

SECTION 13600

SOLAR HEATING SYSTEM

PART 1 GENERAL

1.01 SUMMARY

A. Related Sections:

1. 07600 - Flashing and Sheet Metal.
2. 07900 - Joint Sealers.
3. 15260 - Thermal Insulation (Plumbing).
4. 15410 - Piping (Plumbing).

1.02 SUBMITTALS

A. Submit properly identified manufacturer's literature before starting work.

B. Submit Shop and Erection Drawings, including the following:

1. Pressure and Temperature Relief Valves: Catalog cuts, temperature, and pressure ratings.
2. Automatic Air Vents: Catalog cuts.
3. Balancing Valves: Catalog cuts.
4. Pumps: Catalog cuts with all ratings.
5. Pressure Relief Valves: Catalog cuts.
6. Controls: Diagrams.
7. Solar Collector Panels: Construction details with dimensions, components, materials, and independent laboratory certified performance ratings.
8. Pipe and Solar Collector Panel Support Details: Signed and sealed by a Florida registered professional engineer and shall comply with wind velocity pressures determined American Society of Civil Engineers (ASCE) 7-98.

a. Use a map wind speed of 146 mph, exposure category "C", and a wind load importance factor of 1.15.

1.03 QUALITY ASSURANCE

A. Solar energy system and components shall comply with "The Interim Performance Criteria for Solar Heating and Cooling Systems in Commercial Buildings", NBSIR 76-1187.

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B. Tested flat plate solar collector panels by an authorized independent laboratory according to ASHRAE Standard 93-77 using water as the heat-transfer liquid.

1. Submit complete independent certified test results to the A/E.

1.04 PROJECT CONDITIONS

A. Field verify exact location and inclination of solar collectors to maximize solar exposure and optimize efficiency of solar heating system.

1.05 WARRANTY

A. Full replacement guarantee shall be provided by the manufacturer for defects in materials, quality of construction, and performance for 5 years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Pressure and Temperature Relief Valve: Watts 40 XL-8, Kunkle, or Ashton Valve.

B. Automatic Air Vents: Amtrol, Inc., Eaton Corp. Controls, or Maid O'Mist Autovent No.75.

C. Solar Collector System Circulating Pump: TACO Model 009BF 1/20 hp, or accepted equivalent.

D. Pressure Gages: Ashcroft, Marshalltown, or Taylor Instrument.

E. Flat Plate Solar Collector Panels: Energy Transfer System, Inc., L.O.F. Solar Energy Systems, Solar Energy Products, Inc., or Sun King Corporation.

F. Control Hardware: Independent Energy, Inc., or accepted equivalent.

G. Test Plugs: Peterson Equipment Co., Inc., Universal, or Lancaster, Inc.

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2.02 EQUIPMENT

- A. Pressure and Temperature Relief Valve: ASME adjustable bronze spring and diaphragm type combination pressure and temperature relief, with test lever and automatically resetting thermostatic element.
 - 1. Minimum discharge capacity equal to the input capacity of the heater.
 - 2. Settings: 125 psi pressure and 210 degrees F. temperature relief.
- B. Automatic Air Vents: Float operated, vertical mounting, combination 1/2" female, 3/4" male connection, 150 psi rating at 250 degrees F.
- C. Solar Collector System Circulating Pump:
 - 1. In-line, flanged, suitable for 125 psi operating pressure.
 - 2. Self-lubricating, with sintered bearings and hollow stainless steel shaft.
 - 3. Rotor: Protect against corrosion.
 - 4. Motor: Non-overloading, permanent split capacitor.
- D. Pressure Gages:
 - 1. Standard depth, cast aluminum alloy case, face dial minimum 3-1/2", range selected so that operating pressure is at the middle of the range with maximum of 1.5 percent error at any reading on the scale.
- E. Copper Tube Anchor: 3/8" copper plated steel "U" bolts.
- F. Flat Plate Solar Collector Panels:
 - 1. Standard product of a recognized manufacturer of flat plate solar collectors with at least 3 years experience in the manufacture of this product and have at least 3 major installations of 30 or more collectors installed.
 - 2. Fabrication and Materials: Use materials in the construction of the collector panels meeting the minimum requirements of Class A Fire Zones as specified in Federal Fire Protection Standards.
 - a. Glass Cover Sheets:

