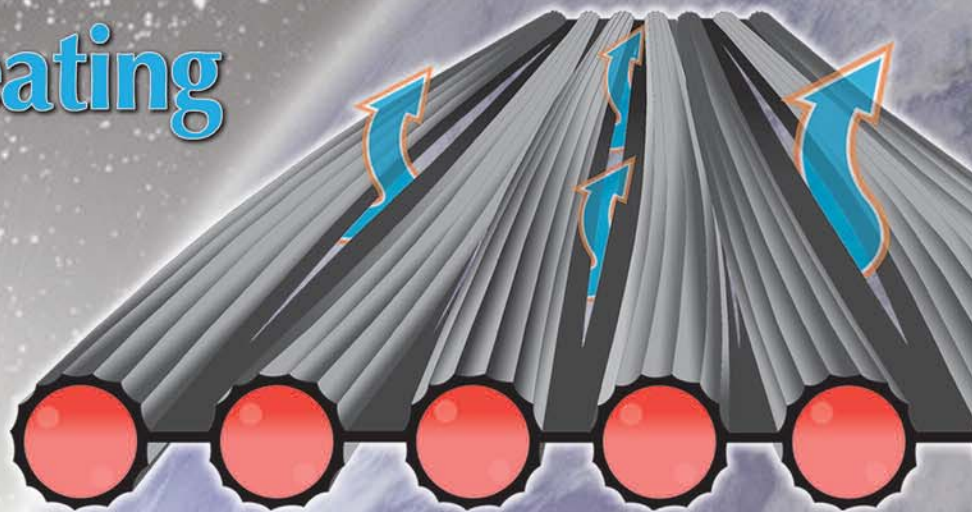


Advanced Hybrid Solar Pool Heating Technology



ECOSUN®
Solar Pool Heating Systems

With its patent pending vented web and unique fluted surface design, only the Ecosun Hybrid combines the strength and high performance of a full plate collector with the benefits of roof ventilation and reduced wind load.

Ecosun is available in either a low profile 1-1/2" manifold or a commercial grade heavy duty 2" manifold for today's high flow, high efficiency pool filtration systems.

TECHNICAL DATA

DIMENSIONS

| | 1-1/2" Series | | | 2" Series | | |
|-----------------------------|---------------|----------|---------|-----------|----------|---------|
| | 16104-12 | 16104-10 | 16104-8 | 16204-12 | 16204-10 | 16204-8 |
| Model Number | 16104-12 | 16104-10 | 16104-8 | 16204-12 | 16204-10 | 16204-8 |
| Nominal Size ft. | 4x12 | 4x10 | 4x8 | 4x12 | 4x10 | 4x8 |
| Overall Collector Length-in | 144.0 | 120.0 | 96.0 | 144.0 | 120.0 | 96.0 |
| Collector Width-in | 47.0 | 47.0 | 47.0 | 47.0 | 47.0 | 47.0 |
| Manifold Length-in | 50.5 | 50.5 | 50.5 | 50.5 | 50.5 | 50.5 |
| Manifold O.D.-in | 1.9 | 1.9 | 1.9 | 2.4 | 2.4 | 2.4 |
| Manifold I.D.-in | 1.5 | 1.5 | 1.5 | 2.0 | 2.0 | 2.0 |
| Gross Collector Area-ft2 | 47.3 | 39.3 | 31.4 | 47.3 | 39.3 | 31.4 |
| Net Collector Area-ft2 | 47.3 | 39.3 | 31.4 | 47.3 | 39.3 | 31.4 |

WEIGHTS

| | | | | | | |
|--------------------|------|------|------|------|------|------|
| Dry-lbs | 21.3 | 17.1 | 14.3 | 22.3 | 18.1 | 15.3 |
| Wet-lbs | 48.0 | 41.6 | 35.1 | 54.0 | 47.6 | 41.1 |
| Wet lbs-ft2 | 1.0 | 1.0 | 1.1 | 1.1 | 1.2 | 1.3 |
| Fluid Capacity-gal | 3.2 | 2.9 | 2.5 | 3.8 | 3.5 | 3.1 |

