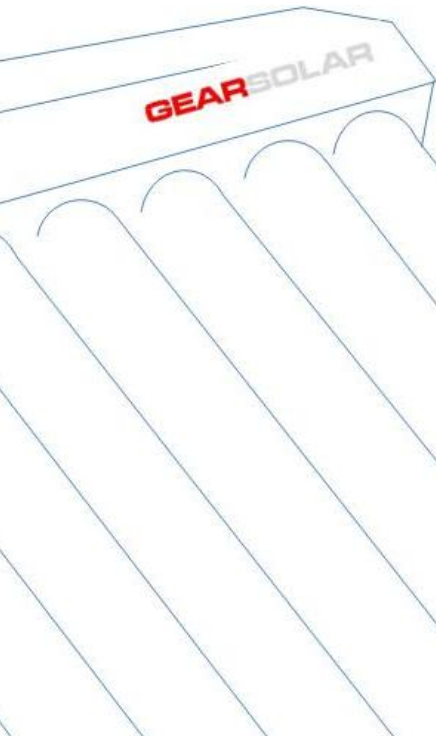
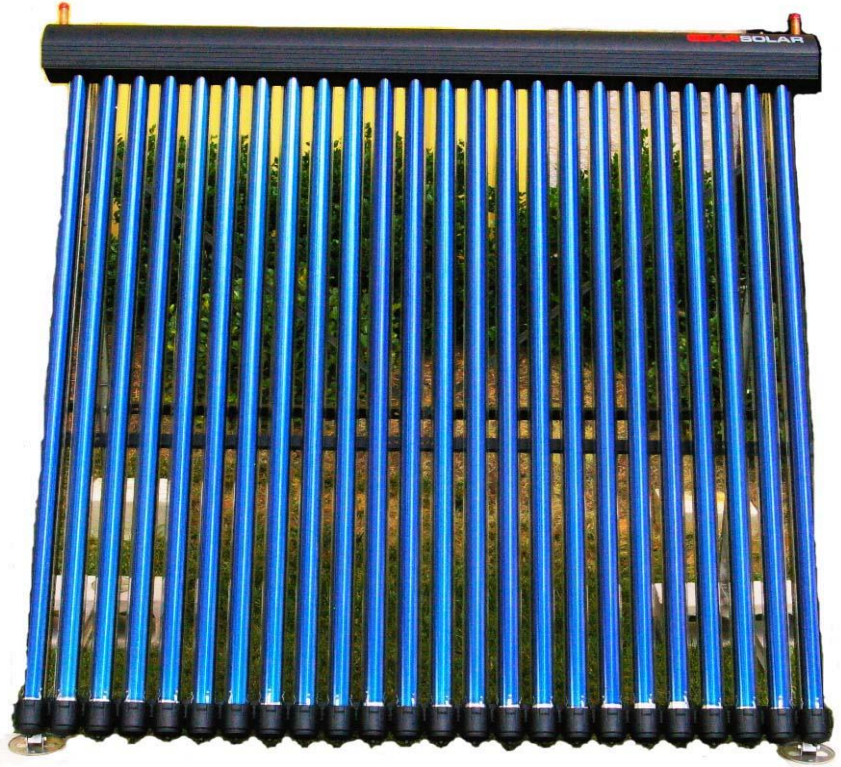


SolarPac Series Solar Thermal Collectors



GEARSOLAR

Providing Solar Thermal Energy Collecting Solutions

Product Overview

GEAR SOLAR's SolarPac collector is our premium solar thermal collector that uses twin glass evacuated tubes as the solar receiver. Our selective coating absorbs solar energy converting it into heat for use in water heating. **GEAR SOLAR's** evacuated tube solar thermal collectors are among the more efficient, cost-effective and affordable solar collectors available on the market today for use in residential, commercial and industrial heating systems.

GEAR SOLAR's collectors feature our proprietary coatings, modular design and assembly process that allow us to deliver industry leading performance and efficiency at a cost that is now competitive with traditional flat-panel collectors. In most types of solar thermal water heating applications, an evacuated tube collector can deliver up to 40% more efficiency compared to traditional "flat plate" solar collectors.

Each solar collector includes: a manifold, tubes, nylon feet holders, rubber sealing rings, bottom track and side tracks, joint bellow pipes for connection. **GEAR SOLAR's** SolarPac collectors have been designed to be suitable for a wide range of system configurations including open loop, closed loop, drain back and even thermosyphon when coupled with a suitable tank.



