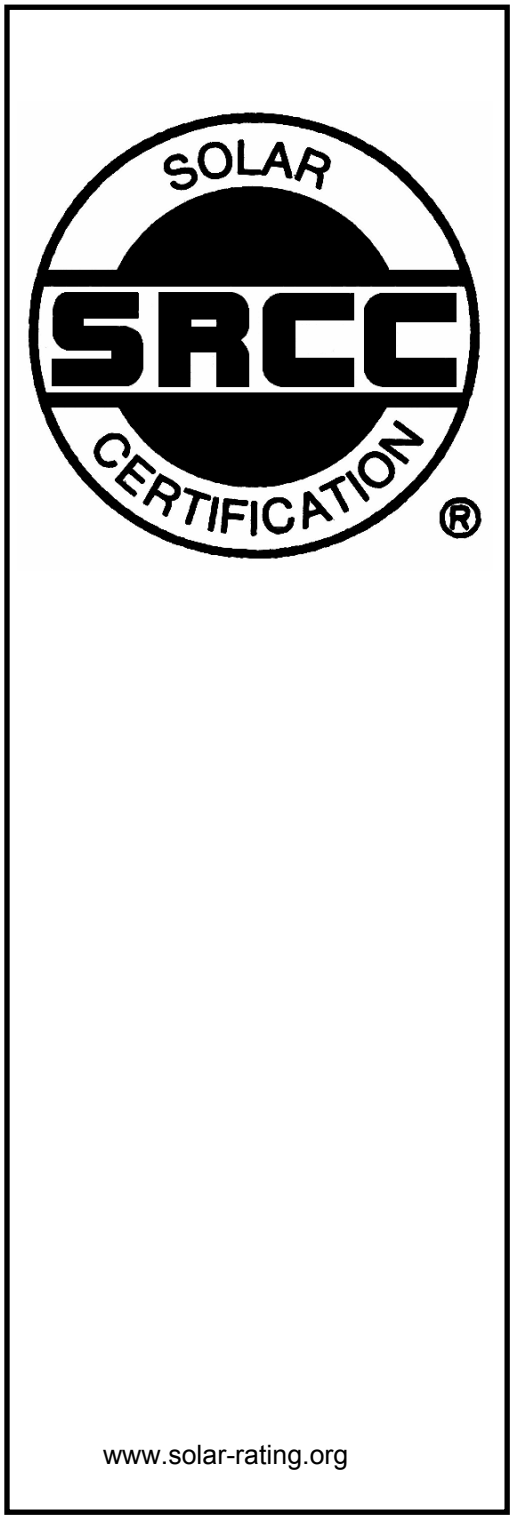


# DIRECTORY OF SRCC CERTIFIED SOLAR COLLECTOR RATINGS

**March 18, 2008**

**Solar Rating and Certification Corporation**
**c/o FSEC, 1679 Clearlake Road**
**Cocoa, FL 32922-5703**
**(321) 638-1537 (321) 638-1010 Fax**

# ABOUT SRCC, RATING AND CERTIFICATION

The Solar Rating and Certification Corporation (SRCC) is an independent third-party certification organization that administers national certification and rating programs for solar energy equipment. The SRCC was incorporated in October 1980 as a non-profit corporation. It is governed by a twelve-member board of Directors with representation from the public, private, and generalist Sectors.

The SRCC currently operates three major solar programs: collector certification (OG-100), water heating system certification (OG-300) and a swimming pool heating system certification (OG-400). The OG-100 collector certification program applies to that part of a solar energy system that is exposed to the sun and collects the sun's heat. The collectors can be used to heat water, air or other heat transfer media. The OG-300 rating and certification program for solar hot water systems integrates results of collector tests with a performance model for the entire systems and determines whether systems meet minimum standards for system durability, reliability, safety and operation. Factors affecting total system design, installation, maintenance and service are also evaluated. The OG-400 certification program provides minimum requirements for solar swimming pool heating system design and installation procedures.

A direct comparison of an SRCC rated collector to an SRCC rated solar water heating system is not possible. The reason for this is two-fold. First, the collector rating shows the performance of one component in the solar package while the system rating shows the performance of an entire solar package. Second, each rating, whether a collector rating or a system rating, is developed using a separate set of assumed conditions.

This directory contains information about solar collectors that have been certified and rated by SRCC.

The information in this directory will provide you with reliable and comparable data for solar water heating collectors you may be considering buying. The rating information is a helpful tool for comparing the efficiency of the various solar collectors on the market. While you can, and should, compare collector ratings, you cannot compare collector ratings with system ratings. All collectors which have been certified by SRCC will bear the SRCC label, which is your assurance that an independent party has verified the performance and basic durability of the solar product you are considering. Copies of SRCC labels are shown in this directory.

The directory contains descriptive information about the solar collectors and also "performance" information about them. "Performance" data relates to the energy output of the collector. The SRCC performance information contained in this directory provides a way to compare the **relative** performance of different solar water heating collectors, not the **actual** performance you can expect from a given collector. This is because the collectors and systems are tested under standard laboratory conditions which are certain to be different from those in your home. **Think of the SRCC ratings as you do the MPG ratings for cars -- a benchmark, but not necessarily the same performance you will experience.** Remember, too, that performance (or energy output) is only one criteria in choosing a solar energy collector. Quality of installation, cost, availability of service and parts, and the expected life of the equipment are also important points to consider. Equipment which is well-designed and well-built, but poorly installed, cannot perform according to the manufacturer's specifications.

# Directory of Solar Collector Ratings

# OG 100

**Certified By**

**The Solar Rating & Certification Corporation**

**c/o FSEC, 1679 Clearlake Road**
**Cocoa, FL 32922**

**(321) 638-1537  Fax: (321) 638-1010**

This directory lists all solar collectors certified and rated under the 0G 100 protocol by the SRCC. All ratings published in this edition supersede any previously published ratings. Collector models appearing in previous editions or supplements of this directory but which are not listed herein are no longer certified by the Corporation. Separate pages and/or sections may be updated from time to time.

Notice: Check with SRCC for status of revisions.

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# A NOTE TO CONSUMERS ABOUT THE RATING OF SOLAR COLLECTORS

## HOW COLLECTORS ARE RATED

Each time SRCC allows a solar manufacturer to attach the SRCC label to its product, very specific steps have been followed to assure consumers that the product meets SRCC's approval and that the performance information provided to you is correct. First, SRCC selects a solar collector at random from the manufacturer's facility. The collector is then sent for testing to an independent laboratory accredited by SRCC. When the collector is received by the lab, it is inspected to document the materials used. (You will see much of this information in the directory pages that follow.) Then, the collector is subjected to a variety of durability tests to reveal any leaks, to check the integrity of construction, and to assess the collector's resistance to sudden expansion and contraction and changes in water temperature. Following the durability tests, the energy output of the collector is measured to determine the performance of the collector under the standard laboratory conditions. These measurements result in the performance figures found in the box at the top of each collector's rating page in this directory. Finally, when the testing is complete, the lab partially disassembles the collector and inspects it for any hidden problems.

When the last inspection is completed, the lab sends the test report to the SRCC for review and calculation of the figures which appear in the rating directory. The SRCC also checks the collector design for reliability and durability. When the collector is certified, the manufacturer is notified and required to begin affixing the SRCC label to the solar collector. Also, the manufacturer must provide a copy of the Certification Award with each certified collector.

## TYPES OF SOLAR COLLECTORS

As you shop for a solar collector, you may see several different types. They are:

1. **Unglazed liquid-type collectors** are those in which a liquid is heated by the sun in a stationary collector which does not have glass or other transparent covering. These collectors are commonly used for swimming pool heating systems, but are also used in domestic water heating systems.

2. **Glazed liquid-type solar collectors** are those in which a liquid is heated by the sun in a stationary collector which has a cover of glass or other transparent material. They are the most common type of collectors, and are often used for domestic water heating and space heating systems.

3. **Air-type collectors** are those in which the sun heats air rather than water in the collector. They are most commonly used for space heating applications.

All three types of collectors work well and can be compared with others of the same type, using the data in this directory.

## HOW TO USE THIS DIRECTORY

SRCC has divided the collectors in this directory into two categories: unglazed and glazed. At the top of each page is the performance data. The remainder of the information on each rating page describes the equipment.

## PERFORMANCE DATA

The performance data about a given collector appears in the box at the top of each rating page. The data on the left is in metric (or SI units) and the data on the right is in English (or Inch-Pound units). The data, whether you read it in metric or English units, provides the total energy produced by that collector in a standard "rating day," that is, under the test conditions used to define a day.

Across the top of the chart are three categories which represent various weather conditions and seasons of the year. See Table 1 for a listing of average daily total solar radiation in several U.S. Cities. The amount of sunlight striking the collector (or "irradiance") is an important factor in how much energy the collector can produce. Also important is how much the energy output of the collector declines as the sunlight declines. Irradiance is measured in megajoules per square meter per day (or in Btu per square foot per day). Generally, a clear sky would be characterized by the 23 MJ/($m^2$ d) [2,000 Btu/($ft^2$ day)] column, while a cloudy sky would be characterized by the 11 MJ/($m^2$ d) [1,000 Btu/($ft^2$ day)] column. The 17 MJ/($m^2$ d) [1,500 Btu/($ft^2$ day)] column characterizes a mildly cloudy conditions.

Once you have determined the correct weather column, you will need to choose the correct category. The categories are listed down the left side of the box, using letters A through E. The accompanying numbers are the difference between the temperature of the water or air entering the collector and the temperature of the air around the collector. These temperature differences are important factors in the ability of the solar collector to produce energy. To use the rating chart, it is easier to refer to the following table for the correct category:

| CATEGORY | | | APPLICATION |
|---|---|---|---|
| A | -5°C | (-9°F) | Certain types of solar assisted heat pumps.<br>Swimming pool heating. |
| B | 5°C | ( 9°F) | Liquid collectors with certain types of solar assisted heat pumps.<br>Swimming pool heating.<br>Space heating - air systems. |
| C | 20°C | (36°F) | Service hot water systems.<br>Space heating - air systems. |
| D | 50°C | (90°F) | Service hot water systems.<br>Space heating - liquid systems.<br>Air conditioning. |
| E | 80°C | (144°F) | Space heating - liquid systems.<br>Air conditioning.<br>Industrial process heat. |

The collector with the higher number in the box which reflects your climate and category produces more energy than those with lower numbers. While such a comparison should not be the only basis for your choice of a solar energy system, you may find it helpful. Remember, too, that the energy output of these collectors in the directory has been measured under test conditions, which are almost certainly not the same as the collector will be subjected to in your home. The remainder of the system and the quality of the installation are also critically important factors in how well your solar system works, and how much energy and money you save.

Table 1 Average Daily Total Solar Radiation for U.S. Cities

| City | MJ/m²·day 23° Tilt | MJ/m²·day 45° Tilt | Btu/ft²·day 23° Tilt | Btu/ft²·day 45° Tilt |
|---|---|---|---|---|
| Albuquerque, NM | 23.58 | 23.42 | 2076 | 2062 |
| Apalachicola, FL | 18.13 | 17.50 | 1596 | 1541 |
| Atlanta, GA | 16.62 | 16.12 | 1463 | 1420 |
| Baltimore, MD/ DC | 14.79 | 14.75 | 1302 | 1299 |
| Billings, MT | 15.91 | 16.58 | 1401 | 1460 |
| Birmingham, AL | 16.25 | 15.76 | 1431 | 1388 |
| Boise, ID | 17.54 | 17.91 | 1545 | 1578 |
| Boston, MA | 11.41 | 11.62 | 1005 | 1023 |
| Burlington, VT | 12.87 | 13.07 | 1134 | 1151 |
| Casper, WY | 18.96 | 19.80 | 1669 | 1743 |
| Charleston, SC | 14.91 | 14.73 | 1313 | 1297 |
| Charleston, WV | 13.12 | 12.81 | 1155 | 1128 |
| Charlotte, NC | 16.96 | 16.67 | 1493 | 1468 |
| Chicago, IL | 14.74 | 14.80 | 1298 | 1302 |
| Cincinnati, OH | 13.50 | 13.20 | 1189 | 1164 |
| Concord, NH | 12.00 | 12.09 | 1057 | 1064 |
| Dallas/Fort Worth, TX | 17.42 | 17.44 | 1533 | 1536 |
| Denver, CO | 20.24 | 20.89 | 1782 | 1839 |
| Des Moines, IA | 14.87 | 15.25 | 1310 | 1343 |
| Detroit, MI | 12.78 | 12.72 | 1125 | 1120 |
| Fairbanks, AK | 2.62 | 3.04 | 231 | 268 |
| Fargo, ND | 14.46 | 14.90 | 1273 | 1319 |
| Greenville, SC | 17.08 | 16.79 | 1503 | 1478 |
| Hartford, CT | 12.35 | 12.37 | 1087 | 1089 |
| Honolulu, HI | 19.24 | 17.67 | 1694 | 1556 |
| Houston, TX | 16.28 | 15.49 | 1434 | 1364 |
| Indianapolis, IN | 13.71 | 13.52 | 1208 | 1191 |
| Jackson, MS | 17.17 | 16.61 | 1512 | 1463 |
| Las Vegas, NV | 24.16 | 24.14 | 2127 | 2126 |
| Little rock, AR | 17.31 | 16.94 | 1524 | 1492 |
| Los Angeles, CA | 20.18 | 19.87 | 1777 | 1749 |
| Louisville, KY | 15.16 | 14.86 | 1335 | 1309 |
| Memphis, TN | 16.76 | 16.30 | 1476 | 1436 |
| Miami, FL | 17.70 | 16.81 | 1559 | 1480 |
| Milwaukee, WI | 13.46 | 13.70 | 1185 | 1206 |
| Minneapolis, MN | 13.73 | 14.08 | 1209 | 1240 |
| New Orleans, LA | 17.15 | 16.41 | 1510 | 1445 |
| Newark, NJ/ New York, NY | 14.16 | 14.12 | 1247 | 1244 |
| Norfolk, VA | 16.57 | 16.30 | 1459 | 1435 |
| Oklahoma City, OK | 18.40 | 18.16 | 1620 | 1599 |
| Omaha, NE | 16.45 | 16.89 | 1449 | 1485 |
| Philadelphia, PA | 13.96 | 13.87 | 1229 | 1221 |
| Phoenix, AZ | 23.55 | 23.08 | 2073 | 2033 |
| Portland, ME | 11.97 | 12.24 | 1054 | 1078 |
| Portland, OR | 12.00 | 11.94 | 1057 | 1051 |
| Providence, RI | 13.00 | 13.10 | 1145 | 1153 |
| Sacramento, CA | 18.80 | 18.69 | 1655 | 1646 |
| St. Louis, MO | 16.10 | 16.02 | 1418 | 1411 |
| Salt Lake City, UT | 19.06 | 19.47 | 1679 | 1714 |
| Seattle, WA | 11.65 | 11.63 | 1026 | 1024 |
| Shreveport, LA | 17.39 | 16.79 | 1531 | 1478 |
| Sioux Falls, SD | 15.12 | 15.63 | 1331 | 1376 |
| Syracuse, NY | 11.40 | 11.29 | 1007 | 995 |
| Topeka, KS | 16.83 | 16.91 | 1482 | 1489 |
| Wilmington, DE | 14.49 | 14.44 | 1276 | 1271 |

NOTE:

The values listed in this table are based upon TMY data for each of the cities listed. The data for the tilted surface radiation was processed using the TRNSYS 13.1 radiation processor with the Hay and Davies tilted surface radiation model.

## DESCRIPTIVE INFORMATION

Included in the descriptive information is the size of the collector. The Gross Area is the size of the top face of the collector; the Net Aperture is the size of the glass or other glazing material that sunlight can enter. The size of the collector may be relevant when comparing energy output and price.

Also, the "dry weight" of the collector combined with the "fluid capacity" (for liquid systems; a gallon of water weighs 8.3 pounds) will give you a rough idea of how much weight the solar system will be adding to your roof, if that is where the system is to be installed. Remember to multiply the dry weight plus the fluid weight by the number of collectors in the system.

## COMPARING COLLECTOR EFFICIENCY AND COST

With the ratings discussed above, it is easy to compare the energy output of one collector to another. It can be difficult however, to take into account the price of the different collectors.

One method is to compare the energy output for each dollar spent on different collectors. Or, in other words, how many Btu (or MJ) does a dollar buy if spent on Collector #1 versus Collector #2? This question can be answered by dividing the energy output by the cost of the collector. For example, you are considering a solar water heating application. Collector #1 has a rating in Category C (for water heating) under the correct climate column of 29 MJ (per collector per day) or 21,000 Btu (per collector panel per day). Collector #1 sells for $387. Collector #2 is rated at 35 MJ or 33,000 Btu; it sells for $675. Thus:

Collector #1

$$\frac{29\ \text{MJ}}{\$\ 387} = 0.07\ \text{MJ} / \$ \qquad \text{or} \qquad \frac{21{,}000\ \text{Btu}}{\$\ 387} = 54.26\ \text{Btu} / \$$$

Collector #2

$$\frac{35\ \text{MJ}}{\$\ 675} = 0.05\ \text{MJ} / \$ \qquad \text{or} \qquad \frac{33{,}000\ \text{Btu}}{\$\ 675} = 48.89\ \text{Btu} / \$$$

Collector #1 is the better buy, based on performance under the test conditions alone. The higher the number of MJs or Btu per dollar, the more cost-effective the collector is...all other things being equal. Remember, though, that the design and quality of the rest of the system and the installation are also critical to a good solar energy system.

# TECHNICAL EXPLANATION OF THE COLLECTOR TESTING AND RATING PROGRAM

## SOLAR COLLECTOR TESTING AND RATING

The SRCC solar collector thermal performance test is based on the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Standard 96-1980, *Methods of Testing to Determine the Thermal Performance of Unglazed Flat-Plate Liquid-Type Solar Collectors*, for unglazed liquid collectors and on ASHRAE Standard 93-1986, *Methods of Testing to Determine the Thermal Performance of Solar Collectors*, for glazed flat-plate liquid collectors, air collectors, linear tracking concentrators, and other collector devices which fall within the scope of the test standard. Based on the thermal performance data derived from the ASHRAE 96-1980 or ASHRAE 93-1986 test methods, SRCC then calculates the collector ratings according to SRCC Document RM-1, *Methodology for Determining the Thermal Performance Rating for Solar Collectors*. This rating methodology accounts for diffuse irradiance, which is assumed to be distributed isotropically throughout the view of the collector. The methodology is applicable to all non-tracking collector panels.

Before a collector model is issued certification and ratings, SRCC requires that an individual collector be selected at random from the manufacturer's inventory. That unit is then sent to an independent laboratory accredited by SRCC for testing according to SRCC Standard 100-81, *Test Methods and Minimum Standards for Certifying Solar Collectors*. The SRCC test sequence for collectors is a combination of durability and performance tests. The required tests and the purpose of each are described below:

- **Receiving Inspection**. To inspect and document the condition of the collector prior to formal testing.
- **Static Pressure Test**. To determine if a loss of pressure occurs or evidence of fluid leakage or fluid path deterioration.
- **30-Day Exposure Test**. To verify integrity of construction after at least 30 days exposure to adverse conditions.
- **Thermal Shock/Water Spray Test**. To verify that the collector structure and performance will not be degraded due to sudden thermal expansion or contraction.
- **Thermal Shock/Cold Fill Test**. To determine the reaction of a hot collector after the introduction of cold water.
- **Post Exposure Static Pressure Test**. To determine if a loss of pressure occurs or evidence of fluid leakage or fluid path deterioration after a collector has been stagnated under worst case conditions.
- **Time Constant Determination Test**. To determine the transient behavior of the collector or the time required to respond to abrupt changes in either insolation or inlet temperature.
- **Thermal Performance Test**. To determine the instantaneous efficiency of the collector over a wide range of operating temperatures. ("Efficiency" is defined as the ratio of collected energy to the available energy falling on the entire collector area.)
- **Incident Angle Modifier Test**. The incident angle modifier needs to be determined in order to predict collector performance over a wide range of conditions. The modifier algorithm is used to modify the efficiency curve to account for changes in performance as a function of the sun's incidence angle.
- **Disassembly and Final Inspection**. To visually inspect the major components and subassemblies and to report their conditions after testing has been completed.

Once the collector test unit has completed the above sequence of tests, the results are sent to SRCC for evaluation and computation of the thermal performance ratings. A collector is judged by SRCC to have successfully completed the durability-type tests if none of the following conditions occurred during the testing:

- Severe deformation of the absorber.
- Severe deformation of the fluid flow passages.
- Loss of bonding between fluid flow passages and absorber plates.
- Leakage from fluid flow passages or connections.
- Loss of mounting integrity.
- Severe corrosion or other deterioration caused by chemical action.
- Crazing, cracking, blistering or flaking of the absorber coating or delamination of reflective surface.
- Retention of water in the insulation.
- Excessive retention of water anywhere in the collector.
- Swelling, severe outgassing or other detrimental changes in collector insulation which adversely affect the collector performance.
- Leakage or damage to hoses inside the collector enclosure or leakage from mechanical connections.
- Cracking, crazing, permanent warping or buckling of the cover plate.
- Cracking or warping of the collector enclosure material.

In addition, in order to qualify for collector certification and ratings, manufacturers must document to SRCC that their collectors meet the SRCC requirements for durability in design and construction. For examples, all collectors must be designed to prevent condensation build-up and all glass cover plates must be of a non shattering or tempered type.

## A WORD ABOUT FLOW RATES

**The SRCC solar collector thermal performance ratings are valid only for the fluid and flow rate used to generate the ASHRAE test data**.

Since performance of a collector may vary with changes in flow rate, in order to allow for an even more direct comparison of the thermal performance of various collector models, SRCC adopted the requirement beginning in April of 1983 that all thermal performance testing of solar collectors be conducted at the ASHRAE standard recommended flow rates except as noted below.

For unglazed flat-plate liquid-type solar collectors, the ASHRAE standard flow rate per unit area (transparent frontal or aperture) is 0.07 kg/(s $m^2$) [51.5 lb/(hr $ft^2$)]. For glazed flat-plate liquid-type solar collectors the ASHRAE standard flow rate per unit area (transparent frontal or aperture) is 0.02 kg/(s $m^2$) [14.7 lb/(hr $ft^2$)]. When air is the transfer fluid, the ASHRAE standard flow rate is 0.01 $m^3$/(s $m^2$) [2 cfm/$ft^2$] or 0.03 $m^3$/(s $m^2$) [6 cfm/$ft^2$], inclusive.

For those collectors which have been designed for a specific flow rate other than the ASHRAE standard recommended flow rate, the manufacturer may petition to have the collector rated at its design flow rate. The flow rate at which each solar collector model was tested is provided on each directory listing.

## SRCC CERTIFICATION LABELS

All solar products certified by SRCC are required to be labeled with an approved SRCC certification label within sixty (60) days of receipt of certification. The label shown below should be on each collector certified under SRCC's OG 100 protocol.

| | | | |
|---|---|---|---|
|  | **This product certified by the**<br>**Solar Rating and Certification Corporation**<br>**c/o FSEC, 1679 Clearlake Road**<br>**Cocoa, FL 32922**<br>**(321)638-1537**<br>**www.solar-rating.org**<br><br>**SRCC Document OG-100** | **Sample Solar Corporation**<br>**P.O. Box 12345**<br>**Anytown, CA 97402**<br><br>**Model No.: Super Sample**<br>**Gross Area: 3.72 $m^2$ (40.00 $ft^2$)**<br><br>**Serial Number:_____** | **Mildly Cloudy Day**<br>**Rating in Category C**<br><br>**31 MJ/day**<br>**29 Mbtu/day** |

# SECTION 1:

# UNGLAZED LIQUID-TYPE SOLAR COLLECTORS

**NOTE:** Collectors listed in this section have been certified by SRCC as having met the test methods and minimum standards for certifying solar collectors. Collectors in this section have been tested for thermal performance in accordance with ASHRAE Standard 96, *Methods of Testing to Determine the Thermal Performance of Unglazed Flat Plate Liquid-Type Solar Collectors*. The SRCC collector ratings contained in this section have been calculated according to SRCC Document RM-1, *Methodology for Determining the Thermal Performance Rating for Solar Collectors*.

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR(S)

SUPPLIER: **Dawn Solar Systems, Inc.**
183 Route 125, Unit A-7
Brentwood, NH 03833 USA

MODEL: Dawn Solar 3004-CT
COLLECTOR TYPE: Unglazed Flat-Plate
CERTIFICATION #: 100-2006-018A

**ALL SIZES OF THIS COLLECTOR MODEL ARE CERTIFIED.**

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Square Meter Per Day | | | | Thousands of Btu Per Square Foot Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5 °C) | 2.0 | 1.6 | 1.3 | A (-9 °F) | 0.17 | 0.14 | 0.11 |
| B (5 °C) | 1.0 | 0.6 | 0.3 | B (9 °F) | 0.09 | 0.06 | 0.03 |
| C (20 °C) | 0.1 | | | C (36 °F) | 0.01 | | |
| D (50 °C) | | | | D (90 °F) | | | |
| E (80 °C) | | | | E (144 °F) | | | |

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

Original Certification Date: November 6, 2006

### TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = 0.074 | -2.88 | (P)/I | +0.0076 | (P)$^2$/I | 0.074 | -2.78 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = 0.074 | -0.508 | (P)/I | 0.00000 | (P)$^2$/I | 0.074 | -0.490 | Btu/hr·ft$^2$·°F |

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

$K_{\alpha\tau}$ = Not conducted (S)

$K_{\alpha\tau}$ = (S) (Linear Fit)

**Model Tested:** 3004-CT
**Test Fluid:** Water
**Test Flow Rate:** 3 ml/s-m$^2$ 0.005 gpm/ft$^2$

### TESTED COLLECTOR SPECIFICATIONS

**Gross Area:** 9.641 m$^2$ 103.78 ft$^2$
**Dry Weight:**
**Test Pressure:** 1103 kPa 160 psig

**Fluid Capacity:** 8.3 l 2.2 gal

### COLLECTOR MATERIALS

**Frame:** Aluminum and wood
**Absorber Material:** Tube - PEX
Plate - Dark concrete tile
**Absorber Coating:** None
**Insulation:** None

### TESTED MODEL PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

**REMARKS:** This collector is integrated into the roof. The ratings listed above are based on the gross area of the tested collector. Collector weight and incident angle modifier were not measured.

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR(S)

SUPPLIER: **Dawn Solar Systems, Inc.**
183 Route 125, Unit A-7
Brentwood, NH 03833 USA

MODEL: Dawn Solar 3004L
COLLECTOR TYPE: Unglazed Flat-Plate
CERTIFICATION #: 100-2004-009A

**ALL SIZES OF THIS COLLECTOR MODEL ARE CERTIFIED.**

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Square Meter Per Day | | | | Thousands of Btu Per Square Foot Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5 °C) | 2.4 | 1.9 | 1.3 | A (-9 °F) | 0.21 | 0.16 | 0.12 |
| B (5 °C) | 1.7 | 1.2 | 0.6 | B (9 °F) | 0.15 | 0.10 | 0.05 |
| C (20 °C) | 0.3 | 0.0 | 0.0 | C (36 °F) | 0.03 | 0.00 | 0.00 |
| D (50 °C) | 0.0 | 0.0 | 0.0 | D (90 °F) | 0.00 | 0.00 | 0.00 |
| E (80 °C) | 0.0 | 0.0 | 0.0 | E (144 °F) | 0.00 | 0.00 | 0.00 |

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

Original Certification Date: June 10, 2005

### TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = 0.125 | -1.87 | (P)/I | -0.0806 | (P)$^2$/I | 0.126 | -3.67 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = 0.125 | -0.330 | (P)/I | -0.00789 | (P)$^2$/I | 0.126 | -0.647 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.2119 | (S) | +0.1184 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.09 | (S) | (Linear Fit) | |

| | | | | |
|---|---|---|---|---|
| **Model Tested:** | 3004L | | | |
| **Test Fluid:** | Water | | | |
| **Test Flow Rate:** | 3 | ml/s-m$^2$ | 0.005 | gpm/ft$^2$ |

### TESTED COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 9.302 | m$^2$ | 100.14 | ft$^2$ | **Fluid Capacity:** | 8.2 | l | 2.2 | gal |
| **Dry Weight:** | | | | | | | | |
| **Test Pressure:** | 1104 | kPa | 160 | psig | | | | |

### COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Galvanized Steel |
| **Absorber Material:** | Tube - PEX |
| | Plate - Steel |
| **Absorber Coating:** | Dark Green Fluorocarbon |
| **Insulation:** | Plywood |

### TESTED MODEL PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| 20 | 0.32 | 2523 | 10.13 |
| 50 | 0.79 | 14934 | 59.96 |
| 80 | 1.27 | 27363 | 109.85 |

**REMARKS:** This collector is integrated into the roof. The ratings listed above are based on the gross area of the tested collector. Collector weight was not measured.

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR(S)

SUPPLIER: **Fafco, Inc.**
435 Otterson Dr.
Chico, CA 95928 USA

MODEL: Revolution
COLLECTOR TYPE: Unglazed Flat-Plate
CERTIFICATION #: 100-2005-011A

**ALL SIZES OF THIS COLLECTOR MODEL ARE CERTIFIED.**

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Square Meter Per Day | | | | Thousands of Btu Per Square Foot Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5 °C) | 21.0 | 16.4 | 11.8 | A (-9 °F) | 1.85 | 1.45 | 1.04 |
| B (5 °C) | 15.1 | 10.6 | 6.1 | B (9 °F) | 1.33 | 0.93 | 0.54 |
| C (20 °C) | 8.0 | 4.0 | 0.7 | C (36 °F) | 0.71 | 0.36 | 0.06 |
| D (50 °C) | 0.1 | | | D (90 °F) | 0.01 | | |
| E (80 °C) | | | | E (144 °F) | | | |

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

Original Certification Date: February 18, 2006

### TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.861 | -15.45 | (P)/I | +0.0266 | (P)$^2$/I | 0.863 | -14.84 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.861 | -2.723 | (P)/I | 0.00000 | (P)$^2$/I | 0.863 | -2.615 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1410 | (S) | +0.0228 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.11 | (S) | (Linear Fit) | |

**Model Tested:** Revolution 912R
**Test Fluid:** Water
**Test Flow Rate:** 70 ml/s-m$^2$ 0.10 gpm/ft$^2$

### TESTED COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 4.408 | m$^2$ | 47.45 | ft$^2$ | **Fluid Capacity:** | 18.9 l | 5.0 gal |
| **Dry Weight:** | 9.1 | kg | 20 | lb | | | |
| **Test Pressure:** | 465 | kPa | 67 | psig | | | |

### COLLECTOR MATERIALS

**Frame:** None
**Absorber Material:** Tube - UV Stabilized Plastic Polymer
Plate - None
**Absorber Coating:** None
**Insulation:** None

### TESTED MODEL PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| 150 | 2.38 | 3677 | 14.76 |
| 250 | 3.97 | 9305 | 37.36 |
| 350 | 5.55 | 176596 | 708.97 |

**REMARKS:** Tests conducted outdoors.

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR(S)

SUPPLIER: **Fafco, Inc.**
435 Otterson Dr.
Chico, CA 95928 USA

MODEL: Sunsaver
COLLECTOR TYPE: Unglazed Flat Plate
CERTIFICATION #: 100-2007-051A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Square Meter Per Day | | | | Thousands of Btu Per Square Foot Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5 °C) | 21.2 | 16.6 | 12.1 | A (-9 °F) | 1.87 | 1.47 | 1.06 |
| B (5 °C) | 14.9 | 10.4 | 6.0 | B (9 °F) | 1.32 | 0.92 | 0.53 |
| C (20 °C) | 6.9 | 3.0 | 0.2 | C (36 °F) | 0.61 | 0.26 | 0.02 |
| D (50 °C) | | | | D (90 °F) | | | |
| E (80 °C) | | | | E (144 °F) | | | |

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

Original Certification Date: December 27, 2007

### TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = 0.834 | -15.92 | (P)/I | -0.0495 | (P)$^2$/I | 0.838 | -17.25 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = 0.834 | -2.806 | (P)/I | -0.00485 | (P)$^2$/I | 0.838 | -3.040 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.0304 | (S) | +0.0282 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | 0.00 | (S) | (Linear Fit) | |

**Model Tested:** 922
**Test Fluid:** Water
**Test Flow Rate:** 40 ml/s-m$^2$ 0.06 gpm/ft$^2$

### TESTED COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.631 | m$^2$ | 39.08 | ft$^2$ | **Fluid Capacity:** | 13.6 l | 3.6 gal |
| **Dry Weight:** | 5.5 | kg | 12 | lb | | | |
| **Test Pressure:** | 240 | kPa | 35 | psig | | | |

### COLLECTOR MATERIALS

**Frame:** None
**Absorber Material:** Tube - UV Stabilized Plastic Polymer
Plate - None
**Absorber Coating:** None
**Insulation:** None

### TESTED MODEL PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

**REMARKS:** Thermal performance tests were done indoors with a solar irradiance simulator.

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR(S)

SUPPLIER: **Fafco, Inc.**
435 Otterson Dr.
Chico, CA 95928 USA

MODEL: Sunsaver ST
COLLECTOR TYPE: Unglazed Flat-Plate
CERTIFICATION #: 100-2005-012A

**ALL SIZES OF THIS COLLECTOR MODEL ARE CERTIFIED.**

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Square Meter Per Day | | | | Thousands of Btu Per Square Foot Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5 °C) | 21.5 | 17.1 | 12.7 | A (-9 °F) | 1.89 | 1.50 | 1.12 |
| B (5 °C) | 13.2 | 8.9 | 4.6 | B (9 °F) | 1.16 | 0.78 | 0.41 |
| C (20 °C) | 3.3 | 0.6 | | C (36 °F) | 0.29 | 0.05 | |
| D (50 °C) | | | | D (90 °F) | | | |
| E (80 °C) | | | | E (144 °F) | | | |

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

Original Certification Date: February 18, 2006

### TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = 0.811 | -21.44 | (P)/I | -0.0993 | (P)$^2$/I | 0.811 | -22.44 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = 0.811 | -3.778 | (P)/I | -0.00972 | (P)$^2$/I | 0.811 | -3.955 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.2340 | (S) | +0.1480 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.08 | (S) | (Linear Fit) | |

**Model Tested:** SunSaver St 948
**Test Fluid:** Water
**Test Flow Rate:** 74 ml/s-m$^2$ 0.11 gpm/ft$^2$

### TESTED COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.934 | m$^2$ | 31.59 | ft$^2$ | **Fluid Capacity:** | 15.5 | l | 4.1 gal |
| **Dry Weight:** | 6 | kg | 13 | lb | | | | |
| **Test Pressure:** | 414 | kPa | 60 | psig | | | | |

### COLLECTOR MATERIALS

**Frame:** None
**Absorber Material:** Tube - UV Stabilized Plastic Polymer
Plate - None
**Absorber Coating:** None
**Insulation:** None

### TESTED MODEL PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| 150 | 2.38 | 3683 | 14.79 |
| 250 | 3.97 | 6363 | 25.55 |
| 350 | 5.55 | 10442 | 41.92 |

**REMARKS:** Tests conducted outdoors.

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR(S)

SUPPLIER: **Heliocol USA, Inc.**
927 Fern Street
Suite 1500
Altamonte Springs, FL 32701 USA

MODEL: Heliocol HC
COLLECTOR TYPE: Unglazed Flat-Plate
CERTIFICATION #: 100-2007-038A

**ALL SIZES OF THIS COLLECTOR MODEL ARE CERTIFIED.**

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Square Meter Per Day | | | | Thousands of Btu Per Square Foot Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5 °C) | 19.8 | 15.8 | 11.8 | A (-9 °F) | 1.75 | 1.40 | 1.04 |
| B (5 °C) | 12.9 | 9.0 | 5.1 | B (9 °F) | 1.14 | 0.79 | 0.45 |
| C (20 °C) | 5.4 | 1.9 | | C (36 °F) | 0.47 | 0.17 | |
| D (50 °C) | | | | D (90 °F) | | | |
| E (80 °C) | | | | E (144 °F) | | | |

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

Original Certification Date: January 15, 2008

### TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.838 | -18.34 (P)/I | -0.0627 | (P)$^2$/I | 0.829 | -18.53 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.838 | -3.232 (P)/I | -0.00614 | (P)$^2$/I | 0.829 | -3.266 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1955 (S) | +0.0855 (S)$^2$ | | |
| $K_{\alpha\tau}$ = | 1.0 | -0.11 (S) | (Linear Fit) | | |

**Model Tested:** Heliocol 50
**Test Fluid:** Water
**Test Flow Rate:** 70 ml/s-m$^2$ 0.10 gpm/ft$^2$

### TESTED COLLECTOR SPECIFICATIONS

| | | | | |
|---|---|---|---|---|
| **Gross Area:** | 4.481 | m$^2$ | 48.24 | ft$^2$ |
| **Dry Weight:** | 10.7 | kg | 24 | lb |
| **Test Pressure:** | 1103 | kPa | 160 | psig |

**Fluid Capacity:** 14.4 l 3.8 gal

### COLLECTOR MATERIALS

**Frame:** None
**Absorber Material:** Tube - None
Plate - Polypropylene with UV Stabilization
**Absorber Coating:** None
**Insulation:** None

### TESTED MODEL PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| 150 | 2.38 | 2700 | 10.84 |
| 250 | 3.97 | 6905 | 27.72 |
| 350 | 5.55 | 13034 | 52.33 |

**REMARKS:**

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR(S)

SUPPLIER: **Sealed Air Corporation**
3433 Arden Road
Hayward, CA 94545 USA

MODEL: FP
COLLECTOR TYPE: Unglazed Flat-Plate
CERTIFICATION #: 100-1997-010A

**ALL SIZES OF THIS COLLECTOR MODEL ARE CERTIFIED.**

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Square Meter Per Day | | | | Thousands of Btu Per Square Foot Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5 °C) | 19.7 | 15.6 | 11.2 | A (-9 °F) | 1.74 | 1.37 | 0.99 |
| B (5 °C) | 13.5 | 9.4 | 5.3 | B (9 °F) | 1.19 | 0.83 | 0.46 |
| C (20 °C) | 6.2 | 2.8 | 0.2 | C (36 °F) | 0.55 | 0.24 | 0.02 |
| D (50 °C) | | | | D (90 °F) | | | |
| E (80 °C) | | | | E (144 °F) | | | |

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

Original Certification Date: April 1, 1997

### TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = 0.794 | -15.78 | (P)/I | -0.0091 | $(P)^2/I$ | 0.794 | -15.94 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = 0.794 | -2.781 | (P)/I | -0.00089 | $(P)^2/I$ | 0.794 | -2.809 | Btu/hr·ft$^2$·°F |

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

| | | |
|---|---|---|
| $K_{\alpha\tau}$ = | (S) | $(S)^2$ |
| $K_{\alpha\tau}$ = | (S) | (Linear Fit) |

**Model Tested:** FP-48
**Test Fluid:** Water
**Test Flow Rate:** 70 ml/s-m$^2$ 0.10 gpm/ft$^2$

### TESTED COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 4.359 | m$^2$ | 46.92 | ft$^2$ | **Fluid Capacity:** | 11.7 l | 3.1 gal |
| **Dry Weight:** | 13.4 | kg | 30 | lb | | | |
| **Test Pressure:** | 207 | kPa | 30 | psig | | | |

### COLLECTOR MATERIALS

**Frame:** None
**Absorber Material:** Tube - Co-polymer plastic
Plate - Co-polymer plastic
**Absorber Coating:** None
**Insulation:** None

### TESTED MODEL PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

**REMARKS:** Tests conducted outdoors.

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR(S)

SUPPLIER: **Sealed Air Corporation**
3433 Arden Road
Hayward, CA 94545 USA

MODEL: FS
COLLECTOR TYPE: Unglazed Flat-Plate
CERTIFICATION #: 100-1997-010B

**ALL SIZES OF THIS COLLECTOR MODEL ARE CERTIFIED.**

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Square Meter Per Day | | | | Thousands of Btu Per Square Foot Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5 °C) | 19.1 | 15.0 | 10.9 | A (-9 °F) | 1.68 | 1.32 | 0.96 |
| B (5 °C) | 13.2 | 9.3 | 5.2 | B (9 °F) | 1.16 | 0.82 | 0.46 |
| C (20 °C) | 6.4 | 2.7 | 0.2 | C (36 °F) | 0.56 | 0.24 | 0.02 |
| D (50 °C) | | | | D (90 °F) | | | |
| E (80 °C) | | | | E (144 °F) | | | |

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

Original Certification Date: April 1, 1997

### TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = 0.782 | -15.04 | (P)/I | -0.0102 | $(P)^2/I$ | 0.781 | -15.22 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = 0.782 | -2.650 | (P)/I | -0.00100 | $(P)^2/I$ | 0.781 | -2.682 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| **$K_{\alpha\tau}$ =** | (S) | $(S)^2$ | **Model Tested:** | FS-48 | | |
| **$K_{\alpha\tau}$ =** | (S) | (Linear Fit) | **Test Fluid:** | Water | | |
| | | | **Test Flow Rate:** | 65 ml/s-m$^2$ | 0.10 | gpm/ft$^2$ |

### TESTED COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 4.404 | m$^2$ | 47.41 | ft$^2$ | **Fluid Capacity:** | 11.7 | l | 3.1 gal |
| **Dry Weight:** | 29 | kg | 64 | lb | | | | |
| **Test Pressure:** | 207 | kPa | 30 | psig | | | | |

### COLLECTOR MATERIALS

**Frame:** Galvanized steel with fiber reinforced back
**Absorber Material:** Tube - Co-polymer plastic
Plate - Co-polymer plastic
**Absorber Coating:** None
**Insulation:** None

### TESTED MODEL PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

**REMARKS:** Tests conducted outdoors.

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR(S)

SUPPLIER: **SolarTech International LLC**
2913 E. 19th St.
Tucson, AZ 85716 USA

MODEL: SolarTech ST-300
COLLECTOR TYPE: Unglazed Flat-Plate
CERTIFICATION #: 100-2004-010A

**ALL SIZES OF THIS COLLECTOR MODEL ARE CERTIFIED.**

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Square Meter Per Day | | | | Thousands of Btu Per Square Foot Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5 °C) | 19.8 | 15.9 | 12.0 | A (-9 °F) | 1.74 | 1.40 | 1.05 |
| B (5 °C) | 11.4 | 7.6 | 3.8 | B (9 °F) | 1.00 | 0.67 | 0.33 |
| C (20 °C) | 2.6 | 0.2 | 0.0 | C (36 °F) | 0.23 | 0.02 | 0.00 |
| D (50 °C) | 0.0 | 0.0 | 0.0 | D (90 °F) | 0.00 | 0.00 | 0.00 |
| E (80 °C) | 0.0 | 0.0 | 0.0 | E (144 °F) | 0.00 | 0.00 | 0.00 |

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

Original Certification Date: March 6, 2006

### TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = 0.696 | -23.36 | (P)/I | -0.1319 | $(P)^2/I$ | 0.709 | -21.99 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = 0.696 | -4.117 | (P)/I | -0.01291 | $(P)^2/I$ | 0.709 | -3.875 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1604 | (S) | -0.2656 | $(S)^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.16 | (S) | (Linear Fit) | |

**Model Tested:** ST-300
**Test Fluid:** Water
**Test Flow Rate:** 63 ml/s-m$^2$ 0.09 gpm/ft$^2$

### TESTED COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.229 | m$^2$ | 34.76 | ft$^2$ | **Fluid Capacity:** | 26.1 l | 6.9 gal |
| **Dry Weight:** | 12.7 | kg | 28 | lb | | | |
| **Test Pressure:** | 517 | kPa | 75 | psig | | | |

### COLLECTOR MATERIALS

**Frame:** None
**Absorber Material:** Tube - Polyethylene
Plate - None
**Absorber Coating:** None
**Insulation:** None

### TESTED MODEL PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| 150 | 2.38 | 17250 | 69.25 |
| 250 | 3.97 | 43750 | 175.64 |
| 350 | 5.55 | 82250 | 330.20 |

**REMARKS:** Tests conducted outdoors.

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR(S)

SUPPLIER: **Suntrek Industries, Inc.**
5 Holland, Building 215
Irvine, CA 92618 USA

MODEL: SunTrek
COLLECTOR TYPE: Unglazed Flat-Plate
CERTIFICATION #: 100-2005-004A

**ALL SIZES OF THIS COLLECTOR MODEL ARE CERTIFIED.**

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Square Meter Per Day | | | | Thousands of Btu Per Square Foot Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5 °C) | 19.7 | 15.7 | 11.8 | A (-9 °F) | 1.73 | 1.39 | 1.04 |
| B (5 °C) | 12.7 | 8.9 | 5.1 | B (9 °F) | 1.12 | 0.78 | 0.44 |
| C (20 °C) | 5.5 | 2.2 | 0.0 | C (36 °F) | 0.48 | 0.19 | 0.00 |
| D (50 °C) | 0.0 | 0.0 | 0.0 | D (90 °F) | 0.00 | 0.00 | 0.00 |
| E (80 °C) | 0.0 | 0.0 | 0.0 | E (144 °F) | 0.00 | 0.00 | 0.00 |

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

Original Certification Date: June 10, 2005

### TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = 0.856 | -17.93 | (P)/I | +0.0386 | (P)$^2$/I | 0.860 | -17.68 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = 0.856 | -3.160 | (P)/I | 0.00000 | (P)$^2$/I | 0.860 | -3.116 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.0827 | (S) | +0.0594 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.03 | (S) | (Linear Fit) | |

**Model Tested:** SunTrek
**Test Fluid:** Water
**Test Flow Rate:** 70 ml/s-m$^2$ 0.10 gpm/ft$^2$

### TESTED COLLECTOR SPECIFICATIONS

| | | | | |
|---|---|---|---|---|
| **Gross Area:** | 3.869 | m$^2$ | 41.65 | ft$^2$ |
| **Dry Weight:** | 21.3 | kg | 47 | lb |
| **Test Pressure:** | 414 | kPa | 60 | psig |

**Fluid Capacity:** 8.7 l 2.3 gal

### COLLECTOR MATERIALS

**Frame:** None
**Absorber Material:** Tube - EPDM
Plate - None
**Absorber Coating:** None
**Insulation:** None

### TESTED MODEL PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

**REMARKS:** Tests conducted outdoors.

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR(S)

SUPPLIER: **Techno-Solis, Inc.**
301 20th Street South
St. Petersburg, FL 33712 USA

MODEL: Swimmaster C20TS10
COLLECTOR TYPE: Unglazed Flat Plate
CERTIFICATION #: 100-2006-017A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Square Meter Per Day | | | | Thousands of Btu Per Square Foot Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5 °C) | 21.0 | 16.5 | 12.0 | A (-9 °F) | 1.85 | 1.45 | 1.05 |
| B (5 °C) | 14.5 | 10.1 | 5.7 | B (9 °F) | 1.28 | 0.89 | 0.50 |
| C (20 °C) | 6.8 | 2.9 | 0.2 | C (36 °F) | 0.60 | 0.26 | 0.02 |
| D (50 °C) | | | | D (90 °F) | | | |
| E (80 °C) | | | | E (144 °F) | | | |

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

Original Certification Date: February 28, 2008

### TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = 0.823 | -16.36 | (P)/I | -0.0133 | $(P)^2/I$ | 0.824 | -16.73 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = 0.823 | -2.883 | (P)/I | -0.00130 | $(P)^2/I$ | 0.824 | -2.948 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.0111 | (S) | -0.0604 | $(S)^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.07 | (S) | (Linear Fit) | |

**Model Tested:** C20TS10
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s-m$^2$ 0.06 gpm/ft$^2$

### TESTED COLLECTOR SPECIFICATIONS

| | | | | |
|---|---|---|---|---|
| **Gross Area:** | 3.672 | m$^2$ | 39.53 | ft$^2$ |
| **Dry Weight:** | 11.1 | kg | 24 | lb |
| **Test Pressure:** | 365 | kPa | 53 | psig |

**Fluid Capacity:** 17.5 l 4.6 gal

### COLLECTOR MATERIALS

**Frame:** None
**Absorber Material:** Tube - Co-polymer plastic
Plate - Co-polymer plastic
**Absorber Coating:** None
**Insulation:** None

**TESTED MODEL PRESSURE DROP**

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

**REMARKS:** Thermal performance tests were done indoors with a solar irradiance simulator.

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR(S)

SUPPLIER: **UMA Solar**
950 Sunshine Lane
Altamonte Springs, FL 32714 USA

MODEL: SunStar STR
COLLECTOR TYPE: Unglazed Flat-Plate
CERTIFICATION #: 100-2007-037A

**ALL SIZES OF THIS COLLECTOR MODEL ARE CERTIFIED.**

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Square Meter Per Day | | | | Thousands of Btu Per Square Foot Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5 °C) | 19.8 | 15.8 | 11.8 | A (-9 °F) | 1.75 | 1.40 | 1.04 |
| B (5 °C) | 12.9 | 9.0 | 5.1 | B (9 °F) | 1.14 | 0.79 | 0.45 |
| C (20 °C) | 5.4 | 1.9 | | C (36 °F) | 0.47 | 0.17 | |
| D (50 °C) | | | | D (90 °F) | | | |
| E (80 °C) | | | | E (144 °F) | | | |

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

Original Certification Date: October 31, 2007

### TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = 0.838 | -18.34 | (P)/I | -0.0627 | $(P)^2/I$ | 0.829 | -18.53 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = 0.838 | -3.232 | (P)/I | -0.00614 | $(P)^2/I$ | 0.829 | -3.266 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1955 | (S) | +0.0855 | $(S)^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.11 | (S) | (Linear Fit) | |

**Model Tested:** Heliocol 50
**Test Fluid:** Water
**Test Flow Rate:** 70 ml/s-m$^2$ 0.10 gpm/ft$^2$

### TESTED COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 4.481 | m$^2$ | 48.24 | ft$^2$ | **Fluid Capacity:** | 14.4 | l | 3.8 gal |
| **Dry Weight:** | 10.7 | kg | 24 | lb | | | | |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | |

### COLLECTOR MATERIALS

**Frame:** None
**Absorber Material:** Tube - None
Plate - Polypropylene with UV Stabilization
**Absorber Coating:** None
**Insulation:** None

### TESTED MODEL PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| 150 | 2.38 | 2700 | 10.84 |
| 250 | 3.97 | 6905 | 27.72 |
| 350 | 5.55 | 13034 | 52.33 |

**REMARKS:**

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR(S)

SUPPLIER: **UMA Solar**
950 Sunshine Lane
Altamonte Springs, FL 32714 USA

MODEL: Terra Cotta TC
COLLECTOR TYPE: Unglazed Flat-Plate
CERTIFICATION #: 100-2007-036A

**ALL SIZES OF THIS COLLECTOR MODEL ARE CERTIFIED.**

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Square Meter Per Day | | | | Thousands of Btu Per Square Foot Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5 °C) | 18.3 | 14.3 | 10.4 | A (-9 °F) | 1.61 | 1.26 | 0.92 |
| B (5 °C) | 12.3 | 8.5 | 4.7 | B (9 °F) | 1.08 | 0.74 | 0.41 |
| C (20 °C) | 5.0 | 2.0 | 0.0 | C (36 °F) | 0.44 | 0.17 | 0.00 |
| D (50 °C) | | | | D (90 °F) | | | |
| E (80 °C) | | | | E (144 °F) | | | |

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

Original Certification Date: October 31, 2007

### TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = 0.733 | -15.32 | (P)/I | -0.0447 | $(P)^2/I$ | 0.726 | -15.60 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = 0.733 | -2.700 | (P)/I | -0.00438 | $(P)^2/I$ | 0.726 | -2.749 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.6710 | (S) | +0.4946 | $(S)^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.15 | (S) | (Linear Fit) | |

**Model Tested:** TC 50
**Test Fluid:** Water
**Test Flow Rate:** 70 ml/s-m$^2$ 0.10 gpm/ft$^2$

### TESTED COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 4.515 | m$^2$ | 48.60 | ft$^2$ | **Fluid Capacity:** | 15.1 | l | 4.0 gal |
| **Dry Weight:** | 10 | kg | 22 | lb | | | | |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | |

### COLLECTOR MATERIALS

**Frame:** None
**Absorber Material:** Tube - None
Plate - Polypropylene with UV Stabilization
**Absorber Coating:** None
**Insulation:** None

### TESTED MODEL PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| 150 | 2.38 | 2710 | 10.88 |
| 250 | 3.97 | 6399 | 25.69 |
| 350 | 5.55 | 11594 | 46.55 |

**REMARKS:**

# SECTION 2:

# GLAZED SOLAR COLLECTORS

**NOTE:** Collectors listed in this section have been certified by SRCC as having met the test methods and minimum standards for certifying solar collectors. Collectors in this section have been tested for thermal performance in accordance with ASHRAE Standard 93, *Methods of Testing to Determine the Thermal Performance of Solar Collectors*. The SRCC collector ratings contained in this section have been calculated according to SRCC Document RM-1, *Methodology for Determining the Thermal Performance Rating for Solar Collectors*.

