frame options.

3.15. Snow Load

a) In areas prone to heavy snow falls the solar collectors should ideally be installed at an angle of 50° or greater to help promote snow sliding off the tubes.

b) It is advisable to raise the front of the collector frame 15-20cm off the roof surface to allows snow to sit beneath the collector and also more easily blow away from under the collector. To achieve this use longer stanchion/poles for roof mounting, or use the Apricus Leg Extension (AERL-EXT) components offered by Apricus.

c) The solar collectors are able to withstand a maximum snow loading of 300kg/m^2. Refer to local regulations regarding snow loading guidelines.

3.16. Hail Resistance

a) Apricus glass evacuated tubes are able to withstand impact from hail up to 25mm in diameter.

b) In areas prone to large hail (>⌀20mm) it is recommended to install at an angle of 40° or greater to provide optimum protection.

c) The solar collector can still function properly with one or more broken tubes, however a reduction in heat output will result (depending upon how many tubes are broken). A broken tube should be replaced by authorised persons only. Please refer to section 8.3 for more details on tube replacement.

3.17. Lightning

a) It is advisable to earth/ground the copper circulation loop of the collector to avoid lightning related damage, or electrical safety issues.

4. Collector Mounting

⚠ WARNING

- ALL INSTALLATIONS SHOULD ONLY BE COMPLETED ON ROOFS THAT ARE IN GOOD CONDITION AND THAT CAN STRUCTURALLY SUPPORT THE COLLECTOR(S). THE MOUNTING POINTS FOR THE COLLECTOR MUST ALWAYS BE INTO STRUCTURAL MEMBERS SUCH AS RAFTERS, TRUSSES OR BLOCKING.
- ENSURE ALL ROOF ATTACHMENT POINTS ARE WELL SEALED TO AVOID WATER LEAKS.
- ADHERE TO RELEVANT LOCAL SAFETY REGULATIONS WHEN WORKING ON ROOFS.

4.1. Frame Material

a) Apricus ETC collectors are supplied as standard with high strength, corrosion resistant frames made from anodised aluminium alloy with marine grade 316 stainless steel fasteners (attachment plates, nuts, bolts and washers).

b) If required to meet a project specification, stainless steel frame components can be provided. Minimum order quality requirements may apply.

4.2. Roof Attachment Strength

a) Frame attachment to the roof should be completed with ⌀7mm or larger screws or stainless steel bolts.

b) Ensure the mounting surface or ballast is solid and able to withstand in excess of 500kg of pull force per 30 tube collector that may be encountered during high winds. Refer to the Apricus toolkit for wind loading estimates.

4.3. Galvanic Reaction

a) Zinc galvanized components should NOT be installed in direct contact with stainless steel, as galvanic reaction between the two metals can cause premature oxidation of the zinc coating and the steel underneath.

b) Avoid using galvanized steel screws or bolts; instead use stainless steel components but ensure the hole in the metal roof is large enough to prevent contact with the stainless steel screw/bolt. If galvanized components are used, avoid direct contact between the two metals by using the rubber/plastic washers under the bolt head.

4.4. Installation Planning

a) Measure the roof and determine the location of the attachment points before assembling the mounting frame. Mark attachment points on the roof with chalk or marker to make the process easier.

b) If any penetrations in the roof are made they must be waterproofed to prevent water ingress. Commercially available flashing kits are available for different roofing materials. Apricus also offers silicone rubber frame pads which can be used for some roofing materials, providing a good roof seal when combined with quality roof sealants.

4.5. Frame Assembly Process

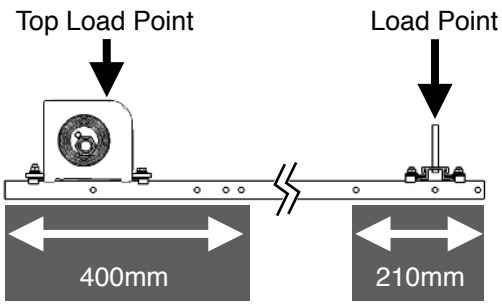
a) Where possible, assemble the mounting frame and attach the manifold at ground level, then carry to the roof. NEVER install the evacuated tubes at ground level, as these should be installed after the system is commissioned with liquid flowing through the manifold.

b) Only gently tighten nuts until attachment to the roof is complete, then hand-tighten all bolts with the provided spanner/wrench or suitably sized socket. NEVER use power tools as the stainless steel fasteners may gall/lock up. If nuts are not smooth when tightening use WD-40 or similar lubricant or anti-gall powder/grease.

c) Do NOT over-tighten stainless steel bolts. Spring washers are provided on each bolt assembly to ensure they do not loosen over time.

4.6. Frame Attachment Points

a) Any attachment point (stanchion, post, roof rail etc) underneath the Front Tracks must be within a limited distance from the load points to avoid excessive bending forces on the frame. The allowable position for a support is within 210mm of the bottom end and 400mm from the top end of the front track.

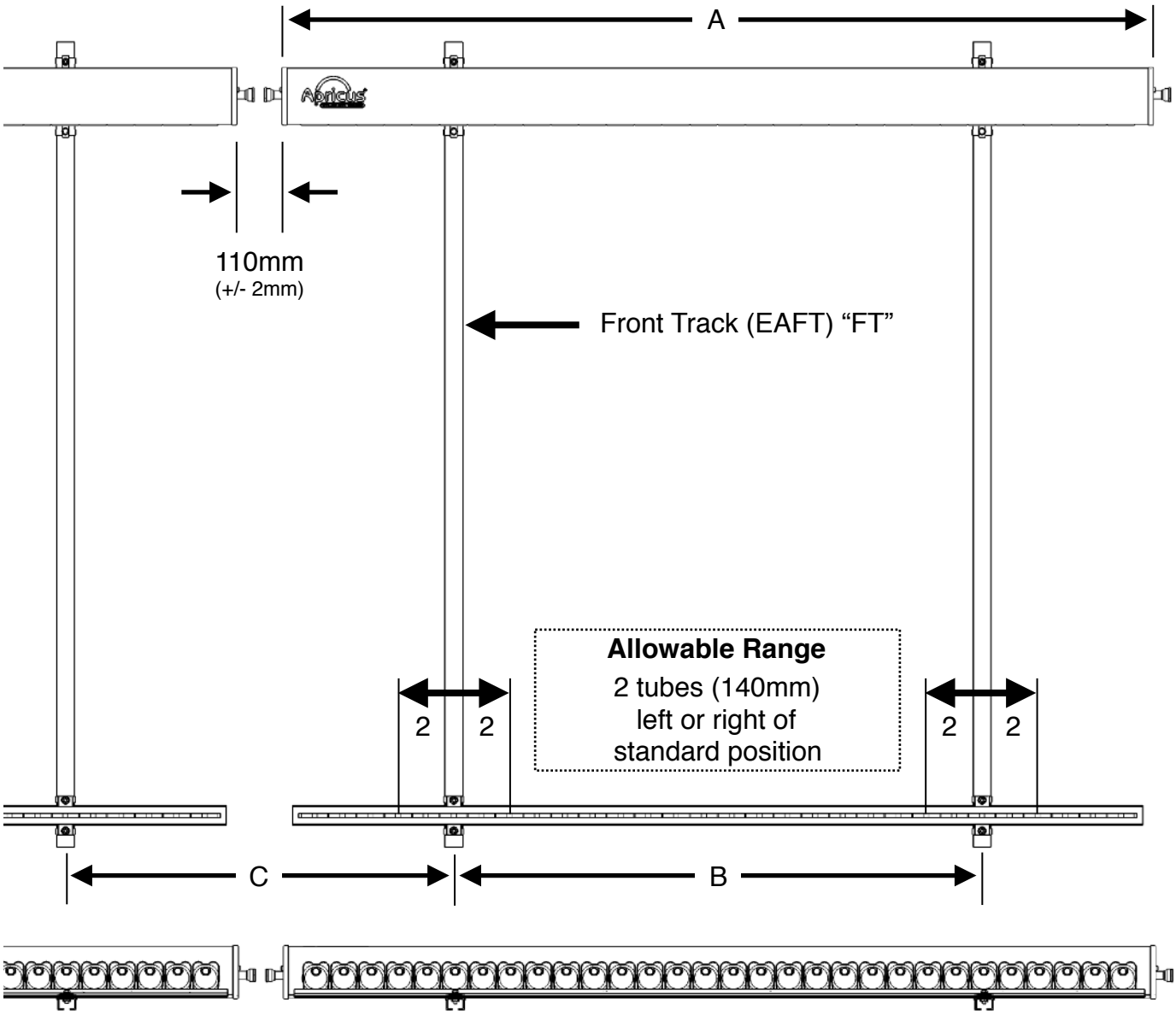


4.7. Frame Front Track & Leg Spacing

a) The Front Tracks can be adjusted left and right underneath the manifold and bottom track to select a suitable location within the allowing range of 2 tubes (140mm) either side of the standard positions. The standard frame spacing (B), locates the Front Tracks directly underneath the evacuated tubes.

b) For angled frames the X Brace (EAXB- XX T) sets the standard position of the Front Tracks and Rear Legs.

c) Spacing between 2 collector joined in series using Apricus connector (BF-ST-FL19xFL19) is 110mm +/- 2mm.



# Tubes	FT Position	A (Manifold Width)	B (FT Spacing)	C (Next FT Spacing)
10	2nd & 9th	796mm	490mm	416mm
20	3rd & 18th	1496mm	1055mm	556mm
22	4th & 19th	1636mm	1055mm	696mm
30	6th & 25th	2196mm	1330mm	976mm