GEAR SOLAR

Solarpac Series

The Most Efficient Solar Thermal Collectors On The Market



- Maximum solar radiation absorption
- Reliable, efficient, twin-glass evacuated tubes
- Three layer special selective coating
- Designed to achieve high temperatures
- High quality copper “clean-room” sealed heat pipes for rapid heat transfer
- Minimum emissivity (heat loss)
- Suitable for main pressure water
- Modular construction facilitates installation
- Flexible purchasing schedules

GEAR Solar manufactures the following solar thermal collectors with the heat pipe and evacuated glass tube.

Model	Gross Area	Absorber Area	Gross Weight	Heat Fluid Content
Solarpac 12	2.11m ² /22.7ft ²	0.96m ² /10.3ft ²	30kg	0.67 liters
Solarpac 24	4.22m ² /45.4ft ²	1.92m ² /20.6ft ²	60kg	1.34 liters

GEAR’s Solarpac solar collector has been designed to be suitable for a wide range of system configurations including open loop, closed loop, drainback and even thermosyphon when coupled with a suitable tank. Collectors may be installed in banks of up to 10 collectors in series and unlimited parallel-connections.

Collector Detail

- Manifold Pipe Material
- Heat Pipe Material
- Tube Material
- Coating of Glass Absorber
- Heat Transfer Fin
- Insulation Material
- Frame Material
- Manifold Casing Material
- Max Operation Pressure (Bar)
- Efficiency
- Warranty



RESIDENTIAL



COMMERCIAL



INDUSTRIAL

Evacuated Twin-Glass Tubes

There are several types of evacuated tubes in use in the solar thermal industry. **GEAR SOLAR's** SolarPac collectors use the advanced "twin-glass tube" design. This type of tube design results in a higher quality product due to its reliability and performance. **GEAR SOLAR** has been able to lower manufacturing costs of its collectors dramatically over the past several years.



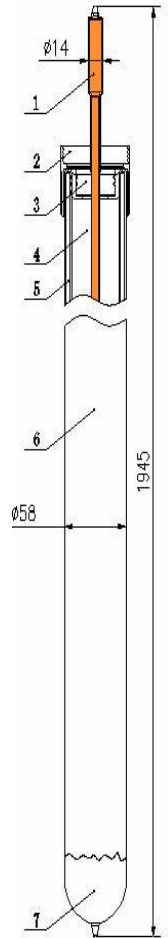
SolarPac Design Features

The evacuated glass tube was a revolutionary breakthrough in solar thermal technology in the late 1970's. Each evacuated tube consists of two glass tubes made from extremely strong borosilicate glass which provides high chemical and thermal shock resistance. The outer tube is transparent allowing light rays to pass through with minimal reflection. The inner tube is coated with our absorber. The evacuated glass tube design has the following advantages:

- The evacuated glass tube design minimizes heat loss and provides superior performance in a wide range of temperatures
- Due to their cylindrical tubular design (which maintains longer solar angles of incident) evacuated glass tube collectors passively track the sun throughout the day which results in a longer "solar day" and "solar year," resulting in more annual savings in utility expenses
- The absorbed solar energy inside the evacuated glass tube is transferred to the manifold within minutes of exposure in the sunlight due to our superior absorptive coatings
- The copper layer in our selective absorptive coating reflects thermal energy back inside the inner tube which contributes to minimal heat loss
- Wind and low temperatures have less effect on the functioning of evacuated glass tubes when compared to flat plate solar collectors due to the insulating properties of the vacuum
- Due to the high efficiency absorption of solar radiation even during overcast conditions, combined with excellent insulative properties of the solar tube, solar tube collectors can provide hot water all year round (backup from gas or electricity is still required)
- Evacuated tubes are strong, long lasting, and should one be broken, they are inexpensive and easy to replace

The figure to the right shows the major components of our SolarPac evacuated glass tube with heat pipe.

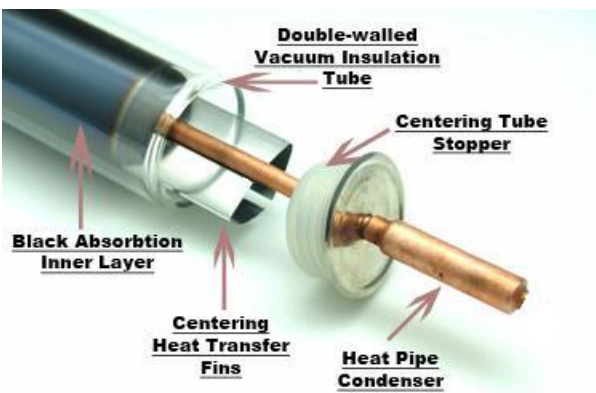
- The heat pipe transfers the thermal energy from the pipe to the condenser efficiently and rapidly.
- The glass tube top holder holds the heat pipe and glass tubes at the right position within the manifold.
- The inside glass tube cover holds the heat pipe in the center position of the inside the glass tube and protects the thermal energy loss from the glass tube.
- The heat conductive aluminum fins assist in transferring the thermal energy from the glass inner wall to the heat pipe.
- The vacuum space between the two outside glass tubes and inside glass tubes provide excellent thermal insulation thereby minimizing heat loss from the inner tube to the outside environment.
- The combination of the evacuated glass tube and the heat pipe result in a highly efficient solar absorber with maximum radiation absorption, minimum thermal radiation loss and high insulation performance;
- The getter (glass mirror) indicates whether or not the vacuum layer is compromised.