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **ACR Solar International**
5840 Gibbons Dr.
Suite G
Carmichael, CA 95608 USA

MODEL: Skyline 10-01
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2001-002B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 12 | 9 | 6 | A (-9°F) | 11 | 9 | 6 |
| B (5°C) | 11 | 8 | 5 | B (9°F) | 10 | 7 | 5 |
| C (20°C) | 9 | 6 | 3 | C (36°F) | 8 | 6 | 3 |
| D (50°C) | 5 | 3 | 1 | D (90°F) | 5 | 3 | 1 |
| E (80°C) | 3 | 1 | | E (144°F) | 3 | 1 | |

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

Original Certification Date: September 22, 2006

## COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 0.933 | m$^2$ | 10.04 | ft$^2$ | **Net Aperture Area:** | 0.847 | m$^2$ | 9.12 | ft$^2$ |
| **Dry Weight:** | 8.62 | kg | 19 | lb | **Fluid Capacity:** | 0.6 | l | 0.2 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Lexan Polycarbonate |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.603 | -3.8665 (P)/I | +0.0015 | (P)$^2$/I | 0.602 | -3.764 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.603 | -0.6814 (P)/I | 0.0000 | (P)$^2$/I | 0.602 | -0.663 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1944 (S) | -0.0186 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.21 (S) | (Linear Fit) | | |

**Model Tested:** Skyline 20-01
**Test Fluid:** Water
**Test Flow Rate:** 32 ml/s 0.50 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **ACR Solar International**
5840 Gibbons Dr.
Suite G
Carmichael, CA 95608 USA

MODEL: Skyline 20-01
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2001-002A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 24 | 18 | 13 | A (-9°F) | 23 | 17 | 12 |
| B (5°C) | 21 | 16 | 10 | B (9°F) | 20 | 15 | 9 |
| C (20°C) | 18 | 12 | 6 | C (36°F) | 17 | 11 | 6 |
| D (50°C) | 11 | 6 | 1 | D (90°F) | 10 | 6 | 1 |
| E (80°C) | 6 | 2 | | E (144°F) | 6 | 2 | |

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

Original Certification Date: March 14, 2002

## COLLECTOR SPECIFICATIONS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.865 | m$^2$ | 20.08 | ft$^2$ | **Net Aperture Area:** | 1.720 | m$^2$ | 18.51 | ft$^2$ |
| **Dry Weight:** | 17.2 | kg | 38 | lb | **Fluid Capacity:** | 1.8 | l | 0.5 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Lexan Polycarbonate |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| 20 | 0.32 | 1291 | 5.18 |
| 40 | 0.63 | 4663 | 18.72 |
| 60 | 0.95 | 9795 | 39.32 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.605 | -3.8370 | (P)/I | +0.0017 | (P)$^2$/I | 0.604 | -3.73 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.605 | -0.6762 | (P)/I | 0.0000 | (P)$^2$/I | 0.604 | -0.657 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1944 | (S) | -0.0186 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.21 | (S) | (Linear Fit) | | |

**Model Tested:** Skyline 20-01
**Test Fluid:** Water
**Test Flow Rate:** 32 ml/s 0.50 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254 USA

MODEL: Alternate Energy AE-21
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2002-001A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 29 | 22 | 15 | A (-9°F) | 27 | 20 | 14 |
| B (5°C) | 26 | 19 | 12 | B (9°F) | 25 | 18 | 11 |
| C (20°C) | 22 | 15 | 8 | C (36°F) | 21 | 14 | 8 |
| D (50°C) | 13 | 7 | 2 | D (90°F) | 12 | 7 | 1 |
| E (80°C) | 5 | 1 | | E (144°F) | 5 | 1 | |

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

Original Certification Date: November 22, 2002

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.931 | m$^2$ | 20.79 | ft$^2$ | **Net Aperture Area:** | 1.783 | m$^2$ | 19.19 | ft$^2$ |
| **Dry Weight:** | 33.6 | kg | 74 | lb | **Fluid Capacity:** | 3.0 | l | 0.8 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 18 | 0.07 |
| 50 | 0.79 | 116 | 0.47 |
| 80 | 1.27 | 301 | 1.21 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 | (P)$^2$/I | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 | (P)$^2$/I | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 | (S) | -0.0055 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | | |

**Model Tested:** AE-21
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254 USA

MODEL: American Energy AE-21E
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1999-001A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 28 | 21 | 15 | A (-9°F) | 27 | 20 | 14 |
| B (5°C) | 25 | 18 | 11 | B (9°F) | 24 | 17 | 11 |
| C (20°C) | 20 | 13 | 6 | C (36°F) | 19 | 12 | 6 |
| D (50°C) | 9 | 3 | | D (90°F) | 8 | 3 | |
| E (80°C) | | | | E (144°F) | | | |

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

Original Certification Date: June 15, 1999

## COLLECTOR SPECIFICATIONS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.926 | m$^2$ | 20.73 | ft$^2$ | **Net Aperture Area:** | 1.776 | m$^2$ | 19.12 | ft$^2$ |
| **Dry Weight:** | 40.8 | kg | 90 | lb | **Fluid Capacity:** | 3.0 | l | 0.8 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 55 | 0.22 |
| 50 | 0.79 | 306 | 1.23 |
| 80 | 1.27 | 745 | 2.99 |

## TECHNICAL INFORMATION

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

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | **Y Intercept** | **Slope** | |
| **S I Units:** | $\eta$ = | 0.638 | -4.2645 | (P)/I | -0.0297 | (P)$^2$/I | 0.66 | -6.37 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.638 | -0.7515 | (P)/I | -0.0029 | (P)$^2$/I | 0.66 | -1.123 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0248 | (S) | -0.0861 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.05 | (S) | (Linear Fit) | | |

**Model Tested:** AE-21E
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.61 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254 USA

MODEL: Alternate Energy AE-24
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2002-001B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 33 | 25 | 17 | A (-9°F) | 31 | 23 | 16 |
| B (5°C) | 30 | 22 | 14 | B (9°F) | 28 | 21 | 13 |
| C (20°C) | 25 | 17 | 9 | C (36°F) | 24 | 16 | 9 |
| D (50°C) | 15 | 8 | 2 | D (90°F) | 14 | 8 | 2 |
| E (80°C) | 6 | 1 | | E (144°F) | 6 | 1 | |

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

Original Certification Date: November 22, 2002

## COLLECTOR SPECIFICATIONS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.212 | m$^2$ | 23.81 | ft$^2$ | **Net Aperture Area:** | 2.043 | m$^2$ | 21.99 | ft$^2$ |
| **Dry Weight:** | 38.1 | kg | 84 | lb | **Fluid Capacity:** | 3.4 | l | 0.9 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 | (P)$^2$/I | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 | (P)$^2$/I | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 | (S) | -0.0055 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | | |

**Model Tested:** AE-21
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254 USA

MODEL: American Energy AE-24E
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1999-001B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 32 | 24 | 17 | A (-9°F) | 31 | 23 | 16 |
| B (5°C) | 29 | 21 | 13 | B (9°F) | 27 | 20 | 12 |
| C (20°C) | 23 | 15 | 7 | C (36°F) | 21 | 14 | 7 |
| D (50°C) | 10 | 4 | | D (90°F) | 10 | 4 | |
| E (80°C) | | | | E (144°F) | | | |

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

Original Certification Date: June 15, 1999

## COLLECTOR SPECIFICATIONS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.212 | m$^2$ | 23.81 | ft$^2$ | **Net Aperture Area:** | 2.043 | m$^2$ | 21.99 | ft$^2$ |
| **Dry Weight:** | 43.1 | kg | 95 | lb | **Fluid Capacity:** | 3.4 | l | 0.9 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.638 | -4.2645 | (P)/I | -0.0297 | (P)$^2$/I | 0.655 | -6.37 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.638 | -0.7515 | (P)/I | -0.0029 | (P)$^2$/I | 0.655 | -1.123 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0248 | (S) | -0.0861 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.05 | (S) | (Linear Fit) | | |

**Model Tested:** AE-21E
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.61 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254 USA

MODEL: Alternate Energy AE-26
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2002-001C

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 35 | 26 | 18 | A (-9°F) | 33 | 25 | 17 |
| B (5°C) | 32 | 23 | 15 | B (9°F) | 30 | 22 | 14 |
| C (20°C) | 27 | 18 | 10 | C (36°F) | 25 | 17 | 9 |
| D (50°C) | 16 | 8 | 2 | D (90°F) | 15 | 8 | 2 |
| E (80°C) | 6 | 1 | | E (144°F) | 6 | 1 | |

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

Original Certification Date: November 22, 2002

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.355 | m$^2$ | 25.35 | ft$^2$ | **Net Aperture Area:** | 2.197 | m$^2$ | 23.65 | ft$^2$ |
| **Dry Weight:** | 40.8 | kg | 90 | lb | **Fluid Capacity:** | 3.8 | l | 1.0 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 | (P)$^2$/I | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 | (P)$^2$/I | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 | (S) | -0.0055 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | | |

**Model Tested:** AE-21
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254 USA

MODEL: American Energy AE-26E
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1999-001H

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 34 | 26 | 18 | A (-9°F) | 33 | 25 | 17 |
| B (5°C) | 30 | 22 | 14 | B (9°F) | 29 | 21 | 13 |
| C (20°C) | 24 | 16 | 8 | C (36°F) | 23 | 15 | 8 |
| D (50°C) | 11 | 4 | | D (90°F) | 10 | 4 | |
| E (80°C) | | | | E (144°F) | | | |

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

Original Certification Date: February 12, 2001

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.355 | m$^2$ | 25.35 | ft$^2$ | **Net Aperture Area:** | 2.197 | m$^2$ | 23.65 | ft$^2$ |
| **Dry Weight:** | 45.4 | kg | 100 | lb | **Fluid Capacity:** | 3.8 | l | 1.0 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.638 | -4.2645 | (P)/I | -0.0297 | (P)$^2$/I | 0.655 | -6.37 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.638 | -0.7515 | (P)/I | -0.0029 | (P)$^2$/I | 0.655 | -1.123 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0248 | (S) | -0.0861 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.05 | (S) | (Linear Fit) | | |

**Model Tested:** AE-21E
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.61 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254 USA

MODEL: Alternate Energy AE-28
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2002-001D

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 39 | 29 | 20 | A (-9°F) | 37 | 28 | 19 |
| B (5°C) | 35 | 26 | 16 | B (9°F) | 33 | 24 | 15 |
| C (20°C) | 29 | 20 | 11 | C (36°F) | 28 | 19 | 10 |
| D (50°C) | 18 | 9 | 2 | D (90°F) | 17 | 9 | 2 |
| E (80°C) | 7 | 1 | | E (144°F) | 6 | 1 | |

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

Original Certification Date: November 22, 2002

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.599 | m$^2$ | 27.98 | ft$^2$ | **Net Aperture Area:** | 2.430 | m$^2$ | 26.16 | ft$^2$ |
| **Dry Weight:** | 44.9 | kg | 99 | lb | **Fluid Capacity:** | 4.2 | l | 1.1 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 | (P)$^2$/I | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 | (P)$^2$/I | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 | (S) | -0.0055 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | | |

**Model Tested:** AE-21
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254 USA

MODEL: American Energy AE-28E
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1999-001F

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 38 | 29 | 20 | A (-9°F) | 36 | 27 | 19 |
| B (5°C) | 34 | 24 | 15 | B (9°F) | 32 | 23 | 15 |
| C (20°C) | 26 | 18 | 9 | C (36°F) | 25 | 17 | 8 |
| D (50°C) | 12 | 5 | | D (90°F) | 11 | 4 | |
| E (80°C) | | | | E (144°F) | | | |

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

Original Certification Date: May 1, 2000

## COLLECTOR SPECIFICATIONS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.599 | m$^2$ | 27.98 | ft$^2$ | **Net Aperture Area:** | 2.430 | m$^2$ | 26.16 | ft$^2$ |
| **Dry Weight:** | 47.6 | kg | 105 | lb | **Fluid Capacity:** | 4.2 | l | 1.1 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.638 | -4.2645 | (P)/I | -0.0297 | (P)$^2$/I | 0.655 | -6.37 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.638 | -0.7515 | (P)/I | -0.0029 | (P)$^2$/I | 0.655 | -1.123 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0248 | (S) | -0.0861 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.05 | (S) | (Linear Fit) | | |

**Model Tested:** AE-21E
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.61 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254 USA

MODEL: Alternate Energy AE-32
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2002-001E

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 44 | 33 | 23 | A (-9°F) | 42 | 31 | 21 |
| B (5°C) | 40 | 29 | 19 | B (9°F) | 38 | 28 | 18 |
| C (20°C) | 33 | 23 | 13 | C (36°F) | 32 | 22 | 12 |
| D (50°C) | 20 | 11 | 2 | D (90°F) | 19 | 10 | 2 |
| E (80°C) | 8 | 1 | | E (144°F) | 7 | 1 | |

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

Original Certification Date: November 22, 2002

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.965 | m$^2$ | 31.92 | ft$^2$ | **Net Aperture Area:** | 2.781 | m$^2$ | 29.94 | ft$^2$ |
| **Dry Weight:** | 51.2 | kg | 113 | lb | **Fluid Capacity:** | 4.9 | l | 1.3 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 | (P)$^2$/I | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 | (P)$^2$/I | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 | (S) | -0.0055 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | | |

**Model Tested:** AE-21
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254 USA

MODEL: American Energy AE-32E
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1999-001I

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 43 | 33 | 23 | A (-9°F) | 41 | 31 | 21 |
| B (5°C) | 38 | 28 | 18 | B (9°F) | 36 | 26 | 17 |
| C (20°C) | 30 | 20 | 10 | C (36°F) | 29 | 19 | 9 |
| D (50°C) | 13 | 5 | | D (90°F) | 13 | 5 | |
| E (80°C) | 1 | | | E (144°F) | | | |

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

Original Certification Date: February 12, 2001

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.965 | m$^2$ | 31.92 | ft$^2$ | **Net Aperture Area:** | 2.781 | m$^2$ | 29.94 | ft$^2$ |
| **Dry Weight:** | 50.8 | kg | 112 | lb | **Fluid Capacity:** | 4.9 | l | 1.3 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.638 | -4.2645 | (P)/I | -0.0297 | (P)$^2$/I | 0.655 | -6.37 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.638 | -0.7515 | (P)/I | -0.0029 | (P)$^2$/I | 0.655 | -1.123 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0248 | (S) | -0.0861 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.05 | (S) | (Linear Fit) | | |

**Model Tested:** AE-21E
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.61 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254 USA

MODEL: Alternate Energy AE-40
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2002-001F

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 55 | 41 | 28 | A (-9°F) | 52 | 39 | 27 |
| B (5°C) | 50 | 36 | 23 | B (9°F) | 47 | 35 | 22 |
| C (20°C) | 42 | 29 | 16 | C (36°F) | 40 | 27 | 15 |
| D (50°C) | 25 | 13 | 3 | D (90°F) | 24 | 13 | 3 |
| E (80°C) | 10 | 1 | | E (144°F) | 9 | 1 | |

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

Original Certification Date: November 22, 2002

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.696 | m$^2$ | 39.78 | ft$^2$ | **Net Aperture Area:** | 3.481 | m$^2$ | 37.47 | ft$^2$ |
| **Dry Weight:** | 69.4 | kg | 153 | lb | **Fluid Capacity:** | 6.1 | l | 1.6 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 | (P)$^2$/I | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 | (P)$^2$/I | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 | (S) | -0.0055 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | | |

**Model Tested:** AE-21
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254 USA

MODEL: American Energy AE-40E
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1999-001C

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
| A (-5°C) | 54 | 41 | 28 | A (-9°F) | 51 | 39 | 27 |
| B (5°C) | 48 | 35 | 22 | B (9°F) | 45 | 33 | 21 |
| C (20°C) | 38 | 25 | 12 | C (36°F) | 36 | 24 | 12 |
| D (50°C) | 17 | 6 | | D (90°F) | 16 | 6 | |
| E (80°C) | 1 | | | E (144°F) | 1 | | |

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

Original Certification Date: June 15, 1999

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.696 | $m^2$ | 39.78 | $ft^2$ | **Net Aperture Area:** | 3.481 | $m^2$ | 37.47 | $ft^2$ |
| **Dry Weight:** | 65.3 | kg | 144 | lb | **Fluid Capacity:** | 6.1 | l | 1.6 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.638 | -4.2645 | (P)/I | -0.0297 | $(P)^2/I$ | 0.655 | -6.37 | $W/m^2 \cdot °C$ |
| **I P Units:** | $\eta$ = | 0.638 | -0.7515 | (P)/I | -0.0029 | $(P)^2/I$ | 0.655 | -1.123 | $Btu/hr \cdot ft^2 \cdot °F$ |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0248 (S) | -0.0861 | $(S)^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.05 (S) | (Linear Fit) | | |

**Model Tested:** AE-21E
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.61 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254 USA

MODEL: Alternate Energy AE-50
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2002-001H

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
| A (-5°C) | 69 | 52 | 35 | A (-9°F) | 66 | 50 | 34 |
| B (5°C) | 63 | 46 | 29 | B (9°F) | 60 | 44 | 28 |
| C (20°C) | 53 | 36 | 20 | C (36°F) | 50 | 34 | 19 |
| D (50°C) | 32 | 17 | 4 | D (90°F) | 30 | 16 | 4 |
| E (80°C) | 12 | 2 | | E (144°F) | 12 | 2 | |

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

Original Certification Date: August 5, 2005

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 4.664 | $m^2$ | 50.20 | $ft^2$ | **Net Aperture Area:** | 4.400 | $m^2$ | 47.36 | $ft^2$ |
| **Dry Weight:** | 82.54 | kg | 182 | lb | **Fluid Capacity:** | 6.4 | l | 1.7 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 | $(P)^2/I$ | 0.706 | -4.9099 | $W/m^2 \cdot °C$ |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 | $(P)^2/I$ | 0.706 | -0.865 | $Btu/hr \cdot ft^2 \cdot °F$ |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 | (S) | -0.0055 | $(S)^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | |

**Model Tested:** AE-21
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254 USA

MODEL: Alternate Energy AE-56
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2002-001G

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 77 | 58 | 39 | A (-9°F) | 73 | 55 | 37 |
| B (5°C) | 70 | 51 | 32 | B (9°F) | 66 | 48 | 31 |
| C (20°C) | 58 | 40 | 22 | C (36°F) | 55 | 38 | 21 |
| D (50°C) | 35 | 19 | 4 | D (90°F) | 33 | 18 | 4 |
| E (80°C) | 14 | 2 | | E (144°F) | 13 | 2 | |

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

Original Certification Date: April 12, 2004

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 5.175 | m$^2$ | 55.71 | ft$^2$ | **Net Aperture Area:** | 4.898 | m$^2$ | 52.72 | ft$^2$ |
| **Dry Weight:** | 92.5 | kg | 204 | lb | **Fluid Capacity:** | 6.8 | l | 1.8 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 | (P)$^2$/I | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 | (P)$^2$/I | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 | (S) | -0.0055 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | |

**Model Tested:** AE-21
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254 USA

MODEL: Morning Star MSC-21
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2002-002A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 30 | 22 | 15 | A (-9°F) | 28 | 21 | 14 |
| B (5°C) | 27 | 20 | 12 | B (9°F) | 26 | 19 | 12 |
| C (20°C) | 23 | 15 | 8 | C (36°F) | 21 | 15 | 8 |
| D (50°C) | 14 | 7 | 2 | D (90°F) | 13 | 7 | 2 |
| E (80°C) | 5 | 1 | | E (144°F) | 5 | 1 | |

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

Original Certification Date: November 22, 2002

## COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.997 | m$^2$ | 21.50 | ft$^2$ | **Net Aperture Area:** | 1.760 | m$^2$ | 18.95 | ft$^2$ |
| **Dry Weight:** | 37.2 | kg | 82 | lb | **Fluid Capacity:** | 3.2 | l | 0.8 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 | (P)$^2$/I | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 | (P)$^2$/I | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 | (S) | -0.0055 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | |

**Model Tested:** AE-21
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254 USA

MODEL: Morning Star MSC-21E
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1999-001D

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 29 | 22 | 15 | A (-9°F) | 28 | 21 | 14 |
| B (5°C) | 26 | 19 | 12 | B (9°F) | 24 | 18 | 11 |
| C (20°C) | 20 | 14 | 7 | C (36°F) | 19 | 13 | 6 |
| D (50°C) | 9 | 3 | | D (90°F) | 9 | 3 | |
| E (80°C) | | | | E (144°F) | | | |

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

Original Certification Date: June 15, 1999

## COLLECTOR SPECIFICATIONS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.999 | m$^2$ | 21.52 | ft$^2$ | **Net Aperture Area:** | 1.748 | m$^2$ | 18.82 | ft$^2$ |
| **Dry Weight:** | 47.6 | kg | 105 | lb | **Fluid Capacity:** | 3.0 | l | 0.8 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 55 | 0.22 |
| 50 | 0.79 | 306 | 1.23 |
| 80 | 1.27 | 745 | 2.99 |

## TECHNICAL INFORMATION

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

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | **Y Intercept** | **Slope** | |
| **S I Units:** | $\eta$ = | 0.638 | -4.2645 | (P)/I | -0.0297 | (P)$^2$/I | 0.655 | -6.37 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.638 | -0.7515 | (P)/I | -0.0029 | (P)$^2$/I | 0.655 | -1.123 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0248 | (S) | -0.0861 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.05 | (S) | (Linear Fit) | | |

**Model Tested:** AE-21E
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.61 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254 USA

MODEL: Morning Star MSC-24
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2002-002B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 34 | 25 | 17 | A (-9°F) | 32 | 24 | 16 |
| B (5°C) | 31 | 22 | 14 | B (9°F) | 29 | 21 | 13 |
| C (20°C) | 26 | 18 | 10 | C (36°F) | 24 | 17 | 9 |
| D (50°C) | 15 | 8 | 2 | D (90°F) | 15 | 8 | 2 |
| E (80°C) | 6 | 1 | | E (144°F) | 6 | 1 | |

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

Original Certification Date: November 22, 2002

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.276 | m$^2$ | 24.50 | ft$^2$ | **Net Aperture Area:** | 2.015 | m$^2$ | 21.69 | ft$^2$ |
| **Dry Weight:** | 46.3 | kg | 102 | lb | **Fluid Capacity:** | 3.4 | l | 0.9 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 | (P)$^2$/I | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 | (P)$^2$/I | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 | (S) | -0.0055 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | | |

**Model Tested:** AE-21
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254 USA

MODEL: Morning Star MSC-24E
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1999-001E

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 33 | 25 | 17 | A (-9°F) | 31 | 24 | 16 |
| B (5°C) | 29 | 21 | 13 | B (9°F) | 28 | 20 | 13 |
| C (20°C) | 23 | 15 | 8 | C (36°F) | 22 | 15 | 7 |
| D (50°C) | 10 | 4 | | D (90°F) | 10 | 4 | |
| E (80°C) | | | | E (144°F) | | | |

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

Original Certification Date: June 15, 1999

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.265 | m$^2$ | 24.38 | ft$^2$ | **Net Aperture Area:** | 2.002 | m$^2$ | 21.55 | ft$^2$ |
| **Dry Weight:** | 49.9 | kg | 110 | lb | **Fluid Capacity:** | 3.4 | l | 0.9 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.638 | -4.2645 | (P)/I | -0.0297 | (P)$^2$/I | 0.655 | -6.37 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.638 | -0.7515 | (P)/I | -0.0029 | (P)$^2$/I | 0.655 | -1.123 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0248 | (S) | -0.0861 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.05 | (S) | (Linear Fit) | | |

**Model Tested:** AE-21E
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.61 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254 USA

MODEL: Morning Star MSC-26
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2002-002C

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 36 | 27 | 18 | A (-9°F) | 34 | 26 | 17 |
| B (5°C) | 33 | 24 | 15 | B (9°F) | 31 | 23 | 14 |
| C (20°C) | 27 | 19 | 10 | C (36°F) | 26 | 18 | 10 |
| D (50°C) | 16 | 9 | 2 | D (90°F) | 16 | 8 | 2 |
| E (80°C) | 6 | 1 | | E (144°F) | 6 | 1 | |

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

Original Certification Date: November 22, 2002

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.416 | m$^2$ | 26.01 | ft$^2$ | **Net Aperture Area:** | 2.171 | m$^2$ | 23.37 | ft$^2$ |
| **Dry Weight:** | 46.3 | kg | 102 | lb | **Fluid Capacity:** | 4.2 | l | 1.1 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 | (P)$^2$/I | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 | (P)$^2$/I | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 | (S) | -0.0055 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | |

**Model Tested:** AE-21
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254 USA

MODEL: Morning Star MSC-26E
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1999-001J

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 35 | 27 | 18 | A (-9°F) | 33 | 25 | 17 |
| B (5°C) | 31 | 23 | 14 | B (9°F) | 29 | 21 | 13 |
| C (20°C) | 24 | 16 | 8 | C (36°F) | 23 | 15 | 8 |
| D (50°C) | 11 | 4 | | D (90°F) | 10 | 4 | |
| E (80°C) | | | | E (144°F) | | | |

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

Original Certification Date: February 12, 2001

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.405 | m$^2$ | 25.89 | ft$^2$ | **Net Aperture Area:** | 2.158 | m$^2$ | 23.23 | ft$^2$ |
| **Dry Weight:** | 52.2 | kg | 115 | lb | **Fluid Capacity:** | 3.8 | l | 1.0 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.638 | -4.2645 | (P)/I | -0.0297 | (P)$^2$/I | 0.655 | -6.37 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.638 | -0.7515 | (P)/I | -0.0029 | (P)$^2$/I | 0.655 | -1.123 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0248 | (S) | -0.0861 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.05 | (S) | (Linear Fit) | | |

**Model Tested:** AE-21E
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.61 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254 USA

MODEL: Morning Star MSC-28
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2002-002D

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 39 | 30 | 20 | A (-9°F) | 37 | 28 | 19 |
| B (5°C) | 36 | 26 | 17 | B (9°F) | 34 | 25 | 16 |
| C (20°C) | 30 | 21 | 11 | C (36°F) | 29 | 20 | 11 |
| D (50°C) | 18 | 10 | 2 | D (90°F) | 17 | 9 | 2 |
| E (80°C) | 7 | 1 | | E (144°F) | 7 | 1 | |

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

Original Certification Date: November 22, 2002

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.663 | m$^2$ | 28.67 | ft$^2$ | **Net Aperture Area:** | 2.403 | m$^2$ | 25.87 | ft$^2$ |
| **Dry Weight:** | 54.4 | kg | 120 | lb | **Fluid Capacity:** | 4.5 | l | 1.2 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 | (P)$^2$/I | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 | (P)$^2$/I | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 | (S) | -0.0055 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | | |

**Model Tested:** AE-21
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254 USA

MODEL: Morning Star MSC-28E
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1999-001G

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 39 | 29 | 20 | A (-9°F) | 37 | 28 | 19 |
| B (5°C) | 34 | 25 | 16 | B (9°F) | 32 | 24 | 15 |
| C (20°C) | 27 | 18 | 9 | C (36°F) | 26 | 17 | 8 |
| D (50°C) | 12 | 5 | | D (90°F) | 11 | 4 | |
| E (80°C) | | | | E (144°F) | | | |

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

Original Certification Date: May 1, 2000

## COLLECTOR SPECIFICATIONS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.652 | m$^2$ | 28.55 | ft$^2$ | **Net Aperture Area:** | 2.389 | m$^2$ | 25.72 | ft$^2$ |
| **Dry Weight:** | 54.4 | kg | 120 | lb | **Fluid Capacity:** | 4.2 | l | 1.1 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.638 | -4.2640 | (P)/I | -0.0297 | (P)$^2$/I | 0.655 | -6.37 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.638 | -0.7514 | (P)/I | -0.0029 | (P)$^2$/I | 0.655 | -1.123 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0248 | (S) | -0.0861 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.05 | (S) | (Linear Fit) | | |

**Model Tested:** AE-21E
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.61 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254 USA

MODEL: Morning Star MSC-32
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2002-002E

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 45 | 34 | 23 | A (-9°F) | 43 | 32 | 22 |
| B (5°C) | 41 | 30 | 19 | B (9°F) | 39 | 28 | 18 |
| C (20°C) | 34 | 23 | 13 | C (36°F) | 32 | 22 | 12 |
| D (50°C) | 21 | 11 | 2 | D (90°F) | 20 | 10 | 2 |
| E (80°C) | 8 | 1 | | E (144°F) | 8 | 1 | |

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

Original Certification Date: November 22, 2002

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.035 | m$^2$ | 32.67 | ft$^2$ | **Net Aperture Area:** | 2.750 | m$^2$ | 29.60 | ft$^2$ |
| **Dry Weight:** | 60.3 | kg | 133 | lb | **Fluid Capacity:** | 4.9 | l | 1.3 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 | (P)$^2$/I | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 | (P)$^2$/I | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 | (S) | -0.0055 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | | |

**Model Tested:** AE-21
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254 USA

MODEL: Morning Star MSC-32E
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1999-001K

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 44 | 34 | 23 | A (-9°F) | 42 | 32 | 22 |
| B (5°C) | 39 | 28 | 18 | B (9°F) | 37 | 27 | 17 |
| C (20°C) | 31 | 20 | 10 | C (36°F) | 29 | 19 | 10 |
| D (50°C) | 14 | 5 | | D (90°F) | 13 | 5 | |
| E (80°C) | 1 | | | E (144°F) | 1 | | |

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

Original Certification Date: February 12, 2001

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.023 | m$^2$ | 32.54 | ft$^2$ | **Net Aperture Area:** | 2.736 | m$^2$ | 29.45 | ft$^2$ |
| **Dry Weight:** | 57.6 | kg | 127 | lb | **Fluid Capacity:** | 4.9 | l | 1.3 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.638 | -4.2645 | (P)/I | -0.0297 | (P)$^2$/I | 0.655 | -6.37 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.638 | -0.7515 | (P)/I | -0.0029 | (P)$^2$/I | 0.655 | -1.123 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0248 | (S) | -0.0861 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.05 | (S) | (Linear Fit) | | |

**Model Tested:** AE-21E
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.61 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254 USA

MODEL: Morning Star MSC-40
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2002-002F

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 58 | 44 | 30 | A (-9°F) | 55 | 42 | 28 |
| B (5°C) | 53 | 39 | 24 | B (9°F) | 50 | 37 | 23 |
| C (20°C) | 44 | 30 | 17 | C (36°F) | 42 | 29 | 16 |
| D (50°C) | 27 | 14 | 3 | D (90°F) | 25 | 13 | 3 |
| E (80°C) | 10 | 1 | | E (144°F) | 10 | 1 | |

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

Original Certification Date: November 22, 2002

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.916 | m$^2$ | 42.15 | ft$^2$ | **Net Aperture Area:** | 3.580 | m$^2$ | 38.54 | ft$^2$ |
| **Dry Weight:** | 72.1 | kg | 159 | lb | **Fluid Capacity:** | 6.1 | l | 1.6 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 | (P)$^2$/I | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 | (P)$^2$/I | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 | (S) | -0.0055 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | | |

**Model Tested:** AE-21
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254 USA

MODEL: Morning Star MSC-40E
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1999-001L

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 55 | 42 | 29 | A (-9°F) | 52 | 40 | 27 |
| B (5°C) | 49 | 35 | 22 | B (9°F) | 46 | 34 | 21 |
| C (20°C) | 38 | 25 | 13 | C (36°F) | 36 | 24 | 12 |
| D (50°C) | 17 | 7 | | D (90°F) | 16 | 6 | |
| E (80°C) | 1 | | | E (144°F) | 1 | | |

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

Original Certification Date: February 12, 2001

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.764 | m$^2$ | 40.52 | ft$^2$ | **Net Aperture Area:** | 3.428 | m$^2$ | 36.90 | ft$^2$ |
| **Dry Weight:** | 76.6 | kg | 169 | lb | **Fluid Capacity:** | 6.1 | l | 1.6 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.638 | -4.2645 | (P)/I | -0.0297 | (P)$^2$/I | 0.655 | -6.37 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.638 | -0.7515 | (P)/I | -0.0029 | (P)$^2$/I | 0.655 | -1.123 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0248 | (S) | -0.0861 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.05 | (S) | (Linear Fit) | | |

**Model Tested:** AE-21E
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.61 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254 USA

MODEL: Starfire ST-21E
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1999-002A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 29 | 22 | 15 | A (-9°F) | 28 | 21 | 14 |
| B (5°C) | 26 | 18 | 12 | B (9°F) | 24 | 18 | 11 |
| C (20°C) | 20 | 13 | 6 | C (36°F) | 19 | 13 | 6 |
| D (50°C) | 10 | 4 | | D (90°F) | 9 | 4 | |
| E (80°C) | 1 | | | E (144°F) | 1 | | |

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

Original Certification Date: June 15, 1999

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.967 | m$^2$ | 21.17 | ft$^2$ | **Net Aperture Area:** | 1.876 | m$^2$ | 20.19 | ft$^2$ |
| **Dry Weight:** | 38.6 | kg | 85 | lb | **Fluid Capacity:** | 1.8 | l | 0.5 | gal |
| **Test Pressure:** | 552 | kPa | 80 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Stainless Steel |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 78 | 0.31 |
| 50 | 0.79 | 338 | 1.36 |
| 80 | 1.27 | 768 | 3.08 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.665 | -4.7160 | (P)/I | -0.0185 | (P)$^2$/I | 0.674 | -6.02 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.665 | -0.8311 | (P)/I | -0.0018 | (P)$^2$/I | 0.674 | -1.061 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.0476 | (S) | -0.1212 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.15 | (S) | (Linear Fit) | | |

**Model Tested:** ST-21E
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.61 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254 USA

MODEL: Starfire ST-40E
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1999-002B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 53 | 40 | 28 | A (-9°F) | 50 | 38 | 26 |
| B (5°C) | 46 | 34 | 21 | B (9°F) | 44 | 32 | 20 |
| C (20°C) | 36 | 24 | 12 | C (36°F) | 35 | 23 | 11 |
| D (50°C) | 18 | 7 | | D (90°F) | 17 | 7 | |
| E (80°C) | 3 | | | E (144°F) | 2 | | |

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

Original Certification Date: June 15, 1999

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.575 | m$^2$ | 38.48 | ft$^2$ | **Net Aperture Area:** | 3.468 | m$^2$ | 37.33 | ft$^2$ |
| **Dry Weight:** | 79.5 | kg | 175 | lb | **Fluid Capacity:** | 6.1 | l | 1.6 | gal |
| **Test Pressure:** | 552 | kPa | 80 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Stainless Steel |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.665 | -4.7160 | (P)/I | -0.0185 | (P)$^2$/I | 0.674 | -6.02 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.665 | -0.8311 | (P)/I | -0.0018 | (P)$^2$/I | 0.674 | -1.061 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.0476 | (S) | -0.1212 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.15 | (S) | (Linear Fit) | |

**Model Tested:** ST-21E
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.61 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

# CERTIFIED SOLAR COLLECTOR

SUPPLIER: **American Solar Works Holdings**
295 Princeton Hightstown Road, Unit 251
West Windsot, NJ 08550 USA

MODEL: American Solar Works ASW52B
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-2006-009A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 26 | 19 | 13 | A (-9°F) | 24 | 18 | 12 |
| B (5°C) | 25 | 18 | 12 | B (9°F) | 23 | 17 | 11 |
| C (20°C) | 23 | 16 | 10 | C (36°F) | 22 | 16 | 10 |
| D (50°C) | 18 | 12 | 6 | D (90°F) | 17 | 11 | 6 |
| E (80°C) | 13 | 7 | 1 | E (144°F) | 12 | 6 | 1 |

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

Original Certification Date: January 18, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.864 | m$^2$ | 30.83 | ft$^2$ | **Net Aperture Area:** | 2.466 | m$^2$ | 26.54 | ft$^2$ |
| **Dry Weight:** | 62.6 | kg | 138 | lb | **Fluid Capacity:** | 1.3 | l | 0.3 | gal |
| **Test Pressure:** | 827 | kPa | 120 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Stainless Steel |
| **Cover (Outer):** | Glass Vacuum Tube |
| **Cover (Inner):** | |
| **Absorber Material:** | Tube - Copper / Plate - Aluminum |
| **Absorber Coating:** | Sputtered aluminium nitride |
| **Insulation (Side):** | Vacuum |
| **Insulation (Back):** | Vacuum |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 62 | 0.25 |
| 50 | 0.79 | 284 | 1.14 |
| 80 | 1.27 | 660 | 2.65 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.474 | -0.8937 | (P)/I | -0.0118 | (P)$^2$/I | 0.481 | -1.6522 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.474 | -0.1575 | (P)/I | -0.0012 | (P)$^2$/I | 0.481 | -0.291 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.7534 | (S) | -1.1963 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.50 | (S) | (Linear Fit) | | |

**Model Tested:** ASW52B
**Test Fluid:** Water
**Test Flow Rate:** 57 ml/s 0.90 gpm

**REMARKS:** Tested with long axis of tubes oriented north-south. IAM perpendicular to the tubes is listed above. IAM parallel to the tubes = 1.0 - 0.59(S)

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **American Solar Works Holdings**
295 Princeton Hightstown Road, Unit 251
West Windsot, NJ 08550 USA

MODEL: American Solar Works ASW52B Stretch
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-2006-009B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 35 | 26 | 18 | A (-9°F) | 33 | 25 | 17 |
| B (5°C) | 34 | 25 | 16 | B (9°F) | 32 | 24 | 15 |
| C (20°C) | 31 | 22 | 14 | C (36°F) | 29 | 21 | 13 |
| D (50°C) | 25 | 16 | 8 | D (90°F) | 24 | 16 | 8 |
| E (80°C) | 18 | 9 | 2 | E (144°F) | 17 | 9 | 2 |

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

Original Certification Date: September 20, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.905 | m$^2$ | 42.03 | ft$^2$ | **Net Aperture Area:** | 3.384 | m$^2$ | 36.43 | ft$^2$ |
| **Dry Weight:** | 85.1 | kg | 188 | lb | **Fluid Capacity:** | 1.8 | l | 0.5 | gal |
| **Test Pressure:** | 827 | kPa | 120 | psig | | | | | |

## COLLECTOR MATERIALS

**Frame:** Stainless Steel
**Cover (Outer):** Glass Vacuum Tube
**Cover (Inner):**
**Absorber Material:** Tube - Copper / Plate - Aluminum
**Absorber Coating:** Sputtered aluminium nitride
**Insulation (Side):** Vacuum
**Insulation (Back):** Vacuum

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.474 | -0.8937 | (P)/I | -0.0118 | (P)$^2$/I | 0.481 | -1.6522 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.474 | -0.1575 | (P)/I | -0.0012 | (P)$^2$/I | 0.481 | -0.291 | Btu/hr·ft$^2$·°F |

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

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.7534 | (S) | -1.1963 | (S)$^2$ | **Model Tested:** | ASW52B |
| $K_{\alpha\tau}$ = | 1.0 | -0.50 | (S) | (Linear Fit) | | **Test Fluid:** | Water |
| | | | | | | **Test Flow Rate:** | 57 ml/s 0.90 gpm |

**REMARKS:** Tested with long axis of tubes oriented north-south. IAM perpendicular to the tubes is listed above. IAM parallel to the tubes = 1.0 - 0.59(S)

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Apricus Solar Co., Ltd.**
402 Building 8 East
Pukou New and High Tech Development Zone
Nanjing, 210061 China

MODEL: Apricus AP-10
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-2004-003C

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 13 | 10 | 7 | A (-9°F) | 13 | 10 | 7 |
| B (5°C) | 13 | 10 | 6 | B (9°F) | 12 | 9 | 6 |
| C (20°C) | 12 | 9 | 6 | C (36°F) | 12 | 8 | 5 |
| D (50°C) | 11 | 7 | 4 | D (90°F) | 10 | 7 | 4 |
| E (80°C) | 9 | 6 | 3 | E (144°F) | 8 | 5 | 2 |

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

Original Certification Date: July 1, 2004

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.342 | m$^2$ | 14.45 | ft$^2$ | **Net Aperture Area:** | 1.169 | m$^2$ | 12.58 | ft$^2$ |
| **Dry Weight:** | 34.8 | kg | 77 | lb | **Fluid Capacity:** | 0.3 | l | 0.1 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Stainless Steel |
| **Cover (Outer):** | Glass Vacuum Tube |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper & steel / Plate - Glass |
| **Absorber Coating:** | Sputtered aluminum nitride |
| **Insulation (Side):** | Vacuum |
| **Insulation (Back):** | Vacuum |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.416 | -0.9646 (P)/I | -0.0023 (P)$^2$/I | | 0.418 | -1.17 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.416 | -0.1700 (P)/I | -0.0002 (P)$^2$/I | | 0.418 | -0.206 | Btu/hr·ft$^2$·°F |

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

$K_{\alpha\tau}$ = 1.0 +1.1718 (S) -0.8470 (S)$^2$

$K_{\alpha\tau}$ = 1.0 +0.29 (S) (Linear Fit)

**Model Tested:** AP-20
**Test Fluid:** Water
**Test Flow Rate:** 55 ml/s 0.86 gpm

**REMARKS:** Collector tested with long axis of tubes oriented north-south. IAM perpendicular to the tubes is listed above. IAM parallel to the tubes = 1.0 - 0.13(S)

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Apricus Solar Co., Ltd.**
402 Building 8 East
Pukou New and High Tech Development Zone
Nanjing, 210061 China

MODEL: Apricus AP-20
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-2004-003A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
| A (-5°C) | 27 | 21 | 14 | A (-9°F) | 26 | 19 | 13 |
| B (5°C) | 26 | 20 | 13 | B (9°F) | 25 | 19 | 12 |
| C (20°C) | 25 | 18 | 11 | C (36°F) | 23 | 17 | 11 |
| D (50°C) | 21 | 15 | 8 | D (90°F) | 20 | 14 | 8 |
| E (80°C) | 18 | 11 | 5 | E (144°F) | 17 | 11 | 5 |

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

Original Certification Date: March 11, 2004

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.709 | $m^2$ | 29.16 | $ft^2$ | **Net Aperture Area:** | 2.378 | $m^2$ | 25.60 | $ft^2$ |
| **Dry Weight:** | 56.9 | kg | 125 | lb | **Fluid Capacity:** | 0.5 | l | 0.1 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Stainless Steel |
| **Cover (Outer):** | Glass Vacuum Tube |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper & steel / Plate - Glass |
| **Absorber Coating:** | Sputtered aluminum nitride |
| **Insulation (Side):** | Vacuum |
| **Insulation (Back):** | Vacuum |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| 55 | 0.86 | 700 | 2.81 |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = 0.416 | -0.9646 | (P)/I | -0.0023 | $(P)^2/I$ | 0.418 | -1.17 | $W/m^2 \cdot °C$ |
| **I P Units:** | $\eta$ = 0.416 | -0.1700 | (P)/I | -0.0002 | $(P)^2/I$ | 0.418 | -0.206 | $Btu/hr \cdot ft^2 \cdot °F$ |

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

$K_{\alpha\tau}$ = 1.0 +1.1718 (S) -0.8470 $(S)^2$

$K_{\alpha\tau}$ = 1.0 +0.29 (S) (Linear Fit)

**Model Tested:** AP-20
**Test Fluid:** Water
**Test Flow Rate:** 55 ml/s 0.86 gpm

**REMARKS:** Collector tested with long axis of tubes oriented north-south. IAM perpendicular to the tubes is listed above. IAM parallel to the tubes = 1.0 - 0.13(S)

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Apricus Solar Co., Ltd.**
402 Building 8 East
Pukou New and High Tech Development Zone
Nanjing, 210061 China

MODEL: Apricus AP-22
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-2004-003D

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 30 | 23 | 15 | A (-9°F) | 28 | 21 | 14 |
| B (5°C) | 29 | 21 | 14 | B (9°F) | 27 | 20 | 13 |
| C (20°C) | 27 | 20 | 12 | C (36°F) | 26 | 19 | 12 |
| D (50°C) | 24 | 16 | 9 | D (90°F) | 22 | 15 | 9 |
| E (80°C) | 20 | 13 | 6 | E (144°F) | 19 | 12 | 5 |

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

Original Certification Date: July 1, 2004

## COLLECTOR SPECIFICATIONS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.983 | m$^2$ | 32.11 | ft$^2$ | **Net Aperture Area:** | 2.620 | m$^2$ | 28.20 | ft$^2$ |
| **Dry Weight:** | 71.3 | kg | 157 | lb | **Fluid Capacity:** | 0.6 | l | 0.2 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

**Frame:** Stainless Steel
**Cover (Outer):** Glass Vacuum Tube
**Cover (Inner):** None
**Absorber Material:** Tube - Copper & steel / Plate - Glass
**Absorber Coating:** Sputtered aluminum nitride
**Insulation (Side):** Vacuum
**Insulation (Back):** Vacuum

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = 0.416 | -0.9646 | (P)/I | -0.0023 | (P)$^2$/I | 0.418 | -1.17 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = 0.416 | -0.1700 | (P)/I | -0.0002 | (P)$^2$/I | 0.418 | -0.206 | Btu/hr·ft$^2$·°F |

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

$K_{\alpha\tau}$ = 1.0 +1.1718 (S) -0.8470 (S)$^2$
$K_{\alpha\tau}$ = 1.0 +0.29 (S) (Linear Fit)

**Model Tested:** AP-20
**Test Fluid:** Water
**Test Flow Rate:** 55 ml/s 0.86 gpm

**REMARKS:** Collector tested with long axis of tubes oriented north-south. IAM perpendicular to the tubes is listed above. IAM parallel to the tubes = 1.0 - 0.13(S)

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Apricus Solar Co., Ltd.**
402 Building 8 East
Pukou New and High Tech Development Zone
Nanjing, 210061 China

MODEL: Apricus AP-30
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-2004-003B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 41 | 31 | 21 | A (-9°F) | 39 | 29 | 20 |
| B (5°C) | 39 | 29 | 19 | B (9°F) | 37 | 28 | 18 |
| C (20°C) | 37 | 27 | 17 | C (36°F) | 35 | 25 | 16 |
| D (50°C) | 32 | 22 | 12 | D (90°F) | 30 | 21 | 12 |
| E (80°C) | 27 | 17 | 8 | E (144°F) | 26 | 16 | 7 |

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

Original Certification Date: March 11, 2004

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 4.053 | m$^2$ | 43.63 | ft$^2$ | **Net Aperture Area:** | 3.795 | m$^2$ | 40.85 | ft$^2$ |
| **Dry Weight:** | 82.5 | kg | 182 | lb | **Fluid Capacity:** | 0.7 | l | 0.2 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

**Frame:** Stainless Steel
**Cover (Outer):** Glass Vacuum Tube
**Cover (Inner):** None
**Absorber Material:** Tube - Copper & steel / Plate - Glass
**Absorber Coating:** Sputtered aluminum nitride
**Insulation (Side):** Vacuum
**Insulation (Back):** Vacuum

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = 0.416 | -0.9646 | (P)/I | -0.0023 | (P)$^2$/I | 0.418 | -1.17 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = 0.416 | -0.1700 | (P)/I | -0.0002 | (P)$^2$/I | 0.418 | -0.206 | Btu/hr·ft$^2$·°F |

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

$K_{\alpha\tau}$ = 1.0 +1.1718 (S) -0.8470 (S)$^2$
$K_{\alpha\tau}$ = 1.0 +0.29 (S) (Linear Fit)

**Model Tested:** AP-20
**Test Fluid:** Water
**Test Flow Rate:** 55 ml/s 0.86 gpm

**REMARKS:** Collector tested with long axis of tubes oriented north-south. IAM perpendicular to the tubes is listed above. IAM parallel to the tubes = 1.0 - 0.13(S)

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **BBT North America Corp**
50 Wentworth Ave
Londonderry, NH 03053 USA

MODEL: Bosch FKC-1 s+w
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2007-043A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 38 | 29 | 20 | A (-9°F) | 36 | 27 | 19 |
| B (5°C) | 34 | 25 | 16 | B (9°F) | 32 | 24 | 15 |
| C (20°C) | 29 | 19 | 10 | C (36°F) | 27 | 18 | 10 |
| D (50°C) | 18 | 10 | 3 | D (90°F) | 17 | 10 | 2 |
| E (80°C) | 9 | 3 | | E (144°F) | 9 | 2 | |

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

Original Certification Date: November 14, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.412 | m$^2$ | 25.96 | ft$^2$ | **Net Aperture Area:** | 2.257 | m$^2$ | 24.29 | ft$^2$ |
| **Dry Weight:** | 41.1 | kg | 91 | lb | **Fluid Capacity:** | 0.9 | l | 0.2 | gal |
| **Test Pressure:** | 255 | kPa | 37 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Fiberglass |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Mineral Wool |
| **Insulation (Back):** | Mineral Wool |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 295 | 1.18 |
| 50 | 0.79 | 985 | 3.95 |
| 80 | 1.27 | 1972 | 7.92 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.72 | -4.0241 | (P)/I | -0.0070 | (P)$^2$/I | 0.723 | -4.4393 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.72 | -0.7092 | (P)/I | -0.0007 | (P)$^2$/I | 0.723 | -0.782 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.0169 | (S) | -0.2340 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.26 | (S) | (Linear Fit) | | |

**Model Tested:** SKN 3.0-s
**Test Fluid:** Water
**Test Flow Rate:** 48 ml/s 0.76 gpm

**REMARKS:** Fluid capacity for the vertical model is reported above. Fluid capacity for the horizontal model is 1.25 l (0.33 gal).

