NOTICE

THIS DOCUMENT HAS BEEN REPRODUCED FROM MICROFICHE. ALTHOUGH IT IS RECOGNIZED THAT CERTAIN PORTIONS ARE ILLEGIBLE, IT IS BEING RELEASED IN THE INTEREST OF MAKING AVAILABLE AS MUCH INFORMATION AS POSSIBLE
SOLAR HOT WATER SYSTEM INSTALLED AT DAY'S INN MOTEL, SAVANNAH, GEORGIA

Prepared from documents furnished by

Day's Inn of America, Inc.
2751 Buford Highway
Atlanta, Georgia 30324

Under Contract DOE EG-77-G-01-1632

Monitored by

National Aeronautics and Space Administration
George C. Marshall Space Flight Center, Alabama 35812

For the U. S. Department of Energy

U.S. Department of Energy
Solar Hot Water System Installed at Days Inn Motel, Savannah, Georgia

This final report describes the solar energy hot water system installed in the Days Inns of America, Inc., Days Inn Motel (122 rooms), Abercorn and Mall Boulevard (Oglethorpe Mall), Savannah Georgia. This Solar Hot Water System is one of eleven systems planned under Grant EG-77-G-01-1632. The Solar System was designed by Natural Power, Inc., to provide 50 percent of the total Domestic Hot Water (DHW) demand. Solar Energy Products Model CU-30 WW Liquid Flat Plate Collectors (900 square feet) are used for the collector subsystem. The collector subsystem is closed-loop, using 50 percent Ethylene Glycol solution anti-freeze for freeze protection. The 1,000 gallon fiberglass storage tank contains two heat exchangers. One of the heat exchangers heats the storage tank with the collector solar energy. The other heat exchanger preheats the cold supply water as it passes through on the way to the Domestic Hot Water (DHW) tank heaters. Electrical energy supplements the solar energy for the DHW. The Collector Mounting System utilizes guy wires to structurally tie the collector array to the building. The solar components were partly funded ($14,657 of $29,314 costs) by the Department of Energy Grant. Technical Management was done by NASA/George C. Marshall Space Flight Center, Huntsville, Alabama. This system was turned on in June, 1979.
Report by
James A. Grissett, Jr.

System Location
Days Inn Motel
114 Ma. Rd.
Savannah, GA 31406
912-352-4455

Operational
June 22, 1979

Days Inn
Solar Water Heating System

SOLAR HOT WATER SYSTEM

DAYS INNS OF AMERICA, INC.
ABERCORN AND HALL BLVD.
SAVANNAH, GEORGIA

SYSTEMS DESCRIPTION

EXHIBIT "A"

SECTION I

PREPARED BY:

Davis O. Coley, Jr.
Natural Power, Inc.
P. O. Box 6069
North Augusta, S. C. 29841
(803) 273-0074
DESCRIPTION OF SOLAR ENERGY SYSTEM AND BUILDING

I DESIGN PHILOSOPHY

The Days Inn property at Abercorn and I'All Boulevard was chosen to retrofit with a solar hot water heating system. This location has three electric hot water heaters to supply service hot water for motel rooms. The following assumptions were made to calculate load data:

1. 122 rooms
2. 25 gallons per room of hot water per day
3. 80% occupancy per day
4. gallons per day = 2440
   (gallons per day = 122 x 25 x .8)

Based on a water set temperature of 180°F, a solar system was designed to supply 45 - 50% of load requirements for hot water.

II SOLAR SYSTEM, GENERAL

This system is composed of thirty (900 ft² net) Solar Energy Products, Inc. CU30-W1 (4 x 8) flat plate collectors. This panel was chosen for its high performance, ease of installation and history of good service. The CU30-W1 has a 120 MPH wind rated mounting system, that eliminates structural steel mounting supports and reduces the installed cost. The collectors were divided into three arrays. Each array is composed of ten collectors coupled with side outlets. An automatic air vent is located at the end of each collector array. Each array is mounted on two 4 x 4 treated sleepers. These sleepers are placed on "carry tread" roof membrane protector. The collector arrays have 2 x 3/8" wire guy cables running through the mounting hardware. These cables are connected to the roof with 1" all thread rod and to 4" x 4" x 3" angle steel. There are no roof penetrations over occupied space.

The freeze protection is afforded by fifty percent inhibited ethylene glycol solution. The heat exchange is accomplished on
the solar loop by 240' feet of 1½" soft copper coil located in the 1,000 gallon storage tank. The solar loop has the typical flow meter, expansion tank, ball valves, check valves, filler ports and F & T valves. The pump is controlled by a differential controller of the usual design with 165°F high limit protection. The thermal storage is a 1,000 gallon fiber glass storage tank located in the laundry room. Insulation is foil backed with R-19 insulation value. The tank is equipped with an over flow piped to drain. Potable water is maintained in the tank. The domestic hot water is supplied by a coil of 1½" copper pipe located in the storage tank. Then cold water flows from the main through this coil, it is preheated before going to the existing hot water heaters.

This system is equipped with an eight point digital thermometer. The temperature of the following eight points are scanned every five seconds.

1. collector plate
2. solar heat exchanger in
3. solar heat exchanger out
4. domestic cold water in
5. domestic cold water out
6. tank
7. room temperature
8. outside temperature (ambient)

Also, the system is equipped with an alarm system. A plate sensor set at 190°F will send a signal to a controller that activates an alarm bell before stagnation temperatures are achieved.
ACCEPTANCE TEST DATA

July 6, 1979

1. Pressure Test

The system was placed under fifty pounds water pressure and allowed to run for two weeks. During this time, several small leaks were repaired. No further corrective action was required.

2. Thermal Performance Testing

On Friday, July 6, 1979, with overcast skies, the following data was recorded:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2:11</td>
<td>109°F</td>
<td>109</td>
<td>94</td>
<td>79</td>
</tr>
<tr>
<td>2:16</td>
<td>107</td>
<td>105</td>
<td>92</td>
<td>79</td>
</tr>
<tr>
<td>2:20</td>
<td>107</td>
<td>104</td>
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<td>79</td>
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<td>2:35</td>
<td>107</td>
<td>107</td>
<td>93</td>
<td>79</td>
</tr>
<tr>
<td>2:52</td>
<td>107.6</td>
<td>107.2</td>
<td>93.6</td>
<td>79</td>
</tr>
</tbody>
</table>

Eastern Daylight Saving Time | Average

From the Hottel-Bliss equation

(1) \( Q_u = \eta \cdot (T_i - T_a) - \eta' \cdot (T_i - T_a) \)

\( Q_u \) = rate of useful energy collection BTU/hr

\( \eta \) = area

\( \eta' \) = heat removal factor = .74

\( \eta' \cdot \eta \) = heat loss coefficient = 1.1

\( T_i \) = collector inlet

\( T_a \) = collector ambient

\( I_T \) = BTU/hr ft² radiation on collector and from

(2) \( Q = \eta' \cdot \eta \cdot I_T \)

Useful collected energy rate is as follows:

\( Q \) (BTU/hr) = (20g/hr)(60 min/hr)(1BTU/°F lb)(5.33 lb/gal)(14.9°F) =

\( Q \) (BTU/hr) = 143,942.4 BTU/hr

Substituting (2) \( Q \) (BTU/hr) into (1) and solving for \( I_T \) (radiation on the collector) we get 143,942.4 = .74 \( I_T \)(900) - 1.1 (92.8 - 79)

\( I_T = 216.15 \) BTU/hr
And from the ASHRAE 93-77 efficiency equation
\[ n = 0.74 - 1.1 \left( \frac{92.5 - 70}{216.15} \right) \]
\[ n = 0.74 - 1.1 (0.0633) \]
\[ n = 0.74 - 0.070 \]
\[ n = 0.67 = 67\% \text{ efficiency} \]
under these conditions.

Conclusion: Under the above noted conditions this system is 67\% efficient in delivering solar energy to storage. From this data it can be concluded the system is operating as expected and no corrective actions are required.
MAJOR PROBLEMS ENCOUNTERED AND RESOLUTIONS THEREFOR

There were no major problems encountered and no corrective action was required.
LESSONS LEARNED AND RECOMMENDATIONS

This system is the result of five years of experience. The installation went smoothly and as planned. There were no design changes after the project was started. The contractor did not experience any difficulty in following the construction documents.
VERIFICATIONS

a) Natural Power, Inc. verifies that the solar hot water system at Days Inn, Mall Boulevard, Savannah, Georgia was installed per the as-built drawings.

b) and: met the acceptance test plan provisions.

c) and: meets the Interim Performance Criteria requirements.