GEAR SOLAR's SolarPac inner glass tube is coated with three layers of special selective coatings (ALN/ALN-SS/CU) which result in excellent solar radiation absorption and minimal reflection properties.

- The aluminum nitride (ALN) is the primary absorber coating
- The aluminum nitride–stainless steel (ALN-SS) coating bonds the ALN to the CU layer
- The copper (CU) coating reflects thermal energy back inside the inner tube which helps minimize heat loss

The top of the two glass tubes are fused together and the air contained in the space between the two layers of glass is pumped out while exposing the tube to high temperatures.



This "evacuation" of the gasses forms a vacuum, which is an important factor in the performance of the evacuated tubes. Once the evacuated tube absorbs the radiation from the sun and converts it to heat, the vacuum helps to prevent the loss of heat. The insulation properties are so good that while the inside of the tube may be very hot, the outer tube is cold to touch. This means that evacuated tube thermal collectors can perform well even in cold weather when flat plate collectors perform poorly due to the design's inherent heat loss.

In order to maintain the vacuum between the two glass layers, a barium getter is used (the same as in television tubes). During the manufacturing of the evacuated tubes, the getter is exposed to high temperatures which cause the bottom of the evacuated tube to be coated with a pure layer of barium. The barium layer also provides a clear visual indicator of the vacuum status. The silver colored barium layer will turn white if the vacuum is ever lost. This makes it easy to determine whether or not a tube is in good condition. The getter is located at the bottom of the evacuated tube.



Heat Pipe



The “engine” in **GEAR SOLAR’s** SolarPac collector is our copper heat exchanger system which begins with our heat pipe. Our heat pipes are manufactured with strict quality control procedures to produce one of the best heat pipes on the market.

The heat pipe used in **GEAR SOLAR’s** SolarPac collectors consists of two copper components, the shaft and the condenser.

SolarPac’s Design Features

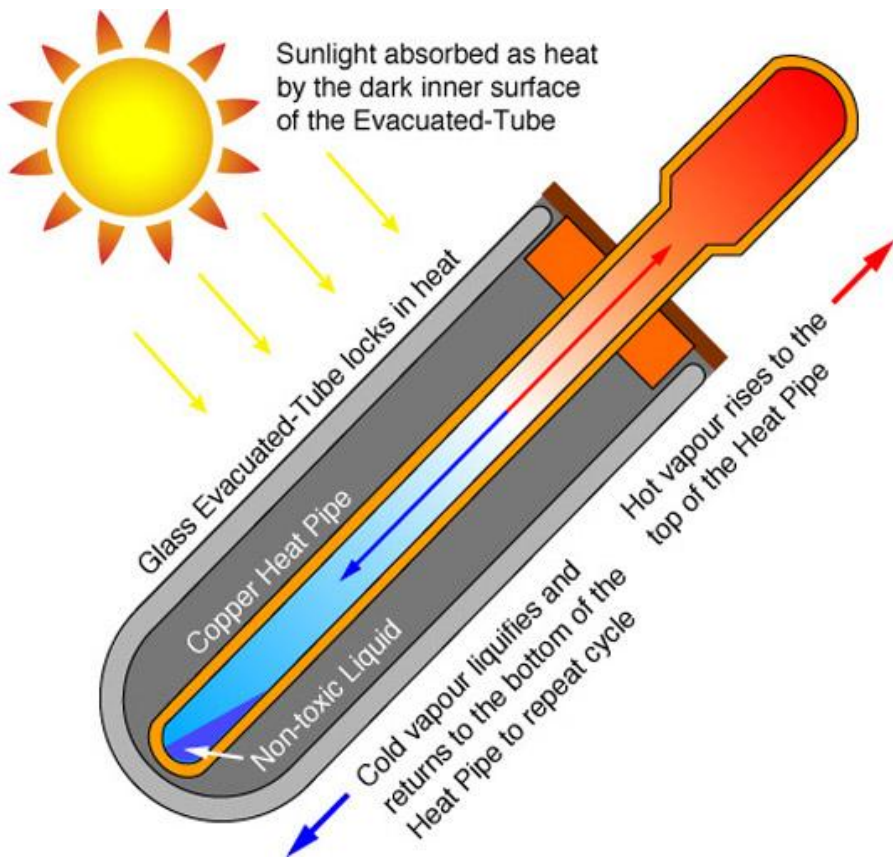
- The copper used is oxygen free copper, therefore ensuring a long life span and better performance
- **GEAR SOLAR’s** heat pipes are manufactured under “clean room” manufacturing conditions which means that there are no contaminants within our heat pipe when the system is sealed
- Excellent Heat Conduction Efficiency
- Our heat pipes can also withstand temperatures down to -34.6°F