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **BBT North America Corp**
50 Wentworth Ave
Londonderry, NH 03053 USA

MODEL: Buderus SKN 3.0-s+w (Vert-Horiz)
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2007-005A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 38 | 29 | 20 | A (-9°F) | 36 | 27 | 19 |
| B (5°C) | 34 | 25 | 16 | B (9°F) | 32 | 24 | 15 |
| C (20°C) | 29 | 19 | 10 | C (36°F) | 27 | 18 | 10 |
| D (50°C) | 18 | 10 | 3 | D (90°F) | 17 | 10 | 2 |
| E (80°C) | 9 | 3 | | E (144°F) | 9 | 2 | |

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

Original Certification Date: November 14, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.412 | m$^2$ | 25.96 | ft$^2$ | **Net Aperture Area:** | 2.257 | m$^2$ | 24.29 | ft$^2$ |
| **Dry Weight:** | 41.1 | kg | 91 | lb | **Fluid Capacity:** | 0.9 | l | 0.2 | gal |
| **Test Pressure:** | 255 | kPa | 37 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Fiberglass |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Mineral Wool |
| **Insulation (Back):** | Mineral Wool |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 295 | 1.18 |
| 50 | 0.79 | 985 | 3.95 |
| 80 | 1.27 | 1972 | 7.92 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.72 | -4.0241 | (P)/I | -0.0070 | (P)$^2$/I | 0.723 | -4.4393 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.72 | -0.7092 | (P)/I | -0.0007 | (P)$^2$/I | 0.723 | -0.782 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.0169 | (S) | -0.2340 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.26 | (S) | (Linear Fit) | | |

**Model Tested:** SKN 3.0-s
**Test Fluid:** Water
**Test Flow Rate:** 48 ml/s 0.76 gpm

**REMARKS:** Fluid capacity for the vertical model is reported above. Fluid capacity for the horizontal model is 1.25 l (0.33 gal).

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **BBT North America Corp**
50 Wentworth Ave
Londonderry, NH 03053 USA

MODEL: Buderus SKS 4.0-s+w (Vert-Horiz)
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2007-006A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 38 | 29 | 19 | A (-9°F) | 36 | 27 | 18 |
| B (5°C) | 35 | 25 | 16 | B (9°F) | 33 | 24 | 15 |
| C (20°C) | 30 | 21 | 12 | C (36°F) | 28 | 20 | 11 |
| D (50°C) | 20 | 12 | 4 | D (90°F) | 19 | 11 | 4 |
| E (80°C) | 11 | 4 | | E (144°F) | 10 | 4 | |

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

Original Certification Date: November 14, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.411 | m$^2$ | 25.95 | ft$^2$ | **Net Aperture Area:** | 2.089 | m$^2$ | 22.49 | ft$^2$ |
| **Dry Weight:** | 46 | kg | 101 | lb | **Fluid Capacity:** | 1.2 | l | 0.3 | gal |
| **Test Pressure:** | 255 | kPa | 37 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Fiberglass |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Mineral Wool |
| **Insulation (Back):** | Mineral Wool |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 3294 | 13.22 |
| 50 | 0.79 | 16505 | 66.26 |
| 80 | 1.27 | 39639 | 159.14 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.709 | -3.2609 | (P)/I | -0.0120 | (P)$^2$/I | 0.715 | -3.9746 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.709 | -0.5747 | (P)/I | -0.0012 | (P)$^2$/I | 0.715 | -0.700 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.0058 | (S) | -0.1652 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.17 | (S) | (Linear Fit) | | |

**Model Tested:** SKS 4.0-s
**Test Fluid:** Water
**Test Flow Rate:** 48 ml/s 0.76 gpm

**REMARKS:** Fluid capacity for the vertical model is reported above. Fluid capacity for the horizontal model is 1.8 l (0.48 gal).

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Beijing Sunda Solar Energy Technology Co Ltd**
No. 3 Hua Yuan Road
Haidian District
Beijing, 100083 China

MODEL: SUNDA SEIDO 10-10AS/AB
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-2006-010A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 17 | 13 | 9 | A (-9°F) | 16 | 12 | 8 |
| B (5°C) | 16 | 12 | 8 | B (9°F) | 15 | 11 | 7 |
| C (20°C) | 15 | 10 | 6 | C (36°F) | 14 | 10 | 6 |
| D (50°C) | 12 | 8 | 4 | D (90°F) | 11 | 7 | 4 |
| E (80°C) | 9 | 5 | 2 | E (144°F) | 8 | 5 | 1 |

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

Original Certification Date: October 11, 2006

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.679 | m$^2$ | 18.07 | ft$^2$ | **Net Aperture Area:** | 1.487 | m$^2$ | 16.01 | ft$^2$ |
| **Dry Weight:** | 40 | kg | 88 | lb | **Fluid Capacity:** | 0.4 | l | 0.1 | gal |
| **Test Pressure:** | 1000 | kPa | 145 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Stainless Steel |
| **Cover (Outer):** | Glass Vacuum Tube |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Aluminum |
| **Absorber Coating:** | Sputtered aluminum nitrate |
| **Insulation (Side):** | Vacuum |
| **Insulation (Back):** | Vacuum |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| 20 | 0.32 | 117 | 0.47 |
| 50 | 0.79 | 520 | 2.09 |
| 80 | 1.27 | 1195 | 4.80 |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.46 | -1.2893 | (P)/I | -0.0043 (P)$^2$/I | 0.462 | -1.565 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.46 | -0.2272 | (P)/I | -0.0004 (P)$^2$/I | 0.462 | -0.276 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.1174 (S) | -0.1400 (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.03 (S) | (Linear Fit) | |

**Model Tested:** SEIDO 10-10AS/AB
**Test Fluid:** Water
**Test Flow Rate:** 34 ml/s 0.54 gpm

**REMARKS:** Tested with long axis of tubes oriented north-south. IAM perpendicular to the tubes is listed above. IAM parallel to the tubes = 1.0 - 0.09(S)

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Beijing Sunda Solar Energy Technology Co Ltd**
No. 3 Hua Yuan Road
Haidian District
Beijing, 100083 China

MODEL: SUNDA SEIDO 10-20AS/AB
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-2006-010B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 34 | 26 | 17 | A (-9°F) | 32 | 24 | 16 |
| B (5°C) | 32 | 24 | 16 | B (9°F) | 31 | 23 | 15 |
| C (20°C) | 30 | 21 | 13 | C (36°F) | 28 | 20 | 12 |
| D (50°C) | 24 | 16 | 8 | D (90°F) | 23 | 15 | 7 |
| E (80°C) | 18 | 10 | 3 | E (144°F) | 17 | 10 | 3 |

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

Original Certification Date: October 11, 2006

## COLLECTOR SPECIFICATIONS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.394 | m$^2$ | 36.53 | ft$^2$ | **Net Aperture Area:** | 3.008 | m$^2$ | 32.38 | ft$^2$ |
| **Dry Weight:** | 75 | kg | 165 | lb | **Fluid Capacity:** | 0.8 | l | 0.2 | gal |
| **Test Pressure:** | 1000 | kPa | 145 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Stainless Steel |
| **Cover (Outer):** | Glass Vacuum Tube |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Aluminum |
| **Absorber Coating:** | Sputtered aluminum nitrate |
| **Insulation (Side):** | Vacuum |
| **Insulation (Back):** | Vacuum |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = 0.46 | -1.2893 | (P)/I | -0.0043 | (P)$^2$/I | 0.462 | -1.565 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = 0.46 | -0.2272 | (P)/I | -0.0004 | (P)$^2$/I | 0.462 | -0.276 | Btu/hr·ft$^2$·°F |

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

$K_{\alpha\tau}$ = 1.0 +0.1174 (S) -0.1400 (S)$^2$

$K_{\alpha\tau}$ = 1.0 -0.03 (S) (Linear Fit)

**Model Tested:** SEIDO 10-10AS/AB
**Test Fluid:** Water
**Test Flow Rate:** 34 ml/s 0.54 gpm

**REMARKS:** Tested with long axis of tubes oriented No-So. IAM perpendicular to the tubes is listed above. IAM parallel to the tubes = 1.0 - 0.09(S)

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

# CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Beijing Sunda Solar Energy Technology Co Ltd**
No. 3 Hua Yuan Road
Haidian District
Beijing, 100083 China

MODEL: SUNDA SEIDO 1-16
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-2004-001B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 43 | 33 | 23 | A (-9°F) | 41 | 31 | 21 |
| B (5°C) | 41 | 31 | 21 | B (9°F) | 39 | 29 | 19 |
| C (20°C) | 37 | 27 | 17 | C (36°F) | 35 | 26 | 16 |
| D (50°C) | 32 | 22 | 12 | D (90°F) | 30 | 21 | 11 |
| E (80°C) | 26 | 16 | 6 | E (144°F) | 25 | 15 | 6 |

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

Original Certification Date: March 4, 2004

## COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.994 | m$^2$ | 42.99 | ft$^2$ | **Net Aperture Area:** | 3.619 | m$^2$ | 38.96 | ft$^2$ |
| **Dry Weight:** | 100.2 | kg | 221 | lb | **Fluid Capacity:** | 1.1 | l | 0.3 | gal |
| **Test Pressure:** | 1000 | kPa | 145 | psig | | | | | |

## COLLECTOR MATERIALS

**Frame:** Stainless Steel
**Cover (Outer):** Glass Vacuum Tube
**Cover (Inner):** None
**Absorber Material:** Tube - Copper / Plate - Aluminum
**Absorber Coating:** Sputtered aluminium nitride
**Insulation (Side):** Vacuum
**Insulation (Back):** Vacuum

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.526 | -1.3253 | (P)/I | -0.0042 (P)$^2$/I | 0.529 | -1.697 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.526 | -0.2336 | (P)/I | -0.0004 (P)$^2$/I | 0.529 | -0.299 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.3023 | (S) | -0.3057 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | 0.00 | (S) | (Linear Fit) | |

**Model Tested:** SEIDO1-8
**Test Fluid:** Water
**Test Flow Rate:** 36 ml/s 0.57 gpm

**REMARKS:** Collector tested with long axis of tubes oriented north-south. IAM perpendicular to the tubes is listed above. IAM parallel to the tubes = 1.0 - 0.08(S)

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Beijing Sunda Solar Energy Technology Co Ltd**
No. 3 Hua Yuan Road
Haidian District
Beijing, 100083 China

MODEL: SUNDA SEIDO 1-8
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-2004-001A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
| A (-5°C) | 21 | 16 | 11 | A (-9°F) | 20 | 16 | 11 |
| B (5°C) | 20 | 15 | 10 | B (9°F) | 19 | 15 | 10 |
| C (20°C) | 19 | 14 | 9 | C (36°F) | 18 | 13 | 8 |
| D (50°C) | 16 | 11 | 6 | D (90°F) | 15 | 10 | 6 |
| E (80°C) | 13 | 8 | 3 | E (144°F) | 12 | 8 | 3 |

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

Original Certification Date: March 4, 2004

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.997 | $m^2$ | 21.50 | $ft^2$ | **Net Aperture Area:** | 1.810 | $m^2$ | 19.48 | $ft^2$ |
| **Dry Weight:** | 47 | kg | 104 | lb | **Fluid Capacity:** | 0.7 | l | 0.2 | gal |
| **Test Pressure:** | 1000 | kPa | 145 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Stainless Steel |
| **Cover (Outer):** | Glass Vacuum Tube |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Aluminum |
| **Absorber Coating:** | Sputtered aluminium nitride |
| **Insulation (Side):** | Vacuum |
| **Insulation (Back):** | Vacuum |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| 20 | 0.32 | 75 | 0.30 |
| 50 | 0.79 | 551 | 2.21 |
| 80 | 1.27 | 1367 | 5.49 |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.5255 | -1.3253 | (P)/I | -0.0042 (P)²/I | 0.529 | -1.697 | W/m²·°C |
| **I P Units:** | $\eta$ = | 0.5255 | -0.2336 | (P)/I | -0.0004 (P)²/I | 0.529 | -0.299 | Btu/hr·ft²·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.3023 | (S) | -0.3057 | $(S)^2$ |
| $K_{\alpha\tau}$ = | 1.0 | 0.00 | (S) | (Linear Fit) | |

**Model Tested:** SEIDO1-8
**Test Fluid:** Water
**Test Flow Rate:** 36 ml/s 0.57 gpm

**REMARKS:** Collector tested with long axis of tubes oriented north-south. IAM perpendicular to the tubes is listed above. IAM parallel to the tubes = 1.0 - .08(S)

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Beijing Sunda Solar Energy Technology Co Ltd**
No. 3 Hua Yuan Road
Haidian District
Beijing, 100083 China

MODEL: SUNDA SEIDO 2-16
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-2007-025B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
| A (-5°C) | 57 | 43 | 29 | A (-9°F) | 54 | 40 | 27 |
| B (5°C) | 55 | 41 | 27 | B (9°F) | 52 | 39 | 25 |
| C (20°C) | 51 | 37 | 23 | C (36°F) | 48 | 35 | 22 |
| D (50°C) | 44 | 30 | 16 | D (90°F) | 41 | 28 | 15 |
| E (80°C) | 35 | 21 | 9 | E (144°F) | 33 | 20 | 8 |

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

Original Certification Date: August 8, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 4.101 | $m^2$ | 44.14 | $ft^2$ | **Net Aperture Area:** | 3.708 | $m^2$ | 39.91 | $ft^2$ |
| **Dry Weight:** | 100 | kg | 221 | lb | **Fluid Capacity:** | 2.9 | l | 0.8 | gal |
| **Test Pressure:** | 600 | kPa | 87 | psig | | | | | |

## COLLECTOR MATERIALS

**Frame:** Stainless Steel
**Cover (Outer):** Glass Vacuum Tube
**Cover (Inner):** None
**Absorber Material:** Tube - Copper / Plate - Aluminum
**Absorber Coating:** Sputtered Selective
**Insulation (Side):** Vacuum
**Insulation (Back):** Vacuum

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.623 | -1.2297 | (P)/I | -0.0076 (P)²/I | 0.628 | -1.719 | W/m²·°C |
| **I P Units:** | $\eta$ = | 0.623 | -0.2167 | (P)/I | -0.0007 (P)²/I | 0.628 | -0.303 | Btu/hr·ft²·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.2661 (S) | -0.3511 (S)² | |
| $K_{\alpha\tau}$ = | 1.0 | -0.10 (S) | (Linear Fit) | |

**Model Tested:** 100-2007-025A
**Test Fluid:** Water
**Test Flow Rate:** 41 ml/s 0.65 gpm

**REMARKS:** Tested with long axis of tubes oriented north-south. IAM perpendicular to the tubes is listed above. IAM parallel to the tubes = 1.0 - 0.10(S)

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Beijing Sunda Solar Energy Technology Co Ltd**
No. 3 Hua Yuan Road
Haidian District
Beijing, 100083 China

MODEL: SUNDA SEIDO 2-8
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-2007-025A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
| A (-5°C) | 28 | 21 | 14 | A (-9°F) | 27 | 20 | 13 |
| B (5°C) | 27 | 20 | 13 | B (9°F) | 26 | 19 | 13 |
| C (20°C) | 25 | 18 | 11 | C (36°F) | 24 | 17 | 11 |
| D (50°C) | 22 | 15 | 8 | D (90°F) | 21 | 14 | 8 |
| E (80°C) | 17 | 10 | 4 | E (144°F) | 16 | 10 | 4 |

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

Original Certification Date: August 8, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.032 | $m^2$ | 21.87 | $ft^2$ | **Net Aperture Area:** | 1.837 | $m^2$ | 19.77 | $ft^2$ |
| **Dry Weight:** | 50 | kg | 110 | lb | **Fluid Capacity:** | 1.5 | l | 0.4 | gal |
| **Test Pressure:** | 600 | kPa | 87 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Stainless Steel |
| **Cover (Outer):** | Glass Vacuum Tube |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Aluminum |
| **Absorber Coating:** | Sputtered Selective |
| **Insulation (Side):** | Vacuum |
| **Insulation (Back):** | Vacuum |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| 20 | 0.32 | 462 | 1.86 |
| 50 | 0.79 | 1395 | 5.60 |
| 80 | 1.27 | 2615 | 10.50 |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.623 | -1.2297 | (P)/I | -0.0076 (P)²/I | 0.628 | -1.719 | W/m²·°C |
| **I P Units:** | $\eta$ = | 0.623 | -0.2167 | (P)/I | -0.0007 (P)²/I | 0.628 | -0.303 | Btu/hr·ft²·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.2661 (S) | -0.3511 (S)² | |
| $K_{\alpha\tau}$ = | 1.0 | -0.10 (S) | (Linear Fit) | |

**Model Tested:** 100-2007-025A
**Test Fluid:** Water
**Test Flow Rate:** 41 ml/s 0.65 gpm

**REMARKS:** Tested with long axis of tubes oriented north-south. IAM perpendicular to the tubes is listed above. IAM parallel to the tubes = 1.0 - 0.10(S)

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Beijing Sunda Solar Energy Technology Co Ltd**
No. 3 Hua Yuan Road
Haidian District
Beijing, 100083 China

MODEL: SUNDA SEIDO 5-16 AS/AB
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-2006-026B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 45 | 34 | 23 | A (-9°F) | 43 | 32 | 22 |
| B (5°C) | 42 | 31 | 20 | B (9°F) | 40 | 30 | 19 |
| C (20°C) | 38 | 27 | 17 | C (36°F) | 36 | 26 | 16 |
| D (50°C) | 31 | 20 | 10 | D (90°F) | 29 | 19 | 9 |
| E (80°C) | 23 | 13 | 3 | E (144°F) | 22 | 12 | 3 |

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

Original Certification Date: October 11, 2006

## COLLECTOR SPECIFICATIONS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 4.097 | m$^2$ | 44.10 | ft$^2$ | **Net Aperture Area:** | 3.634 | m$^2$ | 39.12 | ft$^2$ |
| **Dry Weight:** | 105 | kg | 232 | lb | **Fluid Capacity:** | 1.0 | l | 0.3 | gal |
| **Test Pressure:** | 1000 | kPa | 145 | psig | | | | | |

## COLLECTOR MATERIALS

**Frame:** Stainless Steel
**Cover (Outer):** Glass Vacuum Tube
**Cover (Inner):** None
**Absorber Material:** Tube - Copper / Plate - Aluminum
**Absorber Coating:** Sputtered aluminium nitride
**Insulation (Side):** Vacuum
**Insulation (Back):** Vacuum

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.4886 | -1.5855 | (P)/I | -0.0052 (P)$^2$/I | 0.4916 | -1.9242 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.4886 | -0.2794 | (P)/I | -0.0005 (P)$^2$/I | 0.4916 | -0.339 | Btu/hr·ft$^2$·°F |

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

$K_{\alpha\tau}$ = 1.0 +0.9474 (S) -1.0762 (S)$^2$
$K_{\alpha\tau}$ = 1.0 -0.18 (S) (Linear Fit)

**Model Tested:** SEIDO 5-8 AS/AB
**Test Fluid:** Water
**Test Flow Rate:** 41 ml/s 0.65 gpm

**REMARKS:** Tested with long axis of tubes oriented north-south. IAM perpendicular to the tubes is listed above. IAM parallel to the tubes = 1.0 - 0.32(S)

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Beijing Sunda Solar Energy Technology Co Ltd**
No. 3 Hua Yuan Road
Haidian District
Beijing, 100083 China

MODEL: SUNDA SEIDO 5-8 AS/AB
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-2006-026A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
| A (-5°C) | 22 | 17 | 11 | A (-9°F) | 21 | 16 | 11 |
| B (5°C) | 21 | 16 | 10 | B (9°F) | 20 | 15 | 10 |
| C (20°C) | 19 | 14 | 8 | C (36°F) | 18 | 13 | 8 |
| D (50°C) | 15 | 10 | 5 | D (90°F) | 14 | 9 | 4 |
| E (80°C) | 11 | 6 | 1 | E (144°F) | 11 | 6 | 1 |

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

Original Certification Date: October 11, 2006

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.028 | $m^2$ | 21.83 | $ft^2$ | **Net Aperture Area:** | 1.830 | $m^2$ | 19.70 | $ft^2$ |
| **Dry Weight:** | 49.2 | kg | 108 | lb | **Fluid Capacity:** | 0.5 | l | 0.1 | gal |
| **Test Pressure:** | 1000 | kPa | 145 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Stainless Steel |
| **Cover (Outer):** | Glass Vacuum Tube |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Aluminum |
| **Absorber Coating:** | Sputtered aluminium nitride |
| **Insulation (Side):** | Vacuum |
| **Insulation (Back):** | Vacuum |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| 20 | 0.32 | 73 | 0.29 |
| 50 | 0.79 | 458 | 1.84 |
| 80 | 1.27 | 1173 | 4.71 |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.4886 | -1.5855 | (P)/I | -0.0052 | $(P)^2/I$ | 0.4916 | -1.9242 | $W/m^2 \cdot °C$ |
| **I P Units:** | $\eta$ = | 0.4886 | -0.2794 | (P)/I | -0.0005 | $(P)^2/I$ | 0.4916 | -0.339 | $Btu/hr \cdot ft^2 \cdot °F$ |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.9474 (S) | -1.0762 | $(S)^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.18 (S) | (Linear Fit) | | |

**Model Tested:** SEIDO 5-8 AS/AB
**Test Fluid:** Water
**Test Flow Rate:** 41 ml/s 0.65 gpm

**REMARKS:** Tested with long axis of tubes oriented north-south. IAM perpendicular to the tubes is listed above. IAM parallel to the tubes = 1.0 - 0.32(S)

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **BTF, Ltd.**
P.O. Box 409
Fennville, MI 49408 USA

MODEL: Solar Patriot SP-20
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-2004-013A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 28 | 21 | 14 | A (-9°F) | 26 | 20 | 13 |
| B (5°C) | 26 | 20 | 13 | B (9°F) | 25 | 19 | 12 |
| C (20°C) | 25 | 18 | 11 | C (36°F) | 23 | 17 | 11 |
| D (50°C) | 21 | 14 | 7 | D (90°F) | 20 | 13 | 7 |
| E (80°C) | 16 | 10 | 3 | E (144°F) | 15 | 9 | 3 |

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

Original Certification Date: January 7, 2005

## COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.075 | m$^2$ | 33.10 | ft$^2$ | **Net Aperture Area:** | 2.336 | m$^2$ | 25.15 | ft$^2$ |
| **Dry Weight:** | 55.4 | kg | 122 | lb | **Fluid Capacity:** | 1.3 | l | 0.3 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Stainless Steel |
| **Cover (Outer):** | Glass Vacuum Tube |
| **Cover (Inner):** | Glass tube |
| **Absorber Material:** | Tube - Glass / Plate - Aluminum |
| **Absorber Coating:** | Sputtered aluminum nitride |
| **Insulation (Side):** | Vacuum |
| **Insulation (Back):** | Vacuum |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 21 | 0.08 |
| 50 | 0.79 | 172 | 0.69 |
| 80 | 1.27 | 482 | 1.93 |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.342 | -0.8539 | (P)/I | -0.0050 (P)$^2$/I | 0.345 | -1.153 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.342 | -0.1505 | (P)/I | -0.0005 (P)$^2$/I | 0.345 | -0.203 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +1.1787 (S) | -0.6569 (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | +0.49 (S) | (Linear Fit) | |

**Model Tested:** SP-20
**Test Fluid:** Water
**Test Flow Rate:** 55 ml/s 0.87 gpm

**REMARKS:** Collector tested with long axis of tubes oriented north-south. IAM perpendicular to the tubes is listed above. IAM parallel to the tubes = 1.0 - 0.04(S)

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Bubbling Springs Solar, Inc.**
415 13th Avenue E #132
Menomonie, WI 54751 USA

MODEL: Main Stream MS 29
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-048A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 43 | 32 | 22 | A (-9°F) | 41 | 31 | 21 |
| B (5°C) | 38 | 27 | 17 | B (9°F) | 36 | 26 | 16 |
| C (20°C) | 31 | 20 | 10 | C (36°F) | 29 | 19 | 10 |
| D (50°C) | 17 | 8 | 1 | D (90°F) | 16 | 8 | 1 |
| E (80°C) | 6 | | | E (144°F) | 6 | | |

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

Original Certification Date: October 26, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.922 | m$^2$ | 31.45 | ft$^2$ | **Net Aperture Area:** | 2.726 | m$^2$ | 29.34 | ft$^2$ |
| **Dry Weight:** | 50.5 | kg | 111 | lb | **Fluid Capacity:** | 2.2 | l | 0.6 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Aluminum |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Fiberglass |
| **Insulation (Back):** | Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 54 | 0.22 |
| 50 | 0.79 | 202 | 0.81 |
| 80 | 1.27 | 429 | 1.72 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.701 | -4.3084 | (P)/I | -0.0138 | (P)$^2$/I | 0.707 | -5.122 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.701 | -0.7593 | (P)/I | -0.0014 | (P)$^2$/I | 0.707 | -0.903 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.3381 | (S) | +0.0025 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.34 | (S) | (Linear Fit) | | |

**Model Tested:** MS 29
**Test Fluid:** Water
**Test Flow Rate:** 58 ml/s 0.93 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Bubbling Springs Solar, Inc.**
415 13th Avenue E #132
Menomonie, WI 54751 USA

MODEL: Main Stream MS 32
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-048B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 44 | 33 | 23 | A (-9°F) | 41 | 31 | 21 |
| B (5°C) | 39 | 28 | 17 | B (9°F) | 37 | 27 | 17 |
| C (20°C) | 31 | 21 | 11 | C (36°F) | 30 | 20 | 10 |
| D (50°C) | 18 | 8 | 1 | D (90°F) | 17 | 8 | 1 |
| E (80°C) | 6 | | | E (144°F) | 6 | | |

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

Original Certification Date: October 26, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.975 | m$^2$ | 32.02 | ft$^2$ | **Net Aperture Area:** | 2.781 | m$^2$ | 29.94 | ft$^2$ |
| **Dry Weight:** | 44.9 | kg | 99 | lb | **Fluid Capacity:** | 2.2 | l | 0.6 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Aluminum |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Fiberglass |
| **Insulation (Back):** | Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.702 | -4.3176 | (P)/I | -0.0138 | (P)$^2$/I | 0.708 | -5.132 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.702 | -0.7609 | (P)/I | -0.0014 | (P)$^2$/I | 0.708 | -0.904 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.3381 | (S) | +0.0025 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.34 | (S) | (Linear Fit) | | |

**Model Tested:** MS 29
**Test Fluid:** Water
**Test Flow Rate:** 58 ml/s 0.93 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Bubbling Springs Solar, Inc.**
415 13th Avenue E #132
Menomonie, WI 54751 USA

MODEL: Main Stream MS 40
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-048C

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 55 | 41 | 28 | A (-9°F) | 52 | 39 | 27 |
| B (5°C) | 48 | 35 | 22 | B (9°F) | 46 | 33 | 21 |
| C (20°C) | 39 | 26 | 13 | C (36°F) | 37 | 25 | 13 |
| D (50°C) | 22 | 10 | 1 | D (90°F) | 21 | 10 | 1 |
| E (80°C) | 8 | | | E (144°F) | 7 | | |

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

Original Certification Date: December 27, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.710 | m$^2$ | 39.94 | ft$^2$ | **Net Aperture Area:** | 3.482 | m$^2$ | 37.48 | ft$^2$ |
| **Dry Weight:** | 55.5 | kg | 122 | lb | **Fluid Capacity:** | 2.8 | l | 0.7 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Aluminum |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Fiberglass |
| **Insulation (Back):** | Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.705 | -4.3158 | (P)/I | -0.0139 | (P)$^2$/I | 0.711 | -5.136 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.705 | -0.7606 | (P)/I | -0.0014 | (P)$^2$/I | 0.711 | -0.905 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.3381 | (S) | +0.0025 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.34 | (S) | (Linear Fit) | | |

**Model Tested:** MS 29
**Test Fluid:** Water
**Test Flow Rate:** 58 ml/s 0.93 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Energy Conservation Products and Services**
PO Box 393
Carlton, MN 55718 USA

MODEL: Solarway 6000
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-004A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 31 | 24 | 17 | A (-9°F) | 29 | 23 | 16 |
| B (5°C) | 24 | 17 | 10 | B (9°F) | 23 | 16 | 10 |
| C (20°C) | 15 | 9 | 3 | C (36°F) | 14 | 8 | 3 |
| D (50°C) | 2 | | | D (90°F) | 2 | | |
| E (80°C) | | | | E (144°F) | | | |

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

Original Certification Date: March 29, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.001 | m$^2$ | 32.30 | ft$^2$ | **Net Aperture Area:** | 2.703 m$^2$ | 29.10 ft$^2$ |
| **Dry Weight:** | 48.1 | kg | 106 | lb | **Fluid Capacity:** | | |
| **Test Pressure:** | -0.25 | kPa | -0.04 | psig | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Sheet metal |
| **Cover (Outer):** | Fiberglass Reinforced Plastic |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - / Plate - Fibrous mat spun fiberglass |
| **Absorber Coating:** | None |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 25000 | 396.51 | 48 | 0.19 |
| 50000 | 793.02 | 186 | 0.75 |
| 100000 | 1586.04 | 732 | 2.94 |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.4206 | -5.7169 | (P)/I | -0.0078 (P)$^2$/I | 0.422 | -6.01 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.4206 | -1.0075 | (P)/I | -0.0008 (P)$^2$/I | 0.422 | -1.059 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0673 (S) | -0.1732 (S)$^2$ | | |
| $K_{\alpha\tau}$ = | 1.0 | -0.11 (S) | (Linear Fit) | | |

**Model Tested:** Solarway 6000
**Test Fluid:** Air
**Test Flow Rate:** 27 l/s 58.2 scfm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Enerworks, Inc.**
PO Box 9, 252 Hamilton Crescent
Dorchester, ON NOL 1GO Canada

MODEL: Commercial Collector COL-4X8-NL-SG1-SH10US
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-006A

## COLLECTOR THERMAL PERFORMANCE RATING

**Megajoules Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d |
|---|---|---|---|
| A (-5°C) | 48 | 36 | 25 |
| B (5°C) | 45 | 33 | 21 |
| C (20°C) | 39 | 27 | 15 |
| D (50°C) | 27 | 16 | 5 |
| E (80°C) | 15 | 6 | |

**Thousands of Btu Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
|---|---|---|---|
| A (-9°F) | 46 | 35 | 23 |
| B (9°F) | 42 | 31 | 20 |
| C (36°F) | 37 | 26 | 15 |
| D (90°F) | 25 | 15 | 5 |
| E (144°F) | 15 | 5 | |

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

Original Certification Date: September 14, 2006

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.873 | $m^2$ | 30.93 | $ft^2$ | **Net Aperture Area:** | 2.691 | $m^2$ | 28.97 $ft^2$ |
| **Dry Weight:** | 50.4 | kg | 111 | lb | **Fluid Capacity:** | 1.9 | l | 0.5 gal |
| **Test Pressure:** | 517 | kPa | 75 | psig | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Galvanized Steel |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Aluminum |
| **Absorber Coating:** | Vapor Deposition Selective Coating |
| **Insulation (Side):** | Isocyanurate Foam |
| **Insulation (Back):** | Mineral Wool |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| 20 | 0.32 | 14184 | 56.94 |
| 50 | 0.79 | 42171 | 169.30 |
| 80 | 1.27 | 78210 | 313.98 |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.7622 | -3.2787 | (P)/I | -0.0129 $(P)^2/I$ | 0.7683 | -4.0348 | $W/m^2 \cdot °C$ |
| **I P Units:** | $\eta$ = | 0.7622 | -0.5778 | (P)/I | -0.0013 $(P)^2/I$ | 0.7683 | -0.711 | $Btu/hr \cdot ft^2 \cdot °F$ |

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

$K_{\alpha\tau}$ = 1.0 +0.0566 (S) -0.2167 $(S)^2$
$K_{\alpha\tau}$ = 1.0 -0.17 (S) (Linear Fit)

**Model Tested:** COL-4x8-NL-SGI-SH10US
**Test Fluid:** Propylene Glycol & Water
**Test Flow Rate:** 53 ml/s 0.84 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Enerworks, Inc.**
PO Box 9, 252 Hamilton Crescent
Dorchester, ON NOL 1GO Canada

MODEL: Residential Collector COL-4x8-TL-SG1-SD10US
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2005-014A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 45 | 34 | 23 | A (-9°F) | 43 | 32 | 22 |
| B (5°C) | 41 | 30 | 19 | B (9°F) | 39 | 28 | 18 |
| C (20°C) | 33 | 23 | 12 | C (36°F) | 32 | 22 | 11 |
| D (50°C) | 19 | 10 | 2 | D (90°F) | 18 | 9 | 1 |
| E (80°C) | 7 | | | E (144°F) | 6 | | |

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

Original Certification Date: September 14, 2006

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.874 | m$^2$ | 30.94 | ft$^2$ | **Net Aperture Area:** | 2.691 | m$^2$ | 28.97 | ft$^2$ |
| **Dry Weight:** | 50.4 | kg | 111 | lb | **Fluid Capacity:** | 1.2 | l | 0.3 | gal |
| **Test Pressure:** | 517 | kPa | 75 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Galvanized Steel |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Aluminum |
| **Absorber Coating:** | Vapor Deposition Selective Coating |
| **Insulation (Side):** | Isocyanurate |
| **Insulation (Back):** | Mineral Wool |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| 20 | 0.32 | 17078 | 68.56 |
| 50 | 0.79 | 46648 | 187.27 |
| 80 | 1.27 | 80959 | 325.02 |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.7166 | -4.0141 | (P)/I | -0.0187 (P)$^2$/I | 0.7256 | -5.1127 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.7166 | -0.7074 | (P)/I | -0.0018 (P)$^2$/I | 0.7256 | -0.901 | Btu/hr·ft$^2$·°F |

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

$K_{\alpha\tau}$ = 1.0 -0.1100 (S) -0.0506 (S)$^2$

$K_{\alpha\tau}$ = 1.0 -0.16 (S) (Linear Fit)

**Model Tested:** COL-4x8-TL-SGI-SD10US
**Test Fluid:** Prolylene Glycol & Water
**Test Flow Rate:** 56 ml/s 0.89 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Environmental Solar Systems**
117 West Street
Methuen, MA 01844 USA

MODEL: Sun Mate SM-14
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-002A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
| A (-5°C) | 23 | 18 | 12 | A (-9°F) | 22 | 17 | 12 |
| B (5°C) | 20 | 15 | 9 | B (9°F) | 19 | 14 | 9 |
| C (20°C) | 16 | 10 | 5 | C (36°F) | 15 | 10 | 5 |
| D (50°C) | 7 | 3 | | D (90°F) | 7 | 2 | |
| E (80°C) | 1 | | | E (144°F) | 1 | | |

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

Original Certification Date: March 21, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.742 | $m^2$ | 18.75 | $ft^2$ | **Net Aperture Area:** | 1.603 | $m^2$ | 17.26 | $ft^2$ |
| **Dry Weight:** | 39 | kg | 86 | lb | **Fluid Capacity:** | 0.0 | l | 0.0 | gal |
| **Test Pressure:** | 0 | kPa | 0 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - / Plate - Aluminum |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 25000 | 396.51 | 46 | 0.19 |
| 50000 | 793.02 | 188 | 0.75 |
| 100000 | 1586.04 | 754 | 3.03 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.5758 | -4.4482 | (P)/I | -0.0165 | $(P)^2/I$ | 0.58 | -5.138 | $W/m^2 \cdot °C$ |
| **I P Units:** | $\eta$ = | 0.5758 | -0.7839 | (P)/I | -0.0016 | $(P)^2/I$ | 0.58 | -0.905 | $Btu/hr \cdot ft^2 \cdot °F$ |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.0096 | (S) | -0.0971 | $(S)^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.09 | (S) | (Linear Fit) | |

| | | | | |
|---|---|---|---|---|
| **Model Tested:** | SM-14 | | | |
| **Test Fluid:** | Air | | | |
| **Test Flow Rate:** | 47 | l/s | 100.0 | scfm |

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **G.S. Inc.**
12A1 Moran Drive
Rockland, ME 04841 USA

MODEL: EOS Solar EOS-S10
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-2007-008A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 11 | 8 | 6 | A (-9°F) | 10 | 8 | 5 |
| B (5°C) | 10 | 8 | 5 | B (9°F) | 10 | 7 | 5 |
| C (20°C) | 9 | 7 | 4 | C (36°F) | 9 | 6 | 4 |
| D (50°C) | 7 | 4 | 2 | D (90°F) | 7 | 4 | 2 |
| E (80°C) | 5 | 2 | | E (144°F) | 5 | 2 | |

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

Original Certification Date: December 19, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.583 | m$^2$ | 17.04 | ft$^2$ | **Net Aperture Area:** | 1.318 | m$^2$ | 14.19 | ft$^2$ |
| **Dry Weight:** | 34.7 | kg | 77 | lb | **Fluid Capacity:** | 0.7 | l | 0.2 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Stainless Steel |
| **Cover (Outer):** | Glass Vacuum Tube |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Aluminum |
| **Absorber Coating:** | Selective |
| **Insulation (Side):** | Vacuum |
| **Insulation (Back):** | Vacuum |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 25 | 0.10 |
| 50 | 0.79 | 93 | 0.37 |
| 80 | 1.27 | 201 | 0.81 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.269 | -0.9716 | (P)/I | -0.0058 | (P)$^2$/I | 0.2728 | -1.3463 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.269 | -0.1712 | (P)/I | -0.0006 | (P)$^2$/I | 0.2728 | -0.237 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +1.8968 | (S) | -1.7407 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.08 | (S) | (Linear Fit) | | |

**Model Tested:** EOS-S10
**Test Fluid:** Water
**Test Flow Rate:** 1 ml/s 0.01 gpm

**REMARKS:** Collector tested with long axis of tubes oriented north-south. IAM perpendicular to the tubes is listed above. IAM parallel to the tubes = 1.0 - 0.27(S)

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **G.S. Inc.**
12A1 Moran Drive
Rockland, ME 04841 USA

MODEL: EOS Solar EOS-S20
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-2007-008B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
| A (-5°C) | 21 | 16 | 11 | A (-9°F) | 20 | 15 | 10 |
| B (5°C) | 20 | 15 | 10 | B (9°F) | 19 | 14 | 9 |
| C (20°C) | 18 | 13 | 8 | C (36°F) | 17 | 12 | 7 |
| D (50°C) | 14 | 9 | 4 | D (90°F) | 13 | 8 | 4 |
| E (80°C) | 9 | 5 | | E (144°F) | 9 | 4 | |

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

Original Certification Date: December 19, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.088 | $m^2$ | 33.24 | $ft^2$ | **Net Aperture Area:** | 2.673 | $m^2$ | 28.77 $ft^2$ |
| **Dry Weight:** | 69 | kg | 152 | lb | **Fluid Capacity:** | 1.5 | l | 0.4 gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | |

## COLLECTOR MATERIALS

**Frame:** Stainless Steel
**Cover (Outer):** Glass Vacuum Tube
**Cover (Inner):** None
**Absorber Material:** Tube - Copper / Plate - Aluminum
**Absorber Coating:** Selective
**Insulation (Side):** Vacuum
**Insulation (Back):** Vacuum

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.2694 | -0.9716 | (P)/I | -0.0058 | $(P)^2/I$ | 0.2728 | -1.3463 | $W/m^2 \cdot °C$ |
| **I P Units:** | $\eta$ = | 0.2694 | -0.1712 | (P)/I | -0.0006 | $(P)^2/I$ | 0.2728 | -0.237 | $Btu/hr \cdot ft^2 \cdot °F$ |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +1.8968 (S) | -1.7407 | $(S)^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.08 (S) | (Linear Fit) | | |

**Model Tested:** EOS-S10
**Test Fluid:** Water
**Test Flow Rate:** 1 ml/s 0.01 gpm

**REMARKS:** Collector tested with long axis of tubes oriented north-south. IAM perpendicular to the tubes is listed above. IAM parallel to the tubes = 1.0 - 0.27(S)

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **G.S. Inc.**
12A1 Moran Drive
Rockland, ME 04841 USA

MODEL: EOS Solar EOS-S30
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-2007-008C

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 32 | 24 | 16 | A (-9°F) | 30 | 23 | 15 |
| B (5°C) | 30 | 22 | 15 | B (9°F) | 28 | 21 | 14 |
| C (20°C) | 27 | 19 | 12 | C (36°F) | 26 | 18 | 11 |
| D (50°C) | 21 | 13 | 6 | D (90°F) | 20 | 12 | 6 |
| E (80°C) | 14 | 7 | 1 | E (144°F) | 13 | 7 | 1 |

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

Original Certification Date: December 19, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 4.646 | m$^2$ | 50.01 | ft$^2$ | **Net Aperture Area:** | 4.028 | m$^2$ | 43.36 | ft$^2$ |
| **Dry Weight:** | 104 | kg | 229 | lb | **Fluid Capacity:** | 2.2 | l | 0.6 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Stainless Steel |
| **Cover (Outer):** | Glass Vacuum Tube |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Aluminum |
| **Absorber Coating:** | Selective |
| **Insulation (Side):** | Vacuum |
| **Insulation (Back):** | Vacuum |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.2694 | -0.9716 | (P)/I | -0.0058 | (P)$^2$/I | 0.2728 | -1.3463 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.2694 | -0.1712 | (P)/I | -0.0006 | (P)$^2$/I | 0.2728 | -0.237 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +1.8968 | (S) | -1.7407 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.08 | (S) | (Linear Fit) | | |

**Model Tested:** EOS-S10
**Test Fluid:** Water
**Test Flow Rate:** 1 ml/s 0.01 gpm

**REMARKS:** Collector tested with long axis of tubes oriented north-south. IAM perpendicular to the tubes is listed above. IAM parallel to the tubes = 1.0 - 0.27(S)

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **General Solar Systems GmbH**
Industriepark
St. Veit/Glan, Austria 9300

MODEL: SK500 SK500L
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-030B

## COLLECTOR THERMAL PERFORMANCE RATING

**Megajoules Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d |
|---|---|---|---|
| A (-5°C) | 38 | 28 | 19 |
| B (5°C) | 35 | 25 | 16 |
| C (20°C) | 30 | 21 | 12 |
| D (50°C) | 21 | 12 | 4 |
| E (80°C) | 12 | 4 | |

**Thousands of Btu Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
|---|---|---|---|
| A (-9°F) | 36 | 27 | 18 |
| B (9°F) | 33 | 24 | 15 |
| C (36°F) | 28 | 20 | 11 |
| D (90°F) | 20 | 11 | 4 |
| E (144°F) | 11 | 4 | |

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

Original Certification Date: January 14, 2008

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.571 | m² | 27.67 | ft² | **Net Aperture Area:** | 2.336 | m² | 25.15 ft² |
| **Dry Weight:** | 49 | kg | 108 | lb | **Fluid Capacity:** | 1.6 | l | 0.4 gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Rock Wool |
| **Insulation (Back):** | Rock Wool |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.679 | -2.8521 | (P)/I | -0.0122 | $(P)^2/I$ | 0.686 | -3.593 | W/m²·°C |
| **I P Units:** | $\eta$ = | 0.679 | -0.5026 | (P)/I | -0.0012 | $(P)^2/I$ | 0.686 | -0.633 | Btu/hr·ft²·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1149 | (S) | -0.0882 | $(S)^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.21 | (S) | (Linear Fit) | |

**Model Tested:** SK500N
**Test Fluid:** Water
**Test Flow Rate:** 51 ml/s 0.81 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **General Solar Systems GmbH**
Industriepark
St. Veit/Glan, Austria 9300

MODEL: SK500 SK500N
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-030A

## COLLECTOR THERMAL PERFORMANCE RATING

**Megajoules Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d |
|---|---|---|---|
| A (-5°C) | 38 | 28 | 19 |
| B (5°C) | 35 | 25 | 16 |
| C (20°C) | 30 | 21 | 12 |
| D (50°C) | 21 | 12 | 4 |
| E (80°C) | 12 | 4 | |

**Thousands of Btu Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
|---|---|---|---|
| A (-9°F) | 36 | 27 | 18 |
| B (9°F) | 33 | 24 | 15 |
| C (36°F) | 28 | 20 | 11 |
| D (90°F) | 20 | 11 | 4 |
| E (144°F) | 11 | 4 | |

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

Original Certification Date: October 4, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.571 | m² | 27.67 | ft² | **Net Aperture Area:** | 2.336 | m² | 25.15 ft² |
| **Dry Weight:** | 49 | kg | 108 | lb | **Fluid Capacity:** | 1.6 | l | 0.4 gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Rock Wool |
| **Insulation (Back):** | Rock Wool |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 262 | 1.05 |
| 50 | 0.79 | 885 | 3.55 |
| 80 | 1.27 | 1784 | 7.16 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.679 | -2.8521 | (P)/I | -0.0122 | $(P)^2/I$ | 0.686 | -3.593 | W/m²·°C |
| **I P Units:** | $\eta$ = | 0.679 | -0.5026 | (P)/I | -0.0012 | $(P)^2/I$ | 0.686 | -0.633 | Btu/hr·ft²·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1149 | (S) | -0.0882 | $(S)^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.21 | (S) | (Linear Fit) | |

**Model Tested:** SK500
**Test Fluid:** Water
**Test Flow Rate:** 51 ml/s 0.81 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Genersys PLC**
37 Queen Anne Street
London, W1G 9JB England

MODEL: Genersys 1000-10
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2005-001A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
| A (-5°C) | 27 | 20 | 14 | A (-9°F) | 25 | 19 | 13 |
| B (5°C) | 24 | 17 | 11 | B (9°F) | 23 | 16 | 10 |
| C (20°C) | 20 | 13 | 7 | C (36°F) | 19 | 13 | 7 |
| D (50°C) | 12 | 6 | 1 | D (90°F) | 11 | 6 | 1 |
| E (80°C) | 5 | 1 | | E (144°F) | 5 | 1 | |

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

Original Certification Date: November 21, 2005

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.035 | $m^2$ | 21.91 | $ft^2$ | **Net Aperture Area:** | 1.780 | $m^2$ | 19.16 | $ft^2$ |
| **Dry Weight:** | 39 | kg | 86 | lb | **Fluid Capacity:** | 1.6 | l | 0.4 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Aluminum |
| **Absorber Coating:** | Metallic Oxide |
| **Insulation (Side):** | Mineral Wool |
| **Insulation (Back):** | Mineral Wool |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 10957 | 43.99 |
| 50 | 0.79 | 35106 | 140.94 |
| 80 | 1.27 | 68509 | 275.04 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta =$ | 0.588 | -3.5677 | (P)/I | -0.0071 | $(P)^2/I$ | 0.5913 | -3.992 | $W/m^2 \cdot °C$ |
| **I P Units:** | $\eta =$ | 0.588 | -0.6287 | (P)/I | -0.0007 | $(P)^2/I$ | 0.5913 | -0.704 | $Btu/hr \cdot ft^2 \cdot °F$ |

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

$K_{\alpha\tau} =$ 1.0 -0.0415 (S) -0.1007 $(S)^2$

$K_{\alpha\tau} =$ 1.0 -0.15 (S) (Linear Fit)

**Model Tested:** 1000-10
**Test Fluid:** Propylene Glycol
**Test Flow Rate:** 13 ml/s 0.21 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Heat Transfer Products**
120 Braley Road
East Freetown, MA 02717

MODEL: HTP-Evacuated Tube HP-30SC
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-2008-019A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 41 | 31 | 21 | A (-9°F) | 39 | 29 | 20 |
| B (5°C) | 39 | 29 | 19 | B (9°F) | 37 | 28 | 18 |
| C (20°C) | 37 | 27 | 17 | C (36°F) | 35 | 25 | 16 |
| D (50°C) | 32 | 22 | 12 | D (90°F) | 30 | 21 | 12 |
| E (80°C) | 27 | 17 | 8 | E (144°F) | 26 | 16 | 7 |