[Signature]

Davis O. Colby, Jr.
Natural Power, Inc.
This program is based on the FCHART system developed at the University of Wisconsin. This basic language version of F CHART was written by Mavis Coley

EPIXY DESIGNS
PO BOX 6069
NORTH AUGUSTA, SOUTH CAROLINA 29841

The domestic hot water load is calculated monthly. The collector area is 360 square feet. The collector efficiency data is as follows: (ASHEAE SOFT)

FRTH 0.74
FRUL 1.09

The latitude is 32°.1.
The collector tilt is 22.1.
The monthly water supply temperatures are as follows: 32 81 59 67 75 81 83 90 75 64 54

The number of gallons of hot water required per day is 2440.
The water set temperature is 140°.

<table>
<thead>
<tr>
<th>Month</th>
<th>Percent Solar</th>
<th>Incident Solar (BTU/FT2/MT)</th>
<th>Load BTU/MT(HR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>JANUARY</td>
<td>33.954</td>
<td>42657.8</td>
<td>55.5157</td>
</tr>
<tr>
<td>FEBRUARY</td>
<td>37.76</td>
<td>45620.6</td>
<td>46.674</td>
</tr>
<tr>
<td>MARCH</td>
<td>36.1816</td>
<td>54147.7</td>
<td>31.0378</td>
</tr>
<tr>
<td>APRIL</td>
<td>57.2346</td>
<td>59611.9</td>
<td>44.5656</td>
</tr>
<tr>
<td>MAY</td>
<td>61.9662</td>
<td>55494.7</td>
<td>41.9944</td>
</tr>
<tr>
<td>JUNE</td>
<td>63.3314</td>
<td>54269.8</td>
<td>36.9189</td>
</tr>
<tr>
<td>JULY</td>
<td>64.18</td>
<td>54223.4</td>
<td>36.5811</td>
</tr>
<tr>
<td>AUGUST</td>
<td>65.484</td>
<td>54147.7</td>
<td>31.0378</td>
</tr>
<tr>
<td>SEPTEMBER</td>
<td>56.7355</td>
<td>43196.6</td>
<td>40.6835</td>
</tr>
<tr>
<td>OCTOBER</td>
<td>51.061</td>
<td>51336.8</td>
<td>42.897</td>
</tr>
<tr>
<td>NOVEMBER</td>
<td>36.9132</td>
<td>43196.6</td>
<td>46.3371</td>
</tr>
<tr>
<td>DECEMBER</td>
<td>27.953</td>
<td>32018</td>
<td>54.352</td>
</tr>
</tbody>
</table>

The analysis indicates that 360 square feet of collector will supply 4.5 BTU/FT2/HR.
OPERATION AND MAINTENANCE MANUAL

FOR "CLOSED" SOLAR HOT WATER SYSTEM

SECTION II

PREPARED BY:

Davis G. Coley, Jr.
Natural Power, Inc.
506 Georgia Avenue
North Augusta, S. C. 29841
(803) 278-0074
GENERAL DISCUSSION

This solar system, Days Inn, Mall Boulevard, Savannah, Georgia is a "closed" system. This total system can best be described by breaking it into component parts. Reference to the as built drawings are made through this manual, which are furnished with it.

This system is composed of thirty (900 ft² net) Solar Energy Products, Inc. CU30-WU (4 x 8) flat plate collectors. These collectors are mounted in three rows of ten collectors each. The collectors are piped for reverse return.

The collector loop contains an inhibited glycol solution for heat exchange. In this loop isolation valves, check valves, expansion tanks, flow meter, pump and a heat exchanger will be found. The collected solar heat will be transferred to storage by a coil of copper in the 1,000 gallon storage tank, which is located in the laundry room.

Useful solar energy is transferred to the existing hot water heaters that serve as a back-up.
### SPECIFIC SYSTEM COMPONENTS

#### LOCATION AND FUNCTION

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>LOCATION</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. plate sensors</strong>&lt;br&gt;A) delta temp.&lt;br&gt;B) plate temp.&lt;br&gt;C) upper limit</td>
<td>collector no. 30</td>
<td>A) to sense plate temperature&lt;br&gt;B) to sense plate temperature for temperature scanner&lt;br&gt;C) 190°F upper limit switch for alarm system.</td>
</tr>
<tr>
<td><strong>2. tank sensors</strong>&lt;br&gt;A) delta temp.&lt;br&gt;B) upper limit</td>
<td>bottom of tank: top of tank</td>
<td>A) to sense tank temperature for differential control&lt;br&gt;B) 165°F upper limit switch to protect FRP tank from over-heating.</td>
</tr>
<tr>
<td><strong>3. differential controller</strong></td>
<td>equipment room</td>
<td>to start and stop pump when useful solar energy can be gained.</td>
</tr>
<tr>
<td><strong>digital temperature sensors</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. plate sensors</td>
<td>collector no. 30</td>
<td>to sense plate temperature</td>
</tr>
<tr>
<td>2. solar heat exchange inlet sensor</td>
<td>top of storage tank</td>
<td>to sense the temperature of the solar heated fluid.</td>
</tr>
<tr>
<td>3. solar heat exchange outlet sensor</td>
<td>top of storage tank</td>
<td>to sense the temperature of the solar fluid after exchange with the tank.</td>
</tr>
<tr>
<td>4. domestic cold water heat exchange in</td>
<td>&quot; &quot; &quot; &quot; &quot; &quot; &quot;</td>
<td>to sense the incoming water main temperature.</td>
</tr>
<tr>
<td>5. domestic hot water heat exchange out</td>
<td>&quot; &quot; &quot; &quot; &quot; &quot; &quot;</td>
<td>to sense the temperature rise of the cold water heated by the solar thermal storage.</td>
</tr>
<tr>
<td>6. tank sensor</td>
<td>top of water level (tank)</td>
<td>to sense tank temperature.</td>
</tr>
<tr>
<td>7. room sensor</td>
<td>adjacent to digital thermometer outside laundry room</td>
<td>to sense the room temperature.</td>
</tr>
<tr>
<td>8. outside sensor</td>
<td></td>
<td>to sense collector ambient temperature.</td>
</tr>
<tr>
<td><strong>5. digital thermometer</strong></td>
<td>equipment room</td>
<td>to indicate the temperatures of the solar system and determine its performance.</td>
</tr>
<tr>
<td><strong>6. activator control for alarm bell</strong></td>
<td>equipment room</td>
<td>to produce alarm signal if pump fails.</td>
</tr>
<tr>
<td><strong>7. collector plates</strong></td>
<td>roof top</td>
<td>to collect solar energy.</td>
</tr>
<tr>
<td><strong>8. air vent valves</strong></td>
<td>end of each collector row</td>
<td>to allow collectors to vent any trapped air.</td>
</tr>
<tr>
<td>COMPONENTS</td>
<td>LOCATION</td>
<td>FUNCTION</td>
</tr>
<tr>
<td>----------------------------</td>
<td>---------------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>9. ball valves at</td>
<td>at the inlet of each collector row</td>
<td>flow regulation</td>
</tr>
<tr>
<td>collector inlets (3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. guy cables and turn</td>
<td>roof, two per collector row</td>
<td>to hold collectors down.</td>
</tr>
<tr>
<td>buckles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. flow meter</td>
<td>equipment room</td>
<td>to determine the flow of fluid through collectors.</td>
</tr>
<tr>
<td>12. pressure gauge</td>
<td>equipment room</td>
<td>to measure pressure on solar heat transfer loop.</td>
</tr>
<tr>
<td>13. pump</td>
<td>equipment room</td>
<td>to pump the transfer fluid through the collectors.</td>
</tr>
<tr>
<td>14. relays (2)</td>
<td>equipment room</td>
<td>allows low amperage control to operate 220V 3/4 hp pump.</td>
</tr>
<tr>
<td>15. check valve</td>
<td>equipment room</td>
<td>to prevent reverse flow.</td>
</tr>
<tr>
<td>16. hose connections</td>
<td>equipment room</td>
<td>to allow make-up water to be admitted to solar loop.</td>
</tr>
<tr>
<td>17. expansion tank</td>
<td>equipment room</td>
<td>to allow for expansion of heat transfer fluid.</td>
</tr>
<tr>
<td>18. ball valves</td>
<td>equipment room</td>
<td>flow regulation</td>
</tr>
<tr>
<td>19. tank overflow</td>
<td>top of FRP tank</td>
<td>tank overflow protection.</td>
</tr>
<tr>
<td>20. float valve</td>
<td>inside top of tank</td>
<td>to replace water from storage tank lost due to evaporation.</td>
</tr>
<tr>
<td>21. solar loop heat</td>
<td>inside storage tank</td>
<td>heat exchanger for solar loop.</td>
</tr>
<tr>
<td>exchanger</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22. domestic hot water</td>
<td>inside storage tank</td>
<td>heat exchanger for domestic hot water pre-heat.</td>
</tr>
<tr>
<td>heat exchanger</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
MAINTENANCE REQUIREMENTS