Prior to evacuation, the condenser is brazed to the shaft. Note that the condenser has a much larger diameter than the shaft. This is to provide a large surface area over which heat transfer to the copper header can occur. Each copper super heat pipe is stationed centrally inside an evacuated tube and is then enclosed within aluminum heat transfer fins which help maintain a constant transfer of heat along the length of the heat pipe up to the condenser. There is no water inside the evacuated tubes and no direct contact between the heat pipes and the heat transfer liquid.

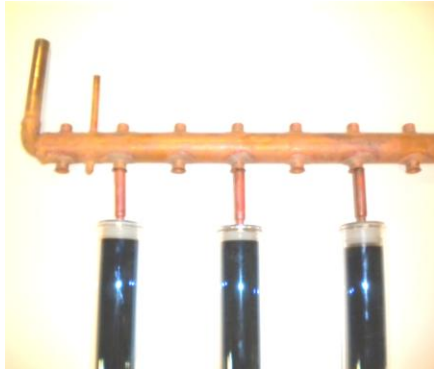
GEAR SOLAR's heat pipe condenser (the larger part at the top of the pipe) is specially constructed to optimize performance. This shape allows for a better flow into the header causing a more effective transfer of heat. In addition, this allows for greater surface area, again allowing for a better heat transfer.

Heat pipes employ evaporative cooling to transfer thermal energy from the shaft to the condenser by the evaporation and condensation of a working fluid or coolant. It is important that heat pipes are composed of oxygen-free copper and that it has as little contaminants as possible. This ensures excellent life span and a better performance.

In order to make sure we have the highest quality heat pipe on the market, **GEAR SOLAR** manufactures them in a "clean room" environment. This makes certain that there are no contaminants in the heat pipe when the system is sealed. Further, after the system is sealed, the top of the heat pipe, or condenser, is dipped in chrome. This procedure is done to assist in the heat transfer to the header, as well as to protect against corrosion caused by copper on copper. As you can see, **GEAR SOLAR** takes every measure to produce the highest quality heat pipe in the market.



Manifold



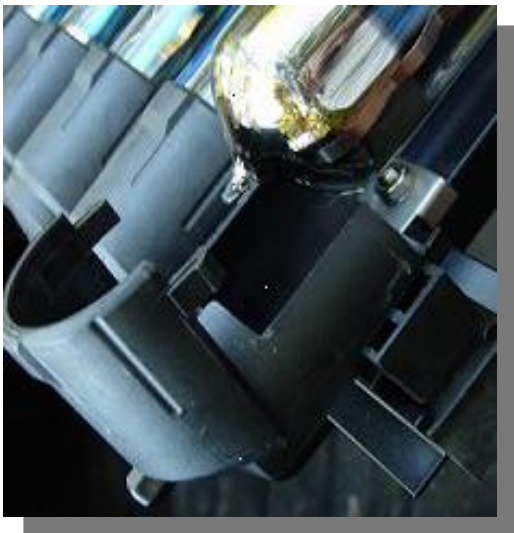
A copper heat transfer header pipe manifold or header is located inside of the light but also durable aluminum manifold casing. The header pipe is designed with dry contact ports into which the heat pipes plug, allowing efficient heat transfer. The condenser is located inside each engineered pocket of the heat exchanger header.

The heat transfer liquid (water or water-glycol mix) is circulated through the header pipe into the hot water storage system.

The heat exchanger header is fully protected by formed compressed rock wool insulation.