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

Original Certification Date: March 5, 2008

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 4.053 | m$^2$ | 43.63 | ft$^2$ | **Net Aperture Area:** | 3.795 | m$^2$ | 40.85 ft$^2$ |
| **Dry Weight:** | 82.5 | kg | 182 | lb | **Fluid Capacity:** | 0.7 | l | 0.2 gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Stainless Steel |
| **Cover (Outer):** | Glass Vacuum Tube |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper & steel / Plate - Glass |
| **Absorber Coating:** | Sputtered aluminum nitride |
| **Insulation (Side):** | Vacuum |
| **Insulation (Back):** | Vacuum |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.416 | -0.9646 | (P)/I | -0.0023 | (P)$^2$/I | 0.418 | -1.17 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.416 | -0.1700 | (P)/I | -0.0002 | (P)$^2$/I | 0.418 | -0.206 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +1.1718 | (S) | -0.8470 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | +0.29 | (S) | (Linear Fit) | | |

**Model Tested:** 100-2004-003B
**Test Fluid:** Water
**Test Flow Rate:** 55 ml/s 0.86 gpm

**REMARKS:** Collector tested with long axis of tubes oriented north-south. IAM perpendicular to the tubes is listed above. IAM parallel to the tubes = 1.0 - 0.13(S)

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Heliodyne, Inc.**
4910 Seaport Avenue
Richmond, CA 94804 USA

MODEL: Gobi 336 001
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2007-027A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 38 | 29 | 20 | A (-9°F) | 36 | 27 | 19 |
| B (5°C) | 35 | 26 | 16 | B (9°F) | 33 | 24 | 15 |
| C (20°C) | 30 | 21 | 12 | C (36°F) | 28 | 20 | 11 |
| D (50°C) | 20 | 12 | 4 | D (90°F) | 19 | 11 | 4 |
| E (80°C) | 12 | 4 | | E (144°F) | 11 | 4 | |

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

Original Certification Date: October 17, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.487 | m$^2$ | 26.77 | ft$^2$ | **Net Aperture Area:** | 2.297 | m$^2$ | 24.73 | ft$^2$ |
| **Dry Weight:** | 45.4 | kg | 100 | lb | **Fluid Capacity:** | 3.0 | l | 0.8 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Aluminum |
| **Absorber Coating:** | Sputtered Selective |
| **Insulation (Side):** | Isocyanurate Foam |
| **Insulation (Back):** | Isocyanurate Foam & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 28 | 0.11 |
| 50 | 0.79 | 115 | 0.46 |
| 80 | 1.27 | 256 | 1.03 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.725 | -3.2374 | (P)/I | -0.0104 | (P)$^2$/I | 0.731 | -4.03 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.725 | -0.5705 | (P)/I | -0.0010 | (P)$^2$/I | 0.731 | -0.710 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0581 | (S) | -0.2744 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.23 | (S) | (Linear Fit) | | |

**Model Tested:** Gobi 336 001
**Test Fluid:** Water
**Test Flow Rate:** 50 ml/s 0.79 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Heliodyne, Inc.**
4910 Seaport Avenue
Richmond, CA 94804 USA

MODEL: Gobi 336 013
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2007-026A

## COLLECTOR THERMAL PERFORMANCE RATING

**Megajoules Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d |
|---|---|---|---|
| A (-5°C) | 37 | 28 | 19 |
| B (5°C) | 33 | 24 | 15 |
| C (20°C) | 28 | 19 | 10 |
| D (50°C) | 17 | 9 | 2 |
| E (80°C) | 8 | 2 | |

**Thousands of Btu Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
|---|---|---|---|
| A (-9°F) | 35 | 26 | 18 |
| B (9°F) | 31 | 23 | 14 |
| C (36°F) | 26 | 18 | 10 |
| D (90°F) | 16 | 9 | 2 |
| E (144°F) | 7 | 2 | |

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

Original Certification Date: October 17, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.487 | m² | 26.77 | ft² | **Net Aperture Area:** | 2.289 | m² | 24.64 ft² |
| **Dry Weight:** | 48.8 | kg | 108 | lb | **Fluid Capacity:** | 4.1 | l | 1.1 gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Isocyanurate Foam |
| **Insulation (Back):** | Isocyanurate Foam & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.701 | -3.7322 | (P)/I | -0.0107 | $(P)^2/I$ | 0.7083 | -4.5441 | W/m²·°C |
| **I P Units:** | $\eta$ = | 0.701 | -0.6577 | (P)/I | -0.0010 | $(P)^2/I$ | 0.7083 | -0.801 | Btu/hr·ft²·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0400 | (S) | -0.2905 | $(S)^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.26 | (S) | (Linear Fit) | |

**Model Tested:** Gobi 336 013
**Test Fluid:** Water
**Test Flow Rate:** 50 ml/s 0.79 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Heliodyne, Inc.**
4910 Seaport Avenue
Richmond, CA 94804 USA

MODEL: Gobi 406 001
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2007-027B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
| A (-5°C) | 39 | 29 | 20 | A (-9°F) | 37 | 28 | 19 |
| B (5°C) | 35 | 26 | 16 | B (9°F) | 33 | 24 | 16 |
| C (20°C) | 30 | 21 | 12 | C (36°F) | 28 | 20 | 11 |
| D (50°C) | 20 | 11 | 3 | D (90°F) | 19 | 11 | 3 |
| E (80°C) | 11 | 4 | | E (144°F) | 10 | 3 | |

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

Original Certification Date: October 17, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.503 | $m^2$ | 26.94 | $ft^2$ | **Net Aperture Area:** | 2.314 | $m^2$ | 24.91 | $ft^2$ |
| **Dry Weight:** | 46.4 | kg | 102 | lb | **Fluid Capacity:** | 3.6 | l | 1.0 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Aluminum |
| **Absorber Coating:** | Sputtered Selective |
| **Insulation (Side):** | Isocyanurate Foam |
| **Insulation (Back):** | Isocyanurate Foam & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.726 | -3.3999 | (P)/I | -0.0104 | $(P)^2/I$ | 0.732 | -4.1949 | $W/m^2 \cdot °C$ |
| **I P Units:** | $\eta$ = | 0.726 | -0.5992 | (P)/I | -0.0010 | $(P)^2/I$ | 0.732 | -0.739 | $Btu/hr \cdot ft^2 \cdot °F$ |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0581 | (S) | -0.2744 | $(S)^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.23 | (S) | (Linear Fit) | |

**Model Tested:** Gobi 336 001
**Test Fluid:** Water
**Test Flow Rate:** 50 ml/s 0.79 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Heliodyne, Inc.**
4910 Seaport Avenue
Richmond, CA 94804 USA

MODEL: Gobi 406 013
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2007-026B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 37 | 28 | 19 | A (-9°F) | 35 | 27 | 18 |
| B (5°C) | 33 | 24 | 15 | B (9°F) | 32 | 23 | 15 |
| C (20°C) | 28 | 19 | 10 | C (36°F) | 26 | 18 | 10 |
| D (50°C) | 17 | 9 | 2 | D (90°F) | 17 | 9 | 2 |
| E (80°C) | 8 | 2 | | E (144°F) | 7 | 2 | |

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

Original Certification Date: October 17, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.503 | m$^2$ | 26.94 | ft$^2$ | **Net Aperture Area:** | 2.314 | m$^2$ | 24.91 | ft$^2$ |
| **Dry Weight:** | 46.4 | kg | 102 | lb | **Fluid Capacity:** | 3.6 | l | 1.0 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Isocyanurate Foam |
| **Insulation (Back):** | Isocyanurate Foam & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.704 | -3.7459 | (P)/I | -0.0108 | (P)$^2$/I | 0.711 | -4.564 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.704 | -0.6601 | (P)/I | -0.0011 | (P)$^2$/I | 0.711 | -0.804 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0400 | (S) | -0.2905 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.26 | (S) | (Linear Fit) | |

**Model Tested:** Gobi 336 013
**Test Fluid:** Water
**Test Flow Rate:** 50 ml/s 0.79 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Heliodyne, Inc.**
4910 Seaport Avenue
Richmond, CA 94804 USA

MODEL: Gobi 408 001
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2007-027C

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 46 | 35 | 24 | A (-9°F) | 44 | 33 | 22 |
| B (5°C) | 42 | 31 | 20 | B (9°F) | 40 | 29 | 19 |
| C (20°C) | 36 | 25 | 14 | C (36°F) | 34 | 24 | 13 |
| D (50°C) | 24 | 14 | 4 | D (90°F) | 23 | 13 | 4 |
| E (80°C) | 13 | 4 | | E (144°F) | 12 | 4 | |

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

Original Certification Date: October 17, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.994 | m$^2$ | 32.23 | ft$^2$ | **Net Aperture Area:** | 2.781 | m$^2$ | 29.94 | ft$^2$ |
| **Dry Weight:** | 57.1 | kg | 126 | lb | **Fluid Capacity:** | 4.3 | l | 1.1 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Aluminum |
| **Absorber Coating:** | Sputtered Selective |
| **Insulation (Side):** | Isocyanurate Foam |
| **Insulation (Back):** | Isocyanurate Foam & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.73 | -3.4078 | (P)/I | -0.0104 | (P)$^2$/I | 0.736 | -4.205 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.73 | -0.6006 | (P)/I | -0.0010 | (P)$^2$/I | 0.736 | -0.741 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0581 | (S) | -0.2744 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.23 | (S) | (Linear Fit) | | |

**Model Tested:** Gobi 336 001
**Test Fluid:** Water
**Test Flow Rate:** 50 ml/s 0.79 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Heliodyne, Inc.**
4910 Seaport Avenue
Richmond, CA 94804 USA

MODEL: Gobi 408 013
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2007-026C

## COLLECTOR THERMAL PERFORMANCE RATING

**Megajoules Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d |
|---|---|---|---|
| A (-5°C) | 45 | 34 | 23 |
| B (5°C) | 40 | 29 | 18 |
| C (20°C) | 33 | 23 | 12 |
| D (50°C) | 20 | 11 | 2 |
| E (80°C) | 9 | 2 | |

**Thousands of Btu Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
|---|---|---|---|
| A (-9°F) | 42 | 32 | 22 |
| B (9°F) | 38 | 28 | 17 |
| C (36°F) | 32 | 21 | 11 |
| D (90°F) | 19 | 10 | 2 |
| E (144°F) | 8 | 2 | |

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

Original Certification Date: October 17, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.994 | $m^2$ | 32.23 | $ft^2$ | **Net Aperture Area:** | 2.781 | $m^2$ | 29.94 | $ft^2$ |
| **Dry Weight:** | 57.1 | kg | 126 | lb | **Fluid Capacity:** | 4.3 | l | 1.1 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Isocyanurate Foam |
| **Insulation (Back):** | Isocyanurate Foam & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.707 | -3.9200 | (P)/I | -0.0108 | $(P)^2/I$ | 0.7149 | -4.7394 | $W/m^2 \cdot °C$ |
| **I P Units:** | $\eta$ = | 0.707 | -0.6908 | (P)/I | -0.0011 | $(P)^2/I$ | 0.7149 | -0.835 | $Btu/hr \cdot ft^2 \cdot °F$ |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0400 | (S) | -0.2905 | $(S)^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.26 | (S) | (Linear Fit) | |

**Model Tested:** Gobi 336 013
**Test Fluid:** Water
**Test Flow Rate:** 50 ml/s 0.79 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Heliodyne, Inc.**
4910 Seaport Avenue
Richmond, CA 94804 USA

MODEL: Gobi 410 001
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2007-027D

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 58 | 44 | 30 | A (-9°F) | 55 | 42 | 28 |
| B (5°C) | 53 | 39 | 25 | B (9°F) | 50 | 37 | 23 |
| C (20°C) | 45 | 31 | 17 | C (36°F) | 43 | 30 | 17 |
| D (50°C) | 30 | 17 | 5 | D (90°F) | 29 | 16 | 5 |
| E (80°C) | 16 | 6 | | E (144°F) | 16 | 5 | |

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

Original Certification Date: October 17, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.730 | m$^2$ | 40.15 | ft$^2$ | **Net Aperture Area:** | 3.482 | m$^2$ | 37.48 | ft$^2$ |
| **Dry Weight:** | 69.4 | kg | 153 | lb | **Fluid Capacity:** | 5.1 | l | 1.3 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Aluminum |
| **Absorber Coating:** | Sputtered Selective |
| **Insulation (Side):** | Isocyanurate Foam |
| **Insulation (Back):** | Isocyanurate Foam & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.733 | -3.4081 | (P)/I | -0.0106 | (P)$^2$/I | 0.739 | -4.213 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.733 | -0.6006 | (P)/I | -0.0010 | (P)$^2$/I | 0.739 | -0.742 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0581 | (S) | -0.2744 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.23 | (S) | (Linear Fit) | |

**Model Tested:** Gobi 336 001
**Test Fluid:** Water
**Test Flow Rate:** 50 ml/s 0.79 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Heliodyne, Inc.**
4910 Seaport Avenue
Richmond, CA 94804 USA

MODEL: Gobi 410 013
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2007-026D

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 56 | 42 | 29 | A (-9°F) | 53 | 40 | 27 |
| B (5°C) | 50 | 37 | 23 | B (9°F) | 48 | 35 | 22 |
| C (20°C) | 42 | 28 | 15 | C (36°F) | 40 | 27 | 14 |
| D (50°C) | 26 | 13 | 3 | D (90°F) | 24 | 13 | 3 |
| E (80°C) | 11 | 2 | | E (144°F) | 11 | 2 | |

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

Original Certification Date: October 17, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.730 | m$^2$ | 40.15 | ft$^2$ | **Net Aperture Area:** | 3.482 | m$^2$ | 37.48 | ft$^2$ |
| **Dry Weight:** | 69.3 | kg | 153 | lb | **Fluid Capacity:** | 5.1 | l | 1.3 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Isocyanurate Foam |
| **Insulation (Back):** | Isocyanurate Foam & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.711 | -3.9257 | (P)/I | -0.0109 | (P)$^2$/I | 0.718 | -4.7501 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.711 | -0.6918 | (P)/I | -0.0011 | (P)$^2$/I | 0.718 | -0.837 | Btu/hr·ft$^2$·°F |

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

$K_{\alpha\tau}$ = 1.0 +0.0400 (S) -0.2905 (S)$^2$

$K_{\alpha\tau}$ = 1.0 -0.26 (S) (Linear Fit)

**Model Tested:** Gobi 336 013
**Test Fluid:** Water
**Test Flow Rate:** 50 ml/s 0.79 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Heliodyne, Inc.**
4910 Seaport Avenue
Richmond, CA 94804 USA

MODEL: Heliodyne Mojave 408
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1981-085C

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 49 | 38 | 26 | A (-9°F) | 46 | 36 | 25 |
| B (5°C) | 43 | 31 | 20 | B (9°F) | 41 | 29 | 19 |
| C (20°C) | 34 | 22 | 11 | C (36°F) | 32 | 21 | 10 |
| D (50°C) | 17 | 7 | | D (90°F) | 16 | 7 | |
| E (80°C) | | | | E (144°F) | | | |

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

Original Certification Date: August 1, 1983

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.000 | m$^2$ | 32.29 | ft$^2$ | **Net Aperture Area:** | 2.771 | m$^2$ | 29.83 | ft$^2$ |
| **Dry Weight:** | 60.382 | kg | 133 | lb | **Fluid Capacity:** | 3.0 | l | 0.8 | gal |
| **Test Pressure:** | 1034 | kPa | 150 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Polyester Flat Black Paint |
| **Insulation (Side):** | Isocyanurate Foam |
| **Insulation (Back):** | Isocyanurate Foam & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.719 | -5.3100 | (P)/I | -0.0100 | (P)$^2$/I | 0.726 | -6.08 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.719 | -0.9358 | (P)/I | -0.0010 | (P)$^2$/I | 0.726 | -1.071 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.0900 | (S) | 0.0000 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.12 | (S) | (Linear Fit) | |

**Model Tested:** Mojave 408
**Test Fluid:** Water
**Test Flow Rate:** 55 ml/s 0.87 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Heliodyne, Inc.**
4910 Seaport Avenue
Richmond, CA 94804 USA

MODEL: Heliodyne Mojave 410
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1981-085D

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 61 | 47 | 32 | A (-9°F) | 58 | 45 | 30 |
| B (5°C) | 54 | 39 | 24 | B (9°F) | 51 | 37 | 23 |
| C (20°C) | 42 | 28 | 14 | C (36°F) | 40 | 27 | 13 |
| D (50°C) | 22 | 9 | 1 | D (90°F) | 21 | 9 | 1 |
| E (80°C) | | | | E (144°F) | | | |

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

Original Certification Date: August 1, 1983

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.727 | m$^2$ | 40.12 | ft$^2$ | **Net Aperture Area:** | 3.558 | m$^2$ | 38.30 | ft$^2$ |
| **Dry Weight:** | 72.64 | kg | 160 | lb | **Fluid Capacity:** | 3.8 | l | 1.0 | gal |
| **Test Pressure:** | 1034 | kPa | 150 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Polyester Flat Black Paint |
| **Insulation (Side):** | Isocyanurate Foam |
| **Insulation (Back):** | Isocyanurate Foam & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.719 | -5.3100 | (P)/I | -0.0100 | (P)$^2$/I | 0.726 | -6.08 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.719 | -0.9358 | (P)/I | -0.0010 | (P)$^2$/I | 0.726 | -1.071 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.0900 | (S) | 0.0000 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.12 | (S) | (Linear Fit) | | |

**Model Tested:** Mojave 408
**Test Fluid:** Water
**Test Flow Rate:** 56 ml/s 0.89 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Integrated Solar, LLC**
2030 W. Pinnacle Peak Road
Phoenix, AZ 85027 USA

MODEL: Radco 308C-HP
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1985-030J

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 36 | 27 | 19 | A (-9°F) | 34 | 26 | 18 |
| B (5°C) | 33 | 24 | 15 | B (9°F) | 31 | 23 | 14 |
| C (20°C) | 28 | 19 | 10 | C (36°F) | 26 | 18 | 10 |
| D (50°C) | 17 | 9 | 2 | D (90°F) | 16 | 9 | 2 |
| E (80°C) | 8 | 2 | | E (144°F) | 8 | 2 | |

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

Original Certification Date: April 10, 2000

## COLLECTOR SPECIFICATIONS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.201 | m$^2$ | 23.69 | ft$^2$ | **Net Aperture Area:** | 2.054 | m$^2$ | 22.11 | ft$^2$ |
| **Dry Weight:** | 35.5 | kg | 78 | lb | **Fluid Capacity:** | 3.3 | l | 0.9 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.772 | -4.3800 | (P)/I | -0.0102 | (P)$^2$/I | 0.778 | -4.964 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.772 | -0.7719 | (P)/I | -0.0010 | (P)$^2$/I | 0.778 | -0.875 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.0520 | (S) | -0.1585 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.22 | (S) | (Linear Fit) | |

| | | | | |
|---|---|---|---|---|
| **Model Tested:** | Radco 408C-HP | | | |
| **Test Fluid:** | Water | | | |
| **Test Flow Rate:** | 56 | ml/s | 0.89 | gpm |

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Integrated Solar, LLC**
2030 W. Pinnacle Peak Road
Phoenix, AZ 85027 USA

MODEL: Radco 308P-HP
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1985-030G

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 38 | 29 | 21 | A (-9°F) | 36 | 27 | 20 |
| B (5°C) | 32 | 23 | 15 | B (9°F) | 30 | 22 | 14 |
| C (20°C) | 24 | 16 | 8 | C (36°F) | 23 | 15 | 8 |
| D (50°C) | 10 | 4 | | D (90°F) | 9 | 4 | |
| E (80°C) | | | | E (144°F) | | | |

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

Original Certification Date: August 1, 1994

## COLLECTOR SPECIFICATIONS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.201 | m$^2$ | 23.69 | ft$^2$ | **Net Aperture Area:** | 2.054 | m$^2$ | 22.11 | ft$^2$ |
| **Dry Weight:** | 34 | kg | 75 | lb | **Fluid Capacity:** | 3.3 | l | 0.9 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Flat Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.759 | -6.8820 | (P)/I | -0.1112 | (P)$^2$/I | 0.764 | -7.51 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.759 | -1.2128 | (P)/I | -0.0109 | (P)$^2$/I | 0.764 | -1.323 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1230 | (S) | -0.1030 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -99.00 | (S) | (Linear Fit) | | |

**Model Tested:** Radco 408P-HP
**Test Fluid:** Water
**Test Flow Rate:** 56 ml/s 0.89 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Integrated Solar, LLC**
2030 W. Pinnacle Peak Road
Phoenix, AZ 85027 USA

MODEL: Radco 408C-HP
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1985-030A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 51 | 38 | 26 | A (-9°F) | 48 | 36 | 25 |
| B (5°C) | 46 | 33 | 21 | B (9°F) | 43 | 32 | 20 |
| C (20°C) | 38 | 26 | 14 | C (36°F) | 36 | 25 | 13 |
| D (50°C) | 24 | 13 | 4 | D (90°F) | 23 | 13 | 3 |
| E (80°C) | 12 | 3 | | E (144°F) | 11 | 3 | |

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

Original Certification Date: February 18, 1985

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.000 | m$^2$ | 32.29 | ft$^2$ | **Net Aperture Area:** | 2.806 | m$^2$ | 30.20 | ft$^2$ |
| **Dry Weight:** | 47.6 | kg | 105 | lb | **Fluid Capacity:** | 2.9 | l | 0.8 | gal |
| **Test Pressure:** | 1102 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 56 | 0.89 | 498 | 2.00 |
| 126 | 2.00 | 2117 | 8.50 |
| 252 | 3.99 | 7844 | 31.49 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.774 | -4.2000 | (P)/I | -0.0090 | (P)$^2$/I | 0.779 | -4.77 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.774 | -0.7402 | (P)/I | -0.0009 | (P)$^2$/I | 0.779 | -0.841 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.0520 | (S) | -0.1585 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.22 | (S) | (Linear Fit) | | |

**Model Tested:** 408C-HP
**Test Fluid:** Water
**Test Flow Rate:** 56 ml/s 0.89 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Integrated Solar, LLC**
2030 W. Pinnacle Peak Road
Phoenix, AZ 85027 USA

MODEL: Radco 408P-HP
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1985-030D

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 51 | 39 | 27 | A (-9°F) | 48 | 37 | 26 |
| B (5°C) | 43 | 31 | 19 | B (9°F) | 41 | 29 | 18 |
| C (20°C) | 32 | 21 | 9 | C (36°F) | 30 | 20 | 9 |
| D (50°C) | 14 | 5 | | D (90°F) | 13 | 5 | |
| E (80°C) | 2 | | | E (144°F) | 2 | | |

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

Original Certification Date: December 18, 1985

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.999 | m$^2$ | 32.28 | ft$^2$ | **Net Aperture Area:** | 2.806 | m$^2$ | 30.20 | ft$^2$ |
| **Dry Weight:** | 46.3 | kg | 102 | lb | **Fluid Capacity:** | 4.7 | l | 1.2 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Flat Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 56 | 0.89 | 498 | 2.00 |
| 126 | 2.00 | 2117 | 8.50 |
| 252 | 3.99 | 7844 | 31.49 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.763 | -6.6200 | (P)/I | -0.0100 | (P)$^2$/I | 0.768 | -7.24 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.763 | -1.1666 | (P)/I | -0.0010 | (P)$^2$/I | 0.768 | -1.276 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1230 | (S) | -0.1030 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | | (S) | (Linear Fit) | | |

**Model Tested:** Radco 408P-HP
**Test Fluid:** Water
**Test Flow Rate:** 56 ml/s 0.89 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Integrated Solar, LLC**
2030 W. Pinnacle Peak Road
Phoenix, AZ 85027 USA

MODEL: Radco 410C-HP
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1985-030B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 62 | 47 | 32 | A (-9°F) | 59 | 45 | 30 |
| B (5°C) | 56 | 41 | 26 | B (9°F) | 53 | 39 | 25 |
| C (20°C) | 47 | 32 | 17 | C (36°F) | 45 | 30 | 16 |
| D (50°C) | 30 | 16 | 4 | D (90°F) | 28 | 15 | 4 |
| E (80°C) | 15 | 4 | | E (144°F) | 14 | 4 | |

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

Original Certification Date: December 18, 1985

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.708 | m$^2$ | 39.91 | ft$^2$ | **Net Aperture Area:** | 3.488 | m$^2$ | 37.55 | ft$^2$ |
| **Dry Weight:** | 58.566 | kg | 129 | lb | **Fluid Capacity:** | 3.3 | l | 0.9 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.774 | -4.2000 | (P)/I | -0.0090 | (P)$^2$/I | 0.779 | -4.77 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.774 | -0.7402 | (P)/I | -0.0009 | (P)$^2$/I | 0.779 | -0.841 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.0520 | (S) | -0.1585 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.22 | (S) | (Linear Fit) | |

**Model Tested:** Radco 408C-HP
**Test Fluid:** Water
**Test Flow Rate:** 56 ml/s 0.89 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Integrated Solar, LLC**
2030 W. Pinnacle Peak Road
Phoenix, AZ 85027 USA

MODEL: Radco 410P-HP
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1985-030E

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 63 | 48 | 33 | A (-9°F) | 60 | 46 | 31 |
| B (5°C) | 53 | 38 | 24 | B (9°F) | 50 | 36 | 23 |
| C (20°C) | 40 | 26 | 12 | C (36°F) | 38 | 25 | 11 |
| D (50°C) | 17 | 6 | | D (90°F) | 16 | 6 | |
| E (80°C) | 2 | | | E (144°F) | 2 | | |

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

Original Certification Date: December 18, 1985

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.708 | m$^2$ | 39.91 | ft$^2$ | **Net Aperture Area:** | 3.488 | m$^2$ | 37.55 | ft$^2$ |
| **Dry Weight:** | 56.75 | kg | 125 | lb | **Fluid Capacity:** | 5.7 | l | 1.5 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Flat Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.763 | -6.6200 | (P)/I | -0.0100 | (P)$^2$/I | 0.768 | -7.24 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.763 | -1.1666 | (P)/I | -0.0010 | (P)$^2$/I | 0.768 | -1.276 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1230 | (S) | -0.1030 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | | (S) | (Linear Fit) | |

**Model Tested:** Radco 408P-HP
**Test Fluid:** Water
**Test Flow Rate:** 56 ml/s 0.89 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Integrated Solar, LLC**
2030 W. Pinnacle Peak Road
Phoenix, AZ 85027 USA

MODEL: Radco 412C-HP
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1985-030C

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 76 | 57 | 39 | A (-9°F) | 72 | 54 | 37 |
| B (5°C) | 68 | 50 | 31 | B (9°F) | 64 | 47 | 29 |
| C (20°C) | 57 | 39 | 21 | C (36°F) | 54 | 37 | 20 |
| D (50°C) | 36 | 20 | 5 | D (90°F) | 34 | 19 | 5 |
| E (80°C) | 18 | 5 | | E (144°F) | 17 | 5 | |

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

Original Certification Date: December 18, 1985

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 4.490 | m$^2$ | 48.33 | ft$^2$ | **Net Aperture Area:** | 4.212 | m$^2$ | 45.34 | ft$^2$ |
| **Dry Weight:** | 70.37 | kg | 155 | lb | **Fluid Capacity:** | 3.7 | l | 1.0 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.774 | -4.2000 | (P)/I | -0.0090 | (P)$^2$/I | 0.779 | -4.77 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.774 | -0.7402 | (P)/I | -0.0009 | (P)$^2$/I | 0.779 | -0.841 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.0520 | (S) | -0.1585 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.22 | (S) | (Linear Fit) | |

**Model Tested:** Radco 408C-HP
**Test Fluid:** Water
**Test Flow Rate:** 56 ml/s 0.89 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Integrated Solar, LLC**
2030 W. Pinnacle Peak Road
Phoenix, AZ 85027 USA

MODEL: Radco 412P-HP
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1985-030F

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 76 | 58 | 40 | A (-9°F) | 72 | 55 | 38 |
| B (5°C) | 65 | 47 | 29 | B (9°F) | 62 | 45 | 27 |
| C (20°C) | 49 | 31 | 14 | C (36°F) | 46 | 29 | 13 |
| D (50°C) | 21 | 7 | | D (90°F) | 20 | 7 | |
| E (80°C) | 3 | | | E (144°F) | 3 | | |

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

Original Certification Date: December 18, 1985

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 4.490 | m$^2$ | 48.33 | ft$^2$ | **Net Aperture Area:** | 4.212 | m$^2$ | 45.34 | ft$^2$ |
| **Dry Weight:** | 68.1 | kg | 150 | lb | **Fluid Capacity:** | 6.7 | l | 1.8 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Flat Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.763 | -6.6200 | (P)/I | -0.0100 | (P)$^2$/I | 0.768 | -7.24 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.763 | -1.1666 | (P)/I | -0.0010 | (P)$^2$/I | 0.768 | -1.276 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1230 | (S) | -0.1030 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | | (S) | (Linear Fit) | |

**Model Tested:** Radco 408P-HP
**Test Fluid:** Water
**Test Flow Rate:** 56 ml/s 0.89 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **King Solar Products**
One World Trade Center
121 SW Salmon Street, Suite 1100
Portland, OR 97204 USA

MODEL: King Solar Products Inc. (AET) KS-21
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-029C

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 29 | 22 | 15 | A (-9°F) | 27 | 20 | 14 |
| B (5°C) | 26 | 19 | 12 | B (9°F) | 25 | 18 | 11 |
| C (20°C) | 22 | 15 | 8 | C (36°F) | 21 | 14 | 8 |
| D (50°C) | 13 | 7 | 2 | D (90°F) | 12 | 7 | 1 |
| E (80°C) | 5 | 1 | | E (144°F) | 5 | 1 | |

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

Original Certification Date: August 16, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.931 | m$^2$ | 20.79 | ft$^2$ | **Net Aperture Area:** | 1.783 | m$^2$ | 19.19 | ft$^2$ |
| **Dry Weight:** | 33.6 | kg | 74 | lb | **Fluid Capacity:** | 3.0 | l | 0.8 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| 20 | 0.32 | 18 | 0.07 |
| 50 | 0.79 | 116 | 0.47 |
| 80 | 1.27 | 301 | 1.21 |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 (P)$^2$/I | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 (P)$^2$/I | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

$K_{\alpha\tau}$ = 1.0 -0.1939 (S) -0.0055 (S)$^2$

$K_{\alpha\tau}$ = 1.0 -0.20 (S) (Linear Fit)

**Model Tested:** AE-21
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **King Solar Products**
One World Trade Center
121 SW Salmon Street, Suite 1100
Portland, OR 97204 USA

MODEL: King Solar Products Inc. (AET) KS-24
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-029D

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 33 | 25 | 17 | A (-9°F) | 31 | 23 | 16 |
| B (5°C) | 30 | 22 | 14 | B (9°F) | 28 | 21 | 13 |
| C (20°C) | 25 | 17 | 9 | C (36°F) | 24 | 16 | 9 |
| D (50°C) | 15 | 8 | 2 | D (90°F) | 14 | 8 | 2 |
| E (80°C) | 6 | 1 | | E (144°F) | 6 | 1 | |

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

Original Certification Date: August 16, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.212 | m$^2$ | 23.81 | ft$^2$ | **Net Aperture Area:** | 2.043 | m$^2$ | 21.99 | ft$^2$ |
| **Dry Weight:** | 38.1 | kg | 84 | lb | **Fluid Capacity:** | 3.4 | l | 0.9 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 (P)$^2$/I | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 (P)$^2$/I | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

$K_{\alpha\tau}$ = 1.0 -0.1939 (S) -0.0055 (S)$^2$

$K_{\alpha\tau}$ = 1.0 -0.20 (S) (Linear Fit)

**Model Tested:** AE-21
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

March, 2008
Certification must be renewed annually. For current status contact:
SOLAR RATING & CERTIFICATION CORPORATION
c/o FSEC ♦ 1679 Clearlake Road ♦ Cocoa, FL 32922 ♦ (321) 638-1537♦ Fax (321) 638-1010

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **King Solar Products**
One World Trade Center
121 SW Salmon Street, Suite 1100
Portland, OR 97204 USA

MODEL: King Solar Products Inc. (AET) KS-26
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-029E

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 35 | 26 | 18 | A (-9°F) | 33 | 25 | 17 |
| B (5°C) | 32 | 23 | 15 | B (9°F) | 30 | 22 | 14 |
| C (20°C) | 27 | 18 | 10 | C (36°F) | 25 | 17 | 9 |
| D (50°C) | 16 | 8 | 2 | D (90°F) | 15 | 8 | 2 |
| E (80°C) | 6 | 1 | | E (144°F) | 6 | 1 | |

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

Original Certification Date: August 16, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.355 | m$^2$ | 25.35 | ft$^2$ | **Net Aperture Area:** | 2.197 | m$^2$ | 23.65 | ft$^2$ |
| **Dry Weight:** | 40.8 | kg | 90 | lb | **Fluid Capacity:** | 3.8 | l | 1.0 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

**Frame:** Anodized Aluminum
**Cover (Outer):** Low Iron Tempered Glass
**Cover (Inner):** None
**Absorber Material:** Tube - Copper / Plate - Copper Fin
**Absorber Coating:** Selective Coating
**Insulation (Side):** Polyisocyanurate
**Insulation (Back):** Polyisocyanurate

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 (P)/I | -0.0197 (P)$^2$/I | | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 (P)/I | -0.0019 (P)$^2$/I | | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

$K_{\alpha\tau}$ = 1.0 -0.1939 (S) -0.0055 (S)$^2$
$K_{\alpha\tau}$ = 1.0 -0.20 (S) (Linear Fit)

**Model Tested:** AE-21
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **King Solar Products**
One World Trade Center
121 SW Salmon Street, Suite 1100
Portland, OR 97204 USA

MODEL: King Solar Products Inc. (AET) KS-28
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-029F

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 39 | 29 | 20 | A (-9°F) | 37 | 28 | 19 |
| B (5°C) | 35 | 26 | 16 | B (9°F) | 33 | 24 | 15 |
| C (20°C) | 29 | 20 | 11 | C (36°F) | 28 | 19 | 10 |
| D (50°C) | 18 | 9 | 2 | D (90°F) | 17 | 9 | 2 |
| E (80°C) | 7 | 1 | | E (144°F) | 6 | 1 | |

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

Original Certification Date: August 16, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.599 | m$^2$ | 27.98 | ft$^2$ | **Net Aperture Area:** | 2.430 | m$^2$ | 26.16 | ft$^2$ |
| **Dry Weight:** | 44.9 | kg | 99 | lb | **Fluid Capacity:** | 4.2 | l | 1.1 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 (P)/I | -0.0197 (P)$^2$/I | | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 (P)/I | -0.0019 (P)$^2$/I | | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 (S) | -0.0055 (S)$^2$ | | |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 (S) | (Linear Fit) | | |

**Model Tested:** AE-21
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **King Solar Products**
One World Trade Center
121 SW Salmon Street, Suite 1100
Portland, OR 97204 USA

MODEL: King Solar Products Inc. (AET) KS-32
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-029A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 44 | 33 | 23 | A (-9°F) | 42 | 31 | 21 |
| B (5°C) | 40 | 29 | 19 | B (9°F) | 38 | 28 | 18 |
| C (20°C) | 33 | 23 | 13 | C (36°F) | 32 | 22 | 12 |
| D (50°C) | 20 | 11 | 2 | D (90°F) | 19 | 10 | 2 |
| E (80°C) | 8 | 1 | | E (144°F) | 7 | 1 | |

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

Original Certification Date: August 31, 2006

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.965 | m$^2$ | 31.92 | ft$^2$ | **Net Aperture Area:** | 2.781 | m$^2$ | 29.94 | ft$^2$ |
| **Dry Weight:** | 51.2 | kg | 113 | lb | **Fluid Capacity:** | 4.9 | l | 1.3 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 (P)$^2$/I | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 (P)$^2$/I | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

$K_{\alpha\tau}$ = 1.0 -0.1939 (S) -0.0055 (S)$^2$

$K_{\alpha\tau}$ = 1.0 -0.20 (S) (Linear Fit)

**Model Tested:** 100-2002-001A
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

March, 2008
Certification must be renewed annually. For current status contact:
SOLAR RATING & CERTIFICATION CORPORATION
c/o FSEC ♦ 1679 Clearlake Road ♦ Cocoa, FL 32922 ♦ (321) 638-1537♦ Fax (321) 638-1010

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **King Solar Products**
One World Trade Center
121 SW Salmon Street, Suite 1100
Portland, OR 97204 USA

MODEL: King Solar Products Inc. (AET) KS-40
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-029B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 55 | 41 | 28 | A (-9°F) | 52 | 39 | 27 |
| B (5°C) | 50 | 36 | 23 | B (9°F) | 47 | 35 | 22 |
| C (20°C) | 42 | 29 | 16 | C (36°F) | 40 | 27 | 15 |
| D (50°C) | 25 | 13 | 3 | D (90°F) | 24 | 13 | 3 |
| E (80°C) | 10 | 1 | | E (144°F) | 9 | 1 | |

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

Original Certification Date: August 31, 2006

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.696 | m$^2$ | 39.78 | ft$^2$ | **Net Aperture Area:** | 3.481 | m$^2$ | 37.47 | ft$^2$ |
| **Dry Weight:** | 69.4 | kg | 153 | lb | **Fluid Capacity:** | 6.1 | l | 1.6 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 (P)$^2$/I | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 (P)$^2$/I | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

$K_{\alpha\tau}$ = 1.0 -0.1939 (S) -0.0055 (S)$^2$

$K_{\alpha\tau}$ = 1.0 -0.20 (S) (Linear Fit)

**Model Tested:** 100-2002-001A
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

March, 2008
Certification must be renewed annually. For current status contact:
SOLAR RATING & CERTIFICATION CORPORATION
c/o FSEC ♦ 1679 Clearlake Road ♦ Cocoa, FL 32922 ♦ (321) 638-1537♦ Fax (321) 638-1010

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Marathon International**
1815 Sismet Road
Mississauga, ONT L4W 1P9 Canada

MODEL: Baxi S-SPC 18
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-041A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 28 | 21 | 15 | A (-9°F) | 27 | 20 | 14 |
| B (5°C) | 25 | 18 | 12 | B (9°F) | 24 | 17 | 11 |
| C (20°C) | 21 | 14 | 7 | C (36°F) | 20 | 13 | 7 |
| D (50°C) | 13 | 7 | 1 | D (90°F) | 12 | 6 | 1 |
| E (80°C) | 6 | 1 | | E (144°F) | 6 | 1 | |

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

Original Certification Date: September 14, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.916 | m$^2$ | 20.62 | ft$^2$ | **Net Aperture Area:** | 1.702 | m$^2$ | 18.32 | ft$^2$ |
| **Dry Weight:** | 32.8 | kg | 72 | lb | **Fluid Capacity:** | 1.5 | l | 0.4 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Glasswool |
| **Insulation (Back):** | Glasswool |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 91 | 0.36 |
| 50 | 0.79 | 307 | 1.23 |
| 80 | 1.27 | 621 | 2.49 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.693 | -4.0357 | (P)/I | -0.0070 | (P)$^2$/I | 0.696 | -4.455 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.693 | -0.7112 | (P)/I | -0.0007 | (P)$^2$/I | 0.696 | -0.785 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1816 | (S) | -0.1220 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.31 | (S) | (Linear Fit) | | |

**Model Tested:** 100-2006-041A
**Test Fluid:** Water
**Test Flow Rate:** 38 ml/s 0.61 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Mr. Sun Solar**
6125 NE Portland Highway
Portland, OR 97218 USA

MODEL: Sol-Reliant AE-40
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2004-008B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 55 | 41 | 28 | A (-9°F) | 52 | 39 | 27 |
| B (5°C) | 50 | 36 | 23 | B (9°F) | 47 | 35 | 22 |
| C (20°C) | 42 | 29 | 16 | C (36°F) | 40 | 27 | 15 |
| D (50°C) | 25 | 13 | 3 | D (90°F) | 24 | 13 | 3 |
| E (80°C) | 10 | 1 | | E (144°F) | 9 | 1 | |

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

Original Certification Date: February 27, 2006

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.696 | m$^2$ | 39.78 | ft$^2$ | **Net Aperture Area:** | 3.481 | m$^2$ | 37.47 | ft$^2$ |
| **Dry Weight:** | 69.4 | kg | 153 | lb | **Fluid Capacity:** | 6.1 | l | 1.6 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 | (P)$^2$/I | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 | (P)$^2$/I | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 | (S) | -0.0055 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | |

**Model Tested:** 100-2002-001A
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Mr. Sun Solar**
6125 NE Portland Highway
Portland, OR 97218 USA

MODEL: Sol-Reliant AE-50
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2004-008C

## COLLECTOR THERMAL PERFORMANCE RATING

**Megajoules Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d |
|---|---|---|---|
| A (-5°C) | 69 | 52 | 35 |
| B (5°C) | 63 | 46 | 29 |
| C (20°C) | 53 | 36 | 20 |
| D (50°C) | 32 | 17 | 4 |
| E (80°C) | 12 | 2 | |

**Thousands of Btu Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
|---|---|---|---|
| A (-9°F) | 66 | 50 | 34 |
| B (9°F) | 60 | 44 | 28 |
| C (36°F) | 50 | 34 | 19 |
| D (90°F) | 30 | 16 | 4 |
| E (144°F) | 12 | 2 | |

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

Original Certification Date: February 27, 2006

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 4.664 | $m^2$ | 50.20 | $ft^2$ | **Net Aperture Area:** | 4.400 | $m^2$ | 47.36 | $ft^2$ |
| **Dry Weight:** | 82.54 | kg | 182 | lb | **Fluid Capacity:** | 6.4 | l | 1.7 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 | $(P)^2/I$ | 0.706 | -4.9099 | $W/m^2 \cdot °C$ |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 | $(P)^2/I$ | 0.706 | -0.865 | $Btu/hr \cdot ft^2 \cdot °F$ |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 | (S) | -0.0055 | $(S)^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | |

**Model Tested:** 100-2002-001A
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Mr. Sun Solar**
6125 NE Portland Highway
Portland, OR 97218 USA

MODEL: Sol-Reliant AE-56
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2004-008A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 77 | 58 | 39 | A (-9°F) | 73 | 55 | 37 |
| B (5°C) | 70 | 51 | 32 | B (9°F) | 66 | 48 | 31 |
| C (20°C) | 58 | 40 | 22 | C (36°F) | 55 | 38 | 21 |
| D (50°C) | 35 | 19 | 4 | D (90°F) | 33 | 18 | 4 |
| E (80°C) | 14 | 2 | | E (144°F) | 13 | 2 | |

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

Original Certification Date: August 26, 2004

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 5.175 | m$^2$ | 55.71 | ft$^2$ | **Net Aperture Area:** | 4.898 | m$^2$ | 52.72 | ft$^2$ |
| **Dry Weight:** | 92.5 | kg | 204 | lb | **Fluid Capacity:** | 6.8 | l | 1.8 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0019 | (P)$^2$/I | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0002 | (P)$^2$/I | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 | (S) | -0.0055 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | |

**Model Tested:** 100-2002-001A
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Oventrop Corporation**
29 Knipes Road
PO Box 789
East Granby, CT 06026 USA

MODEL: Oventrop Solar OV 10-10 AS/AB
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-2006-028A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 17 | 13 | 9 | A (-9°F) | 16 | 12 | 8 |
| B (5°C) | 16 | 12 | 8 | B (9°F) | 15 | 11 | 7 |
| C (20°C) | 15 | 10 | 6 | C (36°F) | 14 | 10 | 6 |
| D (50°C) | 12 | 8 | 4 | D (90°F) | 11 | 7 | 4 |
| E (80°C) | 9 | 5 | 2 | E (144°F) | 8 | 5 | 1 |

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

Original Certification Date: April 13, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.679 | m$^2$ | 18.07 | ft$^2$ | **Net Aperture Area:** | 1.174 | m$^2$ | 12.64 | ft$^2$ |
| **Dry Weight:** | 40 | kg | 88 | lb | **Fluid Capacity:** | 0.4 | l | 0.1 | gal |
| **Test Pressure:** | 1000 | kPa | 145 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Glass Vacuum Tube |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Aluminum |
| **Absorber Coating:** | Sputtered aluminum nitrate |
| **Insulation (Side):** | Vacuum |
| **Insulation (Back):** | Vacuum |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| 20 | 0.32 | 117 | 0.47 |
| 50 | 0.79 | 520 | 2.09 |
| 80 | 1.27 | 1195 | 4.80 |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.46 | -1.2893 | (P)/I | -0.0043 (P)$^2$/I | 0.462 | -1.565 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.46 | -0.2272 | (P)/I | -0.0004 (P)$^2$/I | 0.462 | -0.276 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.1174 (S) | -0.1400 (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.03 (S) | (Linear Fit) | |

**Model Tested:** 2006010A
**Test Fluid:** Water
**Test Flow Rate:** 34 ml/s 0.54 gpm

**REMARKS:** Tested with long axis of tubes oriented No-So. IAM perpendicular to the tubes is listed above. IAM parallel to the tubes = 1.0 - 0.09 S)

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Oventrop Corporation**
29 Knipes Road
PO Box 789
East Granby, CT 06026 USA

MODEL: Oventrop Solar OV 10-20 AS/AB
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-2006-028B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 34 | 26 | 17 | A (-9°F) | 32 | 24 | 16 |
| B (5°C) | 32 | 24 | 16 | B (9°F) | 31 | 23 | 15 |
| C (20°C) | 30 | 21 | 13 | C (36°F) | 28 | 20 | 12 |
| D (50°C) | 24 | 16 | 8 | D (90°F) | 23 | 15 | 7 |
| E (80°C) | 18 | 10 | 3 | E (144°F) | 17 | 10 | 3 |

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

Original Certification Date: April 13, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.394 | m$^2$ | 36.53 | ft$^2$ | **Net Aperture Area:** | 3.008 | m$^2$ | 32.38 | ft$^2$ |
| **Dry Weight:** | 75 | kg | 165 | lb | **Fluid Capacity:** | 0.8 | l | 0.2 | gal |
| **Test Pressure:** | 1000 | kPa | 145 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Glass Vacuum Tube |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Aluminum |
| **Absorber Coating:** | Sputtered aluminum nitrate |
| **Insulation (Side):** | Vacuum |
| **Insulation (Back):** | Vacuum |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = 0.46 | -1.2893 | (P)/I | -0.0043 | (P)$^2$/I | 0.462 | -1.565 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = 0.46 | -0.2272 | (P)/I | -0.0004 | (P)$^2$/I | 0.462 | -0.276 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.1174 | (S) | -0.1400 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.03 | (S) | (Linear Fit) | |

| | | | | |
|---|---|---|---|---|
| **Model Tested:** | 2006010A | | | |
| **Test Fluid:** | Water | | | |
| **Test Flow Rate:** | 34 | ml/s | 0.54 | gpm |

**REMARKS:** Tested with long axis of tubes oriented No-So. IAM perpendicular to the tubes is listed above. IAM parallel to the tubes = 1.0 - 0.09 S)

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Oventrop Corporation**
29 Knipes Road
PO Box 789
East Granby, CT 06026 USA

MODEL: Oventrop Solar OV 5-16 AS/AB
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-2006-027B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 45 | 34 | 23 | A (-9°F) | 43 | 32 | 22 |
| B (5°C) | 42 | 31 | 20 | B (9°F) | 40 | 30 | 19 |
| C (20°C) | 38 | 27 | 17 | C (36°F) | 36 | 26 | 16 |
| D (50°C) | 31 | 20 | 10 | D (90°F) | 29 | 19 | 9 |
| E (80°C) | 23 | 13 | 3 | E (144°F) | 22 | 12 | 3 |

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

Original Certification Date: April 13, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 4.097 | m$^2$ | 44.10 | ft$^2$ | **Net Aperture Area:** | 3.634 | m$^2$ | 39.12 | ft$^2$ |
| **Dry Weight:** | 105 | kg | 232 | lb | **Fluid Capacity:** | 1.0 | l | 0.3 | gal |
| **Test Pressure:** | 1000 | kPa | 145 | psig | | | | | |

## COLLECTOR MATERIALS

**Frame:** Stainless Steel
**Cover (Outer):** Glass Vacuum Tube
**Cover (Inner):** None
**Absorber Material:** Tube - Copper / Plate - Aluminum
**Absorber Coating:** Sputtered aluminium nitride
**Insulation (Side):** Vacuum
**Insulation (Back):** Vacuum

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.4886 | -1.5855 (P)/I | -0.0052 | (P)$^2$/I | 0.4916 | -1.9242 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.4886 | -0.2794 (P)/I | -0.0005 | (P)$^2$/I | 0.4916 | -0.339 | Btu/hr·ft$^2$·°F |

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

$K_{\alpha\tau}$ = 1.0 +0.9474 (S) -1.0762 (S)$^2$
$K_{\alpha\tau}$ = 1.0 -0.18 (S) (Linear Fit)

**Model Tested:** 2006026A
**Test Fluid:** Water
**Test Flow Rate:** 41 ml/s 0.65 gpm

**REMARKS:** Tested with long axis of tubes oriented No-So. IAM perpendicular to the tubes is listed above. IAM parallel to the tubes = 1.0 - 0.32(S)

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Oventrop Corporation**
29 Knipes Road
PO Box 789
East Granby, CT 06026 USA

MODEL: Oventrop Solar OV 5-8 AS/AB
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-2006-027A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
| A (-5°C) | 22 | 17 | 11 | A (-9°F) | 21 | 16 | 11 |
| B (5°C) | 21 | 16 | 10 | B (9°F) | 20 | 15 | 10 |
| C (20°C) | 19 | 14 | 8 | C (36°F) | 18 | 13 | 8 |
| D (50°C) | 15 | 10 | 5 | D (90°F) | 14 | 9 | 4 |
| E (80°C) | 11 | 6 | 1 | E (144°F) | 11 | 6 | 1 |

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

Original Certification Date: April 13, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.028 | $m^2$ | 21.83 | $ft^2$ | **Net Aperture Area:** | 1.830 | $m^2$ | 19.70 $ft^2$ |
| **Dry Weight:** | 49.2 | kg | 108 | lb | **Fluid Capacity:** | 0.5 | l | 0.1 gal |
| **Test Pressure:** | 1000 | kPa | 145 | psig | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Stainless Steel |
| **Cover (Outer):** | Glass Vacuum Tube |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Aluminum |
| **Absorber Coating:** | Sputtered aluminium nitride |
| **Insulation (Side):** | Vacuum |
| **Insulation (Back):** | Vacuum |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| 20 | 0.32 | 73 | 0.29 |
| 50 | 0.79 | 458 | 1.84 |
| 80 | 1.27 | 1173 | 4.71 |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.4886 | -1.5855 | (P)/I | -0.0052 (P)²/I | 0.4916 | -1.9242 | W/m²·°C |
| **I P Units:** | $\eta$ = | 0.4886 | -0.2794 | (P)/I | -0.0005 (P)²/I | 0.4916 | -0.339 | Btu/hr·ft²·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.9474 | (S) | -1.0762 | $(S)^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.18 | (S) | (Linear Fit) | | |