ONCE EACH MONTH

a) check water level in tank by opening man-way on top of tank. Float valve should allow water level to remain constant. Adjust if necessary.
b) periodically check that controller power light is on.
c) check pressure gauge on solar loop. Should read 20 - 25 psig cold. If pressure drops check for leaks.
d) check float in float meter should read 90 - 95% of full scale. (20 gpm) If flow is not correct, adjust using ball valve located at pump.
e) check temperature scanner to insure that readings are nominal.

ONCE EACH YEAR

a) check pump seals for leakage, replace if necessary.
b) check collectors on roof, tighten any loose connections, tighten guy cables if necessary.
c) check air vents caps should be tight.
d) check pH of tank water, should be 7 - 9, if not, drain and replace with fresh water.
e) check pH of solar heat transfer fluid, should be 7 - 9, if it is not drain and replace if necessary.

This solar system has been designed for long and trouble free operation. However, if trouble should occur, please refer to Trouble Shooting Guide in next section.
## TROUBLESHOOTING GUIDE

<table>
<thead>
<tr>
<th>CONDITION</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
</table>
| 1. Power indicator on controller is out | a) check fuse  
b) check power supply to controller |
| 2. Power indicator is "on" on controller, but pump does not run with sunny conditions | a) test the controller using a control tester  
b) check sensors  
c) check high limit  
d) check for loose or shortened sensors  
e) test pump |
| 3. Pump starts but will not stop | check controller using control test procedure. |
| 4. Alarm bell sounds | a) check to insure pump is running, if not take corrective action listed above.  
b) check to insure that tank has not exceeded 165°F.  
The alarm system is to allow time for corrective action in case stagnation conditions occur.  
If the plate temperature is allowed to rise unchecked, the pressure in the system will rise to the preset relief pressure and the antifreeze will be lost. |
WARRANTY INFORMATION

(1) Materials supplied by Natural Power, Inc. are guaranteed for one year from date of installation.

(2) Please refer to additional enclosed warranty information on the collector.

(3) Material and workmanship supplied by L. O. Seckinger is guaranteed for one year.
PROJECT COORDINATOR
Mr. James Grissett
Vice President of Construction
Days Inns of America
2751 Buford Hwy., N. E.
Atlanta, Georgia 30324
(404) 325-4000

PROJECT DESIGNER
Mr. Davis Q. Coley, Jr.
F. O. Box 6069
North Augusta, S. C. 29841
(803) 278-0074

PROJECT SOLAR SYSTEM SUPPLIER
Natural Power, Inc.
506 Georgia Avenue
North Augusta, S. C. 29841
(803) 278-0074

PROJECT INSTALLING SUB-CONTRACTOR
Mr. M. O. Seckinger
412 Whitaker Street
Savannah, Georgia 31401
(912) 233-3087
This system is controlled by a Hawthorne 1503-2 flow control. This controller activates the Teel IP833 collector loop pump when ever the plate temperature is 16°F higher than storage. The control turns the pump off when the plate and tank are within 3°F of each other. There are no other control points in this system; all other heat exchange is by natural convection.
EQUIPMENT INFORMATION
BY MANUFACTURER

SECTION III
OPERATING INSTRUCTIONS & PARTS LIST
CLOSE-COUPLED CENTRIFUGAL PUMPS (Bronze)
MODELS 1P831 THRU 1P837 (Cast Iron)

Description
Teel Centrifugal Pumps use an open type, curved vane impeller centrally located and rotating in an efficiently designed volute housing. The medium to be pumped enters the eye of the impeller and is picked up by the vanes. It is then accelerated to a high velocity by rotation of the impeller and discharged by centrifugal force into the volute and out the discharge. This simplicity of operation affords operation under a wide variety of conditions. Centrifugal pumps when properly installed and maintained will operate trouble-free over long periods of time.

Quiet, continuous, high volume flow are features of your Teel Pump. The complete absence of contacting parts assures long life. The Close-Coupled Pump and Motor Unit operates at 3450 RPM to give maximum design efficiency. Maximum horsepower is required with a wide open discharge line. Increasing the pressure head (discharge restriction) decreases the power required.

Specifications

<table>
<thead>
<tr>
<th>Dayton Motor</th>
<th>60 Hz</th>
<th>Inlet</th>
<th>Outlet</th>
<th>High</th>
<th>Wide</th>
<th>Long</th>
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<tbody>
<tr>
<td>Model Model</td>
<td>HP</td>
<td>Type</td>
<td>Volts</td>
<td>1/4</td>
<td>1/2</td>
<td>3/4</td>
</tr>
<tr>
<td>1P831</td>
<td>1/3</td>
<td>Split Phase</td>
<td>115</td>
<td>6</td>
<td>6</td>
<td>12</td>
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<tr>
<td>1P832</td>
<td>1/2</td>
<td>Capacitor</td>
<td>115,230</td>
<td>6</td>
<td>6</td>
<td>12</td>
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<td>1P837</td>
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<td>Capacitor</td>
<td>208,220,440</td>
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Performance

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</table>

Safety

When wiring motor, follow all local electrical and safety codes, as well as the National Electrical Code (NEC) and the Occupational Safety and Health Act (OSHA).

Motor must be securely and adequately grounded. This can be accomplished by wiring with a grounded, metal-clad raceway system, by using a separate ground wire connected to the bare metal of the motor frame, or other suitable means.

Always disconnect power source before working on or near a motor or its connected load. If the power disconnect point is out-of-sight, lock it in the open position and tag to prevent unexpected application of power.

Be careful when touching the exterior of an operating motor — it may be hot enough to be painful or cause injury. With modern motors this condition is normal if operated at rated load and voltage — modern motors are built to operate at higher temperatures.

Do not insert any object into motor.

Thermal Protection

Motor is equipped with an automatic reset thermal protector, and may restart unexpectedly when motor and protector cool. After tripping, Protector tripping is an indication of motor overloading as a result of operating the pump at low heads (low discharge restriction), excessively high or low voltage, inadequate wiring, incorrect motor connection, or a defective motor or pump.

Installation

Improper installation may cause poor pump efficiency, increase power consumption and decrease operating life. Position your pump as close as possible to the source of liquid. Keep the suction line as short and direct as possible. Plan and install the suction line so that air pockets cannot form in it. Use a minimum of elbows and fittings and use a length of straight pipe at least 6" long for the entrance into the pump suction. Never use pipe smaller than the pump port sizes and preferably use the next larger size. A suitable strainer should be installed in the suction line. The net area of the strainer must be at least four (4) times that of the suction pipe.
Location

Locate pump close to and below the liquid level supply so that there will always be a positive supply of fluid at the pump inlet. It is necessary for the pump to be located above the liquid level, a positive sealing foot valve or check valve must be installed in the suction line below the liquid level.

Open, drip-proof motors are designed to be used in clean, dry location with access to an adequate supply of cooling air. Ambient temperature around the motor should not exceed 104°F (40°C). For outdoor installations, motor must be protected by a cover that does not block air flow to and around the motor. For hazardous locations (explosive atmosphere), an explosion-proof motor may be required; consult your local governmental inspection agency for guidance.