Tube Holder



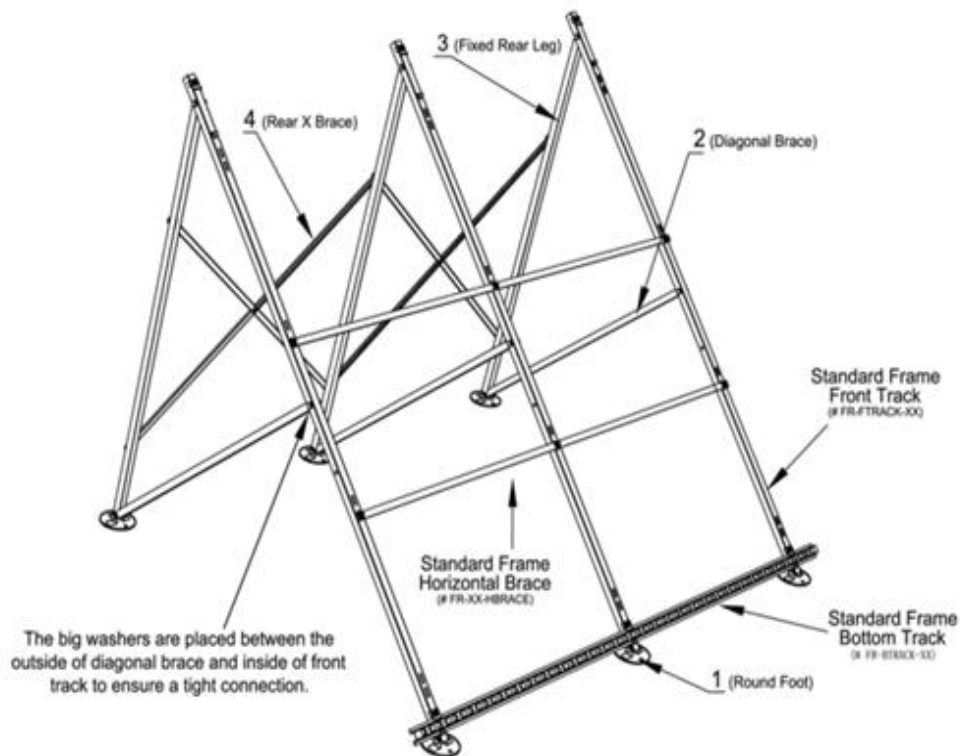
GEAR SOLAR's SolarPac tube holder can be quickly attached to the tube holder track. Each holder has a fast turn screw thread to facilitate ease of installation.

Mounting Frame

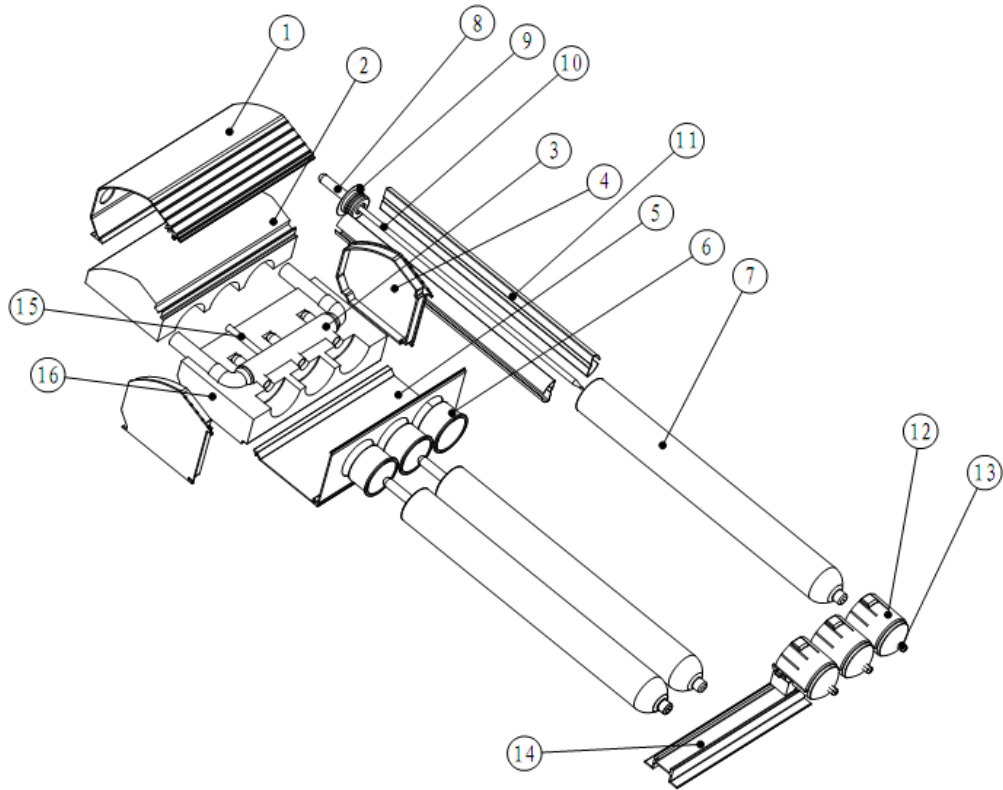
The manifold and tubes are attached to a stainless steel mounting frame, which can be mounted directly on a roof of suitable pitch. Evacuated tubes are aligned in parallel; the angle of mounting depends upon the latitude of your location. In a North-South orientation the tubes can passively track heat from the sun all day. In an East-West orientation they can track the sun all year round.