- 1) Minimum 3/16" thick, low iron content, tempered, edges swiped, and a total transmissivity of 89 percent.
 - 2) Attach in a manner to allow servicing of an individual collector module by removing the cover sheet without special tools, and without requiring the removal of the flashing or the entire module or without disassembling the entire module or the entire array.
 - 3) Assemble the glazing cap with stainless steel screws.
- b. Water Passages: Construct of copper tubing with 3/4" nominal tubing, Type M copper manifolds, and 1/2" I.D., Type L copper risers.
- c. Absorber:
- 1) Furnish with grid flow pattern.
 - 2) Absorber shall be self-draining, and upon filling, shall be self-vented.
- d. Absorber Sheet:
- 1) 0.0216" thick copper.
 - 2) Solder bonded to the tubes, with the absorber plate wrapped 220 degrees around the tube.
- e. Absorbing Surface: Use black chrome over nickel with a minimum absorbtivity of 0.95 and a maximum emissivity of 0.10.
- f. Absorber Frame:
- 1) Frame sides shall be of extruded aluminum, frame back with a minimum 0.25" thick aluminum sheet.
 - 2) Dielectric isolation materials shall be provided between ferrous and non-ferrous metals to prevent electrolytic action.
 - 3) Casing, including glass cover sheet, shall be capable of withstanding wind loads due to minimum wind speed velocities determined by ASCE 7-98.
 - 4) Provide waterproof joints.
- g. Outside Dimensions:
- 1) 48 inches wide X 96 inches long X 4 inches

- thick.
- 2) Net Effective Area: 28.70 square feet.
- h. Make provisions for venting and draining of flow passages.
 - i. Pressure test the tubing within the assembled collector by the manufacturer up to 250 lbs. psi with a working pressure in excess of 125 psi.
3. Thermal Performance: Use minimum BTU/ft²/day requirement, as reported in the FSEC Thermal Performance Rating Publication.
 4. Flat Plate Solar Collector Panel Quantity Determination: Quantity of panels shown on the drawings was determined by using the net effective area of 28.70 square feet per panel.
 - a. Panels with outside dimensions of 36 inches wide X 84 inches long X 4 inches thick are acceptable, but shall provide not less than the total net effective area required by the drawings for each school regardless of the number of panels necessary to meet these requirements.
 5. Square Foot Performance: In excess of 900 BTU/day for an average Florida day.
 6. Flow Rate: 0.5 - 1.0 gpm.
 7. Collector Panel Tilt: Permanently mounted with a tilt of 30 degrees.
 8. Collector panels shall bear the Solar Energy Industries Association (SEIA) label.
- G. Control Hardware: Solar Differential Temperature Control and Performance Monitoring Controller:
1. Electrical digital display type with 3 temperature sensors and 3 output controls, microcomputer operation and low voltage isolated sensors for 105-130 volts, 60 Hz.
 2. Outputs:
 - a. No.1 and No.2: 1/10 HP, 115 volts, 3.0 amps continuous.
 - b. No.3: 115 volts, 1.0 amps continuous.
 3. Power Consumption: 15 watts maximum.
 4. Sensors:

- a. Thermistor type 10K OHM at 77 degrees F.
 - b. Operating Range: -40 degrees F. to 400 degrees F with an accuracy of ± 0.5 degrees F.
 - c. Leads: 18 AWG stranded, Teflon insulated.
- H. Control Sequence of Operation: Solar collector loop pump shall be controlled by a "manual-off-auto" switch.
- 1. In the auto position, pump operation shall be controlled by differential temperature controller with temperature sensors located in storage tank and in solar collectors.
 - 2. When the temperature difference rises to a preset "Activate" setting, pump shall start and when the differential drops to a preset "De-Activate" setting, a time delay relay shall stop pump after preset time interval.
 - 3. If temperature of water in storage tank rises above a set point, pump control circuit shall be de-energized.
- I. Test Plugs: Provide No.230-1955-01 (1/2") pressure and temperature test plug and cap, self-sealing type suitable for insertion of 1/8" O.D. pocket thermometer or pressure gage at the end of each collector group header.
- 1. Fittings: Solid brass with cap.
 - 2. Bushings: Provide NIBCO No.718-3, or accepted equivalent, 1" X 1/2" flush bushings in the collector headers to receive test plugs.
- J. Mounting Fittings and Bolts:
- 1. Angles, clips, brackets, or assemblies required for attachment of the solar collectors to the support structure shall be provided by or approved by the solar collector manufacturer.
 - 2. Material:
 - a. Corrosion resistant and may be fabricated from any of the following:
 - 1) Aluminum.
 - 2) Stainless Steel.
 - 3) Galvanized steel (hot dipped) after fabrication.

3. Fittings:
 - a. Material: Compatible with solar collector mounting bolts.
 - b. Design: Capable of restraining solar collector when it is subjected to sustained 120 mph wind, support structure at points of contact and be dielectrically isolated.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install complete system according to manufacturer's recommendations, accepted Shop Drawings, and as specified in this section.
 1. Circulator Pumps: Support pumps independently of the pipelines in which they are installed.
 2. Copper Tube Anchors: Secure to structure with two 1/4" bolts.
- B. Miscellaneous: Provide hangers, supports and supplementary steel as called for in Section 15100-Valves, Cocks, and Faucets (Plumbing).

3.02 FIELD QUALITY CONTROL

- A. System Pressure Test:
 1. Remove or otherwise protect any equipment that may be damaged at the test pressure.
 2. Plug pressure relief valves for test and remove plugs immediately after test.
 3. Fill entire hot water system including tanks, solar collectors and piping.
 - a. Open manual valves to equipment.
 - b. Static pressure test at 125 psig as measured at the top of the tank for eight hours.

END OF SECTION

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