Suction

Proper suction is the most important part of your pump installation. Most centrifugal pump problems can be traced to improper suction conditions. Flooded suction conditions have been outlined above. On a suction lift installation, install a foot valve at least 3 feet below the liquid level. Make sure there are no air leaks in this line. Suction lifts of more than 15 feet should be avoided.

Power

Voltage, frequency and phase of power supply must be that shown on the motor nameplate. On three phase systems, voltage on all three lines must be balanced. Unbalance greater than a 2 volt variation line-to-line can result in reduced torque, increased heating and noise, and premature motor failure. Low voltage can reduce performance and cause overheating.

Motor current may exceed rated value because of overloading or high voltage. Voltage 5% or more above rated will cause both no load and full load current to increase, frequently above nameplate value.

Wiring

All wiring and electrical connections must comply with the National Electrical Code (NEC) and local electrical codes. In particular, refer to Article 430, "Motors, Motor Circuits and Controllers," of the NEC.

Use of a motor starter, either manual or magnetic, incorporating thermal protection, is advisable and may be required by local electrical codes. Follow motor starter manufacturer's recommendations on thermal overload relay heater selection. Do not oversize heaters. On three phase systems, three heaters must be used.

Wherever possible, each motor should be powered from a separate branch circuit of adequate capacity to keep voltage drop, during starting and running, to a minimum. Increase wire size where the motor is located a distance from the power source.

Where extension cords are used, they should be as short as possible, for minimum voltage drop. Long or inadequately sized cords, especially on hard starting loads, can cause motor failure. Always use grounding-type (3 conductor) extension cords in conjunction with a properly connected, grounding-type receptacle.

<table>
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<th>MOTOR</th>
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<td>10 14 8 14 6 12 4 10 2 8</td>
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</table>

(Use only #14 AWG or larger wire for permanent installations)

To connect motor for proper voltage, refer to the connection diagram located on the nameplate or inside the terminal box. On three phase motors, interchange any two line leads to reverse rotation.

On centrifugal pump applications involving a three phase motor with threaded shaft, motor rotation must be counterclockwise as viewed facing shaft end.

Operation

Priming

Your centrifugal pump must be satisfactorily primed before it will pump. Satisfactory priming requires that all air must be removed from the pump and suction lines and that these areas be completely filled with liquid. This must be accomplished with the pump at a standstill. A priming cup installed in the discharge line just above the pump is recommended.

Maintenance

Routine:

Pump should be drained if subjected to freezing temperatures. A drain plug is provided on the pump casing.

Clean the suction line strainer at regular intervals.

Properly selected and installed electric motors are capable of operating for years with minimal maintenance. Periodically clean dirt accumulations from open-type motors, especially in and around vent openings, preferably by vacuuming (avoids imbedding dirt in windings).

Pump motor is provided with sealed ball bearings. Normal relubrication of the bearings is not required.

Periodically check that electrical connections are tight.

Mechanical Seal

All Teel pumps are furnished with a precision mechanical seal. This seal is installed and checked at the factory and should require no adjustment at the time of the installation of the pump. Running the pump without water will result in rapid seal failure.
Maintenance (Cont.)

After the pump has been in service for a long period of time, or if the pump has seen severe service on abrasive materials, it may be necessary to replace this seal (the seal may leak). Leakage can be detected by a dripping or flow of liquid from the area around the motor shaft.

The following instructions cover the removal and replacement of the mechanical seal:

CAUTION: The precision lapped faces on the mechanical seal are easily damaged. Handle your replacement seal carefully and read these instructions before attempting to replace the seal.

Removal of Old Seal

1. Disassemble the centrifugal housing (Ref. 8) from the pump by removing five (5) hex head capscrews (Ref. 11).

2. Unscrew the impeller (Ref. 7). A screwdriver slot is provided in the rear end of the motor shaft (move bearing cap for access). To hold the shaft from turning, insert a large screwdriver blade into the slot. Thread is standard right hand. Turn the impeller counterclockwise to remove.

3. Grasp the ceramic seal seat (Ref. 5) and slip from the motor shaft.

4. Remove the pump body (Ref. 3) from the motor by removing four (4) hex head capscrews (Ref. 4).

5. Remove the spring seal (Ref. 5) by pushing from the direction of the pump body mounting flange (Ref. 3). Care must be exercised with pusher so as not to damage the seal cavity area.

Installation of Replacement Seal

1. Clean the centrifugal body seal cavity before inserting a new seal.

2. Using a clean cloth wipe the shaft and make sure that it is perfectly clean.

   If removed, slide the rubber shaft slinger washer (Ref. 2) on the shaft until it is latched about ¼" from the face of the motor bearing hub.

3. Carefully wipe the surface of the ceramic seal with a clean cloth.

4. Wet the rubber portion of the ceramic seal with a light coating of oil, bore only.

5. Press the brass cap, bellows, and spring squarely into the cavity in the casing cover. Do not distort the brass cap. Press uniformly around its flange.

6. After the seal is in place, insure that it is clean and has not been scratched or cracked.

7. Mount the centrifugal body (Ref. 3) on the motor mounting face. Carefully guide motor shaft through seal.

8. Apply a light coating of oil on the motor shaft. Slide the seal seat onto the shaft (with the sealing face first). Use a ¼" I.D. tube, or ⅜" drive socket to aid in pushing the rubber portion on to the shaft.

HOW TO ORDER REPLACEMENT PARTS

Please provide following information
- Model Number
- Serial Number (if any)
- Part Description and Number (as shown in Parts List)

Address order to:
CUSTOMER SERVICE DEPT.
5959 W. Howard St.
Chicago, Illinois 60648

WARRANTY

Teel Centrifugal Pumps are warranted against defects in workmanship or materials, under normal use (rental excluded) for one year from date of purchase.

Liability in all events is limited to the purchase price paid and liability under the aforesaid warranty is limited to replacing or repairing any part or parts which are defective in material or workmanship and returned to our Factory or Authorized Service Station, shipping cost prepaid. No warranty, expressed or implied, other than the aforesaid is made or authorized by Dayton Electric Mfg. Co.

PROMPT DISPOSITION will be made if item proves to be defective, within warranty. Before returning any item, write or call Dayton Electric Mfg. Co. or dealer from whom product was purchased, giving date and number of original invoice, and describe nature of defect. If damage was incurred during transit to you, file claim with carrier.

DAYTON ELECTRIC MFG. CO., 5959 W. HOWARD STREET.
CHICAGO, ILLINOIS 60648
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(*) Standard hardware items available locally.
ACTOVATOR CONTROL

The Actovator is a solid state switch designed for the purpose of absolute temperature sensing control, bringing in backup systems, establishing limits of operation, or draining collectors for freeze protection in active or passive systems. Using a thermostat-type sensor or a temperature-sensing reed switch (not included), the Actovator couples low-voltage, low-current sensing to a 117V AC output at 6 amps. A short across the sensor terminals removes power from the controlled output, an open circuit causes power to be applied.

Low-voltage sensing eliminates the time and expense involved in the installation of conduit for sensor leads. The low-to-high-voltage control within the Actovator eliminates the need for installing transformers and relays in a separate package to perform the same function.

The Actovator is available either as the H-1500-A or in combination with differential control in the H-1504-A, H-1506-A, and H-1511-A controls.

SPECIFICATIONS:

- Power requirement: 4 watts
- Power supply regulation for stable operation on line voltages from 105-130V AC, 60 Hz
- Transformer isolation from power line: 1600 volts
- Sensor Voltage: 5V AC, 60 Hz, 4 ma. maximum
- Controlled AC output fused at 6 amperes with 6A 3AG fuse
- Varistor line spike and lightning protection
- "Power On" light emitting diode indicator
- Neon indicator lamp shows power is removed from controlled output
- Controller case durable phenolic thermoplastic with black anodized aluminum faceplate and white epoxy silk-screen lettering
- Case dimensions 6" x 3 1/4" x 2 1/4"
- Modular construction for ease of installation and servicing
- Shipping weight: 2 lbs.
- Applied Research Laboratories approved. Test #21588

INSTALLATION:

Pressure sensitive foam tape mounting. Plug-in line voltage connections. Terminal screw low-voltage (sensor) connections.