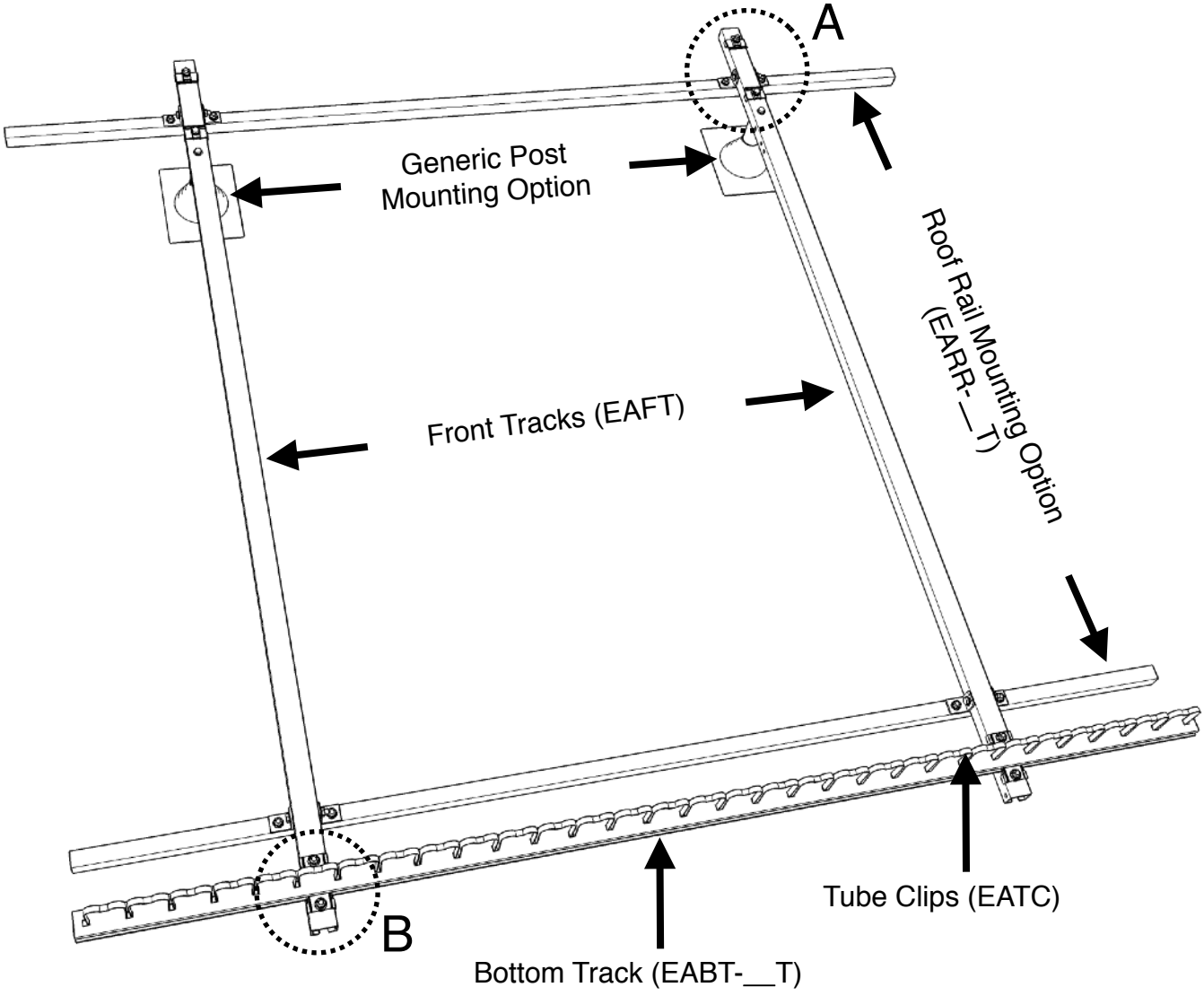
4.8. Standard Frame Overview

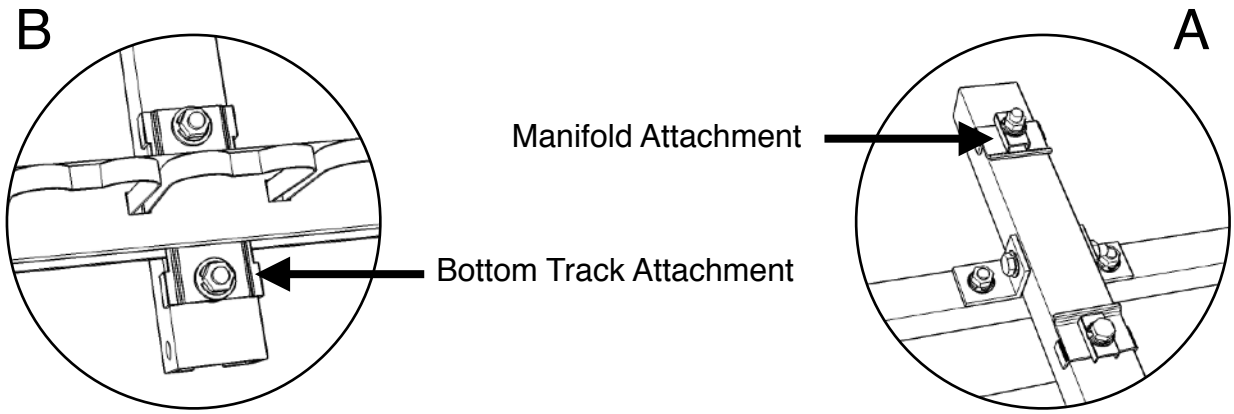
a) The ETC solar collector standard frame is suitable for flush mounting on a >20º pitched roof.

b) Depending on the roof type, there are many methods of attachments formats that can be used, bolted through the sides or top of the Front Tracks. Additional holes may be drilled as required.

c) Apricus Roof Rails are an excellent method for attaching to the roof.

d) 3rd party mounting hardware such as stanchions/posts may also be used.





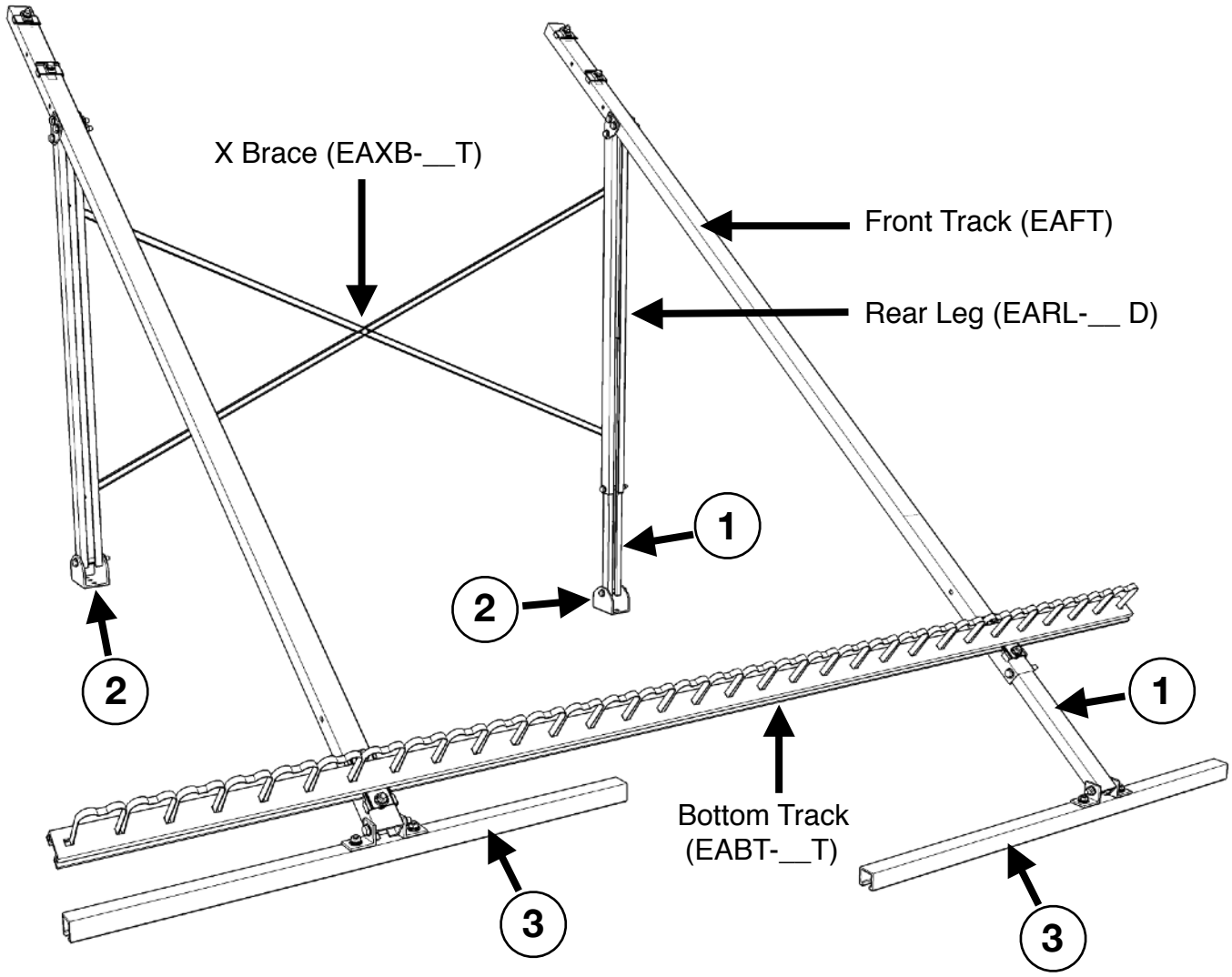
4.9. Angled Frame

a) Two Rear Legs and an X Brace are added to the Standard Frame to raise the rear of the collector.

b) 4 leg lengths are available to achieve angles from ~22° up to ~60°, with finer angle adjustment using Leg Extensions.

c) Leg Extensions can also be used to extend the Front Track to raise the front of the collector in snowy regions.

d) Diagram below shows various different mounting and adjustment hardware offered by Apricus.



1. Leg Extension (EARL-EXT) *
2. U Foot (EAUF-45)
3. Roof Rail (EARR-__T) **

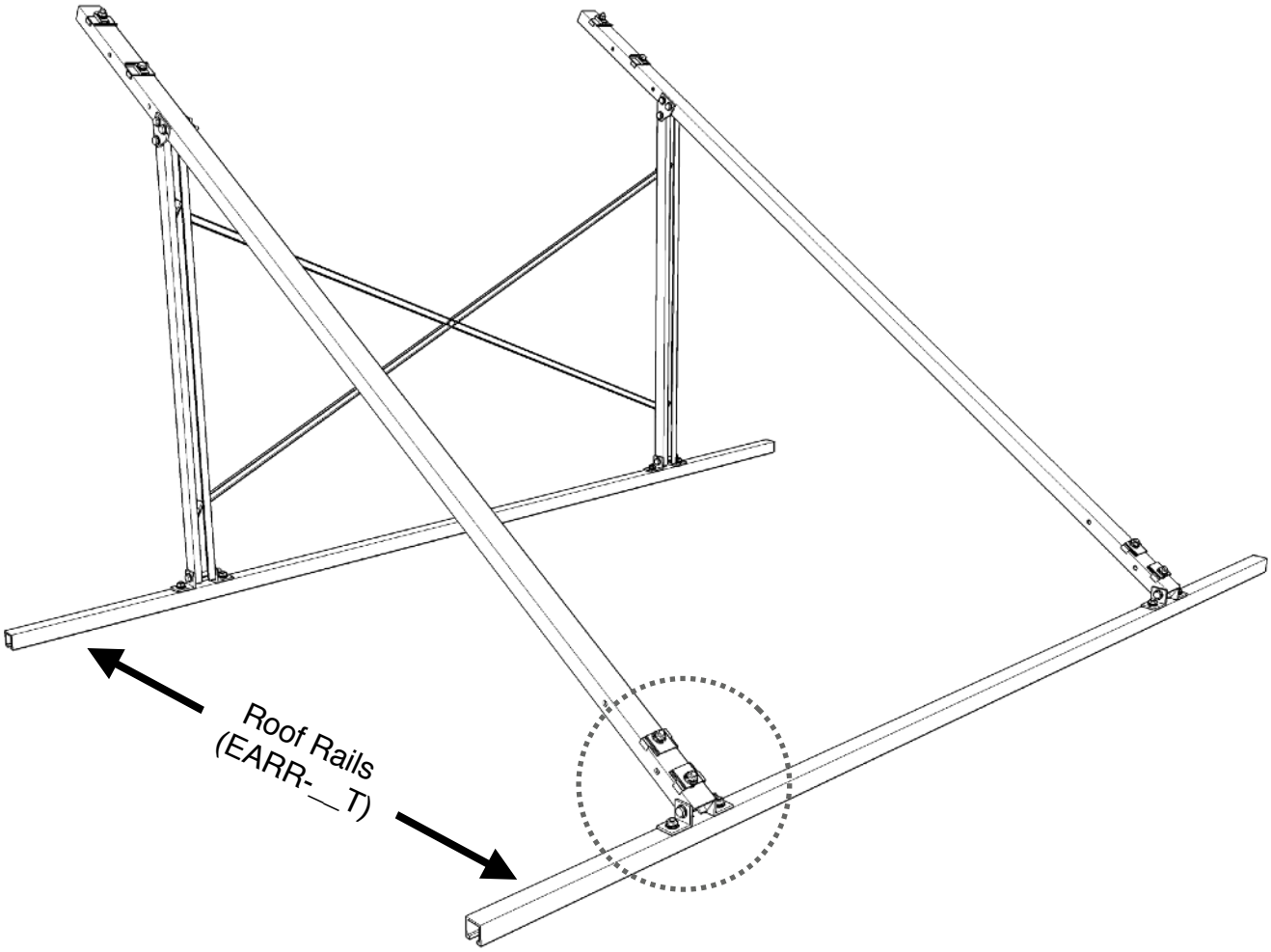
4.10. Frame Attachment Option (Roof Rails)

a) Designed for use where Front Tracks cannot be aligned neatly with roof mounting points or where many attachment points are required to ensure suitable strength.

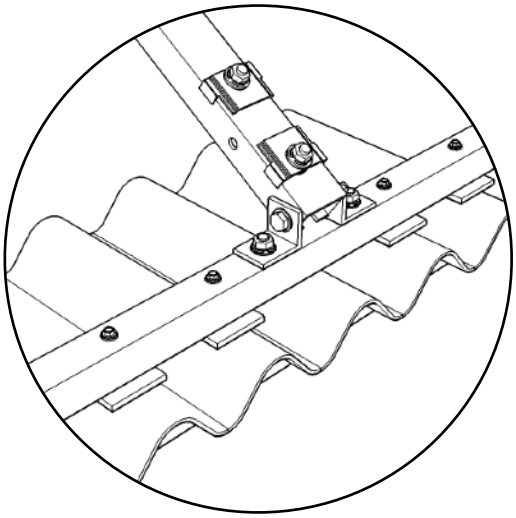
b) Can be used on the standard frame in a flush mounting format, or on high angle frames (shown below)

c) Attached to the Rear Legs or Front tracks using L brackets (supplied) for optimal strength and stability.