FLUID FLOW RATES

| | 1-1/2" Series | | | 2" Series | | |
|---|---------------|----------|---------|-----------|----------|---------|
| | 16104-12 | 16104-10 | 16104-8 | 16204-12 | 16204-10 | 16204-8 |
| Model Number | 16104-12 | 16104-10 | 16104-8 | 16204-12 | 16204-10 | 16204-8 |
| Maximum-GPM | 10.0 | 10.0 | 10.00 | 10.0 | 10.0 | 10.0 |
| Minimum-GPM | 3.0 | 2.5 | 2.5 | 3.0 | 2.5 | 2.5 |
| Recommended-GPM | 5.0 | 4.0 | 3.25 | 5.0 | 4.0 | 3.25 |
| Max. Collector with Single Feed @ Recommended Flow Rate | 10 | 12 | 12 | 12 | 14 | 14 |

PRESSURES

| | |
|-------------------------------------|--|
| Pressure Drop: | 0.14 ft head (0.06PSI) pressure loss @ recommended flow rate 0.09 ft head (0.04PSI) pressure loss @ minimum flow rate |
| Max. Fluid Pressure: | Greater than 85 PSI @ 80°F |
| Recommended Max Operating Pressure: | 35 PSI @ 140°F |

Guide Specifications

Contractor to supply and install _____ collectors, nominal size (4x12, 4x10, 4x8) with overall frontal area of (47.3, 39.3, 31.4) square feet each. Collectors shall be fabricated from a propylene copolymer with stabilizer combination providing long term resistance to heat and light. The weight of collector when filled with water shall be no more than 1.3 pounds per square foot of frontal area. The collectors shall be capable of withstanding an internal static pressure of 85 psi at operating temperature and shall be resistant to corrosion, freezing, and internal scale accumulation.

Collectors shall be capable of thermal performances of at least 85% efficiency when inlet fluid temperature equals ambient temperature and be capable of collecting solar energy when the inlet fluid temperature exceeds the ambient temperature by 60°F with 250 BTU per square foot per hour.

Pressure head loss of a single panel must not exceed 0.14 feet water at recommended flow rate.

Collector shall be vented to allow for moisture ventilation of the mounting surface and wind relief during adverse weather conditions.

Collector mounting shall consist of 18-8 chromium-nickel stainless steel mounting hardware with a minimum of two continuous transverse straps having black polypropylene coating. Transverse straps shall be fastened with 18-8 chromium-nickel stainless steel clamps and brackets.

Water connections shall be made with hose sections extruded from EPDM (ethylene-propylene-diene-terpolymer) 70 durometer minimum hardness. Hose clamps shall be all stainless worm gear type with 18-8 chromium-nickel stainless band.

The collectors shall meet or exceed the minimum standards established by the Florida Solar Energy Center, other applicable nationally recognized standards, and shall be manufactured in the U.S.A..