SOLAR ENERGY DIVISION

CONTROL SYSTEMS • RESEARCH & DEVELOPMENT
1501 South Dixie • West Palm Beach, Florida 33401 • Phone 305 / 659-5400
The Fixflo differential thermostat gives positive on / off control for a wide range of applications. Sensing collector and storage temperatures, the Fixflo applies line voltage to the circulator pump or blower when energy is to be gained from the solar collector panel. Power is removed when no more energy is to be gained.

In domestic hot water, commercial hot water, space heating, and swimming pool applications, the Fixflo has proved itself to be of high quality and reliability. The versatility of this control has been demonstrated by its use in heat recovery systems and as a precision thermostat. Available features such as recirculating frost protection and upper temperature limits are incorporated into the circuitry of every control and require only the addition of the appropriate optional sensors. Any number of sensors may be wired in parallel (frost) or in series (upper limit) for simultaneous monitoring of multiple points. Hysteresis is also incorporated into the circuitry for stability of operation and minimization of system cycling.

Also available with dual parallel outlets (model H-1505-A)

SPECIFICATIONS:

- Power requirement: 4 watts
- Power supply regulation for stable operation on line voltages from 105-130V AC, 60 Hz
- Transformer isolation from power line. 1600V
- Thermistor sensor voltage: 8 3V DC. Maximum short-circuit current: 4 15 mA
- All sensor terminals are short-circuit overload protected
- Controlled AC output: 5 amps (720 watts) at 120V AC. Overload protected with 6A 3AG fuse
- Varistor line spike and lightning protection
- Zener diode static charge bleed-off protection at sensor terminals
- Turn-on differential: 16°F. Turn-off Differential: 3°F
  - "Power On" light emitting diode indicator
  - Neon indicator lamp shows power applied to output
  - Controller case: durable phenolic thermoplastic with black anodized aluminum faceplate and white epoxy silkscreen lettering.
  - Case dimensions: 6" x 3 1/4" x 2 1/4"
  - Modular construction for ease of installation and servicing.
  - Shipping weight: 2 lbs
  - Applied Research Laboratories approved. Test #21588

INSTALLATION:

Pressure sensitive foam tape mounting. Plug-in line voltage connections. Terminal screw low-voltage (sensor) connections.
INTRODUCTION

SOLAR ENERGY PRODUCTS, INC. has actively supported the developing solar energy industry by supplying high-quality equipment. Our role has been to research, manufacturer, market, and maintain SEP’S SUNFIRE™ ENERGY SYSTEMS.

Solar Energy Products, Inc. has chosen to establish its corporate identity and merchandise SUNFIRE™ Energy Systems through a national Sales and Service Network of Solar Specialists.

SUNFIRE™ Energy Systems are carefully designed and constructed of the finest quality materials to provide dependable performance with a maximum service life.

Included in the product line are solar collectors, pumps, controls, storage tanks, heat exchangers, and convection heating equipment.

SERVICES

Solar Energy Products, Inc. is qualified to assist in specifying the most cost-effective solar equipment for your application. SEP offers:

- COMPUTERIZED SOLAR COLLECTOR PANEL PERFORMANCE ANALYSIS - FPA
- COMPUTERIZED ENERGY SYSTEM ECONOMIC LIFE CYCLE COST ANALYSIS - ECO
- Coordination, development, and descriptions of federally sponsored solar demonstration programs as they are released
- Education assistance on pre-engineered projects

TRAINING PROGRAM

Monthly seminars have been established to train the key personnel of SEP Dealerships. The seminar emphasizes the fundamentals of solar engineering, applications of SUNFIRE™ Energy Systems, and the recommended installation, operation, and maintenance procedures.

CERTIFICATIONS AND APPROVALS

- SEP’s SUNFIRE™ Energy Systems have been approved for use in HUD’s SOLAR DOMESTIC HOT WATER INITIATIVE by the Polytechnic Institute of New York and the Florida Solar Energy Center.
- SEP’s Systems satisfy the HUD Minimum Property Standards for Solar Heating and Domestic Hot Water Systems (4930.2).
- SEP’s SUNFIRE™ collector has been approved by the Research Committee of the International Association of Plumbing and Mechanical Officials (IAPMO) S-1884.

SUNFIRE™ COLLECTORS

UNGLAZED
Order No. CA29

SINGLE GLAZED
Order No. CA32 1W

DOUBLY GLAZED
Order No. CA32 2W

SUNFIRE™ CIRCULATORS

1/20 H.P. Cast Iron 1/12 H.P. Cast Iron 1/35 H.P. Stainless 1/20 H.P. Stainless 1/12 H.P. Stainless
Order No. UP 20 62 Order No. UP 28 64 Order No. UM 25 16 Order No. UP 25 62 Order No. UP 25 64

SUNFIRE™ CONTROL SUBSYSTEMS

FLO FLO Active Flo FLO Active Flo
Order No. DC 1640 Order No. DC 1640 Order No. DC 1610 Order No. DC 1610 Order No. TL 12

SUNFIRE™ STORAGE SUBSYSTEMS

ALL GLASS
Order No. G 16 51

25 GALLON
Order No. G 25 51

120 GALLON
Order No. G 120 51

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SOLAR ENERGY PRODUCTS, INC. - P.O. Drawer 1024 - Gainesville, Florida 32602 - (904) 377-6527
Solar Energy Products, Inc.

The basic function of a solar heating and domestic hot water system is the collection and conversion of solar radiation into usable thermal energy. Solar Energy Products, Inc. provides the equipment to achieve this conversion dependably and economically. Each product has been designed specifically for easy installation, simplified servicing, low cost and excellent performance.

### HOT WATER FAN COIL

![Image of a hot water fan coil]

### BASEBOARD RADIATOR

![Image of a baseboard radiator]

### SHELL AND TUBE HEAT EXCHANGER

![Image of a shell and tube heat exchanger]

### FLAT PLATE HEAT EXCHANGER

![Image of a flat plate heat exchanger]

### ROLLED HEAT EXCHANGER

![Image of a rolled heat exchanger]

---

**SUNFIRE® OPEN DOMESTIC HOT WATER SYSTEMS**

SUNFIRE® Open Domestic Hot Water Systems are among the most economical and dependable solar water heating systems available today. SEP's solar equipment can be added to existing hot water systems and will provide many years of energy savings.

These systems are freeze protected by either circulating water through the collector(s) and exposed piping or draining them respectively. SEP offers two Fluid Handling Packages for open system freeze protection: FHP-OMT Manual Drain System and FHP-DA Automatic Drain System.

Solar Energy Products, Inc. is a leader in supplying solar energy equipment and complete SUNFIRE® Energy Systems.

### ORDER NUMBER

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<td>Header Mounting System</td>
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<td>CA32-FG</td>
<td>Collector Fittings &amp; Accessories</td>
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<td>DC-28P</td>
<td>Immersion Sensor &amp; Accessories</td>
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<td>DC-PO</td>
<td>Pro-Float Control Package</td>
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<td>FHP-OMT</td>
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**SUNFIRE® CLOSED DOMESTIC HOT WATER SYSTEMS**

SUNFIRE® Closed Domestic Hot Water Systems eliminate the possibility of freeze damage to your solar system. Antifreeze fluid is circulated through the solar collectors where it absorbs heat from the sun and returns to a heat exchanger surrounding the storage tank. The heat is then transferred to the water within the tank. Closed SUNFIRE® Energy Systems also protect from corrosion and mineral build-up in the collectors. Talk to how easily and economically solar energy can be a part of your future. Call today and let our staff of Solar Specialists show you the many ways solar energy can work for you.

### ORDER NUMBER

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**SUNFIRE® STEAM GENERATION SYSTEMS**

SUNFIRE® Steam Generation Systems are among the most economical and dependable steam generating systems available today. SEP's solar equipment can be added to existing steam systems and will provide many years of energy savings.

These systems are freeze protected by either circulating water through the collector(s) and exposed piping or draining them respectively. SEP offers two Fluid Handling Packages for open system freeze protection: FHP-OMT Manual Drain System and FHP-DA Automatic Drain System.

Solar Energy Products, Inc. is a leader in supplying solar energy equipment and complete SUNFIRE® Energy Systems.