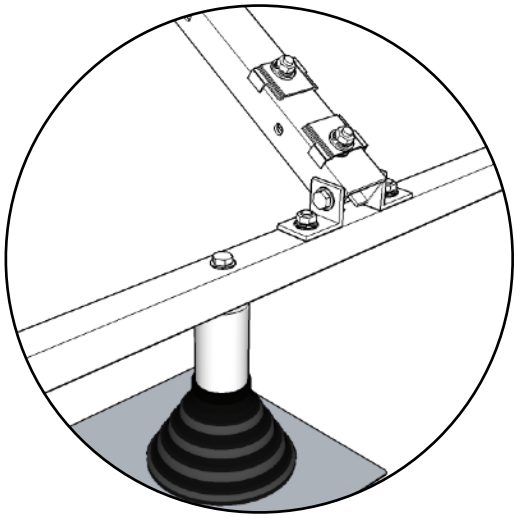
d) Holes can be drilled in the top or sides of the Roof Rails as required for mounting.



Sheet Metal Roofing



Stanchions / Posts



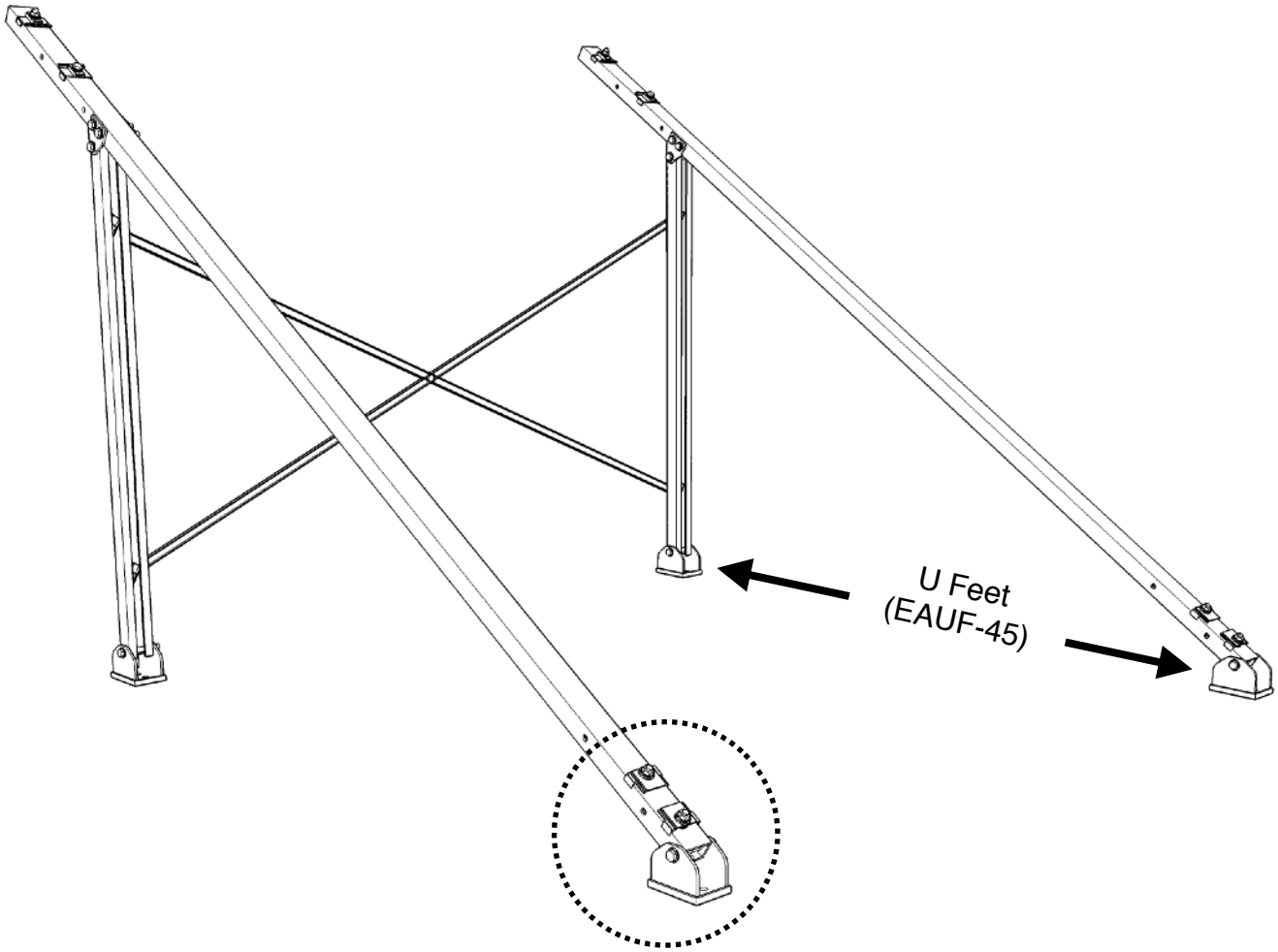
4.11. Frame Attachment Option (U Feet)

a) Ideal for flat roof mounting on concrete blocks or metal framework.

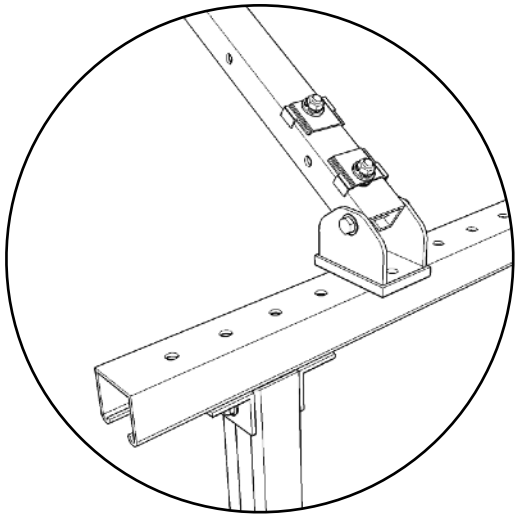
b) Normally used with angled frames (rather than standard frame flush mount).

c) Attached to the end of Rear Legs, Front tracks or Leg Extensions.

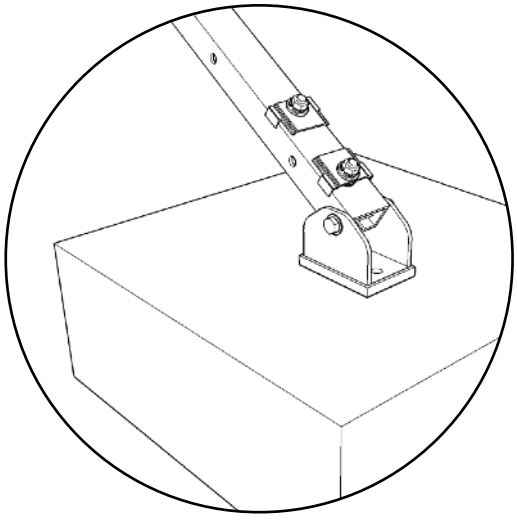
d) Include a silicone rubber cover to protect other metal surfaces and provide basic sealing.



Metal Frame

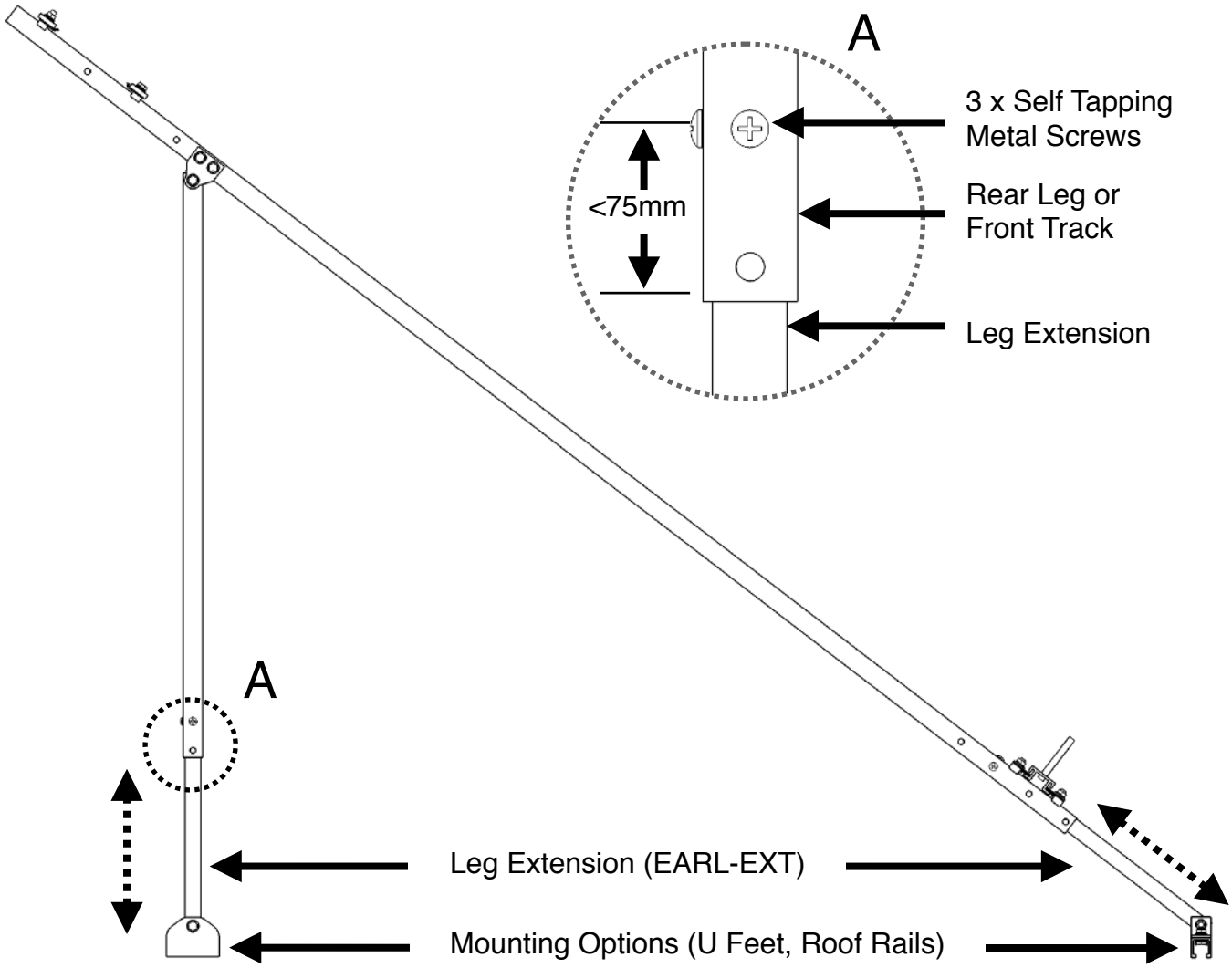


Concrete Block

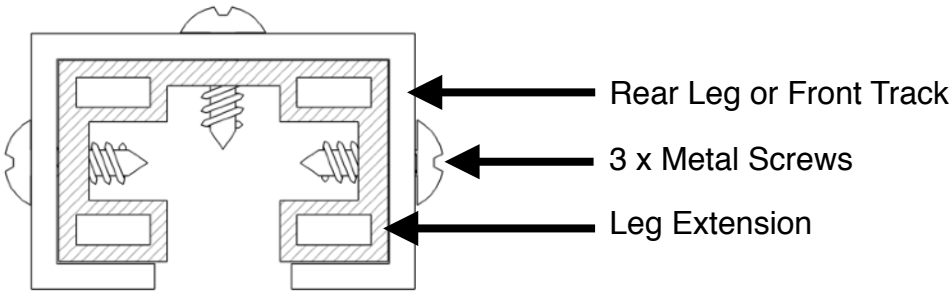


4.12. Frame Option (Leg Extensions)

a) Extend rear legs (RL) to achieve larger installation angle.
b) Extend front tracks (FT) to lift front of collector off roof in high snowfall regions.
c) Leg Extensions are NOT supplied as standard with Rear Legs and must be ordered separately.
d) Fully flexible position as Leg Extension slides inside RL or FT.
e) Leg Extension must insert minimum of 100mm into RL or FT.
f) Leg Extension is secured using 3 stainless steel screws supplied with Leg Extensions.
g) Screws should be located with 75mm of the end of the RL or FT
h) Drill 3.5mm pilot holes through both the Leg Extension and RL/FT for screws.
i) Screws should be positioned on 3 sides (as shown below) for optimal strength.