A stainless steel frame kit is also available which allow mounting on flat roofs, walls or low-pitched roofs or on any level surface.

Collectors may be installed in banks of up to 10 collectors in series and unlimited parallel-connected banks.



Parts Identification



1. Upper part of manifold housing
2. Upper section of the manifold
3. Copper manifold
4. Outer casing UV stable covers
5. Lower part of manifold housing
6. Glass tube silicone ring seals
7. Evacuated glass tubes
8. Heat pipe condenser
9. Stainless steel vent pipe
10. All-copper heat pipe
11. Aluminum transfer fins
12. UV stable tube holder with fast turn screw thread (top)
13. UV stable tube holder with fast turn screw thread (bottom)
14. Aluminum tube holder track
15. Controller sensor pocket
16. Lower section of the manifold

SOLAR RATING & CERTIFICATION CORPORATION

AWARD OF INTERIM COLLECTOR CERTIFICATION

The solar collector listed below has been evaluated by the Solar Rating and Certification Corporation (SRCC) in accordance with SRCC Document IC-1, *Interim Collector Certification Protocol*, and has been certified by the SRCC as specified in that document. Certification and thermal performance ratings are based on the successful durability and performance testing of a sample unit where said tests have been conducted by an independent laboratory accredited by the SRCC.

Collector Interim Certification Number, 100-2009091Ai

Certification Date: 14-APR-10 Type: Tubular Expiration Date: 14-APR-11
 Test Laboratory: Exova Canada Report Number: 09-008-8085 Report Date: 19-FEB-10
 Brand: GEAR Solar Certified Model: Solarpau TP24 Model Tested: 2009091Ai
 Supplier: **Gear Solar**
 1861 South Highway 14
 Greer, SC 29650 USA
 (864) 879-0600

Description: frame: Borosilicate Glass cover: Copper absorber with Selective, Rock Wool side insulation and Rock Wool back insulation. Gross Area: 3.804 m² (40.9 ft²). Aperture Area: 2.429 m² (26.1 ft²).

TUBULAR COLLECTOR THERMAL PERFORMANCE RATING

Megajoules Per Panel Per Day				Thousands of BTU Per Panel Per Day			
CATEGORY (T _s -T _a)	CLEAR DAY	MILDLY CLOUDY	CLOUDY DAY	CATEGORY (T _s -T _a)	CLEAR DAY	MILDLY CLOUDY	CLOUDY DAY
A (-5 °C)	29.3	22.3	15.3	A (-9 °F)	27.8	21.2	14.5
B (5 °C)	26.3	19.3	12.3	B (9 °F)	24.9	18.3	11.7
C (20 °C)	22.2	15.3	8.4	C (36 °F)	21.1	14.5	8.0
D (50 °C)	14.8	8.4	2.3	D (90 °F)	14.0	8.0	2.1
E (80 °C)	8.4	2.6	0.0	E (144 °F)	8.3	2.5	0.0

A- Pool Heating (Warm Climate) B- Pool Heating (Cool Climate) C- Water Heating (Warm Climate) D- Water Heating (Cool Climate) E- Air Conditioning

Efficiency Equation [NOTE: Based on gross area and (T_s-T_a)]

S I UNITS: Quadratic equation not defined
 I P UNITS: Quadratic equation not defined

Y INTERCEPT

0.3
 0.3

SLOPE

-2.0 W/m²·°C
 -0.4 Btu/hr·ft²·°F

Incident Angle Modifier [(S)-1/(msb - 1, 0° ≤ θ ≤ 60°)]

K_a = 1 0.00 (S) 0.00 (S)²

K_a = 1 0.00 (S) Linear Fit

REMARKS:

Caution: The efficiency equation and ratings for this collector are assumed to be very low. They will be revised when the final test is completed. This collector will perform better than the above ratings indicate so use caution when designing a system to avoid overheating.


 Technician Director April 15, 2010



OG-100 SRCC INTERIM COLLECTOR CERTIFICATION

Solar Rating and Certification Corporation, 1679 Clearlake Road, Cocoa, FL 32922

Return to Search

SOLAR RATING & CERTIFICATION CORPORATION

AWARD OF INTERIM COLLECTOR CERTIFICATION

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Collector Interim Certification Number: **100-2009091B1**

Certification Date: 14-APR-10	Type: Tubular	Expiration Date: 14-APR-11
Test Laboratory: Esova Canada	Report Number: 09-008-8085	Report Date: 19-FEB-10
Brand: GEAR Solar	Certified Model: Solarpac TP12	Model Tested: 2009091A

Supplier: **Gear Solar**
 1861 South Highway 14
 Greer, SC 29650 USA
 (864) 879-0600

Description: frame, Borosilicate Glass cover, Copper absorber with Selective, Rock Wool side insulation and Rock Wool back insulation Gross Area: 1.746 m² (18.8 ft²) Aperture Area: 1.215 m² (13.1 ft²)

TUBULAR COLLECTOR THERMAL PERFORMANCE RATING

Megajoules Per Panel Per Day				Thousands of BTU Per Panel Per Day			
CATEGORY (Ti-Ta)	CLEAR DAY	MILDLY CLOUDY	CLOUDY DAY	CATEGORY (Ti-Ta)	CLEAR DAY	MILDLY CLOUDY	CLOUDY DAY
A (-5 °C)	13.5	10.3	7.0	A (-9 °F)	12.8	9.7	6.7
B (5 °C)	13.1	8.9	5.7	B (9 °F)	11.4	8.4	5.4
C (20 °C)	10.2	7.0	3.9	C (36 °F)	9.7	6.7	3.7
D (30 °C)	6.8	3.9	1.0	D (90 °F)	6.5	3.7	1.0
E (60 °C)	4.0	1.2	0.0	E (144 °F)	3.8	1.1	0.0

A- Pool Heating (Warm Climate) B- Pool Heating (Cool Climate) C- Water Heating (Warm Climate) D- Water Heating (Cool Climate) E- No. Conditioning

Efficiency Equation [NOTE: Based on gross area and (P)_g=(Ti-Ta)]

SI UNITS: Quadratic equation not defined

IP UNITS: Quadratic equation not defined

Y INTERCEPT

0.3

0.3

SLOPE

-2.0 W/m²·°C

-6.4 Btu/h·ft²·°F

Incident Angle Modifier [(S)_i]=1/cosθ - 1, 0°≤θ≤60°

Ka = 1 0.00 (S) 0.000 (S)²

Kr = 1 0.00 (S) Linear Fit

REMARKS:

Caution: The efficiency equation and ratings for this collector are assumed to be very low. They will be revised when the final test is completed. This collector will perform better than the above ratings indicate so use caution when designing a system to avoid overheating.

Technical Director

April 19, 2010



OG-100 SRCC INTERIM COLLECTOR CERTIFICATION

Solar Rating and Certification Corporation, 1679 Clearlake Road, Cocoa, FL 32922

Return to Search

Gear Solar warrants to the end-user of this product, for the structure on which this product is originally installed, that it is free from defect in materials and /or workmanship for a period of 10 years from the date of purchase if and only if it is installed by a NABCEP certified installer. The proper operation on this product is dependent on your compliance with the instructions regarding installation, operation, maintenance and testing. Failure to comply strictly with those instructions will void this limited warranty in its entirety.

If, during the limited warranty period, this product appears to contain a defect covered by this warranty, call 1-866-999-0975, toll free, before dismantling this product. Then send this product, pre-paid and insured, to our service center for warranty repair. You will be advised of shipping instructions when you call. Please include a complete description of the problem and dated proof-of-purchase receipt with any product returned for warranty repair. Products returned to Seller for warranty repair, which upon receipt by Seller are confirmed to be defective and covered by this limited warranty, will be repaired or replaced (at Seller's sole option) at no cost to you and returned pre-paid. Defective parts will be repaired or replaced with new or factory-rebuilt parts at Seller's sole option.