### ORDER NUMBER

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**SUNFIRE® CHECKS**

SUNFIRE® Checks are among the most economical and dependable steam generating systems available today. SEP's solar equipment can be added to existing steam systems and will provide many years of energy savings.

These systems are freeze protected by either circulating water through the collector(s) and exposed piping or draining them respectively. SEP offers two Fluid Handling Packages for open system freeze protection: FHP-OMT Manual Drain System and FHP-DA Automatic Drain System.

Solar Energy Products, Inc. is a leader in supplying solar energy equipment and complete SUNFIRE® Energy Systems.

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**SUNFIRE® TANKS**

SUNFIRE® Tanks are among the most economical and dependable steam generating systems available today. SEP's solar equipment can be added to existing steam systems and will provide many years of energy savings.

These systems are freeze protected by either circulating water through the collector(s) and exposed piping or draining them respectively. SEP offers two Fluid Handling Packages for open system freeze protection: FHP-OMT Manual Drain System and FHP-DA Automatic Drain System.

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**SUNFIRE® FUEL TANKS**

SUNFIRE® Fuel Tanks are among the most economical and dependable steam generating systems available today. SEP's solar equipment can be added to existing steam systems and will provide many years of energy savings.

These systems are freeze protected by either circulating water through the collector(s) and exposed piping or draining them respectively. SEP offers two Fluid Handling Packages for open system freeze protection: FHP-OMT Manual Drain System and FHP-DA Automatic Drain System.

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**SUNFIRE® PUMPS**

SUNFIRE® Pumps are among the most economical and dependable steam generating systems available today. SEP's solar equipment can be added to existing steam systems and will provide many years of energy savings.

These systems are freeze protected by either circulating water through the collector(s) and exposed piping or draining them respectively. SEP offers two Fluid Handling Packages for open system freeze protection: FHP-OMT Manual Drain System and FHP-DA Automatic Drain System.

Solar Energy Products, Inc. is a leader in supplying solar energy equipment and complete SUNFIRE® Energy Systems.

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**SUNFIRE® CONDENSERS**

SUNFIRE® Condensers are among the most economical and dependable steam generating systems available today. SEP's solar equipment can be added to existing steam systems and will provide many years of energy savings.

These systems are freeze protected by either circulating water through the collector(s) and exposed piping or draining them respectively. SEP offers two Fluid Handling Packages for open system freeze protection: FHP-OMT Manual Drain System and FHP-DA Automatic Drain System.

Solar Energy Products, Inc. is a leader in supplying solar energy equipment and complete SUNFIRE® Energy Systems.

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**SUNFIRE® TURBINES**

SUNFIRE® Turbines are among the most economical and dependable steam generating systems available today. SEP's solar equipment can be added to existing steam systems and will provide many years of energy savings.

These systems are freeze protected by either circulating water through the collector(s) and exposed piping or draining them respectively. SEP offers two Fluid Handling Packages for open system freeze protection: FHP-OMT Manual Drain System and FHP-DA Automatic Drain System.

Solar Energy Products, Inc. is a leader in supplying solar energy equipment and complete SUNFIRE® Energy Systems.

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SUNFIRE™ "CA SERIES" CA32-1W CA32-2W

OUTSIDE DIMENSIONS (inches): 47.75 x 97.75 x 2.75
GROSS PROJECTED AREA (sq. ft.): 32.36
NET APERTURE AREA (sq. ft.): 32.36
DRY WEIGHT (lbs): 1979

COVER PLATE
Lights per Panel: 2
Material: Tempered Water White Glass
Dimensions (inches, height): 46 x 96 x 3.16
Weight (lbs, height): 74
Solar Transmission (1%): 91 (ASTM E-424-71)
Tensile Strength (psi): 6400
Elastic Modulus (psi): 10.5
Federal Specifications: DD-G-451c & DD-G-1403b

COVER PLATE GASKET SEAL
Material: Extruded ethylene propylene diene monomer (EPDM) channel
with molded corners
Durometer (shore A): 60
Tensile Strength (psi): 2000 minimum
Elongation (%): 400 minimum
Weight: 0.81 lbs (CA32-1W) 1.02 lbs (CA32-2W)

BACK PLATE
Material: 0.032 mil finish aluminum sheet
Weight: 13.0 lbs

FRAMEWORK AND BATTEN
Material: 6063-T5 aluminum extrusion
Finish: Clear anodized unless specified otherwise
Weight: 25.6 lbs (CA32-1W) 35.06 lbs (CA32-2W)

ABSORBER PLATE
Material: 1.2 nominal copper flow tube, mechanically expanded into 6063-T5 aluminum extruded wings. Flow tube is brazed to collared 4.0 nominal copper headers. All extruded surfaces are copper or brass.
Flow Characteristics: "CA Series" may be specified with parallel or series flow. Internal baffles directly flow uniformly to optimize collector efficiency when mounted in the horizontal position. Vertically mounted panels require parallel flow to allow fluid drainage.
Fluid Capacity: 894 gallons
Surface: Assembled plate is chemically treated and coated flat black unless specified otherwise
Solar Absorptivity: 0.98
Emittance: 0.05
Weight: 55 lbs

INSULATION
Material: 1.5-4 glass-reinforced isofoam rigid foam board with reflective surfaces
Thermal Conductivity: 0.026 Btu/hr in 2.5°F
R Value: 10 (ASTM-C 236)
Flame Spread Classification: 25 (ASTM E-84)
Weight: 23 lbs

MAXIMUM WIND LOADING: 100 mph (425 psf)
MAXIMUM OPERATING OR NO-FLOW TEMPERATURE: 300°F
MAXIMUM OPERATING OR NO-FLOW PRESSURE: 150 psi
RECOMMENDED FLOW RATE: 0.75 gpm
MAXIMUM FLOW RATE: 8 gpm

FLUID CONNECTIONS: Standard panel is supplied with connections at point A. Optional connections may be supplied at points B and C-D (specify dimension in drawing)

RECOMMENDED HEAT TRANSFER FLUIDS
1. Domestic water (pH between 7.0 and 9.4)
2. Inhibited water with deionized or distilled water (pH between 7.0 and 9.4)
3. Silicone fluids
4. Hydrocarbons etc.

OPTIONS
Glazings
- Single-Wall White Coverplate
- Double-Wall White Coverplate
- Acid Etched

Flow Characteristics
- Series Flow (Horizontal)
- Parallel Flow (Vertical)

Fluid Connections
- [1/2] 1.2 MPT Inlet Outlets: AA
- [1/2] 1.2 MPT Inlet Outlets: BB
- [1/2] 1.2 MPT Inlet Outlets: CD
- [1/2] 1.2 MPT Inlet Outlets: DD

Frame Colors
- Clear Anodized
- Black Anodized
- Bronze Anodized

Factory Installed Sensors
- Temperature Sensor
- Light Switch
- Low Limit Switch
- High Limit Switch

ORDER NO.
- CA32-1W
- CA32-2W
- CA32-1W-XX
- CA32-2W-XX
- SUB MONOANDARD

SPECIFICATIONS AND DIMENSIONS SUBJECT TO CHANGE WITHOUT NOTICE
FEATURE FOR FEATURE... The CA-Series SUNFIRE™ Solar Collector Panel is designed for DURABILITY, DEPENDABILITY, and COST EFFECTIVENESS.

THE ABSORBER PLATE CONSISTS OF COPPER FLOW TUBES MECHANICALLY EXPANDED INTO HOLLOW ALUMINUM EXTRUDED WINGS. A FOAM BOARD INSULATION IS ROUTED TO RECEIVE FLOW TUBES AND MINIMIZE HEAT LOSS.

The collector panel shall be constructed with the finest quality materials and workmanship. The overall dimensions shall be approximately 4 x 8. The Coverplates(s) shall be replaceable with the use of hand tools.

The absorber plate shall consist of six hollow extruded aluminum wings with 1 1/2" nominal copper tube mechanically expanded inside thereby providing intimate bonding for the entire tube surface. The absorber plate shall be coated with a high absorptivity flat black paint and baked to provide a durable, long lasting absorber surface. The flow tubes shall be brazed into integral collars drawn from 1" nominal copper pipe headers.