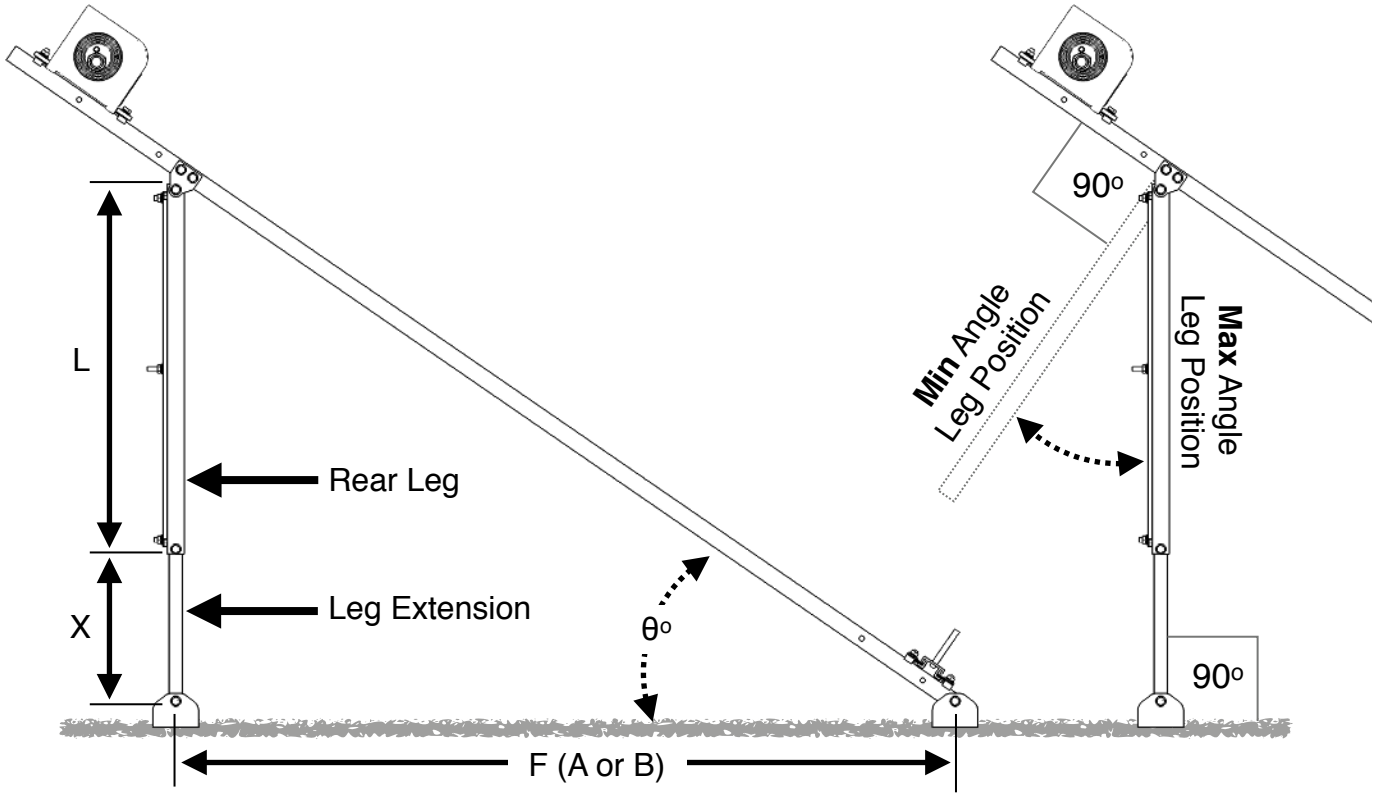
Cross Sectional View



4.13. Mounting Frame Leg Length & Feet Spacing

a) Rear Legs can be adjusted between Min & Max positions to make small adjustments to the angle.

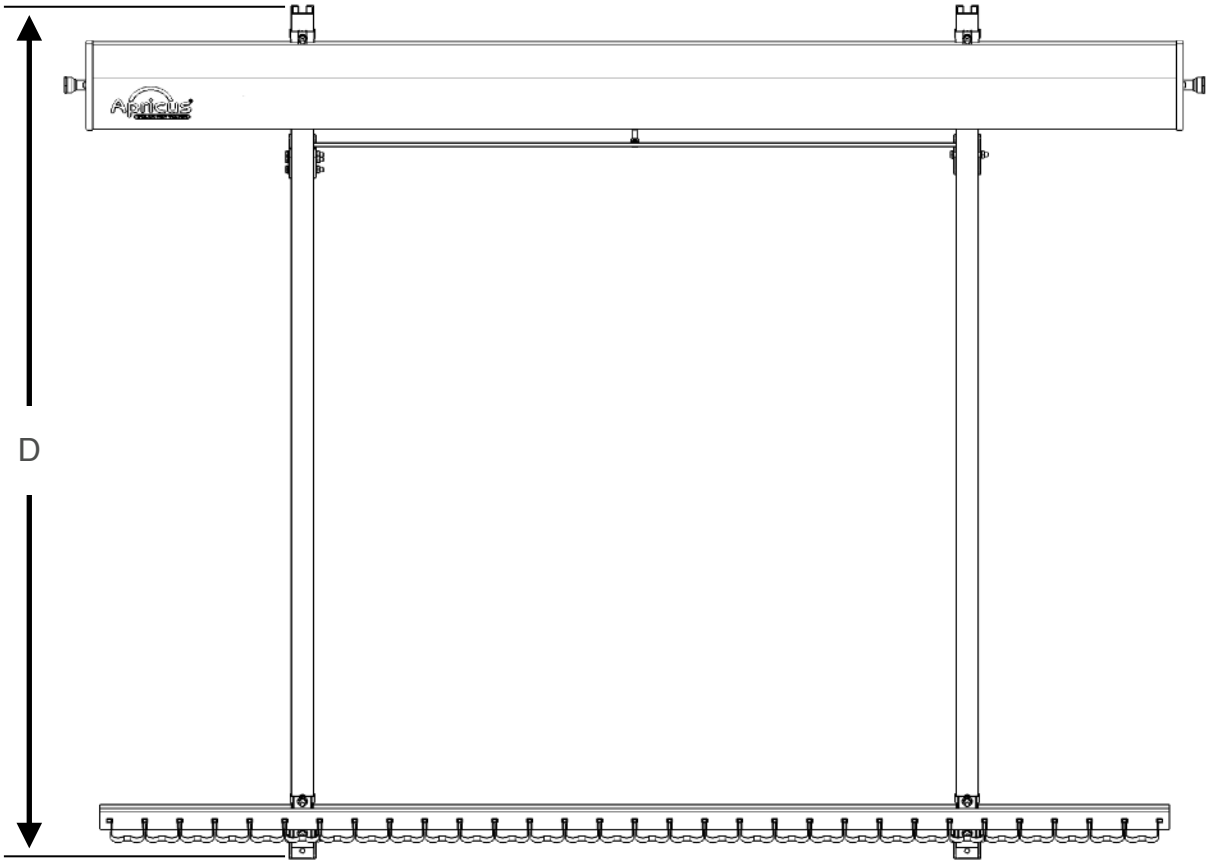
b) Leg positions outside this range are not structurally sound and must not be used.



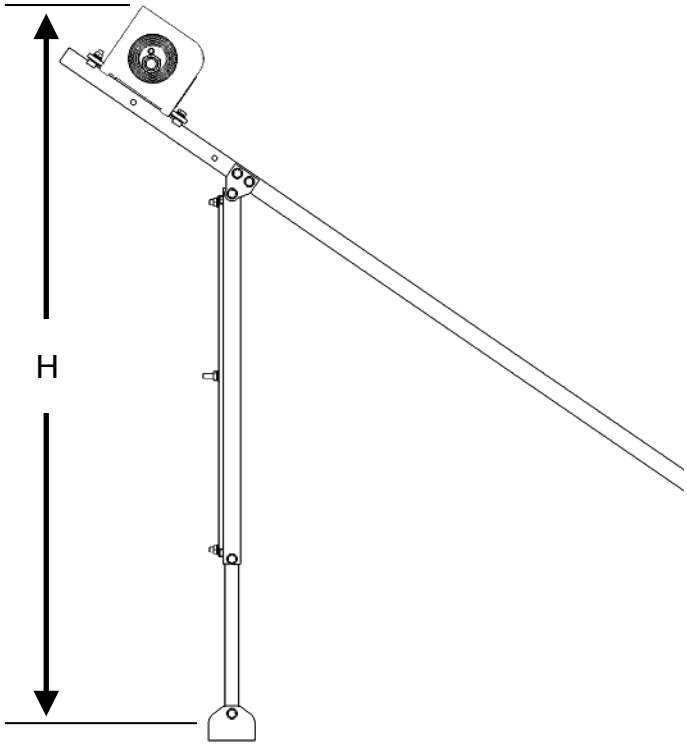
L (Leg Length)	X (Extension)	F (Min)	F (Max)	θo (Min)	θo (Max)
EARL-20D (650mm)	No Extension	1771mm	1515mm	22o	23o
	50mm	1792mm	1494mm	23o	26o
	150mm	1834mm	1444mm	26o	30o
	250mm	1881mm	1385mm	29o	34o
	350mm	1931mm	1317mm	32o	38o
	450mm	1986mm	1236mm	34o	42o
	550mm	2044mm	1141mm	36o	47o
EARL-30D (888mm)	No Extension	1871mm	1393mm	29o	33o
	50mm	1895mm	1361mm	30o	35o
	150mm	1948mm	1288mm	33o	39o
	250mm	2004mm	1202mm	35o	44o
	350mm	2063mm	1101mm	37o	49o
	450mm	2126mm	979mm	39o	55o
	550mm	2191mm	829mm	41o	61o
EARL-45D (1179mm)	No Extension	2027mm	1163mm	36o	46o
EARL-60D (1425mm)	No Extension	2179mm	849mm	50o	60o

4.14. Mounting Frame (Depth & Height Dimensions)

a) The following diagram and table provides the overhead depth (D) and height (H) of the collector at each 5° incremental angle between the allowable 20-80° range.



Angle	D (Depth)	H (Height)
20°	1938mm	802mm
25°	1872mm	954mm
30°	1792mm	1099mm
35°	1699mm	1236mm
40°	1593mm	1363mm
45°	1475mm	1480mm
50°	1346mm	1585mm
55°	1208mm	1679mm
60°	1060mm	1760mm
65°	905mm	1833mm
70°	743mm	1898mm
75°	575mm	1950mm
80°	404mm	1987mm



4.15. Wall Mounting

a) The collector may be mounted on a wall with the bottom of the tubes angled away from the wall. The maximum collector installation angle for this format is 80°.

b) Ideally use short Rear Legs (EARL-20D) attached to the bottom of the front tracks rather than the top.

c) The method used for attachment to the wall will depend on the wall material.

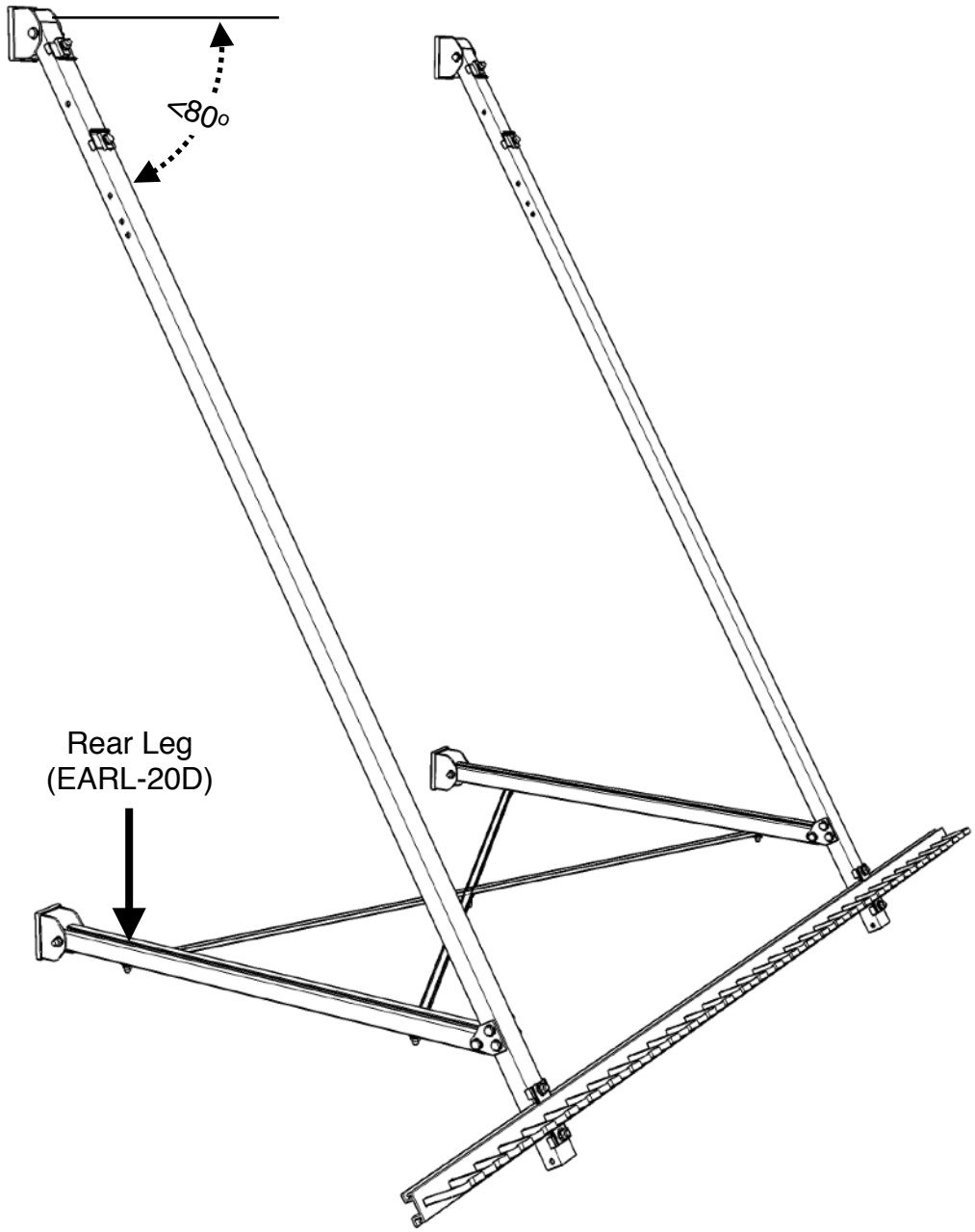
   i) For brick or concrete walls use expansion bolts.