ALL IMPLIED WARRANTIES FOR THE PRODUCT, INCLUDING BUT NOT LIMITED TO AN IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO THE 10 YEAR LIMITED WARRANTY PERIOD SET FORTH ABOVE, AND NO IMPLIED WARRANTIES WILL EXIST OR APPLY AFTER SUCH PERIOD. THIS LIMITED WARRANTY DOES NOT COVER NON-DEFECT DAMAGE, DAMAGE CAUSED BY IMPROPER INSTALLATION, OPERATION OR CARE (INCLUDING, BUT NOT LIMITED TO ABUSE, MISUSE, FAILURE TO PROVIDE REASONABLE AND NECESSARY MAINTENANCE, UNAUTHORIZED REPAIRS OR ANY ALTERATIONS TO THIS PRODUCT), OR LABOR CHARGES FOR REINSTALLING A REPAIRED OR REPLACED UNIT.

UNDER NO CIRCUMSTANCES SHALL SELLER BE LIABLE FOR CONSEQUENTIAL, INCIDENTAL OR SPECIAL DAMAGES ARISING IN CONNECTION WITH USE, OR INABILITY TO USE, THIS PRODUCT. IN NO EVENT SHALL SELLER'S LIABILITY FOR BREACH OF WARRANTY, BREACH OF CONTRACT, NEGLIGENCE OR STRICT LIABILITY EXCEED THE COST OF THE PRODUCT COVERED HEREBY. NO PERSON IS AUTHORIZED TO ASSUME FOR US ANY OTHER LIABILITY IN CONNECTION WITH THE SALE OF THIS PRODUCT.

Some states do not allow the exclusion or limitation of consequential, incidental or special damages, so the above limitation or exclusion may not apply to you. This limited warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Solarpac Specifications

Collector	Solarpac 12	Solarpac 24		
Overall length ¹	1980mm / 80"			
Overall height ²	156mm / 6.4" (manifold & standard frame)			
Overall width ³	996mm / 39.2"	1990mm / 78.3"		
Absorber area ⁴	0.96m ² / 10.3ft ²	1.92m ² / 20.6ft ²		
Aperture area ⁵	1.13m ² / 12.1ft ²	2.26m ² / 23.96ft ²		
Gross area	1.88m ² / 20.3ft ²	3.69m ² / 39.8ft ²		
Gross dry weight – standard frame	41.8kg / 91.8lb	77.8kg / 171.5lb		
Fluid capacity	600 ml	1200 ml		

1. Length of frame front track
2. Height of frame front track & manifold
3. Width of manifold (not inc. inlet/outlet ports)
4. Absorber = outside diameter of inner tube x exposed tube length
5. Aperture = inner diameter of outer glass tube x exposed tube length

Glass Material	Borosilicate Glass 3.3
Absorber Material	ALN/ALN-SS/CU on glass
Thermal Expansion	3.3x10 ⁶ °C
Absorptance	>92%(AM1.5)
Emittance	<8% (80°C)
Vacuum	P<5x10 ⁻³ Pa
Stagnation Temp.	>200°C >395°F
Heat Loss	<0.8W / (m ² °C)
Maximum Strength	0.8Mpa 120psi
Absorber Area Per Tube	0.08m ² or 0.86ft ²
Heat Transfer Fins	0.3mm / 0.0098" thick sets of aluminum fins

Copper Heat Pipes

Length	1800mm 70.88"
Material	8mm OD x 0.7mm 0.314" OD x 0.027" Oxygen Free Copper (TU1) Cu=Ag>99.99% (02<16ppm)
Condenser Dimensions	16 mm OD x 30 mm 0.63" OD x
Heat Transfer Liquid	Water
Maximum Working Temp.	300°C 577°F
Start-up Temp.	SH pipe<30s (80°C) <190°F – ST pipe<60s (75°C) <180°F
Heat Exchange Output	>100W >135W
Vacuum	P<5x10-3P
Vertical Installation Angle	20-70°
Horizontal Installation Angle	0° +/-5°

Rubber Components

Material	HTV Silicon Rubber (UV stabilized)
Density	1.15 g/cm3 +/- 0.05
Durometer Hardness (Shore A)	50-70 (depends on components)
Elongation	320%
Rebound	54%
Maximum Working Temp.	300°C 577°F
Tensile Strength	6.4Mpa
Tear Strength	12.5 KNM

Frame Options

GEAR SOLAR's SolarPac collectors come with a standard frame for mounting flush to a pitched roof.

Type of Mounting	Frame Kit Required
Roof with insufficient pitch	Low Angle Frame Kit
Flat Roof	High Angle Frame Kit (adjustable)
Ground Siting	High Angle Frame Kit
Wall Mounting	NOT Yet Available

Frame Accessories

Mounting Type or Roof Surface	Accessories Suitable
Tiled	
Asphalt Shingle	Silicone rounded pads
Concrete	
Corrugated Iron	Silicone U channel pads
Wall	

GEAR SOLAR

Providing Solar Thermal Energy Collecting Solutions

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