**Model Tested:** 2006026A
**Test Fluid:** Water
**Test Flow Rate:** 41 ml/s 0.65 gpm

**REMARKS:** Tested with long axis of tubes oriented No-So. IAM perpendicular to the tubes is listed above. IAM parallel to the tubes = 1.0 - 0.32(S)

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Pacific West Solar**
9625 N 21st. Drive
Suite 9
Phoenix, AZ 85021 USA

MODEL: Freeze Safe FS410
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2007-062A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 52 | 40 | 27 | A (-9°F) | 50 | 38 | 26 |
| B (5°C) | 45 | 33 | 20 | B (9°F) | 43 | 31 | 19 |
| C (20°C) | 36 | 24 | 12 | C (36°F) | 34 | 23 | 11 |
| D (50°C) | 21 | 10 | 1 | D (90°F) | 20 | 9 | 1 |
| E (80°C) | 9 | 1 | | E (144°F) | 9 | 1 | |

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

Original Certification Date: January 4, 2008

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.880 | m$^2$ | 41.77 | ft$^2$ | **Net Aperture Area:** | 3.608 | m$^2$ | 38.84 | ft$^2$ |
| **Dry Weight:** | 66.7 | kg | 147 | lb | **Fluid Capacity:** | 4.4 | l | 1.2 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Moderately Selective |
| **Insulation (Side):** | Isocyanurate |
| **Insulation (Back):** | Isocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.617 | -4.6304 | (P)/I | +0.0030 | (P)$^2$/I | 0.616 | -4.456 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.617 | -0.8160 | (P)/I | 0.0000 | (P)$^2$/I | 0.616 | -0.785 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1782 | (S) | -0.0191 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.19 | (S) | (Linear Fit) | | |

**Model Tested:** FS410
**Test Fluid:**
**Test Flow Rate:** 114 ml/s 1.80 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Power Partners, Inc.**
200 Newton Bridge Road
Athens, GA 30607 USA

MODEL: Skyline 10-01
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2007-068B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 12 | 9 | 6 | A (-9°F) | 11 | 9 | 6 |
| B (5°C) | 11 | 8 | 5 | B (9°F) | 10 | 7 | 5 |
| C (20°C) | 9 | 6 | 3 | C (36°F) | 8 | 6 | 3 |
| D (50°C) | 5 | 3 | 1 | D (90°F) | 5 | 3 | 1 |
| E (80°C) | 3 | 1 | | E (144°F) | 3 | 1 | |

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

Original Certification Date: March 3, 2008

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 0.933 | m$^2$ | 10.04 | ft$^2$ | **Net Aperture Area:** | 0.847 | m$^2$ | 9.12 ft$^2$ |
| **Dry Weight:** | 8.62 | kg | 19 | lb | **Fluid Capacity:** | 0.6 | l | 0.2 gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Polycarbonate |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.603 | -3.8665 | (P)/I | +0.0015 | (P)$^2$/I | 0.602 | -3.764 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.603 | -0.6814 | (P)/I | 0.0000 | (P)$^2$/I | 0.602 | -0.663 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1944 | (S) | -0.0186 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.21 | (S) | (Linear Fit) | | |

**Model Tested:** 100-2001-002A
**Test Fluid:** Water
**Test Flow Rate:** 32 ml/s 0.50 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Power Partners, Inc.**
200 Newton Bridge Road
Athens, GA 30607 USA

MODEL: Skyline 20-01
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2007-068A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 24 | 18 | 13 | A (-9°F) | 23 | 17 | 12 |
| B (5°C) | 21 | 16 | 10 | B (9°F) | 20 | 15 | 9 |
| C (20°C) | 18 | 12 | 6 | C (36°F) | 17 | 11 | 6 |
| D (50°C) | 11 | 6 | 1 | D (90°F) | 10 | 6 | 1 |
| E (80°C) | 6 | 2 | | E (144°F) | 6 | 2 | |

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

Original Certification Date: March 3, 2008

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.865 | m$^2$ | 20.08 | ft$^2$ | **Net Aperture Area:** | 1.720 | m$^2$ | 18.51 | ft$^2$ |
| **Dry Weight:** | 17.2 | kg | 38 | lb | **Fluid Capacity:** | 1.8 | l | 0.5 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Polycarbonate |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 1291 | 5.18 |
| 40 | 0.63 | 4663 | 18.72 |
| 60 | 0.95 | 9795 | 39.32 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.605 | -3.8370 | (P)/I | +0.0017 | (P)$^2$/I | 0.604 | -3.73 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.605 | -0.6762 | (P)/I | 0.0000 | (P)$^2$/I | 0.604 | -0.657 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1944 | (S) | -0.0186 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.21 | (S) | (Linear Fit) | |

**Model Tested:** 100-2001-002A
**Test Fluid:** Water
**Test Flow Rate:** 32 ml/s 0.50 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **R&R Solar Supply**
922 Austin Lane
Building D
Honolulu, HI 96817 USA

MODEL: Copper Star 21 EPI-308CU(3'x7')
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1999-003D

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 30 | 23 | 15 | A (-9°F) | 28 | 21 | 15 |
| B (5°C) | 26 | 19 | 12 | B (9°F) | 25 | 18 | 11 |
| C (20°C) | 21 | 14 | 7 | C (36°F) | 20 | 13 | 6 |
| D (50°C) | 10 | 4 | | D (90°F) | 10 | 4 | |
| E (80°C) | 2 | | | E (144°F) | 2 | | |

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

Original Certification Date: June 24, 1999

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.901 | m$^2$ | 20.46 | ft$^2$ | **Net Aperture Area:** | 1.745 | m$^2$ | 18.78 | ft$^2$ |
| **Dry Weight:** | 44 | kg | 97 | lb | **Fluid Capacity:** | 7.0 | l | 1.8 | gal |
| **Test Pressure:** | 552 | kPa | 80 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Copper |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Fiberglass Board |
| **Insulation (Back):** | Fiberglass Board |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = 0.697 | -4.8300 | (P)/I | -0.0186 | (P)$^2$/I | 0.708 | -6.11 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = 0.697 | -0.8512 | (P)/I | -0.0018 | (P)$^2$/I | 0.708 | -1.077 | Btu/hr·ft$^2$·°F |

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

$K_{\alpha\tau}$ = 1.0 -0.1297 (S) +0.0214 (S)$^2$
$K_{\alpha\tau}$ = 1.0 -0.11 (S) (Linear Fit)

**Model Tested:** EPI-308SS(3'x7')
**Test Fluid:** Water
**Test Flow Rate:** 35 ml/s 0.55 gpm

## REMARKS:

March, 2008
Certification must be renewed annually. For current status contact:
SOLAR RATING & CERTIFICATION CORPORATION
c/o FSEC ♦ 1679 Clearlake Road ♦ Cocoa, FL 32922 ♦ (321) 638-1537♦ Fax (321) 638-1010

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **R&R Solar Supply**
922 Austin Lane
Building D
Honolulu, HI 96817 USA

MODEL: Copper Star 24 EPI-308CU(3'x8')
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1999-003E

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 34 | 26 | 18 | A (-9°F) | 32 | 24 | 17 |
| B (5°C) | 30 | 22 | 14 | B (9°F) | 28 | 20 | 13 |
| C (20°C) | 24 | 16 | 8 | C (36°F) | 22 | 15 | 7 |
| D (50°C) | 12 | 5 | | D (90°F) | 11 | 5 | |
| E (80°C) | 2 | | | E (144°F) | 2 | | |

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

Original Certification Date: June 24, 1999

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.169 | m$^2$ | 23.35 | ft$^2$ | **Net Aperture Area:** | 2.002 | m$^2$ | 21.55 | ft$^2$ |
| **Dry Weight:** | 48.5 | kg | 107 | lb | **Fluid Capacity:** | 6.9 | l | 1.8 | gal |
| **Test Pressure:** | 552 | kPa | 80 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Copper |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Fiberglass Board |
| **Insulation (Back):** | Fiberglass Board |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.697 | -4.8300 (P)/I | -0.0186 | (P)$^2$/I | 0.708 | -6.11 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.697 | -0.8512 (P)/I | -0.0018 | (P)$^2$/I | 0.708 | -1.077 | Btu/hr·ft$^2$·°F |

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

$K_{\alpha\tau}$ = 1.0 -0.1297 (S) +0.0214 (S)$^2$

$K_{\alpha\tau}$ = 1.0 -0.11 (S) (Linear Fit)

**Model Tested:** EPI-308SS(3'x7')
**Test Fluid:** Water
**Test Flow Rate:** 35 ml/s 0.55 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **R&R Solar Supply**
922 Austin Lane
Building D
Honolulu, HI 96817 USA

MODEL: Copper Star 32 EPI-308CU(4'x8')
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1999-003F

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 46 | 35 | 24 | A (-9°F) | 43 | 33 | 23 |
| B (5°C) | 40 | 29 | 18 | B (9°F) | 38 | 28 | 17 |
| C (20°C) | 32 | 21 | 10 | C (36°F) | 30 | 20 | 10 |
| D (50°C) | 16 | 7 | | D (90°F) | 15 | 6 | |
| E (80°C) | 3 | | | E (144°F) | 3 | | |

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

Original Certification Date: June 24, 1999

## COLLECTOR SPECIFICATIONS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.918 | m$^2$ | 31.41 | ft$^2$ | **Net Aperture Area:** | 2.736 | m$^2$ | 29.45 | ft$^2$ |
| **Dry Weight:** | 68.5 | kg | 151 | lb | **Fluid Capacity:** | 8.8 | l | 2.3 | gal |
| **Test Pressure:** | 552 | kPa | 80 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Copper |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Fiberglass Board |
| **Insulation (Back):** | Fiberglass Board |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = 0.697 | -4.8300 | (P)/I | -0.0186 | (P)$^2$/I | 0.708 | -6.11 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = 0.697 | -0.8512 | (P)/I | -0.0018 | (P)$^2$/I | 0.708 | -1.077 | Btu/hr·ft$^2$·°F |

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

$K_{\alpha\tau}$ = 1.0 -0.1297 (S) +0.0214 (S)$^2$

$K_{\alpha\tau}$ = 1.0 -0.11 (S) (Linear Fit)

**Model Tested:** EPI-308SS(3'x7')
**Test Fluid:** Water
**Test Flow Rate:** 35 ml/s 0.55 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **R&R Solar Supply**
922 Austin Lane
Building D
Honolulu, HI 96817 USA

MODEL: Sunlast 21 EPI-308SS(3'x7')
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1999-003A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 30 | 23 | 15 | A (-9°F) | 28 | 21 | 15 |
| B (5°C) | 26 | 19 | 12 | B (9°F) | 25 | 18 | 11 |
| C (20°C) | 21 | 14 | 7 | C (36°F) | 20 | 13 | 6 |
| D (50°C) | 10 | 4 | | D (90°F) | 10 | 4 | |
| E (80°C) | 2 | | | E (144°F) | 2 | | |

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

Original Certification Date: June 24, 1999

## COLLECTOR SPECIFICATIONS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.901 | m$^2$ | 20.46 | ft$^2$ | **Net Aperture Area:** | 1.745 | m$^2$ | 18.78 | ft$^2$ |
| **Dry Weight:** | 40.6 | kg | 90 | lb | **Fluid Capacity:** | 7.0 | l | 1.8 | gal |
| **Test Pressure:** | 552 | kPa | 80 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Stainless Steel |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Fiberglass Board |
| **Insulation (Back):** | Fiberglass Board |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| 20 | 0.32 | 43 | 0.17 |
| 40 | 0.63 | 149 | 0.60 |
| 60 | 0.95 | 319 | 1.28 |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.697 | -4.8300 | (P)/I | -0.0186 (P)$^2$/I | 0.708 | -6.11 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.697 | -0.8512 | (P)/I | -0.0018 (P)$^2$/I | 0.708 | -1.077 | Btu/hr·ft$^2$·°F |

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

$K_{\alpha\tau}$ = 1.0 -0.1297 (S) +0.0214 (S)$^2$
$K_{\alpha\tau}$ = 1.0 -0.11 (S) (Linear Fit)

**Model Tested:** EPI-308SS(3'x7')
**Test Fluid:** Water
**Test Flow Rate:** 35 ml/s 0.55 gpm

## REMARKS:

March, 2008
Certification must be renewed annually. For current status contact:
SOLAR RATING & CERTIFICATION CORPORATION
c/o FSEC ♦ 1679 Clearlake Road ♦ Cocoa, FL 32922 ♦ (321) 638-1537♦ Fax (321) 638-1010

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **R&R Solar Supply**
922 Austin Lane
Building D
Honolulu, HI 96817 USA

MODEL: Sunlast 24 EPI-308SS(3'x8')
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1999-003B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 34 | 26 | 18 | A (-9°F) | 32 | 24 | 17 |
| B (5°C) | 30 | 22 | 14 | B (9°F) | 28 | 20 | 13 |
| C (20°C) | 24 | 16 | 8 | C (36°F) | 22 | 15 | 7 |
| D (50°C) | 12 | 5 | | D (90°F) | 11 | 5 | |
| E (80°C) | 2 | | | E (144°F) | 2 | | |

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

Original Certification Date: June 24, 1999

## COLLECTOR SPECIFICATIONS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.169 | m$^2$ | 23.35 | ft$^2$ | **Net Aperture Area:** | 2.002 | m$^2$ | 21.55 | ft$^2$ |
| **Dry Weight:** | 43.6 | kg | 96 | lb | **Fluid Capacity:** | 6.9 | l | 1.8 | gal |
| **Test Pressure:** | 552 | kPa | 80 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Stainless Steel |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Fiberglass Board |
| **Insulation (Back):** | Fiberglass Board |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = 0.697 | -4.8300 | (P)/I | -0.0186 | (P)$^2$/I | 0.708 | -6.11 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = 0.697 | -0.8512 | (P)/I | -0.0018 | (P)$^2$/I | 0.708 | -1.077 | Btu/hr·ft$^2$·°F |

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

$K_{\alpha\tau}$ = 1.0 -0.1297 (S) +0.0214 (S)$^2$

$K_{\alpha\tau}$ = 1.0 -0.11 (S) (Linear Fit)

**Model Tested:** EPI-308SS(3'x7')
**Test Fluid:** Water
**Test Flow Rate:** 35 ml/s 0.55 gpm

## REMARKS:

March, 2008
Certification must be renewed annually. For current status contact:
SOLAR RATING & CERTIFICATION CORPORATION
c/o FSEC ♦ 1679 Clearlake Road ♦ Cocoa, FL 32922 ♦ (321) 638-1537♦ Fax (321) 638-1010

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **R&R Solar Supply**
922 Austin Lane
Building D
Honolulu, HI 96817 USA

MODEL: Sunlast 32 EPI-308SS(4'x8')
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1999-003C

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 46 | 35 | 24 | A (-9°F) | 43 | 33 | 23 |
| B (5°C) | 40 | 29 | 18 | B (9°F) | 38 | 28 | 17 |
| C (20°C) | 32 | 21 | 10 | C (36°F) | 30 | 20 | 10 |
| D (50°C) | 16 | 7 | | D (90°F) | 15 | 6 | |
| E (80°C) | 3 | | | E (144°F) | 3 | | |

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

Original Certification Date: June 24, 1999

## COLLECTOR SPECIFICATIONS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.918 | m$^2$ | 31.41 | ft$^2$ | **Net Aperture Area:** | 2.736 | m$^2$ | 29.45 | ft$^2$ |
| **Dry Weight:** | 62.6 | kg | 138 | lb | **Fluid Capacity:** | 8.8 | l | 2.3 | gal |
| **Test Pressure:** | 552 | kPa | 80 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Stainless Steel |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Fiberglass Board |
| **Insulation (Back):** | Fiberglass Board |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = 0.697 | -4.8300 | (P)/I | -0.0186 | (P)$^2$/I | 0.708 | -6.11 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = 0.697 | -0.8512 | (P)/I | -0.0018 | (P)$^2$/I | 0.708 | -1.077 | Btu/hr·ft$^2$·°F |

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

$K_{\alpha\tau}$ = 1.0 -0.1297 (S) +0.0214 (S)$^2$
$K_{\alpha\tau}$ = 1.0 -0.11 (S) (Linear Fit)

**Model Tested:** EPI-308SS(3'x7')
**Test Fluid:** Water
**Test Flow Rate:** 35 ml/s 0.55 gpm

## REMARKS:

March, 2008
Certification must be renewed annually. For current status contact:
SOLAR RATING & CERTIFICATION CORPORATION
c/o FSEC ♦ 1679 Clearlake Road ♦ Cocoa, FL 32922 ♦ (321) 638-1537♦ Fax (321) 638-1010

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **R&R Solar Supply**
922 Austin Lane
Building D
Honolulu, HI 96817 USA

MODEL: Sunpro Sunpro 21
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2001-001A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 30 | 23 | 16 | A (-9°F) | 29 | 22 | 15 |
| B (5°C) | 26 | 19 | 12 | B (9°F) | 25 | 18 | 11 |
| C (20°C) | 21 | 14 | 7 | C (36°F) | 20 | 13 | 6 |
| D (50°C) | 10 | 4 | | D (90°F) | 10 | 4 | |
| E (80°C) | 2 | | | E (144°F) | 2 | | |

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

Original Certification Date: July 2, 2001

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.900 | m$^2$ | 20.45 | ft$^2$ | **Net Aperture Area:** | 1.748 | m$^2$ | 18.82 | ft$^2$ |
| **Dry Weight:** | 39.9 | kg | 88 | lb | **Fluid Capacity:** | 7.0 | l | 1.8 | gal |
| **Test Pressure:** | 552 | kPa | 80 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Fiberglass Board |
| **Insulation (Back):** | Fiberglass Board |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| 20 | 0.32 | 43 | 0.17 |
| 40 | 0.63 | 149 | 0.60 |
| 60 | 0.95 | 319 | 1.28 |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.697 | -4.8300 | (P)/I | -0.0186 (P)$^2$/I | 0.708 | -6.11 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.697 | -0.8512 | (P)/I | -0.0018 (P)$^2$/I | 0.708 | -1.077 | Btu/hr·ft$^2$·°F |

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

$K_{\alpha\tau}$ = 1.0 -0.1297 (S) +0.0214 (S)$^2$
$K_{\alpha\tau}$ = 1.0 -0.11 (S) (Linear Fit)

**Model Tested:** EPI-308SS(3'x7')
**Test Fluid:** Water
**Test Flow Rate:** 35 ml/s 0.55 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **R&R Solar Supply**
922 Austin Lane
Building D
Honolulu, HI 96817 USA

MODEL: Sunpro Sunpro 24
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2001-001B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 34 | 26 | 18 | A (-9°F) | 33 | 25 | 17 |
| B (5°C) | 30 | 22 | 14 | B (9°F) | 29 | 21 | 13 |
| C (20°C) | 24 | 16 | 8 | C (36°F) | 23 | 15 | 7 |
| D (50°C) | 12 | 5 | | D (90°F) | 11 | 5 | |
| E (80°C) | 2 | | | E (144°F) | 2 | | |

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

Original Certification Date: July 2, 2001

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.169 | m$^2$ | 23.35 | ft$^2$ | **Net Aperture Area:** | 2.002 | m$^2$ | 21.55 | ft$^2$ |
| **Dry Weight:** | 44 | kg | 97 | lb | **Fluid Capacity:** | 6.9 | l | 1.8 | gal |
| **Test Pressure:** | 552 | kPa | 80 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Fiberglass Board |
| **Insulation (Back):** | Fiberglass Board |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = 0.697 | -4.8300 | (P)/I | -0.0186 | (P)$^2$/I | 0.708 | -6.11 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = 0.697 | -0.8512 | (P)/I | -0.0018 | (P)$^2$/I | 0.708 | -1.077 | Btu/hr·ft$^2$·°F |

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

$K_{\alpha\tau}$ = 1.0 -0.1297 (S) +0.0214 (S)$^2$
$K_{\alpha\tau}$ = 1.0 -0.11 (S) (Linear Fit)

**Model Tested:** EPI-308SS(3'x7')
**Test Fluid:** Water
**Test Flow Rate:** 35 ml/s 0.55 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **R&R Solar Supply**
922 Austin Lane
Building D
Honolulu, HI 96817 USA

MODEL: Sunpro Sunpro 32
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2001-001C

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 46 | 35 | 24 | A (-9°F) | 44 | 33 | 23 |
| B (5°C) | 40 | 29 | 18 | B (9°F) | 38 | 28 | 17 |
| C (20°C) | 32 | 21 | 10 | C (36°F) | 30 | 20 | 10 |
| D (50°C) | 16 | 7 | | D (90°F) | 15 | 6 | |
| E (80°C) | 3 | | | E (144°F) | 3 | | |

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

Original Certification Date: July 2, 2001

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.918 | m$^2$ | 31.41 | ft$^2$ | **Net Aperture Area:** | 2.736 | m$^2$ | 29.45 | ft$^2$ |
| **Dry Weight:** | 55.8 | kg | 123 | lb | **Fluid Capacity:** | 8.9 | l | 2.4 | gal |
| **Test Pressure:** | 552 | kPa | 80 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Fiberglass Board |
| **Insulation (Back):** | Fiberglass Board |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = 0.697 | -4.8300 | (P)/I | -0.0186 | (P)$^2$/I | 0.708 | -6.11 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = 0.697 | -0.8512 | (P)/I | -0.0018 | (P)$^2$/I | 0.708 | -1.077 | Btu/hr·ft$^2$·°F |

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

$K_{\alpha\tau}$ = 1.0 -0.1297 (S) +0.0214 (S)$^2$

$K_{\alpha\tau}$ = 1.0 -0.11 (S) (Linear Fit)

**Model Tested:** EPI-308SS(3'x7')
**Test Fluid:** Water
**Test Flow Rate:** 35 ml/s 0.55 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **R&R Solar Supply**
922 Austin Lane
Building D
Honolulu, HI 96817 USA

MODEL: Sunpro Sunpro 40
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2001-001D

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 58 | 44 | 30 | A (-9°F) | 55 | 41 | 28 |
| B (5°C) | 50 | 37 | 23 | B (9°F) | 48 | 35 | 22 |
| C (20°C) | 40 | 26 | 13 | C (36°F) | 38 | 25 | 12 |
| D (50°C) | 20 | 8 | | D (90°F) | 19 | 8 | |
| E (80°C) | 4 | | | E (144°F) | 3 | | |

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

Original Certification Date: July 2, 2001

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.642 | m$^2$ | 39.20 | ft$^2$ | **Net Aperture Area:** | 3.428 | m$^2$ | 36.90 | ft$^2$ |
| **Dry Weight:** | 77.1 | kg | 170 | lb | **Fluid Capacity:** | 10.8 | l | 2.9 | gal |
| **Test Pressure:** | 552 | kPa | 80 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Fiberglass Board |
| **Insulation (Back):** | Fiberglass Board |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = 0.697 | -4.8300 | (P)/I | -0.0186 | (P)$^2$/I | 0.708 | -6.11 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = 0.697 | -0.8512 | (P)/I | -0.0018 | (P)$^2$/I | 0.708 | -1.077 | Btu/hr·ft$^2$·°F |

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

$K_{\alpha\tau}$ = 1.0 -0.1297 (S) +0.0214 (S)$^2$
$K_{\alpha\tau}$ = 1.0 -0.11 (S) (Linear Fit)

**Model Tested:** EPI-308SS(3'x7')
**Test Fluid:** Water
**Test Flow Rate:** 35 ml/s 0.55 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Rheem Water Heaters**
101 Bell Rd
Montgomery, AL 36117 USA

MODEL: Rheem RS21-BC
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2005-022A

## COLLECTOR THERMAL PERFORMANCE RATING

**Megajoules Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d |
|---|---|---|---|
| A (-5°C) | 31 | 24 | 16 |
| B (5°C) | 29 | 21 | 14 |
| C (20°C) | 24 | 17 | 9 |
| D (50°C) | 14 | 8 | 2 |
| E (80°C) | 5 | | |

**Thousands of Btu Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
|---|---|---|---|
| A (-9°F) | 30 | 22 | 15 |
| B (9°F) | 27 | 20 | 13 |
| C (36°F) | 23 | 16 | 9 |
| D (90°F) | 14 | 7 | 2 |
| E (144°F) | 4 | | |

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

Original Certification Date: March 8, 2006

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.983 | m² | 21.35 | ft² | **Net Aperture Area:** | 1.867 | m² | 20.10 ft² |
| **Dry Weight:** | 40.6 | kg | 90 | lb | **Fluid Capacity:** | 3.6 | l | 1.0 gal |
| **Test Pressure:** | 179 | kPa | 26 | psig | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - None / Plate - Steel |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Glasswool |
| **Insulation (Back):** | Glasswool |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 56 | 0.22 |
| 50 | 0.79 | 243 | 0.98 |
| 80 | 1.27 | 570 | 2.29 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.731 | -3.0411 | (P)/I | -0.0325 | $(P)^2/I$ | 0.759 | -5.93 | W/m²·°C |
| **I P Units:** | $\eta$ = | 0.731 | -0.5359 | (P)/I | -0.0032 | $(P)^2/I$ | 0.759 | -1.045 | Btu/hr·ft²·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1798 | (S) | +0.0214 | $(S)^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.16 | (S) | (Linear Fit) | |

**Model Tested:** K
**Test Fluid:** Water
**Test Flow Rate:** 37 ml/s 0.59 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Rheem Water Heaters**
101 Bell Rd
Montgomery, AL 36117 USA

MODEL: Rheem RS21-BP
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2005-021A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 32 | 25 | 17 | A (-9°F) | 31 | 23 | 16 |
| B (5°C) | 29 | 21 | 13 | B (9°F) | 27 | 20 | 13 |
| C (20°C) | 23 | 15 | 8 | C (36°F) | 22 | 14 | 7 |
| D (50°C) | 9 | 3 | | D (90°F) | 9 | 3 | |
| E (80°C) | | | | E (144°F) | | | |

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

Original Certification Date: March 8, 2006

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.983 | m$^2$ | 21.35 | ft$^2$ | **Net Aperture Area:** | 1.867 | m$^2$ | 20.10 | ft$^2$ |
| **Dry Weight:** | 40.6 | kg | 90 | lb | **Fluid Capacity:** | 3.6 | l | 1.0 | gal |
| **Test Pressure:** | 179 | kPa | 26 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - None / Plate - Steel |
| **Absorber Coating:** | Polyester Flat Black Paint |
| **Insulation (Side):** | Polyester |
| **Insulation (Back):** | Polyester |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 73 | 0.29 |
| 50 | 0.79 | 312 | 1.25 |
| 80 | 1.27 | 656 | 2.63 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.737 | -4.4193 | (P)/I | -0.0503 | (P)$^2$/I | 0.7724 | -8.36 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.737 | -0.7788 | (P)/I | -0.0049 | (P)$^2$/I | 0.7724 | -1.473 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1395 | (S) | +0.0127 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.13 | (S) | (Linear Fit) | | |

**Model Tested:** J
**Test Fluid:** Water
**Test Flow Rate:** 37 ml/s 0.59 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Rheem Water Heaters**
101 Bell Rd
Montgomery, AL 36117 USA

MODEL: Rheem RS21-SC
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2005-023A

## COLLECTOR THERMAL PERFORMANCE RATING

**Megajoules Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d |
|---|---|---|---|
| A (-5°C) | 34 | 25 | 17 |
| B (5°C) | 30 | 22 | 14 |
| C (20°C) | 24 | 17 | 9 |
| D (50°C) | 15 | 8 | 2 |
| E (80°C) | 8 | 2 | |

**Thousands of Btu Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
|---|---|---|---|
| A (-9°F) | 32 | 24 | 17 |
| B (9°F) | 28 | 21 | 13 |
| C (36°F) | 23 | 16 | 8 |
| D (90°F) | 14 | 8 | 2 |
| E (144°F) | 7 | 2 | |

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

Original Certification Date: March 8, 2006

## COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.983 | m² | 21.35 | ft² | **Net Aperture Area:** | 1.870 m² | 20.13 ft² |
| **Dry Weight:** | 31.5 | kg | 69 | lb | **Fluid Capacity:** | 2.3 l | 0.6 gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Titianium oxide |
| **Insulation (Side):** | Polyester wool |
| **Insulation (Back):** | Glasswool |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 37 | 0.15 |
| 50 | 0.79 | 136 | 0.54 |
| 80 | 1.27 | 289 | 1.16 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.753 | -5.2917 | (P)/I | +0.0064 | $(P)^2/I$ | 0.75 | -4.8668 | W/m²·°C |
| **I P Units:** | $\eta$ = | 0.753 | -0.9325 | (P)/I | 0.0000 | $(P)^2/I$ | 0.75 | -0.858 | Btu/hr·ft²·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.1429 | (S) | -0.2362 | $(S)^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.10 | (S) | (Linear Fit) | | |

**Model Tested:** Bt
**Test Fluid:** Water
**Test Flow Rate:** 37 ml/s 0.59 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Schuco USA L.P.**
240 Pane Road
Newington, CT 06111 USA

MODEL: Compact Compact S
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2005-009B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
| A (-5°C) | 36 | 27 | 18 | A (-9°F) | 34 | 25 | 17 |
| B (5°C) | 33 | 24 | 15 | B (9°F) | 31 | 23 | 15 |
| C (20°C) | 28 | 20 | 11 | C (36°F) | 27 | 19 | 11 |
| D (50°C) | 19 | 11 | 3 | D (90°F) | 18 | 10 | 3 |
| E (80°C) | 9 | 3 | | E (144°F) | 9 | 3 | |

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

Original Certification Date:

## COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.311 | $m^2$ | 24.88 | $ft^2$ | **Net Aperture Area:** | 2.141 | $m^2$ | 23.05 | $ft^2$ |
| **Dry Weight:** | 41 | kg | 90 | lb | **Fluid Capacity:** | 1.5 | l | 0.4 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Sputtered cermet |
| **Insulation (Side):** | None |
| **Insulation (Back):** | Mineral Wool |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 1979 | 7.95 |
| 50 | 0.79 | 8473 | 34.02 |
| 80 | 1.27 | 19198 | 77.07 |

## TECHNICAL INFORMATION

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

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | **Y Intercept** | **Slope** | |
| **S I Units:** | $\eta$ = | 0.706 | -2.9209 | (P)/I | -0.0179 | $(P)^2/I$ | 0.715 | -3.994 | $W/m^2 \cdot °C$ |
| **I P Units:** | $\eta$ = | 0.706 | -0.5147 | (P)/I | -0.0018 | $(P)^2/I$ | 0.715 | -0.704 | $Btu/hr \cdot ft^2 \cdot °F$ |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.0574 | (S) | -0.1117 | $(S)^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.17 | (S) | (Linear Fit) | |

| | | | | |
|---|---|---|---|---|
| **Model Tested:** | Slimline V | | | |
| **Test Fluid:** | Water | | | |
| **Test Flow Rate:** | 43 | ml/s | 0.68 | gpm |

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Schuco USA L.P.**
240 Pane Road
Newington, CT 06111 USA

MODEL: Premium V, H, LA
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2005-008A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 42 | 32 | 21 | A (-9°F) | 40 | 30 | 20 |
| B (5°C) | 38 | 28 | 18 | B (9°F) | 36 | 27 | 17 |
| C (20°C) | 33 | 23 | 13 | C (36°F) | 31 | 22 | 12 |
| D (50°C) | 21 | 12 | 3 | D (90°F) | 20 | 11 | 3 |
| E (80°C) | 10 | 2 | | E (144°F) | 9 | 2 | |

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

Original Certification Date: December 20, 2005

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.699 | m$^2$ | 29.05 | ft$^2$ | **Net Aperture Area:** | 2.504 | m$^2$ | 26.95 | ft$^2$ |
| **Dry Weight:** | 55 | kg | 121 | lb | **Fluid Capacity:** | 2.0 | l | 0.5 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Sputtered cermet |
| **Insulation (Side):** | None |
| **Insulation (Back):** | Mineral Wool |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 2753 | 11.05 |
| 50 | 0.79 | 10758 | 43.19 |
| 80 | 1.27 | 23413 | 93.99 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.708 | -3.1129 | (P)/I | -0.0193 | (P)$^2$/I | 0.718 | -4.276 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.708 | -0.5486 | (P)/I | -0.0019 | (P)$^2$/I | 0.718 | -0.754 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.0163 | (S) | -0.1574 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.18 | (S) | (Linear Fit) | | |

**Model Tested:** Premium V
**Test Fluid:** Water
**Test Flow Rate:** 50 ml/s 0.79 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Schuco USA L.P.**
240 Pane Road
Newington, CT 06111 USA

MODEL: Slimline V, LA
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2005-009A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
| A (-5°C) | 36 | 27 | 18 | A (-9°F) | 34 | 25 | 17 |
| B (5°C) | 33 | 24 | 15 | B (9°F) | 31 | 23 | 15 |
| C (20°C) | 28 | 20 | 11 | C (36°F) | 27 | 19 | 11 |
| D (50°C) | 19 | 11 | 3 | D (90°F) | 18 | 10 | 3 |
| E (80°C) | 9 | 3 | | E (144°F) | 9 | 3 | |

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

Original Certification Date: December 20, 2005

## COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.311 | $m^2$ | 24.88 | $ft^2$ | **Net Aperture Area:** | 2.141 | $m^2$ | 23.05 | $ft^2$ |
| **Dry Weight:** | 41 | kg | 90 | lb | **Fluid Capacity:** | 1.5 | l | 0.4 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Sputtered cermet |
| **Insulation (Side):** | None |
| **Insulation (Back):** | Mineral Wool |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 1979 | 7.95 |
| 50 | 0.79 | 8473 | 34.02 |
| 80 | 1.27 | 19198 | 77.07 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.706 | -2.9209 | (P)/I | -0.0179 | $(P)^2/I$ | 0.715 | -3.994 | $W/m^2 \cdot °C$ |
| **I P Units:** | $\eta$ = | 0.706 | -0.5147 | (P)/I | -0.0018 | $(P)^2/I$ | 0.715 | -0.704 | $Btu/hr \cdot ft^2 \cdot °F$ |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.0574 | (S) | -0.1117 | $(S)^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.17 | (S) | (Linear Fit) | |

**Model Tested:** Slimline V
**Test Fluid:** Water
**Test Flow Rate:** 43 ml/s 0.68 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Sealed Air Corporation**
3433 Arden Road
Hayward, CA 94545 USA

MODEL: FW-48
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1997-010C

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 77 | 60 | 42 | A (-9°F) | 73 | 57 | 40 |
| B (5°C) | 61 | 43 | 26 | B (9°F) | 58 | 41 | 25 |
| C (20°C) | 44 | 27 | 11 | C (36°F) | 42 | 26 | 10 |
| D (50°C) | 26 | 11 | 1 | D (90°F) | 25 | 10 | 1 |
| E (80°C) | 25 | 11 | | E (144°F) | 24 | 10 | |

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

Original Certification Date: April 1, 1997

## COLLECTOR SPECIFICATIONS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 4.403 | m$^2$ | 47.40 | ft$^2$ | **Net Aperture Area:** | 4.098 | m$^2$ | 44.11 | ft$^2$ |
| **Dry Weight:** | 33.1 | kg | 73 | lb | **Fluid Capacity:** | 11.7 | l | 3.1 | gal |
| **Test Pressure:** | 207 | kPa | 30 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Galvanized steel with fiber reinforced back |
| **Cover (Outer):** | None |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Co-polymer plastic / Plate - Co-polymer plastic |
| **Absorber Coating:** | None |
| **Insulation (Side):** | None |
| **Insulation (Back):** | None |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.736 | -9.3230 | (P)/I | -0.0701 | (P)$^2$/I | 0.739 | -8.21 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.736 | -1.6430 | (P)/I | -0.0069 | (P)$^2$/I | 0.739 | -1.447 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.0529 | (S) | -0.0437 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | | (S) | (Linear Fit) | |

**Model Tested:** FW-48
**Test Fluid:** Water
**Test Flow Rate:** 284 ml/s 4.50 gpm

**REMARKS:** Tests conducted outdoors.

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solahart Industries**
101 Bell Road
Montgomery, AL 36117 USA

MODEL: Solahart Bt
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2004-007A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 34 | 25 | 17 | A (-9°F) | 32 | 24 | 17 |
| B (5°C) | 30 | 22 | 14 | B (9°F) | 28 | 21 | 13 |
| C (20°C) | 24 | 17 | 9 | C (36°F) | 23 | 16 | 8 |
| D (50°C) | 15 | 8 | 2 | D (90°F) | 14 | 8 | 2 |
| E (80°C) | 8 | 2 | | E (144°F) | 7 | 2 | |

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

Original Certification Date: May 28, 2004

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.983 | m$^2$ | 21.35 | ft$^2$ | **Net Aperture Area:** | 1.870 | m$^2$ | 20.13 | ft$^2$ |
| **Dry Weight:** | 31.5 | kg | 69 | lb | **Fluid Capacity:** | 2.3 | l | 0.6 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Titianium oxide |
| **Insulation (Side):** | Polyester wool |
| **Insulation (Back):** | Glasswool |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 37 | 0.15 |
| 50 | 0.79 | 136 | 0.54 |
| 80 | 1.27 | 289 | 1.16 |

## TECHNICAL INFORMATION

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

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | **Y Intercept** | **Slope** | |
| **S I Units:** | $\eta$ = | 0.753 | -5.2917 | (P)/I | +0.0064 | (P)$^2$/I | 0.75 | -4.8668 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.753 | -0.9325 | (P)/I | 0.0000 | (P)$^2$/I | 0.75 | -0.858 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.1429 | (S) | -0.2362 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.10 | (S) | (Linear Fit) | | |

**Model Tested:** Bt
**Test Fluid:** Water
**Test Flow Rate:** 37 ml/s 0.59 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solahart Industries**
101 Bell Road
Montgomery, AL 36117 USA

MODEL: Solahart J
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2000-002A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 32 | 25 | 17 | A (-9°F) | 31 | 23 | 16 |
| B (5°C) | 29 | 21 | 13 | B (9°F) | 27 | 20 | 13 |
| C (20°C) | 23 | 15 | 8 | C (36°F) | 22 | 14 | 7 |
| D (50°C) | 9 | 3 | | D (90°F) | 9 | 3 | |
| E (80°C) | | | | E (144°F) | | | |

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

Original Certification Date: October 16, 2000

## COLLECTOR SPECIFICATIONS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.983 | m$^2$ | 21.35 | ft$^2$ | **Net Aperture Area:** | 1.867 | m$^2$ | 20.10 | ft$^2$ |
| **Dry Weight:** | 40.6 | kg | 90 | lb | **Fluid Capacity:** | 3.6 | l | 1.0 | gal |
| **Test Pressure:** | 179 | kPa | 26 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - None / Plate - Steel |
| **Absorber Coating:** | Polyester Flat Black Paint |
| **Insulation (Side):** | Polyester |
| **Insulation (Back):** | Polyester |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 73 | 0.29 |
| 50 | 0.79 | 312 | 1.25 |
| 80 | 1.27 | 656 | 2.63 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.737 | -4.4193 | (P)/I | -0.0503 | (P)$^2$/I | 0.7724 | -8.36 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.737 | -0.7788 | (P)/I | -0.0049 | (P)$^2$/I | 0.7724 | -1.473 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1395 | (S) | +0.0127 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.13 | (S) | (Linear Fit) | | |

**Model Tested:** J
**Test Fluid:** Water
**Test Flow Rate:** 37 ml/s 0.59 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solahart Industries**
101 Bell Road
Montgomery, AL 36117 USA

MODEL: Solahart Kf
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2004-002A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
| A (-5°C) | 31 | 24 | 16 | A (-9°F) | 30 | 22 | 15 |
| B (5°C) | 29 | 21 | 14 | B (9°F) | 27 | 20 | 13 |
| C (20°C) | 24 | 17 | 9 | C (36°F) | 23 | 16 | 9 |
| D (50°C) | 14 | 8 | 2 | D (90°F) | 14 | 7 | 2 |
| E (80°C) | 5 | | | E (144°F) | 4 | | |

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

Original Certification Date: March 5, 2004

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.983 | $m^2$ | 21.35 | $ft^2$ | **Net Aperture Area:** | 1.867 | $m^2$ | 20.10 | $ft^2$ |
| **Dry Weight:** | 40.6 | kg | 90 | lb | **Fluid Capacity:** | 3.6 | l | 1.0 | gal |
| **Test Pressure:** | 179 | kPa | 26 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - None / Plate - Steel |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Glasswool |
| **Insulation (Back):** | Glasswool |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 56 | 0.22 |
| 50 | 0.79 | 243 | 0.98 |
| 80 | 1.27 | 570 | 2.29 |

## TECHNICAL INFORMATION

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

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | **Y Intercept** | **Slope** | |
| **S I Units:** | $\eta$ = | 0.731 | -3.0411 | (P)/I | -0.0325 | $(P)^2/I$ | 0.759 | -5.93 | $W/m^2 \cdot °C$ |
| **I P Units:** | $\eta$ = | 0.731 | -0.5359 | (P)/I | -0.0032 | $(P)^2/I$ | 0.759 | -1.045 | $Btu/hr \cdot ft^2 \cdot °F$ |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1798 | (S) | +0.0214 | $(S)^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.16 | (S) | (Linear Fit) | | |

**Model Tested:** K
**Test Fluid:** Water
**Test Flow Rate:** 37 ml/s 0.59 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solahart Industries**
101 Bell Road
Montgomery, AL 36117 USA

MODEL: Solahart L
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2000-004A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 27 | 20 | 14 | A (-9°F) | 25 | 19 | 13 |
| B (5°C) | 23 | 16 | 10 | B (9°F) | 21 | 15 | 9 |
| C (20°C) | 16 | 10 | 4 | C (36°F) | 15 | 10 | 4 |
| D (50°C) | 5 | 1 | | D (90°F) | 5 | 1 | |
| E (80°C) | | | | E (144°F) | | | |

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

Original Certification Date: October 16, 2000

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.983 | m$^2$ | 21.35 | ft$^2$ | **Net Aperture Area:** | 1.867 | m$^2$ | 20.10 | ft$^2$ |
| **Dry Weight:** | 31.4 | kg | 69 | lb | **Fluid Capacity:** | 2.2 | l | 0.6 | gal |
| **Test Pressure:** | 1104 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Aluminum |
| **Absorber Coating:** | Polyester Flat Black Paint |
| **Insulation (Side):** | Polyester |
| **Insulation (Back):** | Polyester |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 52 | 0.21 |
| 50 | 0.79 | 283 | 1.14 |
| 80 | 1.27 | 706 | 2.83 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.608 | -5.4707 | (P)/I | -0.0271 | (P)$^2$/I | 0.625 | -7.47 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.608 | -0.9641 | (P)/I | -0.0027 | (P)$^2$/I | 0.625 | -1.316 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1718 | (S) | -0.0580 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.23 | (S) | (Linear Fit) | | |

**Model Tested:** L
**Test Fluid:** Water
**Test Flow Rate:** 37 ml/s 0.59 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solahart Industries**
101 Bell Road
Montgomery, AL 36117 USA

MODEL: Solahart M
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2000-005A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 28 | 21 | 14 | A (-9°F) | 26 | 20 | 14 |
| B (5°C) | 24 | 18 | 11 | B (9°F) | 23 | 17 | 11 |
| C (20°C) | 20 | 13 | 7 | C (36°F) | 19 | 13 | 6 |
| D (50°C) | 11 | 6 | 1 | D (90°F) | 11 | 5 | 1 |
| E (80°C) | 5 | 1 | | E (144°F) | 4 | 1 | |

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

Original Certification Date: October 16, 2000

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.983 | m$^2$ | 21.35 | ft$^2$ | **Net Aperture Area:** | 1.867 | m$^2$ | 20.10 | ft$^2$ |
| **Dry Weight:** | 31.5 | kg | 69 | lb | **Fluid Capacity:** | 2.2 | l | 0.6 | gal |
| **Test Pressure:** | 1104 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Polyester |
| **Insulation (Back):** | Polyester |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 51 | 0.20 |
| 50 | 0.79 | 245 | 0.98 |
| 80 | 1.27 | 594 | 2.38 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.621 | -4.1009 | (P)/I | -0.0060 | (P)$^2$/I | 0.625 | -4.53 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.621 | -0.7227 | (P)/I | -0.0006 | (P)$^2$/I | 0.625 | -0.798 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1194 | (S) | -0.0121 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.13 | (S) | (Linear Fit) | |

**Model Tested:** M
**Test Fluid:** Water
**Test Flow Rate:** 37 ml/s 0.59 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solar Development, Inc.**
PO Box 13139
North Palm Beach, FL 33408 USA

MODEL: Solar Development SD8-21
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-042A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 29 | 22 | 15 | A (-9°F) | 27 | 20 | 14 |
| B (5°C) | 26 | 19 | 12 | B (9°F) | 25 | 18 | 11 |
| C (20°C) | 22 | 15 | 8 | C (36°F) | 21 | 14 | 8 |
| D (50°C) | 13 | 7 | 2 | D (90°F) | 12 | 7 | 1 |
| E (80°C) | 5 | 1 | | E (144°F) | 5 | 1 | |

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

Original Certification Date: December 13, 2006

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.931 | m$^2$ | 20.79 | ft$^2$ | **Net Aperture Area:** | 1.783 | m$^2$ | 19.19 | ft$^2$ |
| **Dry Weight:** | 33.6 | kg | 74 | lb | **Fluid Capacity:** | 3.0 | l | 0.8 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 18 | 0.07 |
| 50 | 0.79 | 116 | 0.47 |
| 80 | 1.27 | 301 | 1.21 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 | (P)$^2$/I | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 | (P)$^2$/I | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 | (S) | -0.0055 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | | |

**Model Tested:** 100-2002-001A
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solar Development, Inc.**
PO Box 13139
North Palm Beach, FL 33408 USA

MODEL: Solar Development SD8-26
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-042C

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 35 | 26 | 18 | A (-9°F) | 33 | 25 | 17 |
| B (5°C) | 32 | 23 | 15 | B (9°F) | 30 | 22 | 14 |
| C (20°C) | 27 | 18 | 10 | C (36°F) | 25 | 17 | 9 |
| D (50°C) | 16 | 8 | 2 | D (90°F) | 15 | 8 | 2 |
| E (80°C) | 6 | 1 | | E (144°F) | 6 | 1 | |

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

Original Certification Date: December 13, 2006

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.355 | m$^2$ | 25.35 | ft$^2$ | **Net Aperture Area:** | 2.197 | m$^2$ | 23.65 | ft$^2$ |
| **Dry Weight:** | 40.8 | kg | 90 | lb | **Fluid Capacity:** | 3.8 | l | 1.0 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 | (P)$^2$/I | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 | (P)$^2$/I | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 | (S) | -0.0055 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | |

**Model Tested:** 100-2002-001A
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solar Development, Inc.**
PO Box 13139
North Palm Beach, FL 33408 USA

MODEL: Solar Development SD8-28
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-042D

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 39 | 29 | 20 | A (-9°F) | 37 | 28 | 19 |
| B (5°C) | 35 | 26 | 16 | B (9°F) | 33 | 24 | 15 |
| C (20°C) | 29 | 20 | 11 | C (36°F) | 28 | 19 | 10 |
| D (50°C) | 18 | 9 | 2 | D (90°F) | 17 | 9 | 2 |
| E (80°C) | 7 | 1 | | E (144°F) | 6 | 1 | |

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

Original Certification Date: December 13, 2006

## COLLECTOR SPECIFICATIONS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.599 | m$^2$ | 27.98 | ft$^2$ | **Net Aperture Area:** | 2.430 | m$^2$ | 26.16 | ft$^2$ |
| **Dry Weight:** | 44.9 | kg | 99 | lb | **Fluid Capacity:** | 4.2 | l | 1.1 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 | (P)$^2$/I | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 | (P)$^2$/I | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 | (S) | -0.0055 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | | |

**Model Tested:** 100-2002-001A
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solar Development, Inc.**
PO Box 13139
North Palm Beach, FL 33408 USA

MODEL: Solar Development SD8-32
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-042E

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 44 | 33 | 23 | A (-9°F) | 42 | 31 | 21 |
| B (5°C) | 40 | 29 | 19 | B (9°F) | 38 | 28 | 18 |
| C (20°C) | 33 | 23 | 13 | C (36°F) | 32 | 22 | 12 |
| D (50°C) | 20 | 11 | 2 | D (90°F) | 19 | 10 | 2 |
| E (80°C) | 8 | 1 | | E (144°F) | 7 | 1 | |

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

Original Certification Date: December 13, 2006

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.965 | m$^2$ | 31.92 | ft$^2$ | **Net Aperture Area:** | 2.781 | m$^2$ | 29.94 | ft$^2$ |
| **Dry Weight:** | 51.2 | kg | 113 | lb | **Fluid Capacity:** | 4.9 | l | 1.3 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 | (P)$^2$/I | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 | (P)$^2$/I | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 | (S) | -0.0055 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | |

**Model Tested:** 100-2002-001A
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

# CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solar Development, Inc.**
PO Box 13139
North Palm Beach, FL 33408 USA

MODEL: Solar Development SD8-40
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-042F

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 55 | 41 | 28 | A (-9°F) | 52 | 39 | 27 |
| B (5°C) | 50 | 36 | 23 | B (9°F) | 47 | 35 | 22 |
| C (20°C) | 42 | 29 | 16 | C (36°F) | 40 | 27 | 15 |
| D (50°C) | 25 | 13 | 3 | D (90°F) | 24 | 13 | 3 |
| E (80°C) | 10 | 1 | | E (144°F) | 9 | 1 | |

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

Original Certification Date: December 13, 2006

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.696 | m$^2$ | 39.78 | ft$^2$ | **Net Aperture Area:** | 3.481 | m$^2$ | 37.47 | ft$^2$ |
| **Dry Weight:** | 69.4 | kg | 153 | lb | **Fluid Capacity:** | 6.1 | l | 1.6 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 | (P)$^2$/I | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 | (P)$^2$/I | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 | (S) | -0.0055 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | | |

**Model Tested:** 100-2002-001A
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solar Energy 4 U llc.**
4521 P.G.A. Blvd PMB #307
Palm Beach Gardens, FL 33418 USA

MODEL: Sonnenkraft SK500L
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2007-035B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 38 | 28 | 19 | A (-9°F) | 36 | 27 | 18 |
| B (5°C) | 35 | 25 | 16 | B (9°F) | 33 | 24 | 15 |
| C (20°C) | 30 | 21 | 12 | C (36°F) | 28 | 20 | 11 |
| D (50°C) | 21 | 12 | 4 | D (90°F) | 20 | 11 | 4 |
| E (80°C) | 12 | 4 | | E (144°F) | 11 | 4 | |

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

Original Certification Date: January 24, 2008

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.571 | m$^2$ | 27.67 | ft$^2$ | **Net Aperture Area:** | 2.336 | m$^2$ | 25.15 | ft$^2$ |
| **Dry Weight:** | 49 | kg | 108 | lb | **Fluid Capacity:** | 1.6 | l | 0.4 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Rock Wool |
| **Insulation (Back):** | Rock Wool |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.679 | -2.8521 | (P)/I | -0.0122 | (P)$^2$/I | 0.686 | -3.593 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.679 | -0.5026 | (P)/I | -0.0012 | (P)$^2$/I | 0.686 | -0.633 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1149 | (S) | -0.0882 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.21 | (S) | (Linear Fit) | | |

**Model Tested:** 100-2006-030A
**Test Fluid:** Water
**Test Flow Rate:** 51 ml/s 0.81 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solar Energy 4 U llc.**
4521 P.G.A. Blvd PMB #307
Palm Beach Gardens, FL 33418 USA

MODEL: Sonnenkraft SK500N
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2007-035A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
| A (-5°C) | 38 | 28 | 19 | A (-9°F) | 36 | 27 | 18 |
| B (5°C) | 35 | 25 | 16 | B (9°F) | 33 | 24 | 15 |
| C (20°C) | 30 | 21 | 12 | C (36°F) | 28 | 20 | 11 |
| D (50°C) | 21 | 12 | 4 | D (90°F) | 20 | 11 | 4 |
| E (80°C) | 12 | 4 | | E (144°F) | 11 | 4 | |

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

Original Certification Date: January 24, 2008

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.571 | $m^2$ | 27.67 | $ft^2$ | **Net Aperture Area:** | 2.336 | $m^2$ | 25.15 $ft^2$ |
| **Dry Weight:** | 49 | kg | 108 | lb | **Fluid Capacity:** | 1.6 | l | 0.4 gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Rock Wool |
| **Insulation (Back):** | Rock Wool |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 262 | 1.05 |
| 50 | 0.79 | 885 | 3.55 |
| 80 | 1.27 | 1784 | 7.16 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.679 | -2.8521 | (P)/I | -0.0122 | $(P)^2/I$ | 0.686 | -3.593 | $W/m^2 \cdot °C$ |
| **I P Units:** | $\eta$ = | 0.679 | -0.5026 | (P)/I | -0.0012 | $(P)^2/I$ | 0.686 | -0.633 | $Btu/hr \cdot ft^2 \cdot °F$ |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1149 | (S) | -0.0882 | $(S)^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.21 | (S) | (Linear Fit) | |

**Model Tested:** 100-2006-030A
**Test Fluid:** Water
**Test Flow Rate:** 51 ml/s 0.81 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

# CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solar Skies Mfg, LLC**
800 Industrial Park, Hwy 28 West
Starbuck, MN 56381 USA

MODEL: North Star NSC-21
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2007-040A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 30 | 22 | 15 | A (-9°F) | 28 | 21 | 14 |
| B (5°C) | 27 | 20 | 12 | B (9°F) | 26 | 19 | 12 |
| C (20°C) | 23 | 15 | 8 | C (36°F) | 21 | 15 | 8 |
| D (50°C) | 14 | 7 | 2 | D (90°F) | 13 | 7 | 2 |
| E (80°C) | 5 | 1 | | E (144°F) | 5 | 1 | |

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

Original Certification Date: October 4, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.997 | m$^2$ | 21.50 | ft$^2$ | **Net Aperture Area:** | 1.760 | m$^2$ | 18.95 | ft$^2$ |
| **Dry Weight:** | 37.2 | kg | 82 | lb | **Fluid Capacity:** | 3.2 | l | 0.8 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 | (P)$^2$/I | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 | (P)$^2$/I | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 | (S) | -0.0055 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | | |

**Model Tested:** 100-2002-001A
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solar Skies Mfg, LLC**
800 Industrial Park, Hwy 28 West
Starbuck, MN 56381 USA

MODEL: North Star NSC-24
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2007-040B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 34 | 25 | 17 | A (-9°F) | 32 | 24 | 16 |
| B (5°C) | 31 | 22 | 14 | B (9°F) | 29 | 21 | 13 |
| C (20°C) | 26 | 18 | 10 | C (36°F) | 24 | 17 | 9 |
| D (50°C) | 15 | 8 | 2 | D (90°F) | 15 | 8 | 2 |
| E (80°C) | 6 | 1 | | E (144°F) | 6 | 1 | |

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

Original Certification Date: October 4, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.276 | m$^2$ | 24.50 | ft$^2$ | **Net Aperture Area:** | 2.015 | m$^2$ | 21.69 | ft$^2$ |
| **Dry Weight:** | 46.3 | kg | 102 | lb | **Fluid Capacity:** | 3.4 | l | 0.9 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 | (P)$^2$/I | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 | (P)$^2$/I | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 | (S) | -0.0055 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | | |

**Model Tested:** 100-2002-001A
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solar Skies Mfg, LLC**
800 Industrial Park, Hwy 28 West
Starbuck, MN 56381 USA

MODEL: North Star NSC-26
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2007-040C

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 36 | 27 | 18 | A (-9°F) | 34 | 26 | 17 |
| B (5°C) | 33 | 24 | 15 | B (9°F) | 31 | 23 | 14 |
| C (20°C) | 27 | 19 | 10 | C (36°F) | 26 | 18 | 10 |
| D (50°C) | 16 | 9 | 2 | D (90°F) | 16 | 8 | 2 |
| E (80°C) | 6 | 1 | | E (144°F) | 6 | 1 | |

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

Original Certification Date: October 4, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.416 | m$^2$ | 26.01 | ft$^2$ | **Net Aperture Area:** | 2.171 | m$^2$ | 23.37 | ft$^2$ |
| **Dry Weight:** | 46.3 | kg | 102 | lb | **Fluid Capacity:** | 4.2 | l | 1.1 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 | (P)$^2$/I | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 | (P)$^2$/I | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 | (S) | -0.0055 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | | |

**Model Tested:** 100-2002-001A
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solar Skies Mfg, LLC**
800 Industrial Park, Hwy 28 West
Starbuck, MN 56381 USA

MODEL: North Star NSC-28
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2007-040D

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 39 | 30 | 20 | A (-9°F) | 37 | 28 | 19 |
| B (5°C) | 36 | 26 | 17 | B (9°F) | 34 | 25 | 16 |
| C (20°C) | 30 | 21 | 11 | C (36°F) | 29 | 20 | 11 |
| D (50°C) | 18 | 10 | 2 | D (90°F) | 17 | 9 | 2 |
| E (80°C) | 7 | 1 | | E (144°F) | 7 | 1 | |

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

Original Certification Date: October 4, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.663 | m$^2$ | 28.67 | ft$^2$ | **Net Aperture Area:** | 2.403 | m$^2$ | 25.87 | ft$^2$ |
| **Dry Weight:** | 54.4 | kg | 120 | lb | **Fluid Capacity:** | 4.5 | l | 1.2 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 | (P)$^2$/I | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 | (P)$^2$/I | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 | (S) | -0.0055 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | | |

**Model Tested:** 100-2002-001A
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solar Skies Mfg, LLC**
800 Industrial Park, Hwy 28 West
Starbuck, MN 56381 USA

MODEL: North Star NSC-32
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2007-040E

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 45 | 34 | 23 | A (-9°F) | 43 | 32 | 22 |
| B (5°C) | 41 | 30 | 19 | B (9°F) | 39 | 28 | 18 |
| C (20°C) | 34 | 23 | 13 | C (36°F) | 32 | 22 | 12 |
| D (50°C) | 21 | 11 | 2 | D (90°F) | 20 | 10 | 2 |
| E (80°C) | 8 | 1 | | E (144°F) | 8 | 1 | |

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

Original Certification Date: October 4, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.035 | m$^2$ | 32.67 | ft$^2$ | **Net Aperture Area:** | 2.750 | m$^2$ | 29.60 ft$^2$ |
| **Dry Weight:** | 60.3 | kg | 133 | lb | **Fluid Capacity:** | 4.9 | l | 1.3 gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 | (P)$^2$/I | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 | (P)$^2$/I | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 | (S) | -0.0055 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | | |

**Model Tested:** 100-2002-001A
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solar Skies Mfg, LLC**
800 Industrial Park, Hwy 28 West
Starbuck, MN 56381 USA

MODEL: North Star NSC-40
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2007-040F

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 58 | 44 | 30 | A (-9°F) | 55 | 42 | 28 |
| B (5°C) | 53 | 39 | 24 | B (9°F) | 50 | 37 | 23 |
| C (20°C) | 44 | 30 | 17 | C (36°F) | 42 | 29 | 16 |
| D (50°C) | 27 | 14 | 3 | D (90°F) | 25 | 13 | 3 |
| E (80°C) | 10 | 1 | | E (144°F) | 10 | 1 | |

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

Original Certification Date: October 4, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.916 | m$^2$ | 42.15 | ft$^2$ | **Net Aperture Area:** | 3.580 | m$^2$ | 38.54 | ft$^2$ |
| **Dry Weight:** | 72.1 | kg | 159 | lb | **Fluid Capacity:** | 6.1 | l | 1.6 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 | (P)$^2$/I | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 | (P)$^2$/I | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 | (S) | -0.0055 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | | |

**Model Tested:** 100-2002-001A
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solar Skies Mfg, LLC**
800 Industrial Park, Hwy 28 West
Starbuck, MN 56381 USA

MODEL: Solar Skies SS-21
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2007-039A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 29 | 22 | 15 | A (-9°F) | 27 | 20 | 14 |
| B (5°C) | 26 | 19 | 12 | B (9°F) | 25 | 18 | 11 |
| C (20°C) | 22 | 15 | 8 | C (36°F) | 21 | 14 | 8 |
| D (50°C) | 13 | 7 | 2 | D (90°F) | 12 | 7 | 1 |
| E (80°C) | 5 | 1 | | E (144°F) | 5 | 1 | |

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

Original Certification Date: October 4, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.931 | m$^2$ | 20.79 | ft$^2$ | **Net Aperture Area:** | 1.783 | m$^2$ | 19.19 | ft$^2$ |
| **Dry Weight:** | 33.6 | kg | 74 | lb | **Fluid Capacity:** | 3.0 | l | 0.8 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 18 | 0.07 |
| 50 | 0.79 | 116 | 0.47 |
| 80 | 1.27 | 301 | 1.21 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 | (P)$^2$/I | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 | (P)$^2$/I | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 | (S) | -0.0055 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | |

**Model Tested:** 100-2002-001A
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solar Skies Mfg, LLC**
800 Industrial Park, Hwy 28 West
Starbuck, MN 56381 USA

MODEL: Solar Skies SS-24
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2007-039B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 33 | 25 | 17 | A (-9°F) | 31 | 23 | 16 |
| B (5°C) | 30 | 22 | 14 | B (9°F) | 28 | 21 | 13 |
| C (20°C) | 25 | 17 | 9 | C (36°F) | 24 | 16 | 9 |
| D (50°C) | 15 | 8 | 2 | D (90°F) | 14 | 8 | 2 |
| E (80°C) | 6 | 1 | | E (144°F) | 6 | 1 | |

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

Original Certification Date: October 4, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.212 | m$^2$ | 23.81 | ft$^2$ | **Net Aperture Area:** | 2.043 | m$^2$ | 21.99 | ft$^2$ |
| **Dry Weight:** | 38.1 | kg | 84 | lb | **Fluid Capacity:** | 3.4 | l | 0.9 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 | (P)$^2$/I | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 | (P)$^2$/I | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 | (S) | -0.0055 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | | |

**Model Tested:** 100-2002-001A
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solar Skies Mfg, LLC**
800 Industrial Park, Hwy 28 West
Starbuck, MN 56381 USA

MODEL: Solar Skies SS-26
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2007-039C

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
| A (-5°C) | 35 | 26 | 18 | A (-9°F) | 33 | 25 | 17 |
| B (5°C) | 32 | 23 | 15 | B (9°F) | 30 | 22 | 14 |
| C (20°C) | 27 | 18 | 10 | C (36°F) | 25 | 17 | 9 |
| D (50°C) | 16 | 8 | 2 | D (90°F) | 15 | 8 | 2 |
| E (80°C) | 6 | 1 | | E (144°F) | 6 | 1 | |

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

Original Certification Date: October 4, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.355 | $m^2$ | 25.35 | $ft^2$ | **Net Aperture Area:** | 2.197 | $m^2$ | 23.65 | $ft^2$ |
| **Dry Weight:** | 40.8 | kg | 90 | lb | **Fluid Capacity:** | 3.8 | l | 1.0 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 | $(P)^2/I$ | 0.706 | -4.9099 | $W/m^2 \cdot °C$ |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 | $(P)^2/I$ | 0.706 | -0.865 | $Btu/hr \cdot ft^2 \cdot °F$ |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 | (S) | -0.0055 | $(S)^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | |

**Model Tested:** 100-2002-001A
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solar Skies Mfg, LLC**
800 Industrial Park, Hwy 28 West
Starbuck, MN 56381 USA

MODEL: Solar Skies SS-28
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2007-039D

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 39 | 29 | 20 | A (-9°F) | 37 | 28 | 19 |
| B (5°C) | 35 | 26 | 16 | B (9°F) | 33 | 24 | 15 |
| C (20°C) | 29 | 20 | 11 | C (36°F) | 28 | 19 | 10 |
| D (50°C) | 18 | 9 | 2 | D (90°F) | 17 | 9 | 2 |
| E (80°C) | 7 | 1 | | E (144°F) | 6 | 1 | |

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

Original Certification Date: October 4, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.599 | m$^2$ | 27.98 | ft$^2$ | **Net Aperture Area:** | 2.430 | m$^2$ | 26.16 | ft$^2$ |
| **Dry Weight:** | 44.9 | kg | 99 | lb | **Fluid Capacity:** | 4.2 | l | 1.1 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 | (P)$^2$/I | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 | (P)$^2$/I | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 | (S) | -0.0055 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | | |

**Model Tested:** 100-2002-001A
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solar Skies Mfg, LLC**
800 Industrial Park, Hwy 28 West
Starbuck, MN 56381 USA

MODEL: Solar Skies SS-32
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2007-039E

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 44 | 33 | 23 | A (-9°F) | 42 | 31 | 21 |
| B (5°C) | 40 | 29 | 19 | B (9°F) | 38 | 28 | 18 |
| C (20°C) | 33 | 23 | 13 | C (36°F) | 32 | 22 | 12 |
| D (50°C) | 20 | 11 | 2 | D (90°F) | 19 | 10 | 2 |
| E (80°C) | 8 | 1 | | E (144°F) | 7 | 1 | |

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

Original Certification Date: October 4, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.965 | m$^2$ | 31.92 | ft$^2$ | **Net Aperture Area:** | 2.781 | m$^2$ | 29.94 | ft$^2$ |
| **Dry Weight:** | 51.2 | kg | 113 | lb | **Fluid Capacity:** | 4.9 | l | 1.3 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 | (P)$^2$/I | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 | (P)$^2$/I | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 | (S) | -0.0055 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | |

**Model Tested:** 100-2002-001A
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solar Skies Mfg, LLC**
800 Industrial Park, Hwy 28 West
Starbuck, MN 56381 USA

MODEL: Solar Skies SS-40
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2007-039F

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 55 | 41 | 28 | A (-9°F) | 52 | 39 | 27 |
| B (5°C) | 50 | 36 | 23 | B (9°F) | 47 | 35 | 22 |
| C (20°C) | 42 | 29 | 16 | C (36°F) | 40 | 27 | 15 |
| D (50°C) | 25 | 13 | 3 | D (90°F) | 24 | 13 | 3 |
| E (80°C) | 10 | 1 | | E (144°F) | 9 | 1 | |

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

Original Certification Date: October 4, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.696 | m$^2$ | 39.78 | ft$^2$ | **Net Aperture Area:** | 3.481 | m$^2$ | 37.47 | ft$^2$ |
| **Dry Weight:** | 69.4 | kg | 153 | lb | **Fluid Capacity:** | 6.1 | l | 1.6 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 | (P)$^2$/I | 0.706 | -4.9099 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 | (P)$^2$/I | 0.706 | -0.865 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 | (S) | -0.0055 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | | |

**Model Tested:** 100-2002-001A
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solar Skies Mfg, LLC**
800 Industrial Park, Hwy 28 West
Starbuck, MN 56381 USA

MODEL: Solar Skies SS-50
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2007-039G

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
| A (-5°C) | 69 | 52 | 35 | A (-9°F) | 66 | 50 | 34 |
| B (5°C) | 63 | 46 | 29 | B (9°F) | 60 | 44 | 28 |
| C (20°C) | 53 | 36 | 20 | C (36°F) | 50 | 34 | 19 |
| D (50°C) | 32 | 17 | 4 | D (90°F) | 30 | 16 | 4 |
| E (80°C) | 12 | 2 | | E (144°F) | 12 | 2 | |

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

Original Certification Date: October 4, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 4.664 | $m^2$ | 50.20 | $ft^2$ | **Net Aperture Area:** | 4.400 | $m^2$ | 47.36 | $ft^2$ |
| **Dry Weight:** | 82.54 | kg | 182 | lb | **Fluid Capacity:** | 6.4 | l | 1.7 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.691 | -3.3960 | (P)/I | -0.0197 | $(P)^2/I$ | 0.706 | -4.9099 | $W/m^2 \cdot °C$ |
| **I P Units:** | $\eta$ = | 0.691 | -0.5985 | (P)/I | -0.0019 | $(P)^2/I$ | 0.706 | -0.865 | $Btu/hr \cdot ft^2 \cdot °F$ |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1939 | (S) | -0.0055 | $(S)^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | |

**Model Tested:** 100-2002-001A
**Test Fluid:** Water
**Test Flow Rate:** 39 ml/s 0.62 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

# CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solar Thermal Systems**
4723 Tidewater Avenue
Oakland, CA 94601 USA

MODEL: Solar Thermal Systems STS 410BC
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2008-001B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 59 | 44 | 30 | A (-9°F) | 56 | 42 | 28 |
| B (5°C) | 54 | 40 | 25 | B (9°F) | 52 | 38 | 24 |
| C (20°C) | 47 | 32 | 18 | C (36°F) | 44 | 31 | 17 |
| D (50°C) | 30 | 17 | 5 | D (90°F) | 29 | 17 | 5 |
| E (80°C) | 14 | 4 | | E (144°F) | 14 | 4 | |

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

Original Certification Date: January 10, 2008

## COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.796 | m$^2$ | 40.86 | ft$^2$ | **Net Aperture Area:** | 3.457 | m$^2$ | 37.21 | ft$^2$ |
| **Dry Weight:** | 64 | kg | 141 | lb | **Fluid Capacity:** | 4.5 | l | 1.2 | gal |
| **Test Pressure:** | 0 | kPa | 0 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.75 | -3.0406 | (P)/I | -0.0199 | (P)$^2$/I | 0.758 | -4.1251 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.75 | -0.5358 | (P)/I | -0.0019 | (P)$^2$/I | 0.758 | -0.727 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.2960 | (S) | +0.0191 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.28 | (S) | (Linear Fit) | | |

**Model Tested:** 100-2006-024A
**Test Fluid:** Water
**Test Flow Rate:** 46 ml/s 0.73 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solar Thermal Systems**
4723 Tidewater Avenue
Oakland, CA 94601 USA

MODEL: Solar Thermal Systems STS 410BP
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2007-001B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 56 | 42 | 28 | A (-9°F) | 53 | 40 | 27 |
| B (5°C) | 51 | 37 | 23 | B (9°F) | 48 | 35 | 22 |
| C (20°C) | 43 | 29 | 16 | C (36°F) | 40 | 28 | 15 |
| D (50°C) | 27 | 15 | 4 | D (90°F) | 25 | 14 | 4 |
| E (80°C) | 12 | 3 | | E (144°F) | 12 | 3 | |

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

Original Certification Date: January 24, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.796 | m$^2$ | 40.86 | ft$^2$ | **Net Aperture Area:** | 3.445 | m$^2$ | 37.08 | ft$^2$ |
| **Dry Weight:** | 62.6 | kg | 138 | lb | **Fluid Capacity:** | 4.5 | l | 1.2 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.666 | -3.3563 | (P)/I | -0.0138 | (P)$^2$/I | 0.682 | -4.5392 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.666 | -0.5915 | (P)/I | -0.0014 | (P)$^2$/I | 0.682 | -0.800 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0045 | (S) | -0.2088 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.21 | (S) | (Linear Fit) | |

**Model Tested:** 100-1981-098E
**Test Fluid:** Water
**Test Flow Rate:** 32 ml/s 0.51 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solar Thermal Systems**
4723 Tidewater Avenue
Oakland, CA 94601 USA

MODEL: Solar Thermal Systems STS 48BC
COLLECTOR TYPE: Glazed Flat Plate
CERTIFICATION #: 100-2008-001A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 47 | 35 | 24 | A (-9°F) | 45 | 34 | 23 |
| B (5°C) | 43 | 32 | 20 | B (9°F) | 41 | 30 | 19 |
| C (20°C) | 37 | 26 | 15 | C (36°F) | 35 | 25 | 14 |
| D (50°C) | 24 | 14 | 4 | D (90°F) | 23 | 13 | 4 |
| E (80°C) | 12 | 3 | | E (144°F) | 11 | 3 | |

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

Original Certification Date: January 10, 2008

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.051 | m$^2$ | 32.84 | ft$^2$ | **Net Aperture Area:** | 2.760 | m$^2$ | 29.71 | ft$^2$ |
| **Dry Weight:** | 48.1 | kg | 106 | lb | **Fluid Capacity:** | 3.8 | l | 1.0 | gal |
| **Test Pressure:** | 0 | kPa | 0 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.745 | -3.0285 | (P)/I | -0.0198 | (P)$^2$/I | 0.753 | -4.1062 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.745 | -0.5337 | (P)/I | -0.0019 | (P)$^2$/I | 0.753 | -0.724 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.2960 | (S) | +0.0191 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.28 | (S) | (Linear Fit) | |

**Model Tested:** 100-2006-024A
**Test Fluid:** Water
**Test Flow Rate:** 46 ml/s 0.73 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solar Thermal Systems**
4723 Tidewater Avenue
Oakland, CA 94601 USA

MODEL: Solar Thermal Systems STS 48BP
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2007-001A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 45 | 34 | 23 | A (-9°F) | 42 | 32 | 22 |
| B (5°C) | 41 | 30 | 19 | B (9°F) | 38 | 28 | 18 |
| C (20°C) | 34 | 24 | 13 | C (36°F) | 32 | 22 | 12 |
| D (50°C) | 22 | 12 | 3 | D (90°F) | 20 | 11 | 3 |
| E (80°C) | 10 | 2 | | E (144°F) | 9 | 2 | |

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

Original Certification Date: January 24, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.051 | m$^2$ | 32.84 | ft$^2$ | **Net Aperture Area:** | 2.750 | m$^2$ | 29.60 | ft$^2$ |
| **Dry Weight:** | 47.6 | kg | 105 | lb | **Fluid Capacity:** | 3.9 | l | 1.0 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.666 | -3.3563 | (P)/I | -0.0138 | (P)$^2$/I | 0.682 | -4.5392 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.666 | -0.5915 | (P)/I | -0.0014 | (P)$^2$/I | 0.682 | -0.800 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0045 | (S) | -0.2088 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.21 | (S) | (Linear Fit) | |

**Model Tested:** 100-1981-098E
**Test Fluid:** Water
**Test Flow Rate:** 32 ml/s 0.51 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solargenix Energy, LLC**
3622 S. Morgan Street
Chicago, IL 60609 USA

MODEL: Winston Series CPC WS0503
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-2005-003A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 29 | 22 | 15 | A (-9°F) | 28 | 21 | 15 |
| B (5°C) | 25 | 18 | 11 | B (9°F) | 24 | 17 | 11 |
| C (20°C) | 19 | 13 | 6 | C (36°F) | 18 | 12 | 6 |
| D (50°C) | 10 | 3 | | D (90°F) | 9 | 3 | |
| E (80°C) | 1 | | | E (144°F) | 1 | | |

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

Original Certification Date: July 28, 2005

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.239 | m$^2$ | 24.10 | ft$^2$ | **Net Aperture Area:** | 2.091 | m$^2$ | 22.51 | ft$^2$ |
| **Dry Weight:** | 48.5 | kg | 107 | lb | **Fluid Capacity:** | 9.6 | l | 2.5 | gal |
| **Test Pressure:** | 827 | kPa | 120 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - None |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Polyurethane Foam |
| **Insulation (Back):** | Polyurethane Foam |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 13 | 0.05 |
| 50 | 0.79 | 90 | 0.36 |
| 80 | 1.27 | 235 | 0.94 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.591 | -4.5502 | (P)/I | -0.0189 | (P)$^2$/I | 0.6 | -5.679 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.591 | -0.8019 | (P)/I | -0.0019 | (P)$^2$/I | 0.6 | -1.001 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.6317 | (S) | -1.2396 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | +999.00 | (S) | (Linear Fit) | | |

**Model Tested:** WS0503
**Test Fluid:** Water
**Test Flow Rate:** 41 ml/s 0.65 gpm

**REMARKS:** Collector tested with long axis of the reflectors oriented north-south. IAM perpendicular to the reflectors is listed above. IAM parallel to the reflectors = 1.0 - 0.16(S)

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solarhot**
233-O East Johnson Street
Cary, NC 27513 USA

MODEL: Solarhot S-SC-126P26
COLLECTOR TYPE: Glazed Flat Plate
CERTIFICATION #: 100-2007-007A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 35 | 26 | 18 | A (-9°F) | 33 | 25 | 17 |
| B (5°C) | 32 | 23 | 15 | B (9°F) | 30 | 22 | 14 |
| C (20°C) | 27 | 18 | 10 | C (36°F) | 26 | 18 | 10 |
| D (50°C) | 18 | 10 | 3 | D (90°F) | 17 | 10 | 3 |
| E (80°C) | 9 | 3 | | E (144°F) | 9 | 3 | |

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

Original Certification Date: January 14, 2008

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.446 | m$^2$ | 26.33 | ft$^2$ | **Net Aperture Area:** | 2.268 | m$^2$ | 24.41 | ft$^2$ |
| **Dry Weight:** | 44.4 | kg | 98 | lb | **Fluid Capacity:** | 3.7 | l | 1.0 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Vapor Deposition Selective Coating |
| **Insulation (Side):** | Polyurethane |
| **Insulation (Back):** | Polyurethane and glass wool |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 11 | 0.05 |
| 50 | 0.79 | 95 | 0.38 |
| 80 | 1.27 | 260 | 1.05 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.68 | -3.3200 | (P)/I | -0.0091 | (P)$^2$/I | 0.684 | -3.868 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.68 | -0.5851 | (P)/I | -0.0009 | (P)$^2$/I | 0.684 | -0.682 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.2002 | (S) | -0.1266 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.33 | (S) | (Linear Fit) | | |

**Model Tested:** S-SC-126P26
**Test Fluid:** Water
**Test Flow Rate:** 49 ml/s 0.78 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solarhot**
233-O East Johnson Street
Cary, NC 27513 USA

MODEL: Solarhot S-SC-126P32
COLLECTOR TYPE: Glazed Flat Plate
CERTIFICATION #: 100-2007-007B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 43 | 32 | 22 | A (-9°F) | 40 | 30 | 21 |
| B (5°C) | 39 | 28 | 18 | B (9°F) | 37 | 27 | 17 |
| C (20°C) | 33 | 22 | 12 | C (36°F) | 31 | 21 | 12 |
| D (50°C) | 22 | 12 | 4 | D (90°F) | 21 | 12 | 3 |
| E (80°C) | 12 | 4 | | E (144°F) | 11 | 4 | |

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

Original Certification Date: January 14, 2008

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.972 | m$^2$ | 31.99 | ft$^2$ | **Net Aperture Area:** | 2.758 | m$^2$ | 29.69 | ft$^2$ |
| **Dry Weight:** | 54.7 | kg | 121 | lb | **Fluid Capacity:** | 4.3 | l | 1.1 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Vapor Deposition Selective Coating |
| **Insulation (Side):** | Polyurethane |
| **Insulation (Back):** | Polyurethane and glass wool |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.68 | -3.3158 | (P)/I | -0.0091 | (P)$^2$/I | 0.6846 | -3.8635 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.68 | -0.5843 | (P)/I | -0.0009 | (P)$^2$/I | 0.6846 | -0.681 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.2002 | (S) | -0.1266 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.33 | (S) | (Linear Fit) | | |

**Model Tested:** S-SC-126P26
**Test Fluid:** Water
**Test Flow Rate:** 49 ml/s 0.78 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solarhot**
233-O East Johnson Street
Cary, NC 27513 USA

MODEL: Solarhot S-SC-126S26
COLLECTOR TYPE: Glazed Flat Plate
CERTIFICATION #: 100-2007-010A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
| A (-5°C) | 35 | 27 | 18 | A (-9°F) | 33 | 25 | 17 |
| B (5°C) | 30 | 22 | 13 | B (9°F) | 28 | 20 | 13 |
| C (20°C) | 23 | 14 | 7 | C (36°F) | 21 | 14 | 6 |
| D (50°C) | 9 | 3 | | D (90°F) | 9 | 3 | |
| E (80°C) | | | | E (144°F) | | | |

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

Original Certification Date: January 14, 2008

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.455 | $m^2$ | 26.43 | $ft^2$ | **Net Aperture Area:** | 2.273 | $m^2$ | 24.47 | $ft^2$ |
| **Dry Weight:** | 40.4 | kg | 89 | lb | **Fluid Capacity:** | 3.8 | l | 1.0 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Flat Black Paint |
| **Insulation (Side):** | Glass wool |
| **Insulation (Back):** | Glass wool |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 17 | 0.07 |
| 50 | 0.79 | 109 | 0.44 |
| 80 | 1.27 | 281 | 1.13 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.653 | -5.2497 | (P)/I | -0.0216 | $(P)^2/I$ | 0.663 | -6.5345 | $W/m^2 \cdot °C$ |
| **I P Units:** | $\eta$ = | 0.653 | -0.9251 | (P)/I | -0.0021 | $(P)^2/I$ | 0.663 | -1.152 | $Btu/hr \cdot ft^2 \cdot °F$ |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1548 | (S) | -0.1227 | $(S)^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.28 | (S) | (Linear Fit) | |

| | | | | |
|---|---|---|---|---|
| **Model Tested:** | S-SC-126S26 | | | |
| **Test Fluid:** | Water | | | |
| **Test Flow Rate:** | 49 | ml/s | 0.78 | gpm |

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solarhot**
233-O East Johnson Street
Cary, NC 27513 USA

MODEL: Solarhot S-SC-126S32
COLLECTOR TYPE: Glazed Flat Plate
CERTIFICATION #: 100-2007-010B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
| A (-5°C) | 43 | 32 | 22 | A (-9°F) | 40 | 31 | 21 |
| B (5°C) | 36 | 26 | 16 | B (9°F) | 35 | 25 | 15 |
| C (20°C) | 27 | 18 | 8 | C (36°F) | 26 | 17 | 8 |
| D (50°C) | 11 | 3 | | D (90°F) | 10 | 3 | |
| E (80°C) | | | | E (144°F) | | | |

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

Original Certification Date: January 14, 2008

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.972 | $m^2$ | 31.99 | $ft^2$ | **Net Aperture Area:** | 2.758 | $m^2$ | 29.69 | $ft^2$ |
| **Dry Weight:** | 54.7 | kg | 121 | lb | **Fluid Capacity:** | 4.3 | l | 1.1 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Flat Black Paint |
| **Insulation (Side):** | Glass wool |
| **Insulation (Back):** | Glass wool |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.654 | -5.2520 | (P)/I | -0.0216 | $(P)^2/I$ | 0.665 | -6.5398 | $W/m^2 \cdot °C$ |
| **I P Units:** | $\eta$ = | 0.654 | -0.9256 | (P)/I | -0.0021 | $(P)^2/I$ | 0.665 | -1.152 | $Btu/hr \cdot ft^2 \cdot °F$ |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1548 | (S) | -0.1227 | $(S)^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.28 | (S) | (Linear Fit) | |

**Model Tested:** S-SC-126S26
**Test Fluid:** Water
**Test Flow Rate:** 49 ml/s 0.78 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solene**
927 Fern Street Suite 1500
Altamont Springs, FL 32701 USA

MODEL: Solene-Corona SLCO-30
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-045A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
| A (-5°C) | 37 | 28 | 19 | A (-9°F) | 35 | 27 | 18 |
| B (5°C) | 33 | 24 | 15 | B (9°F) | 32 | 23 | 15 |
| C (20°C) | 28 | 19 | 10 | C (36°F) | 27 | 18 | 10 |
| D (50°C) | 18 | 10 | 3 | D (90°F) | 17 | 9 | 3 |
| E (80°C) | 10 | 3 | | E (144°F) | 9 | 3 | |

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

Original Certification Date: October 20, 2006

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.278 | $m^2$ | 24.52 | $ft^2$ | **Net Aperture Area:** | 2.179 | $m^2$ | 23.46 $ft^2$ |
| **Dry Weight:** | 35.3 | kg | 78 | lb | **Fluid Capacity:** | 1.9 | l | 0.5 gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 91 | 0.36 |
| 50 | 0.79 | 288 | 1.15 |
| 80 | 1.27 | 557 | 2.24 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.779 | -4.2847 | (P)/I | -0.0048 | $(P)^2/I$ | 0.782 | -4.5996 | $W/m^2 \cdot °C$ |
| **I P Units:** | $\eta$ = | 0.779 | -0.7551 | (P)/I | -0.0005 | $(P)^2/I$ | 0.782 | -0.811 | $Btu/hr \cdot ft^2 \cdot °F$ |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.2947 | (S) | -0.0119 | $(S)^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.31 | (S) | (Linear Fit) | |

**Model Tested:** SLCO-30
**Test Fluid:** Water
**Test Flow Rate:** 45 ml/s 0.71 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solene**
927 Fern Street Suite 1500
Altamont Springs, FL 32701 USA

MODEL: Solene-Corona SLCO-32
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-045B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 49 | 37 | 25 | A (-9°F) | 46 | 35 | 24 |
| B (5°C) | 44 | 32 | 20 | B (9°F) | 41 | 30 | 19 |
| C (20°C) | 36 | 25 | 13 | C (36°F) | 35 | 24 | 13 |
| D (50°C) | 24 | 13 | 4 | D (90°F) | 22 | 12 | 3 |
| E (80°C) | 13 | 4 | | E (144°F) | 12 | 4 | |

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

Original Certification Date: October 20, 2006

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.952 | m$^2$ | 31.78 | ft$^2$ | **Net Aperture Area:** | 2.836 | m$^2$ | 30.53 | ft$^2$ |
| **Dry Weight:** | 48 | kg | 106 | lb | **Fluid Capacity:** | 2.4 | l | 0.6 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.782 | -4.2829 | (P)/I | -0.0048 | (P)$^2$/I | 0.785 | -4.598 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.782 | -0.7548 | (P)/I | -0.0005 | (P)$^2$/I | 0.785 | -0.810 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.2947 | (S) | -0.0119 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.31 | (S) | (Linear Fit) | |

**Model Tested:** SLCO-30
**Test Fluid:** Water
**Test Flow Rate:** 45 ml/s 0.71 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solene**
927 Fern Street Suite 1500
Altamont Springs, FL 32701 USA

MODEL: Solene-Corona SLCO-32P
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2007-045A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 43 | 33 | 23 | A (-9°F) | 41 | 31 | 22 |
| B (5°C) | 37 | 27 | 16 | B (9°F) | 35 | 25 | 15 |
| C (20°C) | 28 | 18 | 8 | C (36°F) | 27 | 17 | 8 |
| D (50°C) | 12 | 4 | | D (90°F) | 12 | 4 | |
| E (80°C) | 1 | | | E (144°F) | 1 | | |

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

Original Certification Date: January 23, 2008

## COLLECTOR SPECIFICATIONS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.954 | m$^2$ | 31.80 | ft$^2$ | **Net Aperture Area:** | 2.808 | m$^2$ | 30.23 | ft$^2$ |
| **Dry Weight:** | 43.3 | kg | 95 | lb | **Fluid Capacity:** | 2.5 | l | 0.7 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Flat Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 104 | 0.42 |
| 50 | 0.79 | 317 | 1.27 |
| 80 | 1.27 | 602 | 2.42 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.674 | -5.5224 | (P)/I | -0.0127 | (P)$^2$/I | 0.6793 | -6.219 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.674 | -0.9732 | (P)/I | -0.0012 | (P)$^2$/I | 0.6793 | -1.096 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.2598 | (S) | -0.0434 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.31 | (S) | (Linear Fit) | |

**Model Tested:** SLCO-32P
**Test Fluid:** Water
**Test Flow Rate:** 59 ml/s 0.94 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solene**
927 Fern Street Suite 1500
Altamont Springs, FL 32701 USA

MODEL: Solene-Corona SLCO-40
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-045C

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
| A (-5°C) | 60 | 45 | 31 | A (-9°F) | 57 | 43 | 29 |
| B (5°C) | 53 | 39 | 24 | B (9°F) | 51 | 37 | 23 |
| C (20°C) | 45 | 30 | 16 | C (36°F) | 42 | 29 | 15 |
| D (50°C) | 29 | 16 | 4 | D (90°F) | 28 | 15 | 4 |
| E (80°C) | 16 | 5 | | E (144°F) | 15 | 5 | |

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

Original Certification Date: October 20, 2006

## COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.611 | $m^2$ | 38.87 | $ft^2$ | **Net Aperture Area:** | 3.478 | $m^2$ | 37.44 | $ft^2$ |
| **Dry Weight:** | 60 | kg | 132 | lb | **Fluid Capacity:** | 2.6 | l | 0.7 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.784 | -4.2805 | (P)/I | -0.0048 | $(P)^2/I$ | 0.787 | -4.5961 | $W/m^2 \cdot °C$ |
| **I P Units:** | $\eta$ = | 0.784 | -0.7543 | (P)/I | -0.0005 | $(P)^2/I$ | 0.787 | -0.810 | $Btu/hr \cdot ft^2 \cdot °F$ |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.2947 | (S) | -0.0119 | $(S)^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.31 | (S) | (Linear Fit) | | |

**Model Tested:** SLCO-30
**Test Fluid:** Water
**Test Flow Rate:** 45 ml/s 0.71 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

# CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solene**
927 Fern Street Suite 1500
Altamont Springs, FL 32701 USA

MODEL: Solene-Corona SLCO-40P
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2007-045B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 53 | 40 | 28 | A (-9°F) | 50 | 38 | 26 |
| B (5°C) | 45 | 32 | 20 | B (9°F) | 42 | 31 | 19 |
| C (20°C) | 34 | 22 | 10 | C (36°F) | 32 | 21 | 10 |
| D (50°C) | 15 | 5 | | D (90°F) | 14 | 5 | |
| E (80°C) | 2 | | | E (144°F) | 2 | | |

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

Original Certification Date: January 23, 2008

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.626 | m$^2$ | 39.03 | ft$^2$ | **Net Aperture Area:** | 3.409 | m$^2$ | 36.70 | ft$^2$ |
| **Dry Weight:** | 75.7 | kg | 167 | lb | **Fluid Capacity:** | 2.6 | l | 0.7 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Anodized Aluminum |
| **Cover (Outer):** | Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Flat Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.667 | -5.4462 | (P)/I | -0.0126 | (P)$^2$/I | 0.6718 | -6.1369 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.667 | -0.9598 | (P)/I | -0.0012 | (P)$^2$/I | 0.6718 | -1.081 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.2598 | (S) | -0.0434 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.31 | (S) | (Linear Fit) | | |

| | | | | |
|---|---|---|---|---|
| **Model Tested:** | SLCO-32P | | | |
| **Test Fluid:** | Water | | | |
| **Test Flow Rate:** | 59 | ml/s | 0.94 | gpm |

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

# CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solene**
927 Fern Street Suite 1500
Altamont Springs, FL 32701 USA

MODEL: Solene/Chromagen SLCR-30
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2004-014A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 42 | 31 | 21 | A (-9°F) | 40 | 30 | 20 |
| B (5°C) | 40 | 29 | 19 | B (9°F) | 38 | 28 | 18 |
| C (20°C) | 35 | 24 | 14 | C (36°F) | 33 | 23 | 14 |
| D (50°C) | 21 | 12 | 3 | D (90°F) | 20 | 11 | 3 |
| E (80°C) | 6 | | | E (144°F) | 6 | | |

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

Original Certification Date: November 4, 2004

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.815 | m$^2$ | 30.30 | ft$^2$ | **Net Aperture Area:** | 2.608 | m$^2$ | 28.07 | ft$^2$ |
| **Dry Weight:** | 49.9 | kg | 110 | lb | **Fluid Capacity:** | 2.7 | l | 0.7 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Polyurethane [Foil-faced] |
| **Insulation (Back):** | Mineral Wool & Polyurethane |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 93 | 0.37 |
| 50 | 0.79 | 345 | 1.38 |
| 80 | 1.27 | 732 | 2.94 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.704 | -1.7983 | (P)/I | -0.0470 | (P)$^2$/I | 0.735 | -5.365 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.704 | -0.3169 | (P)/I | -0.0046 | (P)$^2$/I | 0.735 | -0.945 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.2011 | (S) | +0.0069 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.19 | (S) | (Linear Fit) | |

**Model Tested:** SLCR-30
**Test Fluid:** Water
**Test Flow Rate:** 52 ml/s 0.82 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solene**
927 Fern Street Suite 1500
Altamont Springs, FL 32701 USA

MODEL: Solene/Chromagen SLCR-32
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2004-014B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 44 | 33 | 22 | A (-9°F) | 42 | 31 | 21 |
| B (5°C) | 42 | 31 | 20 | B (9°F) | 40 | 29 | 19 |
| C (20°C) | 37 | 26 | 15 | C (36°F) | 35 | 25 | 14 |
| D (50°C) | 22 | 12 | 3 | D (90°F) | 21 | 12 | 3 |
| E (80°C) | 6 | | | E (144°F) | 6 | | |

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

Original Certification Date: November 4, 2004

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.971 | m$^2$ | 31.98 | ft$^2$ | **Net Aperture Area:** | 2.758 | m$^2$ | 29.69 | ft$^2$ |
| **Dry Weight:** | 49 | kg | 108 | lb | **Fluid Capacity:** | 3.0 | l | 0.8 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Polyurethane [Foil-faced] |
| **Insulation (Back):** | Mineral Wool & Polyurethane |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.704 | -1.7983 | (P)/I | -0.0470 | (P)$^2$/I | 0.735 | -5.365 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.704 | -0.3169 | (P)/I | -0.0046 | (P)$^2$/I | 0.735 | -0.945 | Btu/hr·ft$^2$·°F |

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

$K_{\alpha\tau}$ = 1.0 -0.2011 (S) +0.0069 (S)$^2$

$K_{\alpha\tau}$ = 1.0 -0.19 (S) (Linear Fit)

**Model Tested:** SLCR-30
**Test Fluid:** Water
**Test Flow Rate:** 52 ml/s 0.82 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Solene**
927 Fern Street Suite 1500
Altamont Springs, FL 32701 USA

MODEL: Solene/Chromagen SLCR-40
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2004-014C

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 55 | 41 | 28 | A (-9°F) | 52 | 39 | 26 |
| B (5°C) | 53 | 39 | 25 | B (9°F) | 50 | 37 | 24 |
| C (20°C) | 46 | 32 | 19 | C (36°F) | 44 | 31 | 18 |
| D (50°C) | 28 | 15 | 4 | D (90°F) | 26 | 15 | 4 |
| E (80°C) | 8 | | | E (144°F) | 7 | | |

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

Original Certification Date: November 4, 2004

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.721 | m$^2$ | 40.05 | ft$^2$ | **Net Aperture Area:** | 3.469 | m$^2$ | 37.34 | ft$^2$ |
| **Dry Weight:** | 68.9 | kg | 152 | lb | **Fluid Capacity:** | 3.8 | l | 1.0 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Polyurethane [Foil-faced] |
| **Insulation (Back):** | Mineral Wool & Polyurethane |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.704 | -1.7983 | (P)/I | -0.0470 | (P)$^2$/I | 0.735 | -5.365 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.704 | -0.3169 | (P)/I | -0.0046 | (P)$^2$/I | 0.735 | -0.945 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.2011 | (S) | +0.0069 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.19 | (S) | (Linear Fit) | | |

**Model Tested:** SLCR-30
**Test Fluid:** Water
**Test Flow Rate:** 52 ml/s 0.82 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Stiebel Eltron**
17 West Street
West Hatfield, MA 01088 USA

MODEL: Stiebel Eltron Sol 25 Plus
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2005-016A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 41 | 31 | 21 | A (-9°F) | 39 | 29 | 20 |
| B (5°C) | 37 | 27 | 17 | B (9°F) | 35 | 26 | 16 |
| C (20°C) | 32 | 22 | 12 | C (36°F) | 30 | 21 | 12 |
| D (50°C) | 21 | 12 | 4 | D (90°F) | 20 | 11 | 3 |
| E (80°C) | 10 | 3 | | E (144°F) | 10 | 3 | |

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

Original Certification Date: June 26, 2006

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.734 | m$^2$ | 29.43 | ft$^2$ | **Net Aperture Area:** | 2.595 | m$^2$ | 27.93 | ft$^2$ |
| **Dry Weight:** | 48.9 | kg | 108 | lb | **Fluid Capacity:** | 1.6 | l | 0.4 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Sputtered titanium nitride |
| **Insulation (Side):** | Mineral Wool |
| **Insulation (Back):** | Mineral Wool |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 218 | 0.88 |
| 50 | 0.79 | 1145 | 4.60 |
| 80 | 1.27 | 2792 | 11.21 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.649 | -3.1374 | (P)/I | -0.0148 | (P)$^2$/I | 0.66 | -4.287 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.649 | -0.5529 | (P)/I | -0.0014 | (P)$^2$/I | 0.66 | -0.755 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.2824 | (S) | -0.0111 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.27 | (S) | (Linear Fit) | |

**Model Tested:** Sol 25 Plus
**Test Fluid:** Water
**Test Flow Rate:** 55 ml/s 0.87 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunBank Solar**
PO Box 779
Anderson, CA 96007 USA

MODEL: SunBank SB10
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-016B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 12 | 9 | 6 | A (-9°F) | 11 | 9 | 6 |
| B (5°C) | 11 | 8 | 5 | B (9°F) | 10 | 7 | 5 |
| C (20°C) | 9 | 6 | 3 | C (36°F) | 8 | 6 | 3 |
| D (50°C) | 5 | 3 | 1 | D (90°F) | 5 | 3 | 1 |
| E (80°C) | 3 | 1 | | E (144°F) | 3 | 1 | |

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

Original Certification Date: October 12, 2006

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 0.933 | m$^2$ | 10.04 | ft$^2$ | **Net Aperture Area:** | 0.847 | m$^2$ | 9.12 ft$^2$ |
| **Dry Weight:** | 8.6 | kg | 19 | lb | **Fluid Capacity:** | 0.6 | l | 0.2 gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Lexan Polycarbonate |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.603 | -3.8665 | (P)/I | +0.0015 | (P)$^2$/I | 0.602 | -3.764 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.603 | -0.6814 | (P)/I | 0.0000 | (P)$^2$/I | 0.602 | -0.663 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1944 | (S) | -0.0186 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.21 | (S) | (Linear Fit) | | |

**Model Tested:** 100-2001-002A
**Test Fluid:** Water
**Test Flow Rate:** 32 ml/s 0.50 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunBank Solar**
PO Box 779
Anderson, CA 96007 USA

MODEL: SunBank SB20
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-016A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
| A (-5°C) | 24 | 18 | 13 | A (-9°F) | 23 | 17 | 12 |
| B (5°C) | 21 | 16 | 10 | B (9°F) | 20 | 15 | 9 |
| C (20°C) | 18 | 12 | 6 | C (36°F) | 17 | 11 | 6 |
| D (50°C) | 11 | 6 | 1 | D (90°F) | 11 | 6 | 1 |
| E (80°C) | 6 | 2 | | E (144°F) | 6 | 2 | |

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

Original Certification Date: June 2, 2006

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.865 | $m^2$ | 20.08 | $ft^2$ | **Net Aperture Area:** | 1.720 | $m^2$ | 18.51 | $ft^2$ |
| **Dry Weight:** | 17.2 | kg | 38 | lb | **Fluid Capacity:** | 1.8 | l | 0.5 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Lexan Polycarbonate |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Selective Coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 1291 | 5.18 |
| 40 | 0.63 | 4663 | 18.72 |
| 60 | 0.95 | 9795 | 39.32 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.605 | -3.8370 | (P)/I | +0.0017 | $(P)^2/I$ | 0.604 | -3.73 | $W/m^2 \cdot °C$ |
| **I P Units:** | $\eta$ = | 0.605 | -0.6762 | (P)/I | 0.0000 | $(P)^2/I$ | 0.604 | -0.657 | $Btu/hr \cdot ft^2 \cdot °F$ |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1944 | (S) | -0.0186 | $(S)^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.21 | (S) | (Linear Fit) | |

**Model Tested:** 100-2001-002A
**Test Fluid:** Water
**Test Flow Rate:** 32 ml/s 0.50 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunEarth, Inc.**
8425 Almeria Avenue
Fontana, CA 92335 USA