   ii) For wood or metal framing use screws of suitable strength.

d) Ensure the wall attachment points are able to withstand the weight the wind loading that the collector will apply to the attachment points.

e) When installing on a wall consider the possible shading from eves, particularly in the summer.

f) If installing on a wall so the collector is above a walkway, please consider the danger associated with broken glass that could fall if the tubes were ever damaged. It may be necessary for a barrier of to be installed below the collector to catch any such falling materials.



4.16. Manifold Attachment

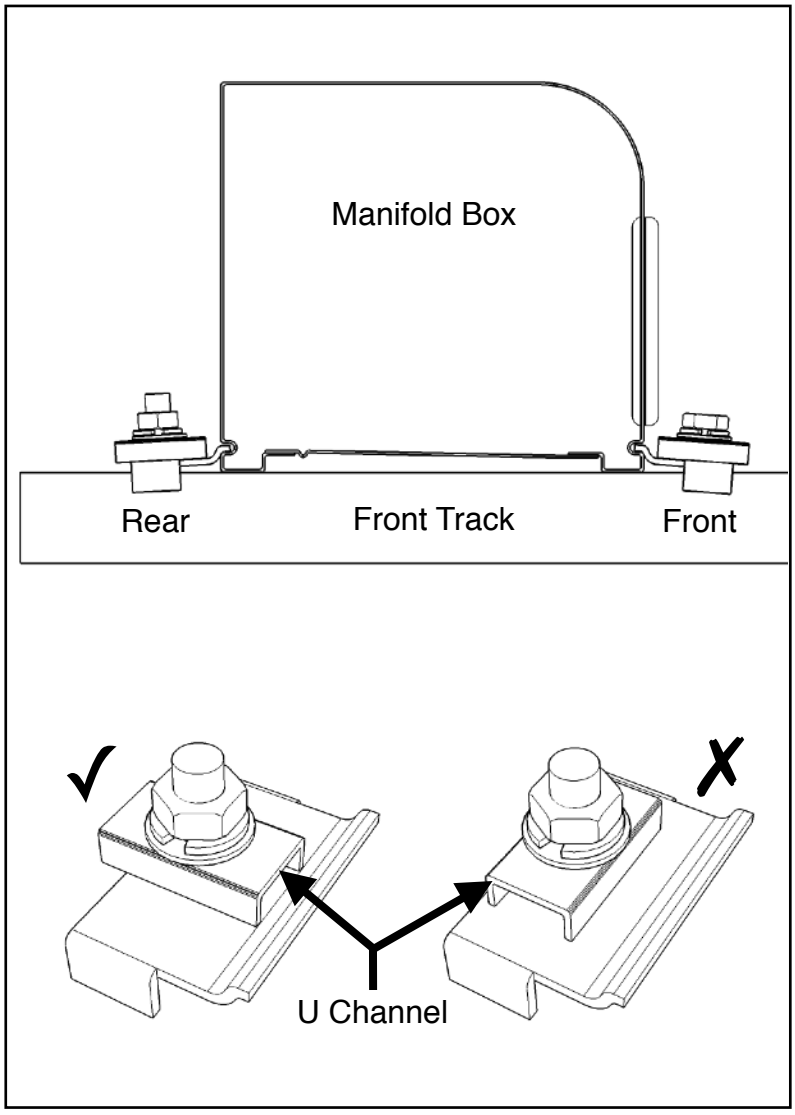
a) The manifold is secured to the frame front tracks using special attachment plates that lock into grooves along the front and rear of the manifold casing.

b) Attachment plates are already attached to the front tracks, so need to be loosened to allow the manifold and bottom track to be fitted. There is no need to completely remove them.

c) The attachment plates are designed such that when loose, the manifold and bottom track are able to slide left and right. This allows the front tracks to be easily adjusted to suit the roof surface attachment points.

d) Attachment steps:

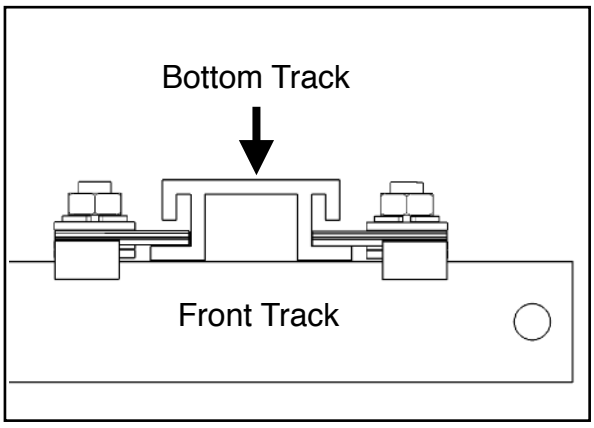
1. Loosen the front and rear attachment plates enough for the manifold to drop into position.
2. Slide the manifold left and right to correct position and align with the bottom track.
3. Push the manifold down and finger tighten the front attachment plate bolts, ensuring the attachment plates are full depth into the manifold casing groove.
4. Push the rear attachment plate down firmly into the groove at the rear of the manifold casing and finger tighten the nut.
5. Tighten both attachment plates, ensuring the U channel on top is in the correct position.

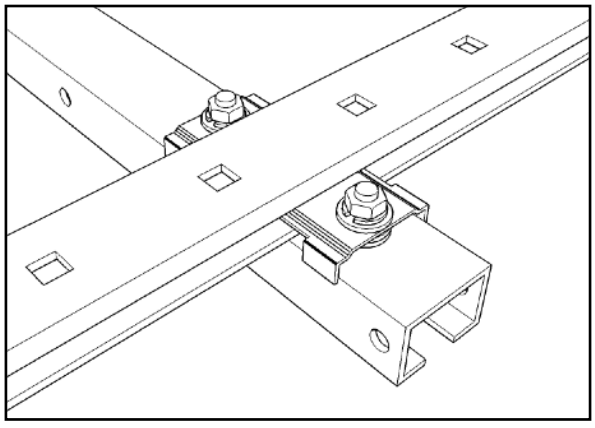


4.17. Bottom Track Attachment

a) The bottom track is secured using attachment plates that slot into

b) Attachment plates are already attached to the front tracks, so need to be loosened to allow the manifold and bottom track to be fitted. There is no need to completely remove them.





5. Piping Connection

5.1. Collector Connection to Plumbing

a) The inlet and outlet of the ETC collector header pipe are factory fitted with a brass flared pipe nut.

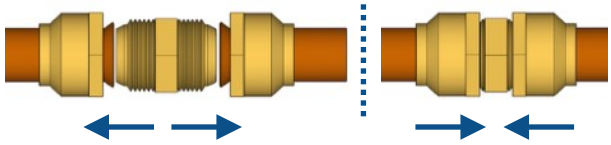
b) This connection forms a metal-metal-metal seal which is far more reliable than o-rings or washers when considering the high temperatures that the solar collectors experience during operation.

c) A small amount of >200ºC rated thread sealant such as Loctite 567 or Leak-tite blue should be applied to the inside and outside faces of the flared copper pipe to provide some lubrication when tightening and to ensure a good seal.

d) The following brass fittings are available from Apricus to provide standard threaded or sweat connection.

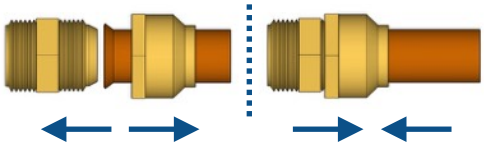
Collector-Collector Fitting

Part: BF-ST-FL19xFL19
Description: This brass fitting is used between two collectors when connected in series.



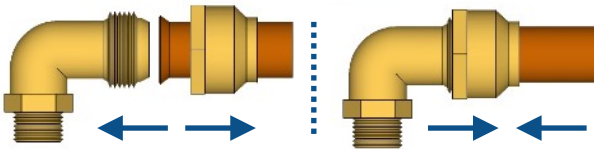
Male BSP Thread Fitting

Part: BF-ST-FL19x3/4”MBSP (show above)
Description: Provides a 3/4” male BSP thread (Metric standard).



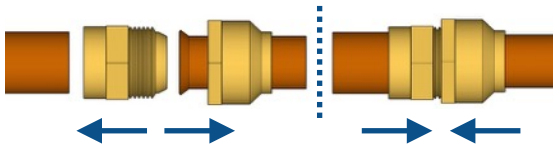
Elbow Male Thread Fitting

Part: BF-L-FL19x1/2”MBSP
Description: Elbow fitting provides a 1/2” male BSP thread. For 1-2 collector systems only.



22mm Copper Pipe Sweat Fitting

Part: BF-ST-FL19x22S
Description: Solder/brazing connection for European standard 22mm OD copper pipe.



5.2. Pipe Size and Flow Rates

a) As a general rule piping should be chosen to achieve a maximum flow speed of 1m/s. Use the Apricus toolkit to help determine suitable pipe sizes.

b) Maximum total flow-rate through any collector is 15L/min (~1m/s).

c) The pipe, pump, valve and fittings on the solar line must be rated to at least 110ºC.

d) Components within 0.5m vertical pipe run from the collector inlet/outlet must be rated for high temperatures of >200ºC.

e) A maximum of 5 x ETC solar collectors may be connected in series with the standard Apricus straight connectors (Part BF-ST-FL19xFL19). For more than 5 collectors in series a flexible connection must be used every 3 collectors and consideration must be made for the greater pressure drop that will occur.

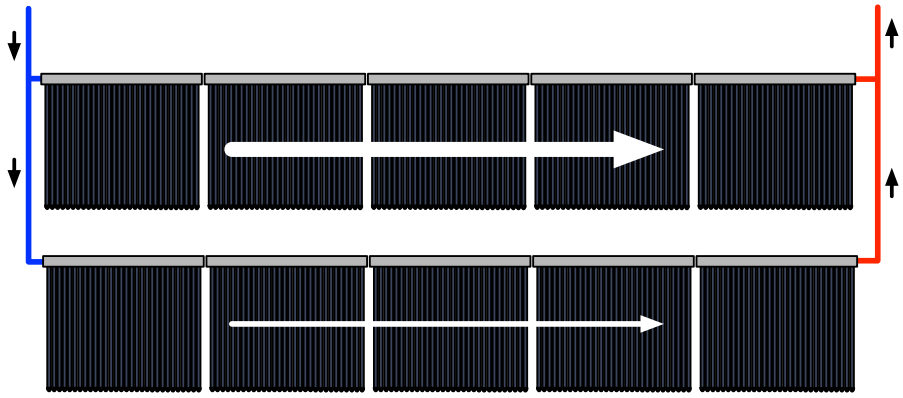
f) Piping connection at each end of banks of collectors must allow movement due to expansion and contraction.

g) Apricus does not warrant the collector against damage resulting from poorly managed header or piping expansion and contraction.