Thermal Performance

Thermal Performance Equation -n = 85.8 - 3.42

Incident Angle Modifier-Kqr = 1.0 - 0.03

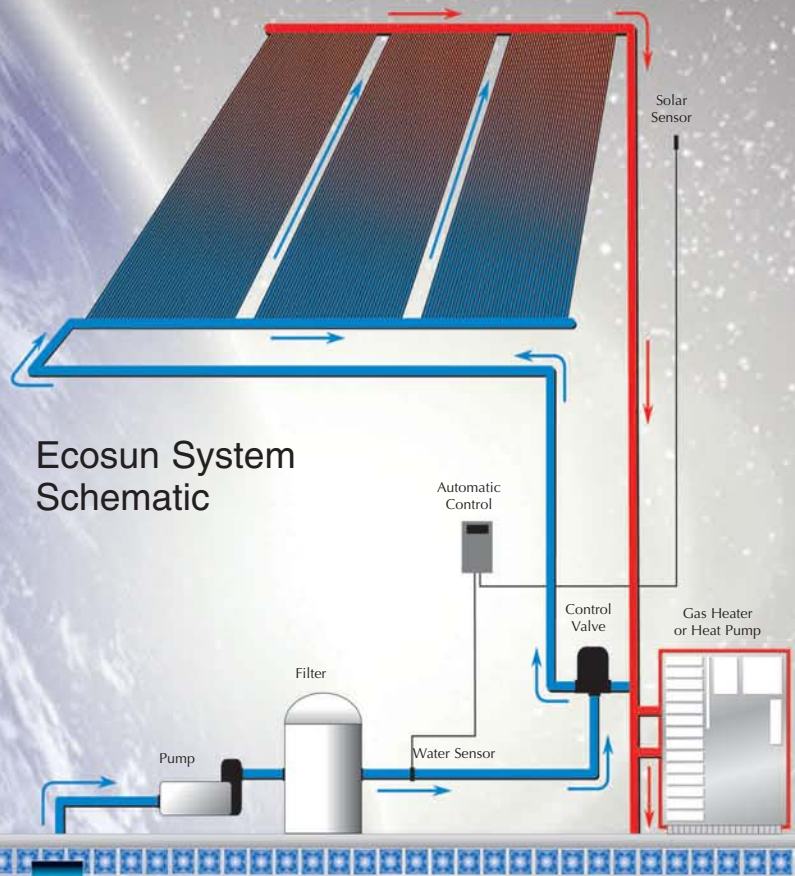
(Rated in accordance with ASHRAE standard 96-80)

Florida Solar Energy Ctr Certification 4x10 - 39,800 (BTU's per std day)
 4x12 - 47,700 (BTU's per std day) 4x8 - 31,800 (BTU's per std day)

CERTIFICATIONS, APPROVALS & TESTING

The Ecosun Solar Pool Heating System meets or exceeds the criteria for approvals from the following accredited independent laboratories and approval agencies:

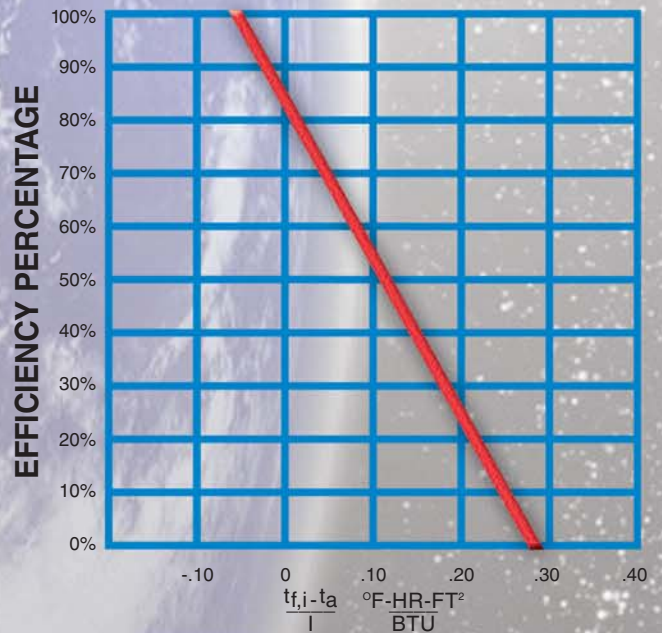
- International Association of Plumbing and Mechanical Officials (IAPMO)
- NSF
- Florida Solar Energy Center
- Dade County
- City of Los Angeles
- DOE- Bright Way Program