The collector panel shall be capable of operation at a water inlet temperature of 180°F and shall provide years of outstanding performance when integrated into a properly designed system. The CA32 4W performs best in the lower ΔT range while the CA32 2W is more efficient in the higher ΔT range (see thermal performance curve). The choice of solar collector should be determined by system performance requirements and energy system economics.

SPECIFICATION SUMMARY: SUNFIRE™ CA SERIES™ SOLAR COLLECTOR

THERMAL PERFORMANCE CURVE

The Thermal Performance Chart illustrated below is derived from statistically averaged instantaneous efficiency results of rigorous computer modeling from a broad range of environmental operating conditions.

The collector panel shall be capable of operation at a water inlet temperature of 180°F and shall provide years of outstanding performance when integrated into a properly designed system. The CA32 4W performs best in the lower ΔT range while the CA32 2W is more efficient in the higher ΔT range (see thermal performance curve). The choice of solar collector should be determined by system performance requirements and energy system economics.
**SUNFIRE** "SC SERIES"  |  **SC19-1W** |  **SC19-2W**

| OUTSIDE DIMENSIONS (inches) | 35.75 x 77.56 x 5.50 | 35.75 x 77.56 x 5.50 |
| GROSS PROJECTED AREA (sq. ft.) | 17.38 | 17.38 |
| NET APERTURE AREA (sq. ft.) | 17.38 | 17.38 |
| DRY WEIGHT (lbs.) | 175 | 175 |
| COVER PLATE: | Single Glazed | Double Glazed |

- Material: Tempered Water White Glass
- Dimensions (inches, light): 33 x 8 x 1.8
- Weight (lbs.): 29
- Solar Transmission (% light): 84.6 (ASIM 42471)
- Tensile Strength (psi): 6400
- Elastic Modulus (psi): 105

**COVER PLATE GASKET SEAL**
- Material: Expanded ethylene propylene diene monomer (EPDM) channel with molded corners
- Durometer (shore A): 60
- Tensile Strength (psi): 2000 minimum
- Elongation (%): 400 minimum
- Specification: ASIM D2000 4RA 12 A 13 813
- Weight: 0.9 (SC19-1W), 1.8 lbs (SC19-2W)

**SACING PLATE**
- Material: 0.032" mill finish aluminum sheet
- Weight: 8.1 lbs

**FRAMEWALL AND BATTEN**
- Material: 0.063" 15 aluminum extrusion
- Finish: Clear anodized unless specified otherwise
- Weight: 26 lbs (SC19-1W), 34 lbs (SC19-2W)

**ABSORBER PLATE**
- Material: 2 sheets of 0.020 inch 122 copper metallurgically bonded by the Roll Bond® process. All foil tubes and headers are integrally formed to ensure uniform flow distribution and maximum wetted surface area.
- Fluid Capacity: 1.48 gallons
- Surface: Absorber plate is chemically treated and electrolytically coated with a thin film of selective surface black chrome
- Solar Absorptivity: 0.96
- Emissivity: 0.10
- Weight: 32 lbs

**INSULATION**
- Material: 1 unbonded borosilicate fiber blanket over 2" glass reinforced polyurethane rigid foam board with foil facings
- R Value: 20 (ASIM C 254)
- Flame Spread Classification: 25 (ASIM E 84)
- Weight: 17 lbs

**MAXIMUM WIND LOADING**: 130 mph (42.8 lbs)

**MAXIMUM OPERATING OR NO-FLOW TEMPERATURE**: 440°F

**MAXIMUM OPERATING OR NO-FLOW PRESSURE**: 125 psi

**RECOMMENDED FLOW RATE**: 0.50 gpm

**MAXIMUM FLOW RATE**: 5.0 gpm

**RECOMMENDED HEAT TRANSFER FLUIDS**
1. Domestic water (pH between 7.0 and 9.4)
2. Inhibited glycol with deionized or distilled water (pH between 7.0 and 9.4)
3. Silicone fluids
4. Hydronaurex

**DESIGN LIFE**: Material selection and design considerations allow for an expected service life of thirty (30) years when collector is maintained and operated properly.

**SPECIFICATIONS AND DIMENSIONS SUBJECT TO CHANGE WITHOUT NOTICE.**
- Registered Trademark of GSI Brass

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**OPTIONS**

- **Glazings**
  - Single Water White Coverplate
  - Double Water White Coverplate
  - (33) Parallel Flow Tubes

- **Fluid Connections**
  - (2) 1/2" MPT End Outlets
  - (2) 1/2" MPT End Outlets

- **Framework Colors**
  - Clear Anodize
  - Black Anodize
  - Bronze Anodize

- **Factory Installed Sensors**
  - Temperature Sensor
  - High Limit Switch
  - Low Limit Switch

**ORDER NO.**
- SC19-1W
- SC19-2W

**SOLAR ENERGY PRODUCTS, INC.**
- P. O. Drawer 1048
- Gainesville, Florida 32602
- (904) 377-6527

**FEATURE FOR FEATURE...**
The "SC-Series" SUNFIRE™ Solar Collector Panel
is designed for DURABILITY, DEPENDABILITY and COST EFFECTIVENESS.

The absorber plate consists of 0.040 inch copper with 33 integrally formed parallel flow tubes designed to evenly distribute flow and allow fluid drainage. A black chrome selective surface is used to maximize collector efficiency at high temperatures. Four layers of unbonded borosilicate fiber insulation is combined with a foil-faced closed cell rigid foam board to provide a minimum R value of 20.

The structural framewall is precision miter cut and securely fastened to a rigid aluminum corner brace. Fluid connections are removable thermally isolated 1/2" nominal brass pipe nipples threaded into a 1/2" female pipe thread adapter integrally brazed to the absorber plate.

Removable coverplate baffles are designed to clamp the "U" shaped gasket around the coverplates to securely fasten to the framewall and seal out moisture. Both single and double glazed options are interchangeable.

The high transmission water white tempered glass has a stippled pattern which greatly reduces specular reflectance and increases aesthetic appeal.

Low cost nm 200 hinged mounting system bolts together to interlock with the structural framewall allowing the collector to be mounted at any tilt angle with stability in wind loads to 130 mph. The lower jaw of the hinge mount is designed to grip the nut and facilitate speed installations using a ratchet socket driver without the need for a back up wrench. Installation costs are greatly reduced through the use of standardized engineered mounting systems.

**SPECIFICATION SUMMARY: SUNFIRE™ "SC SERIES" SOLAR COLLECTOR**

The collector panel shall be constructed with the finest quality materials and workmanship. The overall dimensions shall be approximately 3 x 7. The coverplate(s) gasket seat, absorber plate and insulation shall be site replaceable with the use of hand tools.

The coverplate(s) shall be 1/8" tempered water white glass with a minimum transmissivity of 0.9 per cover and shall comply with the requirements of federal specifications DD-G-451C and DD-G-1403A for fully tempered glass. The coverplate shall be sealed with a continuous "U" shaped gasket and the batten secured with stainless steel nut and bolt type fasteners to allow service of the collector and absorber plate from the front.

The absorber plate shall be made of 0.040" copper with 33 integrally formed parallel flow tubes interconnected with an integral header designed to evenly distribute fluid flow. The absorber plate shall have a selective surface of Black Chrome with a minimum absorptivity of 0.95 and a maximum emissivity of 0.05. The absorber plate shall allow fluid drainage for freeze protection and withstand fluid pressures to 150 psi. Fluid connections shall be removable brass pipe threads thermally isolated from the frame. The collector shall be insulated with a combination of unbonded borosilicate fiber blanket layered on foil-faced closed cell rigid foam board to provide a minimum R value of 20. The collector back plate shall be 0.032" aluminum sheet secured to the frame with stainless steel fasteners. Framewall shall be 0.032" anodized aluminum extrusion with a continuous mounting flange that interlocks with a standardized, structurally certified mounting system capable of withstanding wind loads to 130 mph when properly mounted.

The solar collector panel shall be capable of thermal performance stability with periodic stagnation temperatures to 407°F.
HM-200 HINGE MOUNTING SYSTEM

This standardized structurally certified mounting system is specifically designed to facilitate fast, low cost saw-tooth mounting configurations for flat or sloped roof applications. The extruded aluminum hinge bolts together to interlock with the structural frame-wall and allows the collector tilt angle to be easily adjusted with stability in wind loads to 130 MPH.