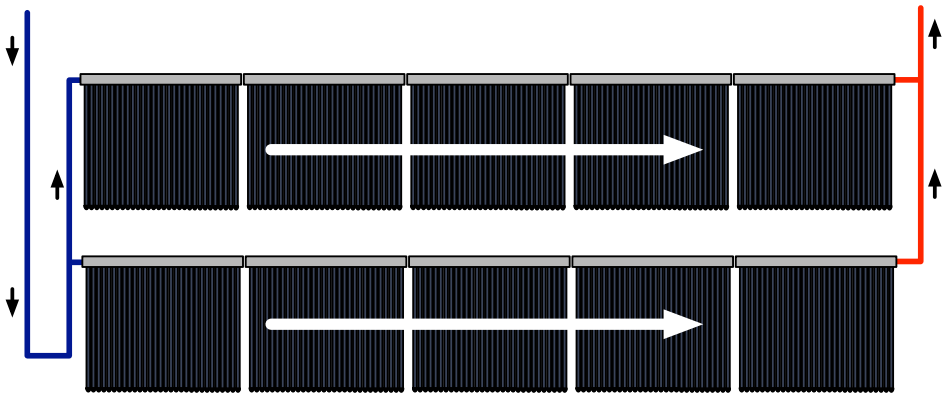
h) It is recommended to use reverse return piping layout where possible to avoid the need for balancing valves.

5.3. Piping Layout

a) It is recommended to use reverse return piping layout where possible to avoid the need for balancing valves.



This configuration would result in uneven flow. Balancing valves would be required.



Reverse return configuration ensures balanced flow without the need for balancing valves.

5.4. Flow Rate & Temperature Rise

a) Recommended flow for ETC collectors is 0.07 L/tube/min. (ie. ETC-30 = 2 L/min). This will achieve up to 14ºC temperature rise in peak sunlight, and avoid excessive stop-starting during periods of lower solar insolation.

b) The following table shows the temperature rise for each collector model at peak output (Watts) and various flow rates.

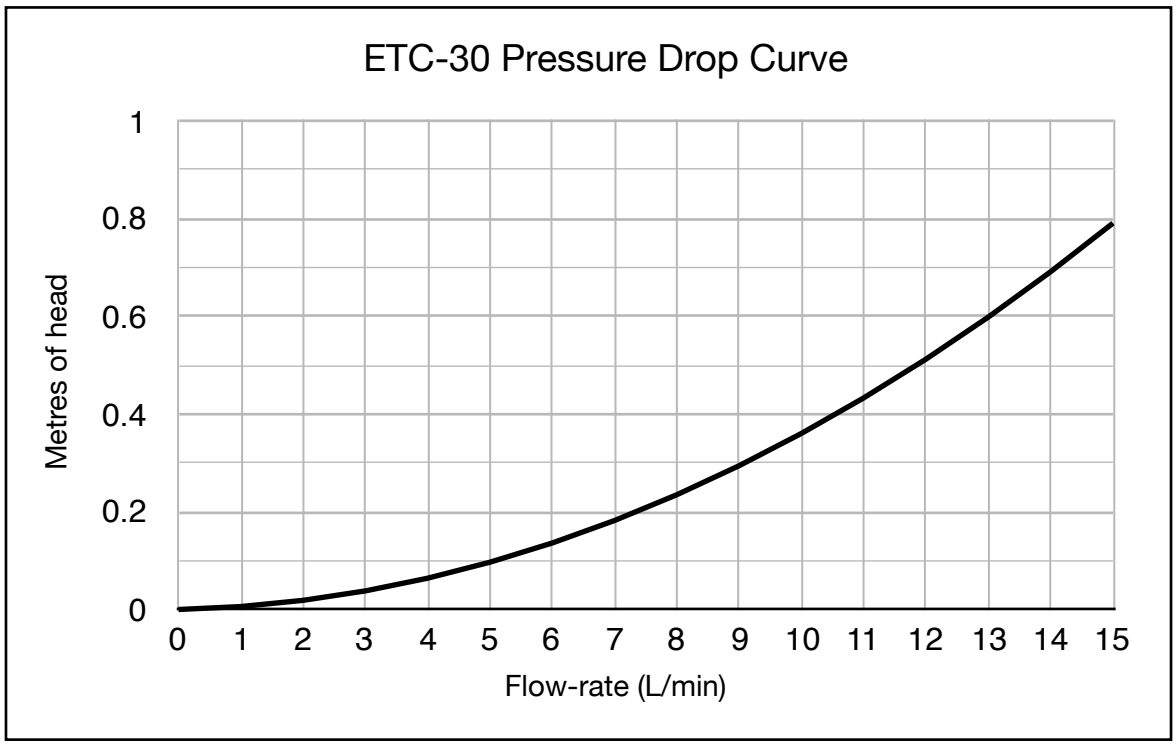
c) Use a flow meter/setter to confirm the flow rate through the system.

Flowrate (L/min)	ETC-10 (671W)	ETC-20 (1342W)	ETC-22 (1477W)	ETC-30 (2014W)
1	9.6ºC	19.2ºC	21.2ºC	30.2ºC
2	4.8ºC	9.6ºC	10.6ºC	15.1ºC
3	3.2ºC	6.4ºC	7.1ºC	10.1ºC
4	2.4ºC	4.8ºC	5.3ºC	7.5ºC
5	1.9ºC	3.8ºC	4.2ºC	6ºC

5.5. Pressure Drop Curve

a) Pressure drop through an ETC-30 tube collector with cold water for flow rates up to the maximum allowable 15L/min is displayed in the following graph.

b) Pressure drop for other heat transfer fluids (such a propylene glycol) may be higher.



5.6. Pump Selection

a) Pump should be selected to meet the following requirements:

i) Flow-rate: Meet the desired flow rate for the system when the system is cold (hardest to pump), especially for system filled with a heat transfer fluid (not just plain water).

ii) Head pressure: Select a pump that has sufficient head to overcome the pressure drop of the solar loop at the desired flow rate. For drain-back systems the vertical height from the drain-back tank to the collector must also be considered.

iii) Material: For closed loop systems a cast-iron body pump can be used. For direct flow systems a brass/ bronze, composite (plastic) or stainless steel body pump is recommended.

iv) Temperature: Must be rated to at least 110^{o}C.

b) If using a variable speed pump, a target delta-t of 7^{o}C is recommended.

c) If the system is not achieving the desired flow, troubleshooting can include:

i) Checking for air lock in the collector or flow and return lines; repeat filling/air vent process.

ii) Check operation of the non-return/check valve.

iii) Pump operation. Pump may not be bled of air, or there may be cavitation (air bubbles forming) due to installation issues.

iv) Pump may not have sufficient head pressure.

d) Always install the pump on the supply cold line to the collector.

e) If the system does NOT have a suitable sized expansion tank located after the check valve on the supply (cold) line, then a check valve should be installed after the pump to protect from exposure to high temperatures. Some pumps may be supplied with a check valve pre-installed in the outlet port. Refer also to section 3.11 about best position for expansion tank, check valve and circulation pump.

5.7. Pipe Insulation

a) Heavily insulate all piping running to and from the manifold with a high quality insulation of at least 15mm thickness, >20mm in cold climates.

b) Insulation foam that is exposed to direct sunlight should be protected against UV related degradation by wrapping/covering with a suitable material such as adhesive backed aluminum foil, PVC conduit or similar.

c) Ensure that the insulation tightly covers the inlet/outlet ports and is sealed against the manifold casing with silicone sealant to prevent water ingress.

d) For systems designed to allow stagnation, high temperature rated insulation such as glass wool or mineral wool should be used on piping close to the collector (~2m). Glass wool insulation may come with an external foil wrap, but any cuts made during installation should be sealed with watertight and UV stabilised material such as adhesive backed aluminium foil.

5.8. System Filling & Air Purge

a) Once the inlet and outlet are connected to the plumbing system, the collector loop should be filled/flooded and purged of air.

b) Mains Pressure Direct Flow (Direct Flow):

1. An isolation valve should be installed on the return (hot) line close to the tank, with an air vent installed on the outlet of the collector, and at any high points in the piping where air could be trapped.
2. Close the return line isolation/ball valve.
3. Fill the tank and open the supply line to the collector. The mains pressure water will purge the collector of air, expelling air from the air vent.
4. Turn on the circulation pump and open the isolation port. Continue to purge any remaining air from the the air vent. Automatic air vents should be removed. A suitable, high temperature manual air vent can be closed and left in place.
5. Check for correct flow rate.

c) Closed Loop (or low pressure Direct Flow):

1. The solar loop return (hot) line should be fitted with fill and drain valves with an isolation valve in between.
2. Open isolation valves below each air vent to allow venting.
3. Close the isolation valve that is between the fill and drain valves
4. Flood the system with mains pressure water, or manually use a pumping station.
5. Run the pump at maximum speed.
6. Continue to flood the system until no more bubbles exit the drain port (with clear pipe run to drain).
7. Close the drain valve, open the isolation valve and continue to fill until the desired pressure is reached.
8. Turn off the pump, raise to the desired pressure then close the fill valve.
9. Monitor the pressure to ensure no leaks are present.

e) For newly installed piping, a pressure test should be completed before finally filling occurs. Refer to local plumbing codes for pressure level and time guidelines. Where no guidelines are present, test to within 0.5 bar of the pressure relief valve setting and monitor the pressure gauge value for at least 2 hours.

f) Always flush with water before filling with heat transfer fluid (if applicable) or replacing old heat transfer fluid.

g) Only flood a system when there is no solar heat being produced; morning/evening, overcast weather or with the collectors covered.

6. Evacuated Tube Installation

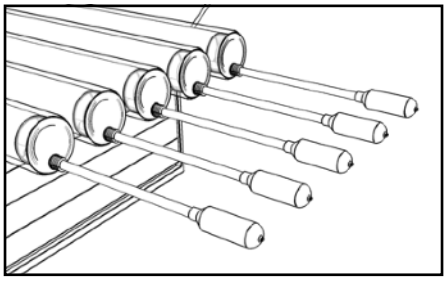
⚠ WARNING
• DO NOT INSTALL THE HEAT PIPES AND EVACUATED TUBES UNTIL SYSTEM PIPING IS COMPLETED, SYSTEM IS FILLED AND THE PUMP AND CONTROLLER ARE OPERATIONAL • ALWAYS WEAR SAFETY GLASSES WHEN HANDLING EVACUATED TUBES • TUBES ARE FRAGILE SO TAKE CARE WHEN HANDLING AS ANY KNOCKS COULD BREAK THE GLASS. • DO NOT EXPOSE TUBES TO SUNLIGHT UNTIL READY TO INSTALL, OTHERWISE THE HEAT PIPES WILL BECOME EXTREMELY HOT, AND COULD CAUSE SERIOUS BURNS IF TOUCHED. • WEAR THICK PROTECTIVE GLOVES IF HANDLING HOT TUBES & HEAT PIPES.

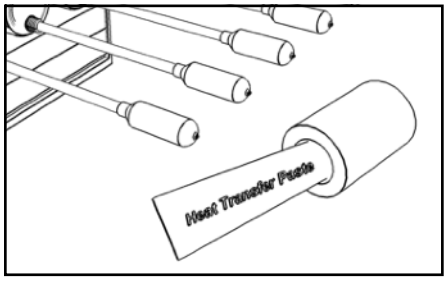
6.1. Tube & Heat Pipe Preparation

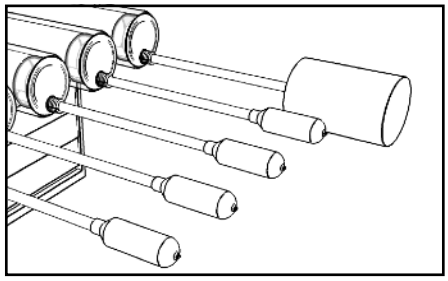
a) Cut open the top end of the evacuated tube box and lift a row of tube up onto the edge of the box.

b) While holding the top spring plate in place, pull out all the heat pipes by ~15-20cm.

c) Coat all the heat heat pipe tips with a very THIN layer of heat transfer paste. The easiest and cleanest way to coat the tips is to use a 10-15cm length of rubber insulation pipe with ID of ~22mm. Squirt some heat transfer paste into the insulation pipe and then insert each heat pipe. Ensure the coated paste is not exposed to any dirt or other contaminates.