Pressure Drop in Head/Feet with Multiple Ecosun Series Collectors

| Collectors | 25 GPM | 30 GPM | 40 GPM | 50 GPM | 60 GPM | 70 GPM |
|------------------------------|--------|--------|--------|--------|--------|--------|
| 8 Collectors (1-1/2" Series) | 0.6 | 0.9 | 1.6 | / | / | / |
| 10 Collectors | / | 1.3 | 1.8 | 3.1 | / | / |
| 12 Collectors | / | / | 2.4 | 3.3 | 4.5 | / |
| 8 Collectors (2" Series) | 0.3 | 0.5 | 1.0 | / | / | / |
| 10 Collectors | / | 0.6 | 1.1 | 1.6 | / | / |
| 12 Collectors | / | / | 1.3 | 1.8 | 2.5 | / |
| 14 Collectors | / | / | / | 1.8 | 2.6 | 3.0 |


Instantaneous Efficiency of Ecosun Series Collectors



Your "Partners in Quality" Representative is:



RESOLUTION ELECTRIC LTD.
 call: 250-448-6355
 web: www.resolutionelectric.ca
 email: solar@resolutionelectric.ca

| | |
|--|--|
| SOLAR COLLECTOR CERTIFICATION AND RATING  SRCC OG-100 | CERTIFIED SOLAR COLLECTOR SUPPLIER: Aquatherm Industries, Inc. 1940 Rutgers University Blvd. Lakewood, NJ 08701 USA MODEL: 16204 COLLECTOR TYPE: Unglazed Flat-Plate CERTIFICATION#: 2009006B |
|--|--|

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 | MILDLY CLOUDY | CLOUDY DAY | CATEGORY (Ti-Ta) | CLEAR DAY | MILDLY CLOUDY | CLOUDY DAY |
| A (-5 °C) | 20.0 | 15.5 | 11.1 | A (-9 °F) | 1.8 | 1.4 | 1.0 |
| B (5 °C) | 14.6 | 10.3 | 5.9 | B (9 °F) | 1.3 | 0.9 | 0.5 |
| C (20 °C) | 6.9 | 3.0 | 0.2 | C (36 °F) | 0.6 | 0.3 | 0.0 |
| D (50 °C) | 0.0 | 0.0 | 0.0 | D (90 °F) | 0.0 | 0.0 | 0 |
| E (80 °C) | 0.0 | 0.0 | 0.0 | E (144 °F) | 0.0 | 0.0 | 0.0 |

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

Original Certification Date: 04-MAY-09

COLLECTOR SPECIFICATIONS

| | | | | | |
|-----------------------|----------------------|-----------------------|---------------------------|---------------------|-----------------------|
| Gross Area: | 4.367 m ² | 47.00 ft ² | Net Aperture Area: | 4.37 m ² | 47.00 ft ² |
| Dry Weight: | 9.3 kg | 21. lb | Fluid Capacity: | 13.4 liter | 3.5 gal |
| Test Pressure: | 358. KPa | 52. psg | | | |

COLLECTOR MATERIALS

| | |
|-----------------------|------|
| Frame: | None |
| Cover (Outer): | None |
| Cover (Inner): | None |

Pressure Drop

| Flow | | ΔP | |
|--------|------|---------|---------------------|
| ml/s | gpm | Pa | in H ₂ O |
| 150.00 | 2.38 | 963.00 | 3.87 |
| 200.00 | 3.17 | 1298.0 | 5.2 |
| 250.00 | 3.96 | 1733.00 | 6.96 |

Absorber Material: Tube - Polypropylene with UV Stabilization /
Plate - Polypropylene with UV stabilization

Insulation Side: None

Absorber Coating: None

Insulation Back: None

TECHNICAL INFORMATION

| | | |
|---|--------------------|--|
| Efficiency Equation [NOTE: Based on gross area and (P)=Ti-Taj] | Y INTERCEPT | SLOPE |
| S I UNITS: $\eta = 0.820 - 13.52640 (P)/I - 0.13525 (P)^2/I$ | 0.816 | -15.763 W/m².°C |
| I P UNITS: $\eta = 0.820 - 2.38268 (P)/I - 0.01324 (P)^2/I$ | 0.816 | -2.777 Btu/hr.ft².°F |

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

Kα = 1 -0.072 (S) -0.006 (S)²

Kα = 1 -0.06 (S) Linear Fit

Model Tested: 16104-12

Test Fluid: Water

Test Flow Rate: 292 ml/s 4.63 gpm

REMARKS: Tests conducted outdoors.

SUMMARY INFORMATION SHEET

FLORIDA SOLAR ENERGY CENTER

300 STATE ROAD 401, CAPE CANAVERAL, FLORIDA 32920-4099, (407) 783-0300



October 1993
FSEC # 93038C

MANUFACTURER

Aquatherm Industries, Inc.
1985 Rutgers University Blvd.
Lakewood, New Jersey 08701

Collector Model

Ecosun 16204-12

This solar collector was evaluated by the Florida Solar Energy Center (FSEC) in accordance with prescribed methods and was found to meet the minimum standards established by FSEC. This evaluation was based on solar collector tests performed at the Florida Solar Energy Center, Cape Canaveral, Florida. The purpose of the tests is to verify initial performance conditions and quality of construction only. The resulting certification is not a guarantee of long term performance or durability.

DESCRIPTION

| | | |
|----------------------------|---------------------|--------------------|
| Gross Length | 3.670 meters | 12.04 feet |
| Gross Width | 1.195 meters | 3.92 feet |
| Gross Depth | 0.009 meters | 0.03 feet |
| Gross Area | 4.385 square meters | 47.20 square feet |
| Transparent Frontal Area | 4.385 square meters | 47.20 square feet |
| Volumetric Capacity | 14.0 liters | 3.7 gallons |
| Weight (empty) | 10.3 kilograms | 22.7 pounds |
| Recommended Flow Rate | 303 ml/s | 4.8 gpm |
| Maximum Operating Pressure | 241 kPag | 35 psig |
| Maximum Wind Load | Not Applicable | |
| Number of Cover Plates | None | |
| Flow Pattern | Parallel | Forced circulation |
| Number of Flow Tubes | Multitube mat | |

MATERIALS

| | |
|------------------|-------------------------------------|
| Enclosure | None |
| Glazing | None |
| Absorber | Polypropylene with UV stabilization |
| Absorber Coating | None |
| Insulation | None |

THERMAL PERFORMANCE

Tested per ASHRAE 96-1980 (RA 1989)

$$\text{Incident Angle Modifier } K_{\tau\alpha} = 1.0 - 0.03 \left(\frac{1}{\cos\theta} - 1 \right)$$

Efficiency Equations

$$\eta = 86.6 - 1978 (T_i - T_a) / I$$

$$\eta = 86.6 - 348 (T_i - T_a) / I$$

$$\eta = 87.3 - 1754 (T_i - T_a) / I - 10901 [(T_i - T_a) / I]^2 \quad \eta = 87.3 - 309 (T_i - T_a) / I - 338 [(T_i - T_a) / I]^2$$

Units of $T_i - T_a / I$ are $^{\circ}\text{C} / \text{Watt} / \text{m}^2$

Units of $T_i - T_a / I$ are $^{\circ}\text{F} / \text{Btu} / \text{hr} \text{ ft}^2$

RATING

The collector has been rated for energy output on measured performance and an assumed standard day. Total solar energy available for the standard day is 5045 watt-hours/ m^2 (1600 Btu/ ft^2) distributed over a 10 hour period.

Output energy ratings for this collector based on the second-order efficiency curve are:

Collector Temperature

| |
|---|
| Low Temperature, 35 $^{\circ}\text{C}$ (95 $^{\circ}\text{F}$) |
| Intermediate Temperature, 50 $^{\circ}\text{C}$ (122 $^{\circ}\text{F}$) |
| High Temperature, 100 $^{\circ}\text{C}$ (212 $^{\circ}\text{F}$) |

Energy Output

| | |
|-----------------------|----------------|
| 50,300 Kilojoules/day | 47,700 Btu/day |
| 18,100 Kilojoules/day | 17,200 Btu/day |
| 0 Kilojoules/day | 0 Btu/day |

Reference 92042