RM-300 RAIL MOUNTING SYSTEM

SEP’s RM-300 is a complete set of standardized structurally certified matching aluminum extrusions designed to facilitate fast, low cost installation of multi-collector arrays on an inclined plane. The collector is securely fastened to a continuous aluminum angle rail with bolt on interlocking aluminum extrusions.

No. RM-346 (6 PER SET) THE CONTINUOUS MOUNTING RAIL IS BOLTED TO
No. RM-345 L-BRACKET ROOF MOUNT (2 PER SET) fixed-in dimensions are for “CA SERIES”

SIDE OUTLETS ALLOW COLLECTOR HEADERS TO BE INTERCONNECTED TO MINIMIZE PIPING COSTS AND INCREASE AESTHETIC APPEARANCE

STANDOFFS

| HM-248 | 1" x 1" x 48" |
| HM-272 | 1" x 1" x 72" |
| 6063-T5 SQUARE ALUMINUM TUBE |

CONTINUOUS MOUNTING RAIL

2" x 2" x 1/4" 6063-T5 ALUMINUM FURNISHED BY OTHERS

SOLAR ENERGY PRODUCTS, INC. - P.O. Drawer 1048 - Gainesville, Florida 32602 - (904) 377-6527


. SYSTEM WARRANTY

Solar Energy Products, Inc. warrants its Solar Domestic Hot Water Systems with the following conditions and limitations.

A. Conditions of System Warranty

1. This warranty is extended to consumers who purchase Solar Domestic Hot Water Systems directly from SEP or from any of SEP's Authorized Dealers and to all subsequent owners of these systems so long as the systems remain in their original installation.

2. This warranty covers Authorized installations only when they are installed, operated and maintained according to the procedures described in the SEP Installation, Operation and Maintenance Manual, and the Authorized SEP Dealer Policy Manual.

3. This warranty covers Unauthorized installations only when they are installed, operated and maintained according to the procedures described in the SEP Installation, Operation and Maintenance Manual.

4. The Warranty Registration Card for System 8 Energy Systems, must be completed by the party who installed the installation as of the effective date of this Warranty, and this warranty is subject to the completion of this warranty registration form and the fulfillment of all Warranty Validation Inspections.

5. The Warranty Validation Inspection form must be completed by the party who approved the Installation, and is subject to the completion of each of the Warranty Validation Inspections.

B. Coverage of System Warranty

1. Authorized Installations

Warranty applies when the system is installed by an Authorized SEP Dealer properly licensed to install Solar Domestic Hot Water Systems.

a. One-year full warranty from date of initial installation against failure of the Solar System including any component of the system where such failure is caused by defects in materials or manufacture. Warranty covers the full cost of parts and labor at the site of installation for direct replacement of the defective equipment at the site (if necessary), and for inspection within a reasonable time of the complaint to verify failure. Establish probable cause and determine corrective action by the Authorized SEP Dealer.

2. Unauthorized Installations

Warranty applies when the system is installed by a properly licensed contractor but not by an Authorized SEP Dealer.

a. One-year limited warranty from date of installation completion against failure of the Solar System, including any component of the system where such defects in materials or manufacture are not caused by defects in materials or manufacture. Warranty is subject to the execution of a written agreement between the installer and the manufacturer for the cost of parts and labor at the site of installation for direct replacement of the defective equipment at the site (if necessary), and for inspection within a reasonable time of the complaint to verify failure. Establish probable cause and determine corrective action by the Authorized SEP Dealer.

3. Unwarranted Installations

System is installed by unlicensed personnel and/or those with no training present.

II. COMPONENTS WARRANTY

SEP Co. warrants the following components, along with each component's manufacturer. Please refer to the manufacturer's warranty terms:

A. Collector Limited Warranty

Solar Energy Products, Inc. warrants the Solar Energy Products, Inc. Collector against any component of the collector for a period of five years. SEP Co. will install a replacement or repair at no additional cost for the collector caused by defects in materials or manufacture, but not gross negligence. The warranty covers the full cost of parts, labor and shipping to the installer's site. All systems covered by this warranty are subject to the change of ownership as long as the system remains in its original installation.

NOTE: Color for is not warranted against damage from exposure to freeze conditions.

B. Absorber Plate and Coolant Passages

Solar Energy Products, Inc. warrants the Solar Energy Products, Inc. Collector absorbent plate and coolant passages for a period of five years from the date of installation, against failure due to corrosion. ONLY when in Closed Systems, the absorber plate and coolant passages are subject to a 10% mixture of Sodium (Na2) manufactured by Union Carbide Corp. (or any equivalent compatible brand exchange fluid as determined by the Copper Development Association) and distilled water or water testing from 9.4 to 7.0 pph. In Open Systems, water having a pH of 9.4 or less not corrosive. Warranty covers the first five years of the maximum period of the warranty for the collector, and the second through fifth years of the maximum period of the warranty for the competitor.

C. Differential Controls Limited Warranty

Solar Energy Products, Inc. warrants the Solar Energy Products, Inc. Differential Controls for a period of one year from date of purchase against failure due to defects in materials or manufacture, provided that the differential control is not exposed to any conditions unsuitable for the differential control or improper installation (by anyone other than the manufacturer). This warranty covers the full cost of parts, labor and shipping and is subject to change of ownership, so long as the controller remains in its original installation.

D. Pumps Limited Warranty

Solar Energy Products, Inc. warrants the Solar Domestic Hot Water Systems Pumps sold by Solar Energy Products, Inc., for a period of eighteen months from date of purchase against failure caused by defects in materials or manufacture, provided that the pumps are properly installed and used with manufacturer's recommendations, and have not been repaired or altered outside the Pump's Original Factory. This warranty covers the full cost of parts, labor and shipping and is subject to change of ownership, so long as the pump remains in its original installation.

E. Storage Tanks and Storage Tanks With Built-In Heat Exchangers Limited Warranty

Solar Energy Products, Inc. warrants the Solar Energy Products, Inc. Storage Tanks sold by Solar Energy Products, Inc., for a period of five years from date of installation completion against failure caused by defects in materials or manufacture, or natural corrosion provided that the heat exchanger is maintained per instructions. This warranty covers the full cost of parts, labor and shipping and is subject to change of ownership, so long as the storage tank remains in its original installation.

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III. AUTHORIZED SEP DEALER WARRANTY REQUIREMENTS

Authorized SEP Dealers are responsible and obligated to comply with all state and federal consumer warranty requirements. Installation must be performed by properly licensed personnel in accordance with all known governing building codes.

Authorized SEP Dealers are responsible for adequate functioning of the adequately installed SEP Dealer's equipment.

Authorized SEP Dealers are responsible for having a qualified SEP dealer present at the end of 365 days of sales operation.

WARRANTY SCHEDULE FOR SOLAR ENERGY PRODUCTS, INC., DOMESTIC HOT WATER SYSTEMS

<table>
<thead>
<tr>
<th>ITEM</th>
<th>System Including All Components and Assemblies</th>
<th>Collector</th>
<th>Absorber Plate coolant Passages Collector</th>
<th>Differential Controls</th>
<th>Pumps</th>
<th>Storage Tank and Heat Exchanger</th>
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<tbody>
<tr>
<td>WARRANTOR</td>
<td>Authorized Dealer Installer</td>
<td>Mtg Vendor</td>
<td>Mtg Vendor</td>
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<tr>
<td>WARRANTOR'S NAME</td>
<td>SEP</td>
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<td>WARRANTY PERIOD</td>
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<td>WARRANTY COVERS FAILURE DUE TO:</td>
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<td>Defect Material Manufacture, Installation, Corrosion:</td>
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<td>Absorber &amp; Passages</td>
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<td>Parts</td>
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</table>

* Not warranted when damage is caused by use of unacceptable transfer fluid

WARRANTOR'S NAME
Solar Energy Products, Inc.
Grundfos Pumps Corporation
MorFlo Industries, Inc.
RHEEM Water Heating Division City Inv Co
RUUD Water Heating Division City Inv Co

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1208 N.W. 8th Avenue, Gainesville, FL 32601
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(312) 434-32
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Supplier of Solar Energy Equipment
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