MODEL: Empire EC-21
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-024B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 30 | 22 | 15 | A (-9°F) | 28 | 21 | 14 |
| B (5°C) | 27 | 20 | 13 | B (9°F) | 26 | 19 | 12 |
| C (20°C) | 24 | 16 | 9 | C (36°F) | 22 | 15 | 9 |
| D (50°C) | 15 | 9 | 3 | D (90°F) | 14 | 8 | 2 |
| E (80°C) | 7 | 2 | | E (144°F) | 7 | 2 | |

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

Original Certification Date: December 18, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.974 | m$^2$ | 21.25 | ft$^2$ | **Net Aperture Area:** | 1.744 | m$^2$ | 18.77 | ft$^2$ |
| **Dry Weight:** | 31.7 | kg | 70 | lb | **Fluid Capacity:** | 2.7 | l | 0.7 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.7274 | -2.9883 | (P)/I | -0.0193 | (P)$^2$/I | 0.735 | -4.0407 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.7274 | -0.5266 | (P)/I | -0.0019 | (P)$^2$/I | 0.735 | -0.712 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.2964 | (S) | +0.0191 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.28 | (S) | (Linear Fit) | | |

**Model Tested:** EC-24
**Test Fluid:** Water
**Test Flow Rate:** 46 ml/s 0.73 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunEarth, Inc.**
8425 Almeria Avenue
Fontana, CA 92335 USA

MODEL: Empire EC-24
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-024A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 35 | 26 | 18 | A (-9°F) | 33 | 25 | 17 |
| B (5°C) | 32 | 23 | 15 | B (9°F) | 30 | 22 | 14 |
| C (20°C) | 27 | 19 | 11 | C (36°F) | 26 | 18 | 10 |
| D (50°C) | 18 | 10 | 3 | D (90°F) | 17 | 10 | 3 |
| E (80°C) | 8 | 2 | | E (144°F) | 8 | 2 | |

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

Original Certification Date: December 18, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.298 | m$^2$ | 24.74 | ft$^2$ | **Net Aperture Area:** | 2.031 | m$^2$ | 21.86 | ft$^2$ |
| **Dry Weight:** | 36.1 | kg | 80 | lb | **Fluid Capacity:** | 2.7 | l | 0.7 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 25 | 0.10 |
| 50 | 0.79 | 118 | 0.47 |
| 80 | 1.27 | 276 | 1.11 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.7275 | -2.9883 | (P)/I | -0.0193 | (P)$^2$/I | 0.7351 | -4.0407 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.7275 | -0.5266 | (P)/I | -0.0019 | (P)$^2$/I | 0.7351 | -0.712 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.2964 | (S) | +0.0191 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.28 | (S) | (Linear Fit) | |

**Model Tested:** EC-24
**Test Fluid:** Water
**Test Flow Rate:** 46 ml/s 0.73 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunEarth, Inc.**
8425 Almeria Avenue
Fontana, CA 92335 USA

MODEL: Empire EC-32
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-024C

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 47 | 35 | 24 | A (-9°F) | 45 | 34 | 23 |
| B (5°C) | 43 | 32 | 20 | B (9°F) | 41 | 30 | 19 |
| C (20°C) | 37 | 26 | 15 | C (36°F) | 35 | 25 | 14 |
| D (50°C) | 24 | 14 | 4 | D (90°F) | 23 | 13 | 4 |
| E (80°C) | 12 | 3 | | E (144°F) | 11 | 3 | |

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

Original Certification Date: December 18, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.051 | m$^2$ | 32.84 | ft$^2$ | **Net Aperture Area:** | 2.760 | m$^2$ | 29.71 | ft$^2$ |
| **Dry Weight:** | 48.1 | kg | 106 | lb | **Fluid Capacity:** | 3.8 | l | 1.0 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.7447 | -3.0285 | (P)/I | -0.0198 | (P)$^2$/I | 0.7525 | -4.1062 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.7447 | -0.5337 | (P)/I | -0.0019 | (P)$^2$/I | 0.7525 | -0.724 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.2964 | (S) | +0.0191 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.28 | (S) | (Linear Fit) | |

**Model Tested:** EC-24
**Test Fluid:** Water
**Test Flow Rate:** 46 ml/s 0.73 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunEarth, Inc.**
8425 Almeria Avenue
Fontana, CA 92335 USA

MODEL: Empire EC-32-1.5
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-024D

## COLLECTOR THERMAL PERFORMANCE RATING

**Megajoules Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d |
|---|---|---|---|
| A (-5°C) | 47 | 35 | 24 |
| B (5°C) | 43 | 32 | 20 |
| C (20°C) | 37 | 26 | 15 |
| D (50°C) | 24 | 14 | 4 |
| E (80°C) | 12 | 3 | |

**Thousands of Btu Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
|---|---|---|---|
| A (-9°F) | 45 | 34 | 23 |
| B (9°F) | 41 | 30 | 19 |
| C (36°F) | 35 | 25 | 14 |
| D (90°F) | 23 | 13 | 4 |
| E (144°F) | 11 | 3 | |

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

Original Certification Date: December 18, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.051 | m² | 32.84 | ft² | **Net Aperture Area:** | 2.760 m² | 29.71 ft² |
| **Dry Weight:** | 49.8 | kg | 110 | lb | **Fluid Capacity:** | 5.4 l | 1.4 gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.7447 | -3.0285 | (P)/I | -0.0198 | $(P)^2/I$ | 0.7525 | -4.1062 | W/m²·°C |
| **I P Units:** | $\eta$ = | 0.7447 | -0.5337 | (P)/I | -0.0019 | $(P)^2/I$ | 0.7525 | -0.724 | Btu/hr·ft²·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.2964 | (S) | +0.0191 | $(S)^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.28 | (S) | (Linear Fit) | |

**Model Tested:** EC-24
**Test Fluid:** Water
**Test Flow Rate:** 46 ml/s 0.73 gpm

## REMARKS:

March, 2008
Certification must be renewed annually. For current status contact:
SOLAR RATING & CERTIFICATION CORPORATION
c/o FSEC ♦ 1679 Clearlake Road ♦ Cocoa, FL 32922 ♦ (321) 638-1537♦ Fax (321) 638-1010

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunEarth, Inc.**
8425 Almeria Avenue
Fontana, CA 92335 USA

MODEL: Empire EC-40
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-024E

## COLLECTOR THERMAL PERFORMANCE RATING

**Megajoules Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d |
|---|---|---|---|
| A (-5°C) | 59 | 44 | 30 |
| B (5°C) | 54 | 40 | 25 |
| C (20°C) | 47 | 32 | 18 |
| D (50°C) | 30 | 17 | 5 |
| E (80°C) | 14 | 4 | |

**Thousands of Btu Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
|---|---|---|---|
| A (-9°F) | 56 | 42 | 28 |
| B (9°F) | 52 | 38 | 24 |
| C (36°F) | 44 | 31 | 17 |
| D (90°F) | 29 | 17 | 5 |
| E (144°F) | 14 | 4 | |

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

Original Certification Date: December 18, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.796 | m² | 40.86 | ft² | **Net Aperture Area:** | 3.457 | m² | 37.21 ft² |
| **Dry Weight:** | 64 | kg | 141 | lb | **Fluid Capacity:** | 4.5 | l | 1.2 gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.7496 | -3.0406 | (P)/I | -0.0199 | $(P)^2/I$ | 0.7575 | -4.1251 | W/m²·°C |
| **I P Units:** | $\eta$ = | 0.7496 | -0.5358 | (P)/I | -0.0019 | $(P)^2/I$ | 0.7575 | -0.727 | Btu/hr·ft²·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.2964 | (S) | +0.0191 | $(S)^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.28 | (S) | (Linear Fit) | |

**Model Tested:** EC-24
**Test Fluid:** Water
**Test Flow Rate:** 46 ml/s 0.73 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunEarth, Inc.**
8425 Almeria Avenue
Fontana, CA 92335 USA

MODEL: Empire EC-40-1.5
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-024F

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 59 | 44 | 30 | A (-9°F) | 56 | 42 | 28 |
| B (5°C) | 54 | 40 | 25 | B (9°F) | 52 | 38 | 24 |
| C (20°C) | 47 | 32 | 18 | C (36°F) | 44 | 31 | 17 |
| D (50°C) | 30 | 17 | 5 | D (90°F) | 29 | 17 | 5 |
| E (80°C) | 14 | 4 | | E (144°F) | 14 | 4 | |

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

Original Certification Date: December 18, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.796 | m$^2$ | 40.86 | ft$^2$ | **Net Aperture Area:** | 3.457 | m$^2$ | 37.21 | ft$^2$ |
| **Dry Weight:** | 65.8 | kg | 145 | lb | **Fluid Capacity:** | 6.1 | l | 1.6 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.7496 | -3.0406 | (P)/I | -0.0199 | (P)$^2$/I | 0.7575 | -4.1251 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.7496 | -0.5358 | (P)/I | -0.0019 | (P)$^2$/I | 0.7575 | -0.727 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.2964 | (S) | +0.0191 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.28 | (S) | (Linear Fit) | |

**Model Tested:** EC-24
**Test Fluid:** Water
**Test Flow Rate:** 46 ml/s 0.73 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunEarth, Inc.**
8425 Almeria Avenue
Fontana, CA 92335 USA

MODEL: Empire EP-20
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1981-098E

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 27 | 20 | 14 | A (-9°F) | 25 | 19 | 13 |
| B (5°C) | 24 | 18 | 11 | B (9°F) | 23 | 17 | 11 |
| C (20°C) | 21 | 14 | 8 | C (36°F) | 19 | 13 | 7 |
| D (50°C) | 13 | 7 | 2 | D (90°F) | 12 | 7 | 2 |
| E (80°C) | 6 | 1 | | E (144°F) | 6 | 1 | |

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

Original Certification Date: May 1, 1992

## COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.831 | m$^2$ | 19.71 | ft$^2$ | **Net Aperture Area:** | 1.607 | m$^2$ | 17.30 | ft$^2$ |
| **Dry Weight:** | 29.5 | kg | 65 | lb | **Fluid Capacity:** | 2.4 | l | 0.6 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.666 | -3.3563 | (P)/I | -0.0138 | (P)$^2$/I | 0.682 | -4.5392 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.666 | -0.5915 | (P)/I | -0.0014 | (P)$^2$/I | 0.682 | -0.800 | Btu/hr·ft$^2$·°F |

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

$K_{\alpha\tau}$ = 1.0 +0.0045 (S) -0.2088 (S)$^2$

$K_{\alpha\tau}$ = 1.0 -0.21 (S) (Linear Fit)

**Model Tested:** EP-20
**Test Fluid:** Water
**Test Flow Rate:** 32 ml/s 0.50 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunEarth, Inc.**
8425 Almeria Avenue
Fontana, CA 92335 USA

MODEL: Empire EP-21
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1981-098P

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 29 | 22 | 15 | A (-9°F) | 27 | 21 | 14 |
| B (5°C) | 26 | 19 | 12 | B (9°F) | 25 | 18 | 12 |
| C (20°C) | 22 | 15 | 8 | C (36°F) | 21 | 14 | 8 |
| D (50°C) | 14 | 8 | 2 | D (90°F) | 13 | 7 | 2 |
| E (80°C) | 6 | 1 | | E (144°F) | 6 | 1 | |

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

Original Certification Date: September 7, 1999

## COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.971 | m$^2$ | 21.22 | ft$^2$ | **Net Aperture Area:** | 1.734 | m$^2$ | 18.67 | ft$^2$ |
| **Dry Weight:** | 32 | kg | 71 | lb | **Fluid Capacity:** | 2.7 | l | 0.7 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.666 | -3.3563 | (P)/I | -0.0138 | (P)$^2$/I | 0.682 | -4.5392 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.666 | -0.5915 | (P)/I | -0.0014 | (P)$^2$/I | 0.682 | -0.800 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0045 | (S) | -0.2088 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.21 | (S) | (Linear Fit) | |

**Model Tested:** EP-20
**Test Fluid:** Water
**Test Flow Rate:** 32 ml/s 0.50 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunEarth, Inc.**
8425 Almeria Avenue
Fontana, CA 92335 USA

MODEL: Empire EP-24
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1981-098F

## COLLECTOR THERMAL PERFORMANCE RATING

**Megajoules Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d |
|---|---|---|---|
| A (-5°C) | 34 | 25 | 17 |
| B (5°C) | 30 | 22 | 14 |
| C (20°C) | 26 | 18 | 10 |
| D (50°C) | 16 | 9 | 2 |
| E (80°C) | 7 | 2 | |

**Thousands of Btu Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
|---|---|---|---|
| A (-9°F) | 32 | 24 | 16 |
| B (9°F) | 29 | 21 | 13 |
| C (36°F) | 24 | 17 | 9 |
| D (90°F) | 15 | 9 | 2 |
| E (144°F) | 7 | 2 | |

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

Original Certification Date: May 1, 1992

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.290 | m² | 24.65 | ft² | **Net Aperture Area:** | 2.015 | m² | 21.69 | ft² |
| **Dry Weight:** | 36.3 | kg | 80 | lb | **Fluid Capacity:** | 2.9 | l | 0.8 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.666 | -3.3563 | (P)/I | -0.0138 | $(P)^2/I$ | 0.682 | -4.5392 | W/m²·°C |
| **I P Units:** | $\eta$ = | 0.666 | -0.5915 | (P)/I | -0.0014 | $(P)^2/I$ | 0.682 | -0.800 | Btu/hr·ft²·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0045 | (S) | -0.2088 | $(S)^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.21 | (S) | (Linear Fit) | |

**Model Tested:** EP-20
**Test Fluid:** Water
**Test Flow Rate:** 32 ml/s 0.51 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunEarth, Inc.**
8425 Almeria Avenue
Fontana, CA 92335 USA

MODEL: Empire EP-32
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1981-098G

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 45 | 34 | 23 | A (-9°F) | 42 | 32 | 22 |
| B (5°C) | 41 | 30 | 19 | B (9°F) | 38 | 28 | 18 |
| C (20°C) | 34 | 24 | 13 | C (36°F) | 32 | 22 | 12 |
| D (50°C) | 22 | 12 | 3 | D (90°F) | 20 | 11 | 3 |
| E (80°C) | 10 | 2 | | E (144°F) | 9 | 2 | |

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

Original Certification Date: May 1, 1992

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.051 | m$^2$ | 32.84 | ft$^2$ | **Net Aperture Area:** | 2.750 | m$^2$ | 29.60 | ft$^2$ |
| **Dry Weight:** | 47.6 | kg | 105 | lb | **Fluid Capacity:** | 3.9 | l | 1.0 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.666 | -3.3563 | (P)/I | -0.0138 | (P)$^2$/I | 0.682 | -4.5392 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.666 | -0.5915 | (P)/I | -0.0014 | (P)$^2$/I | 0.682 | -0.800 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0045 | (S) | -0.2088 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.21 | (S) | (Linear Fit) | |

**Model Tested:** EP-20
**Test Fluid:** Water
**Test Flow Rate:** 32 ml/s 0.51 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunEarth, Inc.**
8425 Almeria Avenue
Fontana, CA 92335 USA

MODEL: Empire EP-40
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1981-098H

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 56 | 42 | 28 | A (-9°F) | 53 | 40 | 27 |
| B (5°C) | 51 | 37 | 23 | B (9°F) | 48 | 35 | 22 |
| C (20°C) | 43 | 29 | 16 | C (36°F) | 40 | 28 | 15 |
| D (50°C) | 27 | 15 | 4 | D (90°F) | 25 | 14 | 4 |
| E (80°C) | 12 | 3 | | E (144°F) | 12 | 3 | |

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

Original Certification Date: May 1, 1992

## COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.796 | m$^2$ | 40.86 | ft$^2$ | **Net Aperture Area:** | 3.445 | m$^2$ | 37.08 | ft$^2$ |
| **Dry Weight:** | 62.6 | kg | 138 | lb | **Fluid Capacity:** | 4.5 | l | 1.2 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.666 | -3.3563 | (P)/I | -0.0138 | (P)$^2$/I | 0.682 | -4.5392 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.666 | -0.5915 | (P)/I | -0.0014 | (P)$^2$/I | 0.682 | -0.800 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0045 | (S) | -0.2088 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.21 | (S) | (Linear Fit) | |

**Model Tested:** EP-20
**Test Fluid:** Water
**Test Flow Rate:** 32 ml/s 0.51 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunEarth, Inc.**
8425 Almeria Avenue
Fontana, CA 92335 USA

MODEL: Imperial IC-24
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2008-014A

## COLLECTOR THERMAL PERFORMANCE RATING

**Megajoules Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d |
|---|---|---|---|
| A (-5°C) | 35 | 26 | 18 |
| B (5°C) | 32 | 23 | 15 |
| C (20°C) | 27 | 19 | 11 |
| D (50°C) | 18 | 10 | 3 |
| E (80°C) | 8 | 2 | |

**Thousands of Btu Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
|---|---|---|---|
| A (-9°F) | 33 | 25 | 17 |
| B (9°F) | 30 | 22 | 14 |
| C (36°F) | 26 | 18 | 10 |
| D (90°F) | 17 | 10 | 3 |
| E (144°F) | 8 | 2 | |

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

Original Certification Date: March 14, 2008

## COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.298 | m² | 24.74 | ft² | **Net Aperture Area:** | 2.031 m² | 21.86 ft² |
| **Dry Weight:** | 36.1 | kg | 80 | lb | **Fluid Capacity:** | 2.7 l | 0.7 gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 25 | 0.10 |
| 50 | 0.79 | 118 | 0.47 |
| 80 | 1.27 | 276 | 1.11 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.7275 | -2.9883 | (P)/I | -0.0193 | $(P)^2/I$ | 0.7351 | -4.0407 | W/m²·°C |
| **I P Units:** | $\eta$ = | 0.7275 | -0.5266 | (P)/I | -0.0019 | $(P)^2/I$ | 0.7351 | -0.712 | Btu/hr·ft²·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.2964 | (S) | +0.0191 | $(S)^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.28 | (S) | (Linear Fit) | |

**Model Tested:** EC-24
**Test Fluid:** Water
**Test Flow Rate:** 46 ml/s 0.73 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunEarth, Inc.**
8425 Almeria Avenue
Fontana, CA 92335 USA

MODEL: Imperial IC-32
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2008-014B

## COLLECTOR THERMAL PERFORMANCE RATING

**Megajoules Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d |
|---|---|---|---|
| A (-5°C) | 47 | 35 | 24 |
| B (5°C) | 43 | 32 | 20 |
| C (20°C) | 37 | 26 | 15 |
| D (50°C) | 24 | 14 | 4 |
| E (80°C) | 12 | 3 | |

**Thousands of Btu Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
|---|---|---|---|
| A (-9°F) | 45 | 34 | 23 |
| B (9°F) | 41 | 30 | 19 |
| C (36°F) | 35 | 25 | 14 |
| D (90°F) | 23 | 13 | 4 |
| E (144°F) | 11 | 3 | |

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

Original Certification Date: March 14, 2008

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.051 | m² | 32.84 | ft² | **Net Aperture Area:** | 2.760 | m² | 29.71 ft² |
| **Dry Weight:** | 48.1 | kg | 106 | lb | **Fluid Capacity:** | 3.8 | l | 1.0 gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.7447 | -3.0285 | (P)/I | -0.0198 | $(P)^2/I$ | 0.7525 | -4.1062 | W/m²·°C |
| **I P Units:** | $\eta$ = | 0.7447 | -0.5337 | (P)/I | -0.0019 | $(P)^2/I$ | 0.7525 | -0.724 | Btu/hr·ft²·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.2964 | (S) | +0.0191 | $(S)^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.28 | (S) | (Linear Fit) | |

**Model Tested:** EC-24
**Test Fluid:** Water
**Test Flow Rate:** 46 ml/s 0.73 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunEarth, Inc.**
8425 Almeria Avenue
Fontana, CA 92335 USA

MODEL: Imperial IC-40
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2008-014C

## COLLECTOR THERMAL PERFORMANCE RATING

**Megajoules Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d |
|---|---|---|---|
| A (-5°C) | 59 | 44 | 30 |
| B (5°C) | 54 | 40 | 25 |
| C (20°C) | 47 | 32 | 18 |
| D (50°C) | 30 | 17 | 5 |
| E (80°C) | 14 | 4 | |

**Thousands of Btu Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
|---|---|---|---|
| A (-9°F) | 56 | 42 | 28 |
| B (9°F) | 52 | 38 | 24 |
| C (36°F) | 44 | 31 | 17 |
| D (90°F) | 29 | 17 | 5 |
| E (144°F) | 14 | 4 | |

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

Original Certification Date: March 14, 2008

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.796 | $m^2$ | 40.86 | $ft^2$ | **Net Aperture Area:** | 3.457 | $m^2$ | 37.21 $ft^2$ |
| **Dry Weight:** | 64 | kg | 141 | lb | **Fluid Capacity:** | 4.5 | l | 1.2 gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.7496 | -3.0406 | (P)/I | -0.0199 | $(P)^2/I$ | 0.7575 | -4.1251 | $W/m^2 \cdot °C$ |
| **I P Units:** | $\eta$ = | 0.7496 | -0.5358 | (P)/I | -0.0019 | $(P)^2/I$ | 0.7575 | -0.727 | $Btu/hr \cdot ft^2 \cdot °F$ |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.2964 | (S) | +0.0191 | $(S)^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.28 | (S) | (Linear Fit) | |

**Model Tested:** EC-24
**Test Fluid:** Water
**Test Flow Rate:** 46 ml/s 0.73 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunEarth, Inc.**
8425 Almeria Avenue
Fontana, CA 92335 USA

MODEL: Imperial IP-24
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1981-098L

## COLLECTOR THERMAL PERFORMANCE RATING

**Megajoules Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d |
|---|---|---|---|
| A (-5°C) | 34 | 25 | 17 |
| B (5°C) | 31 | 22 | 14 |
| C (20°C) | 26 | 18 | 10 |
| D (50°C) | 16 | 9 | 2 |
| E (80°C) | 7 | 2 | |

**Thousands of Btu Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
|---|---|---|---|
| A (-9°F) | 32 | 24 | 16 |
| B (9°F) | 29 | 21 | 13 |
| C (36°F) | 24 | 17 | 9 |
| D (90°F) | 15 | 9 | 2 |
| E (144°F) | 7 | 2 | |

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

Original Certification Date: May 1, 1992

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.301 | $m^2$ | 24.77 | $ft^2$ | **Net Aperture Area:** | 2.015 | $m^2$ | 21.69 | $ft^2$ |
| **Dry Weight:** | 36.3 | kg | 80 | lb | **Fluid Capacity:** | 2.9 | l | 0.8 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.666 | -3.3563 | (P)/I | -0.0138 | $(P)^2/I$ | 0.682 | -4.5392 | $W/m^2 \cdot °C$ |
| **I P Units:** | $\eta$ = | 0.666 | -0.5915 | (P)/I | -0.0014 | $(P)^2/I$ | 0.682 | -0.800 | $Btu/hr \cdot ft^2 \cdot °F$ |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0045 | (S) | -0.2088 | $(S)^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.21 | (S) | (Linear Fit) | |

**Model Tested:** EP-20
**Test Fluid:** Water
**Test Flow Rate:** 32 ml/s 0.51 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunEarth, Inc.**
8425 Almeria Avenue
Fontana, CA 92335 USA

MODEL: Imperial IP-32
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1981-098M

## COLLECTOR THERMAL PERFORMANCE RATING

**Megajoules Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d |
|---|---|---|---|
| A (-5°C) | 45 | 34 | 23 |
| B (5°C) | 41 | 30 | 19 |
| C (20°C) | 34 | 24 | 13 |
| D (50°C) | 22 | 12 | 3 |
| E (80°C) | 10 | 2 | |

**Thousands of Btu Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
|---|---|---|---|
| A (-9°F) | 43 | 32 | 22 |
| B (9°F) | 39 | 28 | 18 |
| C (36°F) | 33 | 22 | 12 |
| D (90°F) | 21 | 11 | 3 |
| E (144°F) | 9 | 2 | |

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

Original Certification Date: May 1, 1992

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.062 | m² | 32.96 | ft² | **Net Aperture Area:** | 2.750 | m² | 29.60 ft² |
| **Dry Weight:** | 42.6 | kg | 94 | lb | **Fluid Capacity:** | 3.9 | l | 1.0 gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.666 | -3.3563 | (P)/I | -0.0138 | $(P)^2/I$ | 0.682 | -4.5392 | W/m²·°C |
| **I P Units:** | $\eta$ = | 0.666 | -0.5915 | (P)/I | -0.0014 | $(P)^2/I$ | 0.682 | -0.800 | Btu/hr·ft²·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0045 | (S) | -0.2088 | $(S)^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.21 | (S) | (Linear Fit) | |

**Model Tested:** EP-20
**Test Fluid:** Water
**Test Flow Rate:** 32 ml/s 0.51 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunEarth, Inc.**
8425 Almeria Avenue
Fontana, CA 92335 USA

MODEL: Imperial IP-40
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1981-098N

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 56 | 42 | 29 | A (-9°F) | 53 | 40 | 27 |
| B (5°C) | 51 | 37 | 24 | B (9°F) | 48 | 35 | 22 |
| C (20°C) | 43 | 29 | 16 | C (36°F) | 41 | 28 | 15 |
| D (50°C) | 27 | 15 | 4 | D (90°F) | 26 | 14 | 4 |
| E (80°C) | 12 | 3 | | E (144°F) | 12 | 3 | |

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

Original Certification Date: May 1, 1992

## COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.809 | m$^2$ | 41.00 | ft$^2$ | **Net Aperture Area:** | 3.445 | m$^2$ | 37.08 | ft$^2$ |
| **Dry Weight:** | 62.6 | kg | 138 | lb | **Fluid Capacity:** | 4.5 | l | 1.2 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.666 | -3.3563 | (P)/I | -0.0138 | (P)$^2$/I | 0.682 | -4.5392 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.666 | -0.5915 | (P)/I | -0.0014 | (P)$^2$/I | 0.682 | -0.800 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0045 | (S) | -0.2088 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.21 | (S) | (Linear Fit) | | |

**Model Tested:** EP-20
**Test Fluid:** Water
**Test Flow Rate:** 32 ml/s 0.51 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunEarth, Inc.**
8425 Almeria Avenue
Fontana, CA 92335 USA

MODEL: SunBelt SB-24-0.75
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-025B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 34 | 26 | 18 | A (-9°F) | 32 | 25 | 17 |
| B (5°C) | 29 | 21 | 13 | B (9°F) | 28 | 20 | 12 |
| C (20°C) | 22 | 14 | 6 | C (36°F) | 21 | 13 | 6 |
| D (50°C) | 9 | 3 | | D (90°F) | 8 | 3 | |
| E (80°C) | | | | E (144°F) | | | |

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

Original Certification Date: December 18, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.290 | m$^2$ | 24.65 | ft$^2$ | **Net Aperture Area:** | 2.024 | m$^2$ | 21.79 | ft$^2$ |
| **Dry Weight:** | 36.3 | kg | 80 | lb | **Fluid Capacity:** | 3.0 | l | 0.8 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Flat Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.653 | -5.5225 | (P)/I | -0.0194 | (P)$^2$/I | 0.6608 | -6.5792 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.653 | -0.9732 | (P)/I | -0.0019 | (P)$^2$/I | 0.6608 | -1.159 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.0530 | (S) | -0.1034 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.16 | (S) | (Linear Fit) | | |

**Model Tested:** SP-32
**Test Fluid:** Water
**Test Flow Rate:** 61 ml/s 0.97 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunEarth, Inc.**
8425 Almeria Avenue
Fontana, CA 92335 USA

MODEL: SunBelt SB-32-0.75
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-025A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 46 | 35 | 24 | A (-9°F) | 44 | 33 | 23 |
| B (5°C) | 39 | 29 | 18 | B (9°F) | 37 | 27 | 17 |
| C (20°C) | 30 | 19 | 9 | C (36°F) | 28 | 18 | 8 |
| D (50°C) | 12 | 4 | | D (90°F) | 11 | 4 | |
| E (80°C) | | | | E (144°F) | | | |

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

Original Certification Date: December 18, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.058 | m$^2$ | 32.92 | ft$^2$ | **Net Aperture Area:** | 2.753 | m$^2$ | 29.63 | ft$^2$ |
| **Dry Weight:** | 45.8 | kg | 101 | lb | **Fluid Capacity:** | 3.8 | l | 1.0 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Flat Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 28 | 0.11 |
| 50 | 0.79 | 158 | 0.63 |
| 80 | 1.27 | 393 | 1.58 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.6653 | -5.5985 | (P)/I | -0.0197 | (P)$^2$/I | 0.6732 | -6.6739 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.6653 | -0.9866 | (P)/I | -0.0019 | (P)$^2$/I | 0.6732 | -1.176 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.0530 | (S) | -0.1034 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.16 | (S) | (Linear Fit) | |

**Model Tested:** SP-32
**Test Fluid:** Water
**Test Flow Rate:** 61 ml/s 0.97 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunEarth, Inc.**
8425 Almeria Avenue
Fontana, CA 92335 USA

MODEL: SunBelt SB-40-0.75
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-025C

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 58 | 44 | 31 | A (-9°F) | 55 | 42 | 29 |
| B (5°C) | 50 | 36 | 22 | B (9°F) | 47 | 34 | 21 |
| C (20°C) | 37 | 24 | 11 | C (36°F) | 35 | 23 | 11 |
| D (50°C) | 15 | 5 | | D (90°F) | 14 | 4 | |
| E (80°C) | | | | E (144°F) | | | |

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

Original Certification Date: December 18, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.796 | m$^2$ | 40.86 | ft$^2$ | **Net Aperture Area:** | 3.457 | m$^2$ | 37.21 | ft$^2$ |
| **Dry Weight:** | 64 | kg | 141 | lb | **Fluid Capacity:** | 4.5 | l | 1.2 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Flat Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.6729 | -5.6556 | (P)/I | -0.0199 | (P)$^2$/I | 0.6809 | -6.742 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.6729 | -0.9967 | (P)/I | -0.0019 | (P)$^2$/I | 0.6809 | -1.188 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.0530 | (S) | -0.1034 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.16 | (S) | (Linear Fit) | |

**Model Tested:** SP-32
**Test Fluid:** Water
**Test Flow Rate:** 61 ml/s 0.97 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunEarth, Inc.**
8425 Almeria Avenue
Fontana, CA 92335 USA

MODEL: Sunwise SC-24
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2008-012A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 35 | 26 | 18 | A (-9°F) | 33 | 25 | 17 |
| B (5°C) | 32 | 23 | 15 | B (9°F) | 30 | 22 | 14 |
| C (20°C) | 27 | 19 | 11 | C (36°F) | 26 | 18 | 10 |
| D (50°C) | 18 | 10 | 3 | D (90°F) | 17 | 10 | 3 |
| E (80°C) | 8 | 2 | | E (144°F) | 8 | 2 | |

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

Original Certification Date: March 14, 2008

## COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.298 | m$^2$ | 24.74 | ft$^2$ | **Net Aperture Area:** | 2.031 | m$^2$ | 21.86 | ft$^2$ |
| **Dry Weight:** | 36.1 | kg | 80 | lb | **Fluid Capacity:** | 2.7 | l | 0.7 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 25 | 0.10 |
| 50 | 0.79 | 118 | 0.47 |
| 80 | 1.27 | 276 | 1.11 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.7275 | -2.9883 | (P)/I | -0.0193 | (P)$^2$/I | 0.7351 | -4.0407 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.7275 | -0.5266 | (P)/I | -0.0019 | (P)$^2$/I | 0.7351 | -0.712 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.2964 | (S) | +0.0191 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.28 | (S) | (Linear Fit) | |

**Model Tested:** EC-24
**Test Fluid:** Water
**Test Flow Rate:** 46 ml/s 0.73 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunEarth, Inc.**
8425 Almeria Avenue
Fontana, CA 92335 USA

MODEL: Sunwise SC-32
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2008-012B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
| A (-5°C) | 47 | 35 | 24 | A (-9°F) | 45 | 34 | 23 |
| B (5°C) | 43 | 32 | 20 | B (9°F) | 41 | 30 | 19 |
| C (20°C) | 37 | 26 | 15 | C (36°F) | 35 | 25 | 14 |
| D (50°C) | 24 | 14 | 4 | D (90°F) | 23 | 13 | 4 |
| E (80°C) | 12 | 3 | | E (144°F) | 11 | 3 | |

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

Original Certification Date: March 14, 2008

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.051 | $m^2$ | 32.84 | $ft^2$ | **Net Aperture Area:** | 2.760 | $m^2$ | 29.71 $ft^2$ |
| **Dry Weight:** | 48.1 | kg | 106 | lb | **Fluid Capacity:** | 3.8 | l | 1.0 gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.7447 | -3.0285 | (P)/I | -0.0198 | $(P)^2/I$ | 0.7525 | -4.1062 | $W/m^2 \cdot °C$ |
| **I P Units:** | $\eta$ = | 0.7447 | -0.5337 | (P)/I | -0.0019 | $(P)^2/I$ | 0.7525 | -0.724 | $Btu/hr \cdot ft^2 \cdot °F$ |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.2964 | (S) | +0.0191 | $(S)^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.28 | (S) | (Linear Fit) | |

**Model Tested:** EC-24
**Test Fluid:** Water
**Test Flow Rate:** 46 ml/s 0.73 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunEarth, Inc.**
8425 Almeria Avenue
Fontana, CA 92335 USA

MODEL: Sunwise SC-40
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2008-012C

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 59 | 44 | 30 | A (-9°F) | 56 | 42 | 28 |
| B (5°C) | 54 | 40 | 25 | B (9°F) | 52 | 38 | 24 |
| C (20°C) | 47 | 32 | 18 | C (36°F) | 44 | 31 | 17 |
| D (50°C) | 30 | 17 | 5 | D (90°F) | 29 | 17 | 5 |
| E (80°C) | 14 | 4 | | E (144°F) | 14 | 4 | |

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

Original Certification Date: March 14, 2008

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.796 | m$^2$ | 40.86 | ft$^2$ | **Net Aperture Area:** | 3.457 | m$^2$ | 37.21 | ft$^2$ |
| **Dry Weight:** | 64 | kg | 141 | lb | **Fluid Capacity:** | 4.5 | l | 1.2 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.7496 | -3.0406 | (P)/I | -0.0199 | (P)$^2$/I | 0.7575 | -4.1251 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.7496 | -0.5358 | (P)/I | -0.0019 | (P)$^2$/I | 0.7575 | -0.727 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.2964 | (S) | +0.0191 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.28 | (S) | (Linear Fit) | | |

**Model Tested:** EC-24
**Test Fluid:** Water
**Test Flow Rate:** 46 ml/s 0.73 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunEarth, Inc.**
8425 Almeria Avenue
Fontana, CA 92335 USA

MODEL: Sunwise SP-24
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1995-001A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 34 | 25 | 17 | A (-9°F) | 32 | 24 | 16 |
| B (5°C) | 30 | 22 | 14 | B (9°F) | 29 | 21 | 13 |
| C (20°C) | 26 | 18 | 10 | C (36°F) | 24 | 17 | 9 |
| D (50°C) | 16 | 9 | 2 | D (90°F) | 15 | 9 | 2 |
| E (80°C) | 7 | 2 | | E (144°F) | 7 | 2 | |

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

Original Certification Date: August 1, 1995

## COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.290 | m$^2$ | 24.65 | ft$^2$ | **Net Aperture Area:** | 2.015 | m$^2$ | 21.69 | ft$^2$ |
| **Dry Weight:** | 36.3 | kg | 80 | lb | **Fluid Capacity:** | 2.9 | l | 0.8 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.666 | -3.3563 | (P)/I | -0.0138 | (P)$^2$/I | 0.682 | -4.5392 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.666 | -0.5915 | (P)/I | -0.0014 | (P)$^2$/I | 0.682 | -0.800 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0045 | (S) | -0.2088 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.21 | (S) | (Linear Fit) | | |

**Model Tested:** EP-20
**Test Fluid:** Water
**Test Flow Rate:** 32 ml/s 0.51 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunEarth, Inc.**
8425 Almeria Avenue
Fontana, CA 92335 USA

MODEL: Sunwise SP-32
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1995-001B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
| A (-5°C) | 45 | 34 | 23 | A (-9°F) | 42 | 32 | 22 |
| B (5°C) | 41 | 30 | 19 | B (9°F) | 38 | 28 | 18 |
| C (20°C) | 34 | 24 | 13 | C (36°F) | 32 | 22 | 12 |
| D (50°C) | 22 | 12 | 3 | D (90°F) | 20 | 11 | 3 |
| E (80°C) | 10 | 2 | | E (144°F) | 9 | 2 | |

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

Original Certification Date: August 1, 1995

## COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.051 | $m^2$ | 32.84 | $ft^2$ | **Net Aperture Area:** | 2.750 | $m^2$ | 29.60 | $ft^2$ |
| **Dry Weight:** | 47.6 | kg | 105 | lb | **Fluid Capacity:** | 3.9 | l | 1.0 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.666 | -3.3563 | (P)/I | -0.0138 | $(P)^2/I$ | 0.682 | -4.5392 | $W/m^2 \cdot °C$ |
| **I P Units:** | $\eta$ = | 0.666 | -0.5915 | (P)/I | -0.0014 | $(P)^2/I$ | 0.682 | -0.800 | $Btu/hr \cdot ft^2 \cdot °F$ |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0045 | (S) | -0.2088 | $(S)^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.21 | (S) | (Linear Fit) | |

**Model Tested:** EP-20
**Test Fluid:** Water
**Test Flow Rate:** 32 ml/s 0.51 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunEarth, Inc.**
8425 Almeria Avenue
Fontana, CA 92335 USA

MODEL: Sunwise SP-40
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1995-001C

## COLLECTOR THERMAL PERFORMANCE RATING

**Megajoules Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d |
|---|---|---|---|
| A (-5°C) | 56 | 42 | 28 |
| B (5°C) | 51 | 37 | 23 |
| C (20°C) | 43 | 29 | 16 |
| D (50°C) | 27 | 15 | 4 |
| E (80°C) | 12 | 3 | |

**Thousands of Btu Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
|---|---|---|---|
| A (-9°F) | 53 | 40 | 27 |
| B (9°F) | 48 | 35 | 22 |
| C (36°F) | 40 | 28 | 15 |
| D (90°F) | 25 | 14 | 4 |
| E (144°F) | 12 | 3 | |

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

Original Certification Date: August 1, 1995

## COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.796 | m² | 40.86 | ft² | **Net Aperture Area:** | 3.445 | m² | 37.08 | ft² |
| **Dry Weight:** | 62.6 | kg | 138 | lb | **Fluid Capacity:** | 4.5 | l | 1.2 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.666 | -3.3563 | (P)/I | -0.0138 | $(P)^2/I$ | 0.682 | -4.5392 | W/m²·°C |
| **I P Units:** | $\eta$ = | 0.666 | -0.5915 | (P)/I | -0.0014 | $(P)^2/I$ | 0.682 | -0.800 | Btu/hr·ft²·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0045 | (S) | -0.2088 | $(S)^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.21 | (S) | (Linear Fit) | |

**Model Tested:** EP-20
**Test Fluid:** Water
**Test Flow Rate:** 32 ml/s 0.51 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunEarth, Inc.**
8425 Almeria Avenue
Fontana, CA 92335 USA

MODEL: SolarStar SSC-21
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2008-013B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 30 | 22 | 15 | A (-9°F) | 28 | 21 | 14 |
| B (5°C) | 27 | 20 | 13 | B (9°F) | 26 | 19 | 12 |
| C (20°C) | 24 | 16 | 9 | C (36°F) | 22 | 15 | 9 |
| D (50°C) | 15 | 9 | 3 | D (90°F) | 14 | 8 | 2 |
| E (80°C) | 7 | 2 | | E (144°F) | 7 | 2 | |

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

Original Certification Date: March 14, 2008

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.974 | m$^2$ | 21.25 | ft$^2$ | **Net Aperture Area:** | 1.744 | m$^2$ | 18.77 | ft$^2$ |
| **Dry Weight:** | 31.7 | kg | 70 | lb | **Fluid Capacity:** | 2.7 | l | 0.7 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.7274 | -2.9883 | (P)/I | -0.0193 | (P)$^2$/I | 0.735 | -4.0407 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.7274 | -0.5266 | (P)/I | -0.0019 | (P)$^2$/I | 0.735 | -0.712 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.2964 | (S) | +0.0191 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.28 | (S) | (Linear Fit) | |

**Model Tested:** EC-24
**Test Fluid:** Water
**Test Flow Rate:** 46 ml/s 0.73 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunEarth, Inc.**
8425 Almeria Avenue
Fontana, CA 92335 USA

MODEL: SolarStar SSC-24
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2008-013A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 35 | 26 | 18 | A (-9°F) | 33 | 25 | 17 |
| B (5°C) | 32 | 23 | 15 | B (9°F) | 30 | 22 | 14 |
| C (20°C) | 27 | 19 | 11 | C (36°F) | 26 | 18 | 10 |
| D (50°C) | 18 | 10 | 3 | D (90°F) | 17 | 10 | 3 |
| E (80°C) | 8 | 2 | | E (144°F) | 8 | 2 | |

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

Original Certification Date: March 14, 2008

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.298 | m$^2$ | 24.74 | ft$^2$ | **Net Aperture Area:** | 2.031 | m$^2$ | 21.86 | ft$^2$ |
| **Dry Weight:** | 36.1 | kg | 80 | lb | **Fluid Capacity:** | 2.7 | l | 0.7 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 25 | 0.10 |
| 50 | 0.79 | 118 | 0.47 |
| 80 | 1.27 | 276 | 1.11 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.7275 | -2.9883 | (P)/I | -0.0193 | (P)$^2$/I | 0.7351 | -4.0407 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.7275 | -0.5266 | (P)/I | -0.0019 | (P)$^2$/I | 0.7351 | -0.712 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.2964 | (S) | +0.0191 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.28 | (S) | (Linear Fit) | |

**Model Tested:** EC-24
**Test Fluid:** Water
**Test Flow Rate:** 46 ml/s 0.73 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunEarth, Inc.**
8425 Almeria Avenue
Fontana, CA 92335 USA

MODEL: SolarStar SSC-32
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2008-013C

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 47 | 35 | 24 | A (-9°F) | 45 | 34 | 23 |
| B (5°C) | 43 | 32 | 20 | B (9°F) | 41 | 30 | 19 |
| C (20°C) | 37 | 26 | 15 | C (36°F) | 35 | 25 | 14 |
| D (50°C) | 24 | 14 | 4 | D (90°F) | 23 | 13 | 4 |
| E (80°C) | 12 | 3 | | E (144°F) | 11 | 3 | |

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

Original Certification Date: March 14, 2008

## COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.051 | m$^2$ | 32.84 | ft$^2$ | **Net Aperture Area:** | 2.760 | m$^2$ | 29.71 | ft$^2$ |
| **Dry Weight:** | 48.1 | kg | 106 | lb | **Fluid Capacity:** | 3.8 | l | 1.0 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.7447 | -3.0285 | (P)/I | -0.0198 | (P)$^2$/I | 0.7525 | -4.1062 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.7447 | -0.5337 | (P)/I | -0.0019 | (P)$^2$/I | 0.7525 | -0.724 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.2964 | (S) | +0.0191 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.28 | (S) | (Linear Fit) | |

**Model Tested:** EC-24
**Test Fluid:** Water
**Test Flow Rate:** 46 ml/s 0.73 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunEarth, Inc.**
8425 Almeria Avenue
Fontana, CA 92335 USA

MODEL: SolarStar SSC-40
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2008-013D

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 59 | 44 | 30 | A (-9°F) | 56 | 42 | 28 |
| B (5°C) | 54 | 40 | 25 | B (9°F) | 52 | 38 | 24 |
| C (20°C) | 47 | 32 | 18 | C (36°F) | 44 | 31 | 17 |
| D (50°C) | 30 | 17 | 5 | D (90°F) | 29 | 17 | 5 |
| E (80°C) | 14 | 4 | | E (144°F) | 14 | 4 | |

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

Original Certification Date: March 14, 2008

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.796 | m$^2$ | 40.86 | ft$^2$ | **Net Aperture Area:** | 3.457 | m$^2$ | 37.21 | ft$^2$ |
| **Dry Weight:** | 64 | kg | 141 | lb | **Fluid Capacity:** | 4.5 | l | 1.2 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.7496 | -3.0406 | (P)/I | -0.0199 | (P)$^2$/I | 0.7575 | -4.1251 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.7496 | -0.5358 | (P)/I | -0.0019 | (P)$^2$/I | 0.7575 | -0.727 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.2964 | (S) | +0.0191 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.28 | (S) | (Linear Fit) | | |

**Model Tested:** EC-24
**Test Fluid:** Water
**Test Flow Rate:** 46 ml/s 0.73 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunEarth, Inc.**
8425 Almeria Avenue
Fontana, CA 92335 USA

MODEL: SolarStar SSP-21
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1999-006A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 27 | 21 | 14 | A (-9°F) | 26 | 20 | 13 |
| B (5°C) | 25 | 18 | 11 | B (9°F) | 23 | 17 | 11 |
| C (20°C) | 21 | 14 | 8 | C (36°F) | 20 | 14 | 7 |
| D (50°C) | 13 | 7 | 2 | D (90°F) | 12 | 7 | 2 |
| E (80°C) | 6 | 1 | | E (144°F) | 6 | 1 | |

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

Original Certification Date: October 28, 1999

## COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.860 | m$^2$ | 20.02 | ft$^2$ | **Net Aperture Area:** | 1.699 | m$^2$ | 18.29 | ft$^2$ |
| **Dry Weight:** | 37.2 | kg | 82 | lb | **Fluid Capacity:** | 2.7 | l | 0.7 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Stainless Steel |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.666 | -3.3563 | (P)/I | -0.0138 | (P)$^2$/I | 0.682 | -4.5392 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.666 | -0.5915 | (P)/I | -0.0014 | (P)$^2$/I | 0.682 | -0.800 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0045 | (S) | -0.2088 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.21 | (S) | (Linear Fit) | | |

**Model Tested:** EP-20
**Test Fluid:** Water
**Test Flow Rate:** 32 ml/s 0.50 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunEarth, Inc.**
8425 Almeria Avenue
Fontana, CA 92335 USA

MODEL: SolarStar SSP-24
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1999-006B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 32 | 24 | 16 | A (-9°F) | 30 | 23 | 15 |
| B (5°C) | 29 | 21 | 13 | B (9°F) | 27 | 20 | 13 |
| C (20°C) | 24 | 17 | 9 | C (36°F) | 23 | 16 | 9 |
| D (50°C) | 15 | 8 | 2 | D (90°F) | 14 | 8 | 2 |
| E (80°C) | 7 | 2 | | E (144°F) | 7 | 1 | |

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

Original Certification Date: October 28, 1999

## COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.159 | m$^2$ | 23.24 | ft$^2$ | **Net Aperture Area:** | 1.992 | m$^2$ | 21.44 | ft$^2$ |
| **Dry Weight:** | 42.6 | kg | 94 | lb | **Fluid Capacity:** | 3.0 | l | 0.8 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Stainless Steel |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.666 | -3.3563 | (P)/I | -0.0138 | (P)$^2$/I | 0.682 | -4.5392 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.666 | -0.5915 | (P)/I | -0.0014 | (P)$^2$/I | 0.682 | -0.800 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0045 | (S) | -0.2088 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.21 | (S) | (Linear Fit) | | |

**Model Tested:** EP-20
**Test Fluid:** Water
**Test Flow Rate:** 32 ml/s 0.50 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunEarth, Inc.**
8425 Almeria Avenue
Fontana, CA 92335 USA

MODEL: SolarStar SSP-32
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1999-006C

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 43 | 32 | 22 | A (-9°F) | 40 | 30 | 21 |
| B (5°C) | 39 | 28 | 18 | B (9°F) | 37 | 27 | 17 |
| C (20°C) | 33 | 22 | 12 | C (36°F) | 31 | 21 | 12 |
| D (50°C) | 21 | 11 | 3 | D (90°F) | 20 | 11 | 3 |
| E (80°C) | 9 | 2 | | E (144°F) | 9 | 2 | |

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

Original Certification Date: October 28, 1999

## COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.907 | m$^2$ | 31.29 | ft$^2$ | **Net Aperture Area:** | 2.724 | m$^2$ | 29.32 | ft$^2$ |
| **Dry Weight:** | 54.4 | kg | 120 | lb | **Fluid Capacity:** | 3.8 | l | 1.0 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Stainless Steel |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.666 | -3.3563 | (P)/I | -0.0138 | (P)$^2$/I | 0.682 | -4.5392 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.666 | -0.5915 | (P)/I | -0.0014 | (P)$^2$/I | 0.682 | -0.800 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0045 | (S) | -0.2088 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.21 | (S) | (Linear Fit) | |

**Model Tested:** EP-20
**Test Fluid:** Water
**Test Flow Rate:** 32 ml/s 0.50 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **SunEarth, Inc.**
8425 Almeria Avenue
Fontana, CA 92335 USA

MODEL: SolarStar SSP-40
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1999-006D

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 53 | 40 | 27 | A (-9°F) | 50 | 38 | 26 |
| B (5°C) | 48 | 35 | 22 | B (9°F) | 46 | 33 | 21 |
| C (20°C) | 41 | 28 | 15 | C (36°F) | 39 | 27 | 15 |
| D (50°C) | 26 | 14 | 4 | D (90°F) | 24 | 13 | 4 |
| E (80°C) | 12 | 3 | | E (144°F) | 11 | 2 | |

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

Original Certification Date: October 20, 2000

## COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.629 | m$^2$ | 39.06 | ft$^2$ | **Net Aperture Area:** | 3.415 | m$^2$ | 36.76 | ft$^2$ |
| **Dry Weight:** | 72.7 | kg | 160 | lb | **Fluid Capacity:** | 4.5 | l | 1.2 | gal |
| **Test Pressure:** | 1104 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Stainless Steel |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate & Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.666 | -3.3563 | (P)/I | -0.0138 | (P)$^2$/I | 0.682 | -4.5392 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.666 | -0.5915 | (P)/I | -0.0014 | (P)$^2$/I | 0.682 | -0.800 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0045 | (S) | -0.2088 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.21 | (S) | (Linear Fit) | |

**Model Tested:** EP-20
**Test Fluid:** Water
**Test Flow Rate:** 32 ml/s 0.50 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Sunsiaray Solar Manufacturing, Inc.**
4414 Washburn Rd.
Davison, MI 48423-8006 USA