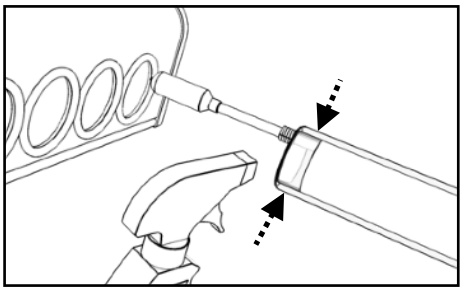


d) If an evacuated tube is damaged for any reason (e.g. knocked heavily or dropped), it will need to be replaced. Either use another tube with heat pipe already inserted, or if a plain evacuated tube spare is being used, carefully remove the heat pipe from the broken tube and insert into the new tube. Never throw heat pipes away as they are will generally not be damaged even if the tube is broken. Heat pipes can be kept as spares, or inserted into plain spare evacuated tubes.

6.2. Tube & Heat Pipe Insertion

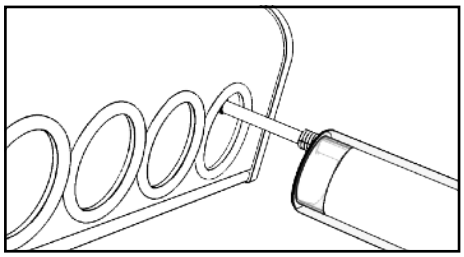
a) The heat pipe should be pulled out of the ET by ~15-20cm to allow the heat pipe to be properly inserted. This should have already been done when applying the heat transfer paste (see 6.1 above).

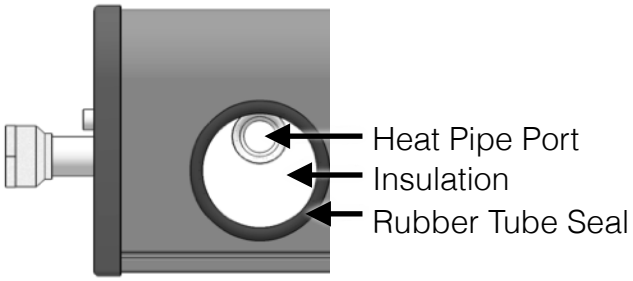
b) Lubricate the top outer surface of the evacuated tube with a small amount of water. This facilitates easy insertion past the manifold rubber ring seal. A small pump spray bottle is the best method for carrying and applying the water. Do not spray water into the evacuated tube.



c) Firmly hold the evacuated tube, taking care to ensure the metal spring plate is sitting in the mouth/top of the evacuated tube.

d) Guide the heat pipe tip in past the manifold rubber seal and into the heat pipe port. Note the location of the heat pipe port at the TOP of the hole. Push the heat pipe in full depth.





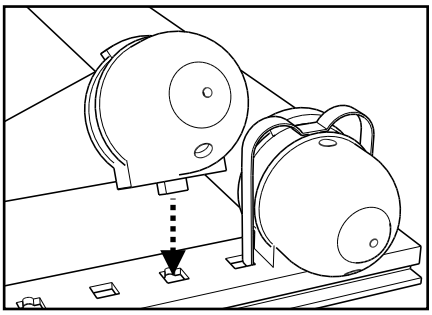
e) Using a 1/8th left and right twisting action, push the evacuated tube up into the manifold. Do not rotate the tubes around too far in either direction otherwise the heat pipe will end up along the side or underside of the tube.

f) The neck of the evacuated tube will push against the spring at the base of the heat pipe tip, forcing it fully into the port. The heat pipe and evacuated tube are fully inserted once the black coating of the evacuated tube has disappeared up into the manifold (no clear glass visible) and the bottom of the tube sits correctly in the bottom track.

g) As each tube is inserted, secure the tubes to the bottom track using the stainless steel clips as follows:

1. Position the tube caps with the square rubber base into the hole in the bottom track. Always start installing the ETs at one end of the collector.
2. Note the different hole shapes in the bottom track for the tube caps and tube clips.
3. Secure ETs to the bottom track with tube clips. Insert the clips from below the tubes. Push down one side at a time until they click into the holes.

1.



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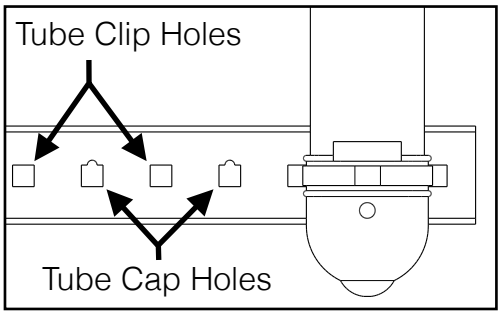

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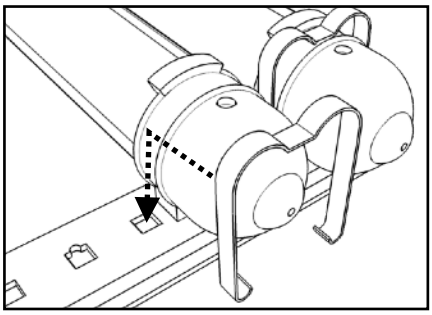


h) The clip can be removed by using a small screwdriver or needle nosed pliers to pull each side outward.

i) As the tubes sit close together, it may be necessary to push a adjacent tube slightly off to the side while attaching the clip to allow enough room to operate.

j) If a tube is extended longer than the other tubes the heat pipe may not have been inserted fully into the heat pipe port. Remove the tube and repeat the installation process ensuring that the heat pipe slides in fully before pushing the evacuated tube up into place.

6.3. Post Installation Cleaning

a) Clean each evacuated tube with a liquid glass cleaner and cloth/paper.

7. Temperature Sensor Installation

7.1. Temperature Sensors

a) Ensure that sensors used on the collector are high temperature rated (up to 200°C), including the cable.

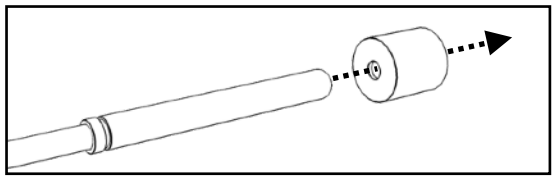
b) The temperature sensor port is located beside the header ports. Always insert the sensor port in the outlet (hot) port.

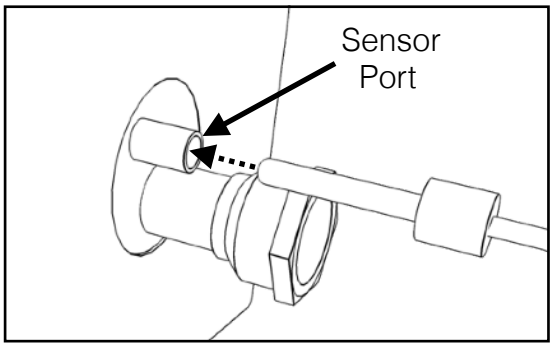
c) If multiple collectors are installed in series, install in the outlet of the last collector.

d) Do not allow the sensor cable to come in direct contact with the solar flow or return lines, as the heat may damage the cable. The sensor cable should run along the outside of the insulation pipe, wrapped with aluminium foil to secure in place and protect from UV exposure.

e) Following these steps to install the sensor:

1. Wet the sensor tip and cable with water.
2. Push the sensor through the rubber cover until it is onto the cable.
3. Dry the sensor tip and coat with heat transfer paste.
4. Insert the sensor into the sensor port and push rubber cover over the outside of the sensor port.
5. Secure the cable in place along the insulation pipe.





8. Post Installation Check

After installing all the tubes, and in good sunlight, the solar collector will begin to produce heat after a 5-10min "warm up" period. Check the controller and pump for correct operation and adjust settings as required.

The following checklist is provides as a guide. It is recommended to develop a more comprehensive that is appropriate for the local system design and installation method.

1	Collector faces correct direction (equator pointing) and is suitable installation angle of 20° – 80°	Y	N
2	Collector is not shaded through the day, especially between 9-3pm	Y	N
3	No overhanding trees or objects are likely to fall on the collector	Y	N
4	In areas prone to large hail (>∅20mm / ∅3/4"), collector is installed at an angle of 40° or greater.	Y	N
5	Frame is secured to structurally sound roof/wall with engineering approval where applicable	Y	N
6	Plumbing is pressure tested and confirm as leak free (closed loop is holding pressure)	Y	N
7	Plumbing pipe runs are well insulated and sealed against the manifold casing.	Y	N
8	Sensor cable is not in contact with any metal objects, is secured in place along pipeline and protected from direct sunlight.	Y	N
9	Controller is configured correctly with freeze setting on (if required).	Y	N
10	System is fitted with pressure relief valve on the pump station (closed) or tank (direct).	Y	N
11	Pressure relief valve will dump only onto high temperature resistant material and will not pose a danger of scolding people.	Y	N
12	Pump, controller and all electrical connections are protected from water ingress.	Y	N
13	Evacuated tubes have been cleaned.	Y	N
14	Installation record form with key information filled in has been given to customer and the system basic operation explained.	Y	N
15	Functional checks for controller and pump have been completed.	Y	N
16	Water quality has been checked (if applicable).	Y	N
17	Installation site has been cleaned.	Y	N

9. Maintenance

⚠ WARNING
• APART FROM THOSE MAINTENANCE ITEMS OUTLINED BELOW, ANY SYSTEM INSPECTION, MAINTENANCE OR REPAIR SHOULD ONLY BE COMPLETED BY AUTHORISED PERSONS. • THE SOLAR COLLECTOR WARRANTY COVERAGE MAY BE VOID IF NON-AUTHORISED PERSONS ATTEMPT TO MAINTAIN OR REPAIR THE SOLAR COLLECTOR OR ASSOCIATED COMPONENTS. • HOME OWNER MAY ONLY COMPLETE THOSE MAINTENANCE ACTIVITIES OUTLINED IN THIS DOCUMENT IF **SAFE** TO DO SO. • HOME OWNER MUST **NEVER** CLIMB ONTO A ROOF.

Under normal conditions the solar collector is maintenance free. Other system components such as the pump, glycol liquid (if used) may require periodic inspection and changing/maintenance. Please refer to the documentation provided by the manufacturer of these other components.

The following maintenance may be completed by HOME OWNER if SAFE to do so.

9.1. Cleaning

a) If tubes become dirty they may be cleaned with high pressure water or glass cleaner.

b) Leaves may accumulate between or beneath the tubes and should be removed. The solar collector is NOT a heat source that could ignite the leaves during hot water.

9.2. Other Components

a) Other system components such as the pump station or controller may have certain maintenance functions that can be safely completed by the Home Owner. Refer to the owner's manuals for those components for more information.

The following maintenance may ONLY be completed by AUTHORISED PERSONS.

9.3. Broken Tube Replacement

a) If a tube is broken it should be replaced as soon as possible to maintain maximum collector performance.

b) The system will still operate normally and safely even with a tube broken.

c) Any broken glass should be cleared away to prevent injury.

d) To replace a tube, follow these guidelines:

1. Remove the tube clip(s), slide broken tube out and carefully pick up any glass pieces. Protective gloves must be worn when handling broken glass, and avoid touching the glass wool insulation with bare hands, as it can cause mild skin irritation.
2. When removing the broken tube, the rubber ring in the manifold casing may pop out. Just return this ring into place before inserting the new tube.
3. If the heat pipe is not easy to remove (commonly the case), it can be left in place and a new evacuated tube inserted. Slide the heat pipe down the groove between the evacuated tube inner wall and heat transfer fin.
4. If the heat pipe is easily removed, the easiest option is to replace the heat pipe and evacuated tube completely.

9.4. Insulation

a) The plumbing pipes running to and from the collector should be heavily insulated. This insulation foam should be checked periodically (at least once every 3 years) for damage.

b) For any insulation that is exposed to sunlight, ensure any protective cover/wrap/foil is in good condition, replacing as required.

9.5. Draining the Collector

a) Draining of the manifold may be required if maintaining the system or in preparation for extremely cold

conditions (extended snow cover).

b) Only drain systems when the collector is operating at a safe temperature (<50°C).

c) Direct flow system draining instructions:

1. Turn off the mains water supply to the solar storage tank. If the storage tank or other system components are being concurrently drained, refer to their instruction manuals for details.
2. If storage tank is not being drained, isolate piping to and from the solar collector (isolation valves should already be installed), and immediately open drain valves on both lines (or undo fittings). Never leave the isolation valves in the off position while the collector is full of water and exposed to sunlight as the water will heat cause a pressure increase which may rupture fittings/connections. In good weather the water may be hot or have built up pressure, so take care when opening the drain valve.
3. Allow the manifold to sit in a vented state for 5-10min to allow the manifold to boil dry (may need longer in poor weather).
4. Always leave one drain valve or fitting open, otherwise the system may build up pressure when it heats up.

d) Closed loop system:

1. Connect hoses to the fill and drain valves on the closed loop pump station and run to a suitable sized vessel or the drain. Consider any local regulations regarding pouring the heat transfer fluid down the drain.
2. Open fill and drain valves.
3. Open the insolation valves at the outlet of each collector where the air vent was installed during commissioning. If there are no isolation valves on the collector outlets, collector fittings may need to be opened to break the vacuum and allow the liquid to drain down.

9.6. Other Components

a) Other parts of the system such as the pump and storage tank (electric or gas water heater) should be serviced/inspected according to their manufacturer's own maintenance guidelines.

10. Troubleshooting

In some cases it may be possible for the those inspection items with an (H) to be completed by the home-owner, but only if such investigation is clearly both SAFE and the home-owner has sufficient technical understanding. Any information obtained during an investigation can then be relayed onto the company who supplied and installed the system. Any other system troubleshooting, system adjustments, or repairs may only be completed by authorised persons.

The following table includes a range of troubleshooting possibilities covering Closed Loop (CL) and Direct Flow (DF) systems. Items that are specific to one type will have (CL) or (DF) in front.

Problem	Cause	Solution
Pump not ON during good solar radiation conditions	Temperature sensors not working properly	• Check that sensor is installed correctly • Check that sensor wire is not damaged • Swap sensors to confirm temperature reading
	Incorrect controller settings	• Check controller settings **(H)**
	Controller Max Temp or Max Collector setting reached	• Check maximum tank and collector settings **(H)**
Pump cycling ON and OFF during good solar conditions	Partial shading of collector	• Check collector location for shading **(H)**
	System flow rate too fast	• Adjust restrictor screw on flow setter • Reduce pump speed (select slower speed)
	Controller settings incorrect	• Solar off (delta-t) value may be set too high. **(H)**
Pump always ON even during minimal solar radiation conditions	Insufficient flow rate	• Check flow gauge for proper flow rate **(H)** • Adjust restrictor screw on flow setter **(H)** • Clean any in-line filters • Check non-return valve operation and pipe for obstructions. • (CL) Check heat transfer fluid pH, color and viscosity, may need to be flushed and replaced.
	Air lock in piping system	• Purge system of air by following Filling procedures (section 5.4)
	Bottom tank sensor not getting accurate reading.	• Check operation of sensor. Should be getting accurate ready of bottom tank temperature. • Ideal position of low tank sensor is slightly ABOVE solar supply (tank to solar) port position.
	Controller settings incorrect	• Solar off (delta-t) value may be set too low. **(H)**
Pump running at night	Controller settings incorrect	• (DF) Check that freeze protection setting is correct. Intermittent circulation is freezing conditions is normal. Ensure pipes are well insulated. **(H)**
	Bottom tank sensor not getting accurate reading.	• Check operation of sensor. Should be getting accurate reading of low tank temperature. • Ideal position of low tank sensor is slightly ABOVE solar supply (tank to solar) port position.
Fluid dumping from pressure relief valve on pump station	Faulty pressure relief valve	• (CL) Replace pressure relief valve
	Expansion tank too small	• (CL) Install larger expansion tank
	Expansion tank pressure setting incorrect	• (CL) Check pressure setting. Pressure setting should be set slightly lower than the system cold charge pressure.
	Faulty expansion tank	• (CL) Replace expansion tank on pump station
Lots of fluid dumping from pressure relief valve on tank	Excessive tank temperature	• Check Max Tank setting of controller **(H)** • Check tank sensor operation (that measures top tank temp)
	Faulty expansion tank	• Replace expansion tank on potable water side
Not enough hot water	IF ELECTRIC Electric not heating water	• Check operation and power supply to element. May be on timer? • Check if element is on off-peak power supply. Any changes? **(H)** • Replace element if faulty • Check controller boost settings (if controller managed) **(H)**
	IF BOILER or GAS TANKLESS Booster not heating water	• Check gas/fuel supply **(H)** • Check operation of boiler/heater • Check controller boost settings **(H)** • Check circulation pump (if heated by boiler)
	Faulty tempering valve, mixing the water too cold	• Check operation of tempering valve
	Increased hot water demand	• Install larger capacity boiler/booster • Revise boost settings of controller or timer **(H)** • Install larger storage tank

Problem	Cause	Solution
Poor Solar Heating Contribution (Compared to previous output at same time of year)	Increased hot water demand	• Check if hot water demand has increased, which would reduce the % contribution from solar even with the same level of output. **(H)**
	Insufficient flow rate	• Check flow gauge for proper flow rate **(H)** • Adjust restrictor screw on flow setter **(H)** • Clean any in-line filters • Check non-return valve operation and pipe for obstructions. • (CL) Check heat transfer fluid pH, color and viscosity, may need to be flushed and replaced.
	Partial shading of collector	• Check collector location for shading or snow coverage. **(H)**
	Dirty tubes	• Clean tubes. Refer to Maintenance section for safety instructions. **(H)**
	Damaged insulation	• Check that insulation is still in good condition with no exposed pipe. **(H)**
	Damaged evacuated tubes	• Check that evacuated tubes are all intact and the bottom is still silver
	Heat pipes not operating	• Check that heat pipes are making good contact in header, and are hot at the tip.
	Scale build up in collector header or external heat exchanger.	• (DF) Back flush solar collector loop with scale cleaning liquid. Install scale inhibitor. • (CL) Back flush external heat exchanger with scale cleaning liquid.
	Insufficient pump run time	• For normal ON/OFF pump operation (not variable speed) ensure the pump is running long enough for the heat from the collector to return to tank - feel return line with hand (careful) to check. Reduce dTMin value slightly.
	Pump cycling too long and dissipating heat	• Solar off (delta-t) value may be set too low. **(H)** • Tank bottom sensor too low in tank, always reading cold water. Move to correct location above solar flow (tank to collector) port.
Tank cooling down at night. It is normal for tank to loose 0.3 - 0.4°C/ hour depending on tank and ambient temps.	Thermo-siphoning	• System may be “core” or “reverse’ thermo-siphoning at night. Install sprung check valve on return (collector to tank) line close to tank or form U shaped heat trap in piping.
	Excessive tank heat losses	• Insulate both the hot and cold water pipes connected to the storage tank. **(H)** • Insulate any exposed fittings and valves on the storage tank. DO NOT impair the operation of the PTRV. • Add a layer of insulation to the outside of the tank. **(H)**
Intermittent short patches of cold water when showering	Faulty tempering valve	• Check operation of tempering valve
	Faulty tankless gas booster operation (if post gas system)	• Check operation of tankless gas booster

11. Disclaimer

Apricus Solar Co., Ltd withholds the right to change dimensions and the characteristics of the product without any forewarning, and rejects any kind of responsibility for misprints.

This booklet is only a guide and as such Apricus Solar Co., Ltd will not be held responsible for any damage to person or property that results during the installation or subsequent use of this solar collector and related system components.

12. Manufacturer's Limited Warranty

LIMIT OF LIABILITY

EXCEPT FOR THE EXPRESS LIMITED WARRANTY PROVIDED FOR HEREIN APRICUS HEREBY DISCLAIMS AND EXCLUDES ANY AND ALL OTHER WRITTEN OR ORAL EXPRESS WARRANTIES OR REPRESENTATIONS. ANY IMPLIED WARRANTY OF MERCHANTABILITY OR IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE MUST ARISE UNDER STATE LAW TO APPLY, AND IS HEREBY LIMITED IN DURATION TO THE DURATION OF THE WRITTEN LIMITED WARRANTIES PROVIDED HEREIN UNLESS OTHERWISE BARRED BY ANY APPLICABLE STATUTE OF LIMITATION. APRICUS DISCLAIMS ANY RESPONSIBILITY 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. NO AGENT OR REPRESENTATIVE OF APRICUS HAS ANY AUTHORITY TO EXTEND OR MODIFY THIS WARRANTY UNLESS SUCH EXTENSION OR MODIFICATION IS MADE IN WRITING BY A CORPORATE OFFICER. WHERE ANY DISCLAIMERS AND LIMITATIONS CONFLICT WITH APPLICABLE STATE LAW, APPLICABLE STATE LAW SHALL PREVAIL.

Some states do not allow the exclusion or limitation of incidental or consequential damages and some states do not allow limitations on how long implied warranties may last, so the above limitations may not apply to you.

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 WARRANT 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.

Components	Failure Type	Coverage
Manifold Box	Manifold Box Leaking Rubber Seal Cracking	Ten years parts
	Manifold Case Colour Fading	One year parts
	Manifold Case Coating Pitting or Peeling	Three year parts
Header Pipe	Leaking	Fifteen years parts
	Brass Fittings	Ten years parts
Evacuated Tube	Complete Loss of Vacuum	Ten years parts
Heat Pipe	Not Transferring Heat	Ten years parts
Mounting Frame	Structural Failure Dimensional Errors Effecting Operation	Fifteen years parts
Tube Clips	Structural Failure	Ten years parts
Tube Caps	Cracking	Ten years parts

WARRANTY EXCLUSIONS

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

General

a) The design or structure of the Products are attempted to be modified or altered in any way, including but 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) Failure due to vibrations or movement of the piping connected to the collector, such as when valve or faucet/tap is closed.
g) Failure is due to wind, hail, storms or other acts of God;
h) Failure or loss of efficiency is due to lime-scale formation;
i) Product serial tag or other identification is defaced or removed;
j) Product is relocated from its original point of installation;
k) Collector is not commissioned and is left to dry stagnate for a period exceeding 14 consecutive days;
l) Any operation or environmental conditions that exceed documented design limits of the system components or materials.

Manifold Casing

a) Damage to the manifold casing during or after installation;
b) Failure to seal insulation up to manifold casing for rear port manifolds;
c) Piping connected to the inlet/outlet is not properly supported causing rubber seal to be pulled out of shape:
d) Gradual colour fade
e) Damage due to attacks by insects or animals
f) Piping connected to the inlet/outlet is "hung" off the collector.

Header Pipe

a) Leakage from any connection to header inlet or outlet;
b) Exposure of the manifold header pipe to pressure exceeding 0.8Mpa/8bar/116psi;
c) Exposure to flow rates exceeding 15 L/min or 4gpm;
d) Freezing of the liquid contained in the manifold header pipe;
e) Leakage of the manifold header pipe as a clear result of metallic corrosion and not structural braze failure;
f) Poor heat transfer, excessive pressure drop, or blockage of header as a result of scale formation;
g) Installation of more than five end port manifolds in series without at least one suitably flexible connection that allows longitudinal expansion and contraction of the header pipe(s);
h) Piping connection on the inlet/outlet of the collector that restricts longitudinal expansion and contraction of the header pipe(s).
i) Piping connected to the inlet/outlet is "hung" off the collector.
j) Brass fitting has been over torqued, indicated by deformation marks on corners of the HEX of the nut, crossed thread or other clear evidence of incorrect use;
k) Spanner/wrench with teeth (rather than flats) has been used to tighten the fitting;
l) Non Apricus supplied nipple has been used with the flared nut;
m) Copper flare has been deformed from original manufacturer shape.

Evacuated Tubes

a) Heat pipes are not correctly installed full depth into header ports, indicated by deformation of the evacuated tube top plate;
b) Heat pipes are not running straight up and down the top side of the evacuate tube due to excessive rotation of the evacuated tube during installation;
c) Collector mounting frame is installed in twisted (not squared or even) position putting stress on evacuated tubes;

Heat Pipes

a) Heat pipes are installed outside of the required 20-80deg installation angle;
b) Heat pipes have been bent or damaged causing rupture to the copper pipe.

Mounting Frame & Tube Clips

a) Failure attributable to any modification to the mounting frame components;
b) Failure when not installed in accordance with Apricus installation guidelines;
c) Failure of non-Apricus fastening components or the structure to which mounting frame is attached;
d) Failure due to wind loading when the mounting frame has not been installed in line with installation guidelines and local structural codes for high wind regions.
e) Failure due to wind loading in areas that experience >205km/h / 127mph where local structural engineering approval has not been obtained;
f) Failure due to excessive snow loading;

Tube Caps

a) Damage is due to attacks by insects or animals.

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.

13. Installation Record Form

If an installation record form is not provided with the solar system, please use this form.

Customer's Name:	
Address of Installation:	
Date of Product Installation:	
Installer's Name:	
Installation Company Name:	
Installation Company Ph:	
Product Serial Number(s):	
Comments:	
Signed by Installer:	
Signed by Customer:	

IMPORTANT NOTES:

1. Please only sign if you are happy with the service provided by the Installation Officer and the system is working properly.
2. Keep this document as a record of the installation as it will be required in the case of any warranty claims.