MODEL: Northern Comfort NC-32
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1986-005A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 38 | 30 | 21 | A (-9°F) | 36 | 28 | 20 |
| B (5°C) | 32 | 23 | 15 | B (9°F) | 30 | 22 | 14 |
| C (20°C) | 24 | 15 | 7 | C (36°F) | 23 | 14 | 7 |
| D (50°C) | 11 | 4 | | D (90°F) | 10 | 4 | |
| E (80°C) | | | | E (144°F) | | | |

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

Original Certification Date: May 23, 1986

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.177 | m$^2$ | 34.20 | ft$^2$ | **Net Aperture Area:** | 2.759 | m$^2$ | 29.70 | ft$^2$ |
| **Dry Weight:** | 54.026 | kg | 119 | lb | **Fluid Capacity:** | 0.0 | l | 0.0 | gal |
| **Test Pressure:** | 0 | kPa | 0 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Aluminum / Plate - Aluminum |
| **Absorber Coating:** | Black Nickel |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.508 | -4.8400 | (P)/I | 0.0000 | (P)$^2$/I | 0.508 | -4.84 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.508 | -0.8529 | (P)/I | 0.0000 | (P)$^2$/I | 0.508 | -0.853 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.0720 | (S) | 0.0000 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.07 | (S) | (Linear Fit) | |

**Model Tested:** NC-32
**Test Fluid:** Air
**Test Flow Rate:** 84 l/s 178.1 scfm

**REMARKS:** Thermal performance is for the 2 module system

March, 2008
Certification must be renewed annually. For current status contact:
SOLAR RATING & CERTIFICATION CORPORATION
c/o FSEC ♦ 1679 Clearlake Road ♦ Cocoa, FL 32922 ♦ (321) 638-1537♦ Fax (321) 638-1010

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Synergy Solar**
6114 Bullard
Suite A
Austin, TX 78757 USA

MODEL: Synergy S19.78
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2004-005A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 25 | 19 | 13 | A (-9°F) | 24 | 18 | 12 |
| B (5°C) | 22 | 16 | 10 | B (9°F) | 21 | 15 | 9 |
| C (20°C) | 17 | 11 | 5 | C (36°F) | 16 | 11 | 5 |
| D (50°C) | 8 | 3 | | D (90°F) | 7 | 3 | |
| E (80°C) | 1 | | | E (144°F) | 1 | | |

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

Original Certification Date: May 28, 2004

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.850 | m$^2$ | 19.91 | ft$^2$ | **Net Aperture Area:** | 1.653 | m$^2$ | 17.79 | ft$^2$ |
| **Dry Weight:** | 35 | kg | 77 | lb | **Fluid Capacity:** | 2.3 | l | 0.6 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Glasswool |
| **Insulation (Back):** | Glasswool |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| 20 | 0.32 | 33 | 0.13 |
| 50 | 0.79 | 117 | 0.47 |
| 80 | 1.27 | 327 | 1.31 |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.612 | -4.3317 | (P)/I | -0.0206 (P)$^2$/I | 0.626 | -6.0142 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.612 | -0.7634 | (P)/I | -0.0020 (P)$^2$/I | 0.626 | -1.060 | Btu/hr·ft$^2$·°F |

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

$K_{\alpha\tau}$ = 1.0 -0.0507 (S) -0.1253 (S)$^2$

$K_{\alpha\tau}$ = 1.0 -0.18 (S) (Linear Fit)

**Model Tested:** S19.78
**Test Fluid:** Water
**Test Flow Rate:** 33 ml/s 0.52 gpm

## REMARKS:

March, 2008
Certification must be renewed annually. For current status contact:
SOLAR RATING & CERTIFICATION CORPORATION
c/o FSEC ♦ 1679 Clearlake Road ♦ Cocoa, FL 32922 ♦ (321) 638-1537♦ Fax (321) 638-1010

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Synergy Solar**
6114 Bullard
Suite A
Austin, TX 78757 USA

MODEL: Synergy S26.68
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2004-005B

## COLLECTOR THERMAL PERFORMANCE RATING

**Megajoules Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d |
|---|---|---|---|
| A (-5°C) | 33 | 25 | 17 |
| B (5°C) | 29 | 21 | 13 |
| C (20°C) | 23 | 15 | 7 |
| D (50°C) | 10 | 4 | |
| E (80°C) | 1 | | |

**Thousands of Btu Per Panel Per Day**

| CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
|---|---|---|---|
| A (-9°F) | 32 | 24 | 17 |
| B (9°F) | 28 | 20 | 13 |
| C (36°F) | 22 | 14 | 7 |
| D (90°F) | 10 | 4 | |
| E (144°F) | 1 | | |

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

Original Certification Date: May 28, 2004

## COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.479 | m² | 26.68 | ft² | **Net Aperture Area:** | 2.272 | m² | 24.46 | ft² |
| **Dry Weight:** | 47.2 | kg | 104 | lb | **Fluid Capacity:** | 3.1 | l | 0.8 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

**Frame:** Aluminum
**Cover (Outer):** Low Iron Tempered Glass
**Cover (Inner):** None
**Absorber Material:** Tube - Copper / Plate - Copper Fin
**Absorber Coating:** Moderately Selective Black Paint
**Insulation (Side):** Glasswool
**Insulation (Back):** Glasswool

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = 0.612 | -4.3317 | (P)/I | -0.0206 | $(P)^2/I$ | 0.626 | -6.0142 | W/m²·°C |
| **I P Units:** | $\eta$ = 0.612 | -0.7634 | (P)/I | -0.0020 | $(P)^2/I$ | 0.626 | -1.060 | Btu/hr·ft²·°F |

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

$K_{\alpha\tau}$ = 1.0 -0.0507 (S) -0.1253 $(S)^2$
$K_{\alpha\tau}$ = 1.0 -0.18 (S) (Linear Fit)

**Model Tested:** S19.78
**Test Fluid:** Water
**Test Flow Rate:** 33 ml/s 0.52 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Synergy Solar**
6114 Bullard
Suite A
Austin, TX 78757 USA

MODEL: Synergy T19.78
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2004-006A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 25 | 19 | 13 | A (-9°F) | 24 | 18 | 12 |
| B (5°C) | 23 | 17 | 11 | B (9°F) | 22 | 16 | 10 |
| C (20°C) | 19 | 13 | 7 | C (36°F) | 18 | 12 | 7 |
| D (50°C) | 12 | 6 | 1 | D (90°F) | 11 | 6 | 1 |
| E (80°C) | 5 | 1 | | E (144°F) | 4 | 1 | |

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

Original Certification Date: May 28, 2004

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.851 | m$^2$ | 19.92 | ft$^2$ | **Net Aperture Area:** | 1.786 | m$^2$ | 19.22 | ft$^2$ |
| **Dry Weight:** | 37.7 | kg | 83 | lb | **Fluid Capacity:** | 2.3 | l | 0.6 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Sputtered aluminum nitride |
| **Insulation (Side):** | Glasswool |
| **Insulation (Back):** | Glasswool |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| 20 | 0.32 | 23 | 0.09 |
| 50 | 0.79 | 104 | 0.42 |
| 80 | 1.27 | 239 | 0.96 |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.633 | -3.2437 | (P)/I | -0.0153 (P)$^2$/I | 0.647 | -4.6653 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.633 | -0.5716 | (P)/I | -0.0015 (P)$^2$/I | 0.647 | -0.822 | Btu/hr·ft$^2$·°F |

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

$K_{\alpha\tau}$ = 1.0 -0.0313 (S) -0.1424 (S)$^2$
$K_{\alpha\tau}$ = 1.0 -0.18 (S) (Linear Fit)

**Model Tested:** T19.78
**Test Fluid:** Water
**Test Flow Rate:** 33 ml/s 0.52 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Synergy Solar**
6114 Bullard
Suite A
Austin, TX 78757 USA

MODEL: Synergy T26.68
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2004-006B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 34 | 26 | 17 | A (-9°F) | 32 | 24 | 17 |
| B (5°C) | 31 | 23 | 14 | B (9°F) | 29 | 21 | 14 |
| C (20°C) | 26 | 18 | 10 | C (36°F) | 24 | 17 | 9 |
| D (50°C) | 16 | 8 | 2 | D (90°F) | 15 | 8 | 2 |
| E (80°C) | 6 | 1 | | E (144°F) | 6 | 1 | |

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

Original Certification Date: May 28, 2004

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.479 | m$^2$ | 26.68 | ft$^2$ | **Net Aperture Area:** | 2.272 | m$^2$ | 24.46 | ft$^2$ |
| **Dry Weight:** | 37.7 | kg | 83 | lb | **Fluid Capacity:** | 2.3 | l | 0.6 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Sputtered aluminum nitride |
| **Insulation (Side):** | Glasswool |
| **Insulation (Back):** | Glasswool |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.633 | -3.2437 (P)/I | -0.0153 (P)$^2$/I | | 0.647 | -4.6653 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.633 | -0.5716 (P)/I | -0.0015 (P)$^2$/I | | 0.647 | -0.822 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.0313 (S) | -0.1424 (S)$^2$ | | |
| $K_{\alpha\tau}$ = | 1.0 | -0.18 (S) | (Linear Fit) | | |

**Model Tested:** T19.78
**Test Fluid:** Water
**Test Flow Rate:** 33 ml/s 0.52 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Synergy Solar**
6114 Bullard
Suite A
Austin, TX 78757 USA

MODEL: Synergy TC-19.78
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2005-007B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 27 | 20 | 14 | A (-9°F) | 26 | 19 | 13 |
| B (5°C) | 24 | 18 | 11 | B (9°F) | 23 | 17 | 11 |
| C (20°C) | 20 | 14 | 7 | C (36°F) | 19 | 13 | 7 |
| D (50°C) | 12 | 7 | 2 | D (90°F) | 12 | 6 | 1 |
| E (80°C) | 6 | 1 | | E (144°F) | 5 | 1 | |

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

Original Certification Date: March 8, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.838 | m$^2$ | 19.78 | ft$^2$ | **Net Aperture Area:** | 1.657 | m$^2$ | 17.84 | ft$^2$ |
| **Dry Weight:** | 35.6 | kg | 78 | lb | **Fluid Capacity:** | 1.7 | l | 0.4 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Sputtered aluminium nitride |
| **Insulation (Side):** | Paper-faced fiberglass |
| **Insulation (Back):** | Foil-faced fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.677 | -3.7302 | (P)/I | -0.0103 | (P)$^2$/I | 0.686 | -4.59 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.677 | -0.6574 | (P)/I | -0.0010 | (P)$^2$/I | 0.686 | -0.809 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.0558 | (S) | -0.1313 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.17 | (S) | (Linear Fit) | | |

**Model Tested:** TC-26.52
**Test Fluid:** Water
**Test Flow Rate:** 51 ml/s 0.80 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Synergy Solar**
6114 Bullard
Suite A
Austin, TX 78757 USA

MODEL: Synergy TC-26.52
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2005-007A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 37 | 28 | 19 | A (-9°F) | 35 | 27 | 18 |
| B (5°C) | 33 | 24 | 15 | B (9°F) | 32 | 23 | 15 |
| C (20°C) | 28 | 19 | 10 | C (36°F) | 26 | 18 | 10 |
| D (50°C) | 17 | 9 | 2 | D (90°F) | 16 | 9 | 2 |
| E (80°C) | 8 | 2 | | E (144°F) | 7 | 2 | |

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

Original Certification Date: October 3, 2005

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.480 | m$^2$ | 26.70 | ft$^2$ | **Net Aperture Area:** | 2.271 | m$^2$ | 24.45 | ft$^2$ |
| **Dry Weight:** | 49 | kg | 108 | lb | **Fluid Capacity:** | 2.3 | l | 0.6 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Sputtered aluminum nitride |
| **Insulation (Side):** | Paper-faced fiberglass |
| **Insulation (Back):** | Foil-faced fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| 20 | 0.32 | 164 | 0.66 |
| 50 | 0.79 | 647 | 2.60 |
| 80 | 1.27 | 1412 | 5.67 |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.688 | -3.6994 | (P)/I | -0.0105 (P)$^2$/I | 0.697 | -4.573 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.688 | -0.6519 | (P)/I | -0.0010 (P)$^2$/I | 0.697 | -0.806 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.0558 (S) | -0.1313 (S)$^2$ | | |
| $K_{\alpha\tau}$ = | 1.0 | -0.17 (S) | (Linear Fit) | | |

**Model Tested:** TC-26.52
**Test Fluid:** Water
**Test Flow Rate:** 51 ml/s 0.80 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Thermo Dynamics, Ltd.**
101 Frazee Avenue
Dartmouth, Nova Scotia B3B 1Z4 Canada

MODEL: Thermo Dynamics G Series G32-P
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-005A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 42 | 32 | 21 | A (-9°F) | 40 | 30 | 20 |
| B (5°C) | 37 | 27 | 17 | B (9°F) | 35 | 26 | 16 |
| C (20°C) | 30 | 20 | 10 | C (36°F) | 29 | 19 | 10 |
| D (50°C) | 17 | 8 | 1 | D (90°F) | 16 | 8 | 1 |
| E (80°C) | 6 | | | E (144°F) | 5 | | |

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

Original Certification Date: March 12, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.982 | m$^2$ | 32.10 | ft$^2$ | **Net Aperture Area:** | 2.783 | m$^2$ | 29.96 | ft$^2$ |
| **Dry Weight:** | 43.5 | kg | 96 | lb | **Fluid Capacity:** | 2.3 | l | 0.6 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Low Iron Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Aluminum |
| **Absorber Coating:** | Moderately Selective Black Paint |
| **Insulation (Side):** | Fiberglass |
| **Insulation (Back):** | Fiberglass |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 73 | 0.29 |
| 50 | 0.79 | 228 | 0.91 |
| 80 | 1.27 | 437 | 1.75 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.689 | -3.8475 | (P)/I | -0.0174 | (P)$^2$/I | 0.7 | -4.934 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.689 | -0.6780 | (P)/I | -0.0017 | (P)$^2$/I | 0.7 | -0.870 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.4920 | (S) | -0.1291 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.36 | (S) | (Linear Fit) | |

**Model Tested:** G32-P
**Test Fluid:** Water
**Test Flow Rate:** 60 ml/s 0.94 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Thermo Technologies**
5560 Sterrett Place
Suite 115
Columbia, MD 21044 USA

MODEL: Mazdon TMA-600-20
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-1998-001B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 31 | 23 | 16 | A (-9°F) | 29 | 22 | 15 |
| B (5°C) | 30 | 22 | 15 | B (9°F) | 28 | 21 | 14 |
| C (20°C) | 28 | 20 | 13 | C (36°F) | 26 | 19 | 12 |
| D (50°C) | 24 | 16 | 8 | D (90°F) | 22 | 15 | 8 |
| E (80°C) | 18 | 11 | 4 | E (144°F) | 17 | 11 | 4 |

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

Original Certification Date: February 14, 2002

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 3.060 | m$^2$ | 32.94 | ft$^2$ | **Net Aperture Area:** | 2.254 | m$^2$ | 24.26 | ft$^2$ |
| **Dry Weight:** | 61.2 | kg | 135 | lb | **Fluid Capacity:** | 0.5 | l | 0.1 | gal |
| **Test Pressure:** | 1034 | kPa | 150 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Stainless Steel |
| **Cover (Outer):** | Iron Free Glass Vacuum Tube |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Vacuum |
| **Insulation (Back):** | Vacuum |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| 40 | 0.63 | 624 | 2.51 |
| 80 | 1.27 | 2096 | 8.41 |
| 120 | 1.90 | 4350 | 17.46 |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.525 | -0.8860 | (P)/I | -0.0074 (P)$^2$/I | 0.53 | -1.421 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.525 | -0.1561 | (P)/I | -0.0007 (P)$^2$/I | 0.53 | -0.250 | Btu/hr·ft$^2$·°F |

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

$K_{\alpha\tau}$ = 1.0 -0.1441 (S) -0.0948 (S)$^2$

$K_{\alpha\tau}$ = 1.0 -0.24 (S) (Linear Fit)

**Model Tested:** 30
**Test Fluid:** Water
**Test Flow Rate:** 76 ml/s 1.20 gpm

**REMARKS:** Collector tested with long axis of tubes oriented north-south. IAM perpendicular to the tubes is listed above. IAM parallel to the tubes = 1.0 - 0.28(S)

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Thermo Technologies**
5560 Sterrett Place
Suite 115
Columbia, MD 21044 USA

MODEL: Mazdon TMA-600-30
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-1998-001A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 46 | 35 | 23 | A (-9°F) | 44 | 33 | 22 |
| B (5°C) | 45 | 33 | 22 | B (9°F) | 42 | 31 | 21 |
| C (20°C) | 42 | 30 | 19 | C (36°F) | 40 | 29 | 18 |
| D (50°C) | 35 | 24 | 13 | D (90°F) | 33 | 23 | 12 |
| E (80°C) | 27 | 17 | 6 | E (144°F) | 26 | 16 | 6 |

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

Original Certification Date: April 20, 1998

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 4.581 | m$^2$ | 49.31 | ft$^2$ | **Net Aperture Area:** | 3.381 | m$^2$ | 36.39 | ft$^2$ |
| **Dry Weight:** | 89.4 | kg | 197 | lb | **Fluid Capacity:** | 0.7 | l | 0.2 | gal |
| **Test Pressure:** | 1034 | kPa | 150 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Stainless Steel |
| **Cover (Outer):** | Iron Free Glass Vacuum Tube |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Vacuum |
| **Insulation (Back):** | Vacuum |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| 40 | 0.63 | 935 | 3.75 |
| 80 | 1.27 | 3128 | 12.56 |
| 120 | 1.90 | 6492 | 26.06 |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.525 | -0.8858 | (P)/I | -0.0074 (P)$^2$/I | 0.53 | -1.421 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.525 | -0.1561 | (P)/I | -0.0007 (P)$^2$/I | 0.53 | -0.250 | Btu/hr·ft$^2$·°F |

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

$K_{\alpha\tau}$ = 1.0 -0.1441 (S) -0.0948 (S)$^2$

$K_{\alpha\tau}$ = 1.0 -0.24 (S) (Linear Fit)

**Model Tested:** 30
**Test Fluid:** Water
**Test Flow Rate:** 76 ml/s 1.20 gpm

**REMARKS:** Collector tested with long axis of tubes oriented north-south. IAM perpendicular to the tubes is listed above. IAM parallel to the tubes = 1.0 - 0.28(S)

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Thermo Technologies**
5560 Sterrett Place
Suite 115
Columbia, MD 21044 USA

MODEL: Mazdon TMA-600-50
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-1998-001C

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 77 | 58 | 39 | A (-9°F) | 73 | 55 | 37 |
| B (5°C) | 74 | 55 | 36 | B (9°F) | 71 | 52 | 34 |
| C (20°C) | 70 | 50 | 31 | C (36°F) | 66 | 48 | 30 |
| D (50°C) | 59 | 40 | 21 | D (90°F) | 56 | 38 | 20 |
| E (80°C) | 45 | 28 | 10 | E (144°F) | 43 | 26 | 10 |

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

Original Certification Date: January 17, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 7.641 | m$^2$ | 82.25 | ft$^2$ | **Net Aperture Area:** | 5.635 | m$^2$ | 60.66 | ft$^2$ |
| **Dry Weight:** | 150.6 | kg | 332 | lb | **Fluid Capacity:** | 1.2 | l | 0.3 | gal |
| **Test Pressure:** | 1034 | kPa | 150 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Stainless Steel |
| **Cover (Outer):** | Iron Free Glass Vacuum Tube |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Vacuum |
| **Insulation (Back):** | Vacuum |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| 0 | 0.00 | 0 | 0.00 |
| 0 | 0.00 | 0 | 0.00 |
| 0 | 0.00 | 0 | 0.00 |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.525 | -0.8858 | (P)/I | -0.0074 (P)$^2$/I | 0.53 | -1.421 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.525 | -0.1561 | (P)/I | -0.0007 (P)$^2$/I | 0.53 | -0.250 | Btu/hr·ft$^2$·°F |

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

$K_{\alpha\tau}$ = 1.0 -0.1441 (S) -0.0948 (S)$^2$

$K_{\alpha\tau}$ = 1.0 -0.24 (S) (Linear Fit)

**Model Tested:** 30
**Test Fluid:** Water
**Test Flow Rate:** 76 ml/s 1.20 gpm

**REMARKS:** This collector is a combination of models TMA-600-20 and TMA-600-30. It is listed for use in those systems requiring 50 tubes.

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Thermo Technologies**
5560 Sterrett Place
Suite 115
Columbia, MD 21044 USA

MODEL: Mazdon TMA-600-70
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-1998-001D

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 108 | 81 | 55 | A (-9°F) | 102 | 77 | 52 |
| B (5°C) | 104 | 78 | 51 | B (9°F) | 99 | 73 | 48 |
| C (20°C) | 97 | 71 | 44 | C (36°F) | 92 | 67 | 42 |
| D (50°C) | 82 | 56 | 29 | D (90°F) | 78 | 53 | 28 |
| E (80°C) | 64 | 39 | 14 | E (144°F) | 60 | 37 | 14 |

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

Original Certification Date: January 17, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 10.701 | m$^2$ | 115.19 | ft$^2$ | **Net Aperture Area:** | 7.889 | m$^2$ | 84.92 | ft$^2$ |
| **Dry Weight:** | 211.8 | kg | 467 | lb | **Fluid Capacity:** | 1.7 | l | 0.4 | gal |
| **Test Pressure:** | 1034 | kPa | 150 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Stainless Steel |
| **Cover (Outer):** | Iron Free Glass Vacuum Tube |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Vacuum |
| **Insulation (Back):** | Vacuum |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| 0 | 0.00 | 0 | 0.00 |
| 0 | 0.00 | 0 | 0.00 |
| 0 | 0.00 | 0 | 0.00 |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.525 | -0.8858 | (P)/I | -0.0074 (P)$^2$/I | 0.53 | -1.421 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.525 | -0.1561 | (P)/I | -0.0007 (P)$^2$/I | 0.53 | -0.250 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1441 (S) | -0.0948 (S)$^2$ | **Model Tested:** | 30 |
| $K_{\alpha\tau}$ = | 1.0 | -0.24 (S) | (Linear Fit) | **Test Fluid:** | Water |
| | | | | **Test Flow Rate:** | 76 ml/s 1.20 gpm |

**REMARKS:** This collector is a combination of two model TMA-600-20 collectors and one TMA-600-30. It is listed for use in those systems requiring 70 tubes.

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Thermo Technologies**
5560 Sterrett Place
Suite 115
Columbia, MD 21044 USA

MODEL: Mazdon TMA-600-80
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-1998-001E

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 123 | 93 | 62 | A (-9°F) | 117 | 88 | 59 |
| B (5°C) | 119 | 89 | 58 | B (9°F) | 113 | 84 | 55 |
| C (20°C) | 111 | 81 | 50 | C (36°F) | 105 | 77 | 48 |
| D (50°C) | 94 | 64 | 34 | D (90°F) | 89 | 60 | 32 |
| E (80°C) | 73 | 44 | 17 | E (144°F) | 69 | 42 | 16 |

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

Original Certification Date: January 17, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 12.222 | m$^2$ | 131.56 | ft$^2$ | **Net Aperture Area:** | 9.016 | m$^2$ | 97.05 | ft$^2$ |
| **Dry Weight:** | 240 | kg | 529 | lb | **Fluid Capacity:** | 1.9 | l | 0.5 | gal |
| **Test Pressure:** | 1034 | kPa | 150 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Stainless Steel |
| **Cover (Outer):** | Iron Free Glass Vacuum Tube |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Black Chrome |
| **Insulation (Side):** | Vacuum |
| **Insulation (Back):** | Vacuum |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| 0 | 0.00 | 0 | 0.00 |
| 0 | 0.00 | 0 | 0.00 |
| 0 | 0.00 | 0 | 0.00 |

## TECHNICAL INFORMATION

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

| | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.525 | -0.8858 | (P)/I | -0.0074 (P)$^2$/I | 0.53 | -1.421 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.525 | -0.1561 | (P)/I | -0.0007 (P)$^2$/I | 0.53 | -0.250 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1441 (S) | -0.0948 (S)$^2$ | | |
| $K_{\alpha\tau}$ = | 1.0 | -0.24 (S) | (Linear Fit) | | |

**Model Tested:** 30
**Test Fluid:** Water
**Test Flow Rate:** 76 ml/s 1.20 gpm

**REMARKS:** This collector is a combination of two model TMA-600-30 collectors and one TMA-600-20. It is listed for use in those systems requiring 80 tubes.

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Thermomax Industries Ltd.**
3181 Kingsley St.
Victoria, BC V8P4J5 Canada

MODEL: Solamax AST20
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-2003-004A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 31 | 24 | 17 | A (-9°F) | 30 | 23 | 16 |
| B (5°C) | 28 | 21 | 13 | B (9°F) | 27 | 20 | 13 |
| C (20°C) | 24 | 16 | 9 | C (36°F) | 23 | 16 | 9 |
| D (50°C) | 16 | 9 | 3 | D (90°F) | 16 | 9 | 3 |
| E (80°C) | 9 | 4 | | E (144°F) | 9 | 3 | |

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

Original Certification Date: May 20, 2004

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.849 | m$^2$ | 30.67 | ft$^2$ | **Net Aperture Area:** | 2.496 | m$^2$ | 26.87 | ft$^2$ |
| **Dry Weight:** | 57.1 | kg | 126 | lb | **Fluid Capacity:** | 1.4 | l | 0.4 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Stainless Steel |
| **Cover (Outer):** | Glass Vacuum Tube |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Sputtered aluminum nitride |
| **Insulation (Side):** | Vacuum |
| **Insulation (Back):** | Vacuum |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 50 | 0.20 |
| 50 | 0.79 | 257 | 1.03 |
| 80 | 1.27 | 608 | 2.44 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.573 | -2.8501 | (P)/I | -0.0028 | (P)$^2$/I | 0.574 | -3.0491 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.573 | -0.5023 | (P)/I | -0.0003 | (P)$^2$/I | 0.574 | -0.537 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0469 | (S) | -0.1044 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.08 | (S) | (Linear Fit) | | |

**Model Tested:** AST 20
**Test Fluid:** Water
**Test Flow Rate:** 50 ml/s 0.79 gpm

**REMARKS:** Collector tested with long axis of tubes oriented north-south. IAM perpendicular to the tubes is listed above. IAM parallel to the tubes = 1.0 - 0.45(S)

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Thermomax Industries Ltd.**
3181 Kingsley St.
Victoria, BC V8P4J5 Canada

MODEL: Solamax AST30
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-2003-004B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 47 | 36 | 25 | A (-9°F) | 45 | 34 | 24 |
| B (5°C) | 42 | 31 | 20 | B (9°F) | 40 | 30 | 19 |
| C (20°C) | 36 | 25 | 14 | C (36°F) | 34 | 23 | 13 |
| D (50°C) | 25 | 14 | 4 | D (90°F) | 23 | 13 | 4 |
| E (80°C) | 14 | 5 | | E (144°F) | 13 | 5 | |

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

Original Certification Date: May 20, 2004

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 4.280 | m$^2$ | 46.07 | ft$^2$ | **Net Aperture Area:** | 3.749 | m$^2$ | 40.36 | ft$^2$ |
| **Dry Weight:** | 85.6 | kg | 189 | lb | **Fluid Capacity:** | 2.1 | l | 0.6 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Stainless Steel |
| **Cover (Outer):** | Glass Vacuum Tube |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Sputtered aluminum nitride |
| **Insulation (Side):** | Vacuum |
| **Insulation (Back):** | Vacuum |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.573 | -2.8501 | (P)/I | -0.0028 | (P)$^2$/I | 0.574 | -3.0491 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.573 | -0.5023 | (P)/I | -0.0003 | (P)$^2$/I | 0.574 | -0.537 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0469 | (S) | -0.1044 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.08 | (S) | (Linear Fit) | | |

**Model Tested:** AST 20
**Test Fluid:** Water
**Test Flow Rate:** 50 ml/s 0.79 gpm

**REMARKS:** Collector tested with long axis of tubes oriented north-south. IAM perpendicular to the tubes is listed above. IAM parallel to the tubes = 1.0 - 0.45(S)

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Thermomax Industries Ltd.**
3181 Kingsley St.
Victoria, BC V8P4J5 Canada

MODEL: Solamax AST50
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-2003-004C

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 79 | 60 | 42 | A (-9°F) | 75 | 57 | 40 |
| B (5°C) | 71 | 52 | 34 | B (9°F) | 67 | 49 | 32 |
| C (20°C) | 60 | 41 | 23 | C (36°F) | 56 | 39 | 22 |
| D (50°C) | 41 | 24 | 7 | D (90°F) | 39 | 22 | 7 |
| E (80°C) | 24 | 9 | | E (144°F) | 22 | 8 | |

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

Original Certification Date: June 28, 2004

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 7.129 | m$^2$ | 76.74 | ft$^2$ | **Net Aperture Area:** | 6.245 | m$^2$ | 67.22 | ft$^2$ |
| **Dry Weight:** | 142.7 | kg | 315 | lb | **Fluid Capacity:** | 3.5 | l | 0.9 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Stainless Steel |
| **Cover (Outer):** | Glass Vacuum Tube |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Sputtered aluminum nitride |
| **Insulation (Side):** | Vacuum |
| **Insulation (Back):** | Vacuum |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.573 | -2.8501 | (P)/I | -0.0028 | (P)$^2$/I | 0.574 | -3.0491 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.573 | -0.5023 | (P)/I | -0.0003 | (P)$^2$/I | 0.574 | -0.537 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0469 | (S) | -0.1044 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.08 | (S) | (Linear Fit) | | |

**Model Tested:** AST 20
**Test Fluid:** Water
**Test Flow Rate:** 50 ml/s 0.79 gpm

**REMARKS:** This collector is a combination of models AST 20 and AST 30. It is listed for use in those systems requiring 50 tubes.

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Thermomax Industries Ltd.**
3181 Kingsley St.
Victoria, BC V8P4J5 Canada

MODEL: Solamax AST70
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-2003-004D

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 110 | 84 | 58 | A (-9°F) | 104 | 80 | 55 |
| B (5°C) | 99 | 73 | 47 | B (9°F) | 94 | 69 | 45 |
| C (20°C) | 83 | 58 | 32 | C (36°F) | 79 | 55 | 30 |
| D (50°C) | 57 | 33 | 10 | D (90°F) | 54 | 31 | 10 |
| E (80°C) | 33 | 12 | | E (144°F) | 31 | 12 | |

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

Original Certification Date: January 17, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 9.978 | m$^2$ | 107.41 | ft$^2$ | **Net Aperture Area:** | 8.741 | m$^2$ | 94.09 ft$^2$ |
| **Dry Weight:** | 199.8 | kg | 441 | lb | **Fluid Capacity:** | 4.9 | l | 1.3 gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Stainless Steel |
| **Cover (Outer):** | Glass Vacuum Tube |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Sputtered aluminum nitride |
| **Insulation (Side):** | Vacuum |
| **Insulation (Back):** | Vacuum |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 0 | 0.00 | 0 | 0.00 |
| 0 | 0.00 | 0 | 0.00 |
| 0 | 0.00 | 0 | 0.00 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.573 | -2.8501 | (P)/I | -0.0028 | (P)$^2$/I | 0.574 | -3.0491 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.573 | -0.5023 | (P)/I | -0.0003 | (P)$^2$/I | 0.574 | -0.537 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0469 | (S) | -0.1044 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.08 | (S) | (Linear Fit) | |

**Model Tested:** AST 20
**Test Fluid:** Water
**Test Flow Rate:** 50 ml/s 0.79 gpm

**REMARKS:** This collector is a combination of two model AST 20 collectors and one AST 30. It is listed for use in those systems requiring 70 tubes.

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Thermomax Industries Ltd.**
3181 Kingsley St.
Victoria, BC V8P4J5 Canada

MODEL: Solamax AST80
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-2003-004E

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 126 | 96 | 67 | A (-9°F) | 119 | 91 | 63 |
| B (5°C) | 113 | 83 | 54 | B (9°F) | 107 | 79 | 51 |
| C (20°C) | 95 | 66 | 37 | C (36°F) | 90 | 63 | 35 |
| D (50°C) | 66 | 38 | 12 | D (90°F) | 62 | 36 | 11 |
| E (80°C) | 38 | 14 | | E (144°F) | 36 | 13 | |

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

Original Certification Date: January 17, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 11.408 | m$^2$ | 122.80 | ft$^2$ | **Net Aperture Area:** | 9.994 | m$^2$ | 107.58 | ft$^2$ |
| **Dry Weight:** | 228.3 | kg | 503 | lb | **Fluid Capacity:** | 5.6 | l | 1.5 | gal |
| **Test Pressure:** | 1103 | kPa | 160 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Stainless Steel |
| **Cover (Outer):** | Glass Vacuum Tube |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Sputtered aluminum nitride |
| **Insulation (Side):** | Vacuum |
| **Insulation (Back):** | Vacuum |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 0 | 0.00 | 0 | 0.00 |
| 0 | 0.00 | 0 | 0.00 |
| 0 | 0.00 | 0 | 0.00 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.573 | -2.8501 | (P)/I | -0.0028 | (P)$^2$/I | 0.574 | -3.0491 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.573 | -0.5023 | (P)/I | -0.0003 | (P)$^2$/I | 0.574 | -0.537 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.0469 | (S) | -0.1044 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.08 | (S) | (Linear Fit) | | |

**Model Tested:** AST 20
**Test Fluid:** Water
**Test Flow Rate:** 50 ml/s 0.79 gpm

**REMARKS:** This collector is a combination of two model AST 30 collectors and one AST 20. It is listed for use in those systems requiring 80 tubes.

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **VELUX America Inc.**
104 Ben Casey Drive
Fort Mill, SC 29708 USA

MODEL: VELUX CLI U12 4000
COLLECTOR TYPE: Glazed Flat Plate
CERTIFICATION #: 100-2007-018A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 38 | 28 | 19 | A (-9°F) | 36 | 27 | 18 |
| B (5°C) | 35 | 26 | 16 | B (9°F) | 33 | 24 | 16 |
| C (20°C) | 30 | 21 | 12 | C (36°F) | 29 | 20 | 11 |
| D (50°C) | 20 | 12 | 4 | D (90°F) | 19 | 11 | 4 |
| E (80°C) | 10 | 3 | | E (144°F) | 9 | 3 | |

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

Original Certification Date: February 26, 2008

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.514 | m$^2$ | 27.06 | ft$^2$ | **Net Aperture Area:** | 2.153 | m$^2$ | 23.18 | ft$^2$ |
| **Dry Weight:** | 59 | kg | 130 | lb | **Fluid Capacity:** | 2.2 | l | 0.6 | gal |
| **Test Pressure:** | 903 | kPa | 131 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper |
| **Absorber Coating:** | Selective |
| **Insulation (Side):** | Rock Wool |
| **Insulation (Back):** | Rock Wool |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 62 | 0.25 |
| 50 | 0.79 | 160 | 0.64 |
| 80 | 1.27 | 265 | 1.06 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.686 | -2.6936 | (P)/I | -0.0202 | (P)$^2$/I | 0.696 | -3.896 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.686 | -0.4747 | (P)/I | -0.0020 | (P)$^2$/I | 0.696 | -0.687 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.0161 | (S) | -0.1417 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.16 | (S) | (Linear Fit) | |

**Model Tested:** CLI U12 4000
**Test Fluid:** Water
**Test Flow Rate:** 50 ml/s 0.78 gpm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Viessmann Manufacturing Company (US) Inc.**
45 Access Road
Warwick, RI 02886 USA

MODEL: Vitosol 100 SV1, SH1
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2005-019A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 39 | 30 | 20 | A (-9°F) | 37 | 28 | 19 |
| B (5°C) | 36 | 27 | 17 | B (9°F) | 34 | 25 | 16 |
| C (20°C) | 31 | 22 | 13 | C (36°F) | 30 | 21 | 12 |
| D (50°C) | 23 | 14 | 5 | D (90°F) | 22 | 13 | 5 |
| E (80°C) | 15 | 6 | | E (144°F) | 14 | 6 | |

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

Original Certification Date: July 31, 2006

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.523 | m$^2$ | 27.16 | ft$^2$ | **Net Aperture Area:** | 2.334 | m$^2$ | 25.12 | ft$^2$ |
| **Dry Weight:** | 44.2 | kg | 97 | lb | **Fluid Capacity:** | 1.9 | l | 0.5 | gal |
| **Test Pressure:** | 897 | kPa | 130 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Sputtered cermet |
| **Insulation (Side):** | Polyurethane Foam |
| **Insulation (Back):** | Mineral Wool |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 18 | 0.07 |
| 50 | 0.79 | 64 | 0.25 |
| 80 | 1.27 | 133 | 0.53 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.7162 | -3.0562 | (P)/I | -0.0067 | (P)$^2$/I | 0.7203 | -3.4981 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.7162 | -0.5386 | (P)/I | -0.0007 | (P)$^2$/I | 0.7203 | -0.616 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.0707 | (S) | -0.1232 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.20 | (S) | (Linear Fit) | |

**Model Tested:** Vitosol 100, SVI
**Test Fluid:** Propylene Glycol & Water
**Test Flow Rate:** 50 ml/s 0.79 gpm

**REMARKS:** Pressure drop shown above is for Model SV1

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Viessmann Manufacturing Company (US) Inc.**
45 Access Road
Warwick, RI 02886 USA

MODEL: Vitosol 300 Type SP3, 2m2
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-2005-020A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 31 | 23 | 16 | A (-9°F) | 29 | 22 | 15 |
| B (5°C) | 30 | 22 | 14 | B (9°F) | 28 | 21 | 14 |
| C (20°C) | 28 | 20 | 13 | C (36°F) | 26 | 19 | 12 |
| D (50°C) | 25 | 17 | 10 | D (90°F) | 23 | 16 | 9 |
| E (80°C) | 21 | 13 | 6 | E (144°F) | 20 | 13 | 6 |

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

Original Certification Date: July 31, 2006

## COLLECTOR SPECIFICATIONS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.878 | m$^2$ | 30.98 | ft$^2$ | **Net Aperture Area:** | 2.504 | m$^2$ | 26.95 | ft$^2$ |
| **Dry Weight:** | 57.6 | kg | 127 | lb | **Fluid Capacity:** | 1.3 | l | 0.3 | gal |
| **Test Pressure:** | 130 | kPa | 19 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Glass Vacuum Tube |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper Fin |
| **Absorber Coating:** | Sputtered cermet |
| **Insulation (Side):** | Vacuum |
| **Insulation (Back):** | Vacuum |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 20 | 0.32 | 411 | 1.65 |
| 50 | 0.79 | 1557 | 6.25 |
| 80 | 1.27 | 3336 | 13.39 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.5079 | -0.9156 | (P)/I | -0.0030 | (P)$^2$/I | 0.5093 | -1.0948 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.5079 | -0.1614 | (P)/I | -0.0003 | (P)$^2$/I | 0.5093 | -0.193 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.5192 | (S) | -0.7428 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.26 | (S) | (Linear Fit) | | |

**Model Tested:** Vitosol 300, SP3, 2 m2
**Test Fluid:** Propylene Glycol & Water
**Test Flow Rate:** 59 ml/s 0.94 gpm

**REMARKS:** Collector tested with long axis of tubes oriented north-south. IAM perpendicular to the tubes is listed above. IAM parallel to the tubes = 1.0 - 0.31(S)

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Viessmann Manufacturing Company (US) Inc.**
45 Access Road
Warwick, RI 02886 USA

MODEL: Vitosol 300 Type SP3, 3m2
COLLECTOR TYPE: Tubular
CERTIFICATION #: 100-2005-020B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 46 | 34 | 23 | A (-9°F) | 43 | 33 | 22 |
| B (5°C) | 44 | 33 | 22 | B (9°F) | 42 | 31 | 20 |
| C (20°C) | 42 | 30 | 19 | C (36°F) | 39 | 29 | 18 |
| D (50°C) | 37 | 25 | 14 | D (90°F) | 35 | 24 | 13 |
| E (80°C) | 31 | 20 | 10 | E (144°F) | 29 | 19 | 9 |

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

Original Certification Date: August 9, 2006

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 4.287 | m$^2$ | 46.15 | ft$^2$ | **Net Aperture Area:** | 3.760 | m$^2$ | 40.47 | ft$^2$ |
| **Dry Weight:** | 68 | kg | 150 | lb | **Fluid Capacity:** | 1.8 | l | 0.5 | gal |
| **Test Pressure:** | 130 | kPa | 19 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum |
| **Cover (Outer):** | Glass Vacuum Tube |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - Copper / Plate - Copper fin |
| **Absorber Coating:** | Sputtered cermet |
| **Insulation (Side):** | Vacuum |
| **Insulation (Back):** | Vacuum |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| ml/s | gpm | Pa | in $H_2O$ |
| | | | |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.5079 | -0.9156 | (P)/I | -0.0030 | (P)$^2$/I | 0.5093 | -1.0948 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.5079 | -0.1614 | (P)/I | -0.0003 | (P)$^2$/I | 0.5093 | -0.193 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | +0.5192 | (S) | -0.7428 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.26 | (S) | (Linear Fit) | | |

**Model Tested:** Vitosol 300, SP3, 2m2
**Test Fluid:** Prolylene Glycol & Water
**Test Flow Rate:** ml/s 0.00 gpm

**REMARKS:** Collector tested with long axis of tubes oriented north-south. IAM perpendicular to the tubes is listed above. IAM parallel to the tubes = 1.0 - 0.31(S)

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Your Solar Home, Inc.**
299 Applewood Crescent, Unit 4
Vaughan, ON L4K 4E7 Canada

MODEL: SolarSheat 1000G
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-008C

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 13 | 10 | 7 | A (-9°F) | 12 | 10 | 7 |
| B (5°C) | 10 | 7 | 4 | B (9°F) | 10 | 7 | 4 |
| C (20°C) | 6 | 4 | 1 | C (36°F) | 6 | 3 | 1 |
| D (50°C) | 1 | | | D (90°F) | 1 | | |
| E (80°C) | | | | E (144°F) | | | |

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

Original Certification Date: June 4, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.204 | m$^2$ | 12.96 | ft$^2$ | **Net Aperture Area:** | 1.037 | m$^2$ | 11.16 | ft$^2$ |
| **Dry Weight:** | 19.5 | kg | 43 | lb | **Fluid Capacity:** | | l | 0.0 | gal |
| **Test Pressure:** | 0 | kPa | 0 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - / Plate - Aluminum |
| **Absorber Coating:** | Powder coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 0 | 0.00 | 0 | 0.00 |
| 0 | 0.00 | 0 | 0.00 |
| 0 | 0.00 | 0 | 0.00 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.489 | -6.8242 | (P)/I | -0.0043 | (P)$^2$/I | 0.49 | -6.9913 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.489 | -1.2026 | (P)/I | -0.0004 | (P)$^2$/I | 0.49 | -1.232 | Btu/hr·ft$^2$·°F |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1084 | (S) | -0.1851 | (S)$^2$ | |
| $K_{\alpha\tau}$ = | 1.0 | -0.09 | (S) | (Linear Fit) | | |

**Model Tested:** 1500GS
**Test Fluid:** Air
**Test Flow Rate:** 40 l/s 85.0 scfm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Your Solar Home, Inc.**
299 Applewood Crescent, Unit 4
Vaughan, ON L4K 4E7 Canada

MODEL: SolarSheat 1000GS
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-008D

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m²·d | MILDLY CLOUDY 17 MJ/m²·d | CLOUDY DAY 11 MJ/m²·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft²·d | MILDLY CLOUDY 1500 Btu/ft²·d | CLOUDY DAY 1000 Btu/ft²·d |
| A (-5°C) | 17 | 13 | 9 | A (-9°F) | 16 | 13 | 9 |
| B (5°C) | 13 | 9 | 6 | B (9°F) | 13 | 9 | 5 |
| C (20°C) | 8 | 5 | 2 | C (36°F) | 8 | 5 | 1 |
| D (50°C) | 1 | | | D (90°F) | 1 | | |
| E (80°C) | | | | E (144°F) | | | |

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

Original Certification Date: June 4, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 1.578 | $m^2$ | 16.99 | $ft^2$ | **Net Aperture Area:** | 1.392 | $m^2$ | 14.98 | $ft^2$ |
| **Dry Weight:** | 26.3 | kg | 58 | lb | **Fluid Capacity:** | | l | 0.0 | gal |
| **Test Pressure:** | 0 | kPa | 0 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - / Plate - Aluminum |
| **Absorber Coating:** | Powder coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 0 | 0.00 | 0 | 0.00 |
| 0 | 0.00 | 0 | 0.00 |
| 0 | 0.00 | 0 | 0.00 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.489 | -6.8242 | (P)/I | -0.0043 | $(P)^2/I$ | 0.49 | -6.9913 | $W/m^2 \cdot °C$ |
| **I P Units:** | $\eta$ = | 0.489 | -1.2026 | (P)/I | -0.0004 | $(P)^2/I$ | 0.49 | -1.232 | $Btu/hr \cdot ft^2 \cdot °F$ |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1084 | (S) | -0.1851 | $(S)^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.09 | (S) | (Linear Fit) | |

**Model Tested:** 1500GS
**Test Fluid:** Air
**Test Flow Rate:** 40 l/s 85.0 scfm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Your Solar Home, Inc.**
299 Applewood Crescent, Unit 4
Vaughan, ON L4K 4E7 Canada

MODEL: SolarSheat 1500G
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-008B

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 22 | 17 | 12 | A (-9°F) | 21 | 16 | 12 |
| B (5°C) | 17 | 12 | 7 | B (9°F) | 16 | 12 | 7 |
| C (20°C) | 11 | 6 | 2 | C (36°F) | 10 | 6 | 2 |
| D (50°C) | 2 | | | D (90°F) | 2 | | |
| E (80°C) | | | | E (144°F) | | | |

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

Original Certification Date: June 4, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.051 | m$^2$ | 22.08 | ft$^2$ | **Net Aperture Area:** | 1.896 | m$^2$ | 20.41 | ft$^2$ |
| **Dry Weight:** | 41.2 | kg | 91 | lb | **Fluid Capacity:** | | l | 0.0 | gal |
| **Test Pressure:** | 0 | kPa | 0 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - / Plate - Aluminum |
| **Absorber Coating:** | Powder coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 0 | 0.00 | 0 | 0.00 |
| 0 | 0.00 | 0 | 0.00 |
| 0 | 0.00 | 0 | 0.00 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.489 | -6.8242 | (P)/I | -0.0043 | (P)$^2$/I | 0.49 | -6.9913 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.489 | -1.2026 | (P)/I | -0.0004 | (P)$^2$/I | 0.49 | -1.232 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1084 | (S) | -0.1851 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.09 | (S) | (Linear Fit) | |

**Model Tested:** 1500GS
**Test Fluid:** Air
**Test Flow Rate:** 40 l/s 85.0 scfm

## REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

## CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Your Solar Home, Inc.**
299 Applewood Crescent, Unit 4
Vaughan, ON L4K 4E7 Canada

MODEL: SolarSheat 1500GS
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2006-008A

## COLLECTOR THERMAL PERFORMANCE RATING

| Megajoules Per Panel Per Day | | | | Thousands of Btu Per Panel Per Day | | | |
|---|---|---|---|---|---|---|---|
| CATEGORY ( Ti-Ta) | CLEAR DAY 23 MJ/m$^2$·d | MILDLY CLOUDY 17 MJ/m$^2$·d | CLOUDY DAY 11 MJ/m$^2$·d | CATEGORY ( Ti-Ta) | CLEAR DAY 2000 Btu/ft$^2$·d | MILDLY CLOUDY 1500 Btu/ft$^2$·d | CLOUDY DAY 1000 Btu/ft$^2$·d |
| A (-5°C) | 29 | 23 | 16 | A (-9°F) | 28 | 22 | 15 |
| B (5°C) | 23 | 16 | 10 | B (9°F) | 22 | 15 | 9 |
| C (20°C) | 14 | 8 | 3 | C (36°F) | 14 | 8 | 2 |
| D (50°C) | 2 | | | D (90°F) | 2 | | |
| E (80°C) | | | | E (144°F) | | | |

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

Original Certification Date: June 4, 2007

## COLLECTOR SPECIFICATIONS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Area:** | 2.428 | m$^2$ | 26.14 | ft$^2$ | **Net Aperture Area:** | 2.211 | m$^2$ | 23.80 | ft$^2$ |
| **Dry Weight:** | 37 | kg | 82 | lb | **Fluid Capacity:** | | l | 0.0 | gal |
| **Test Pressure:** | 0 | kPa | 0 | psig | | | | | |

## COLLECTOR MATERIALS

| | |
|---|---|
| **Frame:** | Aluminum Extrusion |
| **Cover (Outer):** | Tempered Glass |
| **Cover (Inner):** | None |
| **Absorber Material:** | Tube - / Plate - Aluminum |
| **Absorber Coating:** | Powder coating |
| **Insulation (Side):** | Polyisocyanurate |
| **Insulation (Back):** | Polyisocyanurate |

## PRESSURE DROP

| Flow | | Δ P | |
|---|---|---|---|
| **ml/s** | **gpm** | **Pa** | **in $H_2O$** |
| 25000 | 396.51 | 69 | 0.28 |
| 50000 | 793.02 | 280 | 1.12 |
| 100000 | 1586.04 | 1125 | 4.51 |

## TECHNICAL INFORMATION

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

| | | | | | | | Y Intercept | Slope | |
|---|---|---|---|---|---|---|---|---|---|
| **S I Units:** | $\eta$ = | 0.489 | -6.8242 | (P)/I | -0.0043 | (P)$^2$/I | 0.49 | -6.9913 | W/m$^2$·°C |
| **I P Units:** | $\eta$ = | 0.489 | -1.2026 | (P)/I | -0.0004 | (P)$^2$/I | 0.49 | -1.232 | Btu/hr·ft$^2$·°F |

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

| | | | | | |
|---|---|---|---|---|---|
| $K_{\alpha\tau}$ = | 1.0 | -0.1084 | (S) | -0.1851 | (S)$^2$ |
| $K_{\alpha\tau}$ = | 1.0 | -0.09 | (S) | (Linear Fit) | |

**Model Tested:** 1500GS
**Test Fluid:** Air
**Test Flow Rate:** 40 l/s 85.0 scfm

## REMARKS: