Specification Sheet for Architects

1.0 Collector Subsystem: Residential

1.0.1 Solar Collector Construction

Collectors shall be of the flat plate, liquid, serpentine flow or pass-through flow type as required by BTU requirements of the system. Each collector shall be provided with cover glazing, an absorber plate, heat transfer liquid flow tubes, insulation, and a casing. Collectors shall be of weather-tight construction. Solar collectors shall withstand a stagnation temperature of 250º F and a working pressure of 150 PSIG without degrading, out-gassing, or warping. The net individual collector weight is not to exceed 38 lb per collector.

1.0.2 Absorber Plate and Flow Tubes

Absorber plate and flow tubes shall be manufactured from copper. The top of absorber plate shall be coated with a multilayer coating to selectively absorb short wavelength light and to reflect long wavelength light. The thermal emissivity shall be less than 0.1 and the solar absorptivity greater than 0.94. Flow tubes shall be forge welded to the absorber plate.

1.0.3 Cover Glazing

Each collector shall have a single layer of cover glazing made of ¼ " thick, double walled, impact resistant polycarbonate glazing. Polycarbonate cover glazing shall be treated for UV resistance. The polycarbonate cover shall exceed ASTM E822.87 Hail impact tests and be capable of withstanding an impact of 16 lbs. dropped 25 feet without breakage. The cover glazing shall be separated from the collector frame by closed cell polyethylene foam sealant in tape form.

1.0.4 Insulation

The back and sides of the absorber plate be insulated with glass fiber reinforced polyisocyanurate foam insulation with an R value of 6. The polyisocyanurate foam insulation shall fill space between the absorber plate and the casing and shall consist of a glass fiber reinforced foam core laminated between 1.0 mil smooth aluminum foil facers on both sides. The insulation shall withstand the moisture, sun exposure, and stagnation temperature limitations of the collector.

1.0.5 Casing

Casing shall be aluminum. Finish shall be mill finish on interior areas and shall be factory applied baked enamel on exterior areas. Cover glazing shall be separated from the casing by closed cell polyethylene foam sealant in tape form. The foam sealant shall thickness and composition shall allow for thermal expansion between the cover, absorber plates and the casing.

1.0.6 Mounting and Assembly Hardware

Mounting brackets and rails shall be aluminum. Assembly hardware including all screws, washers and nuts shall be zinc plated carbon steel or austenitic stainless steel, as required by environment.

1.0.7 Collector Warranty

Manufacturer shall provide a 10 year warranty that the collector will be free of defects in workmanship or material for a period of ten years from the date of original shipment. The warranty shall include full repair or replacement of defective materials or equipment.

1.0.8 Solar Collector Performance

The solar collectors shall have passed the Solar Rating and Certification Corporation (SRCC) OG100 and Florida Solar Energy Center Collector thermal performance rating tests. Copies of the collector certification shall be provided with the Installation, Operation and Maintenance manuals.

1.1 Solar Collector Array

1.1.1 Net Absorber Area and Array Layout

The net absorber area for the installation shall be determined by the Manufacturer based on the geographic location, hot water requirements, roof surface and slope, and the local environment. The collector array shall have all the collectors oriented to face the same direction and this direction shall be within 30 degrees of true south.

1.1.2 Piping

The array piping shall include interconnecting piping between solar collectors. Automatic pressure relief valves shall be provided in the array piping system, and shall be adjusted to open when the pressure within the solar array rises above 150 psig. Manually operated air vents shall be located at system high points, and all array piping shall be pitched a minimum of 0.25 inch/foot so that piping can be drained by gravity.

1.1.3 Supports for Solar Collector Array

Support structure shall secure collector array at the tilt angle determined by the manufacturer with respect to horizontal and orientation with respect to true south. Support structure shall withstand the static weight of the filled collectors and piping, wind, snow, seismic, and other loads. The roof attachment shall be capable of withstanding a 150 MPH wind speed when installed in the central area of the roof, Area 1 as per the Florida Building Code. Support structure shall allow access to all supplied solar equipment for maintenance repair, and replacement.

1.2 STORAGE TANK

Solar system hot water storage tank shall have a minimum storage volume of 1 gallon per 1 square foot of collector area. Tank penetrations shall be designed to allow for connections to copper piping without risk of corrosion due to dissimilar metals, and shall be factory installed. Tank shall be protected from corrosion by sacrificial anode.

1.3 TRANSPORT SUBSYSTEM

1.3.1.1 Plate Heat Exchanger

Plate heat exchanger shall be an Alfa Laval CB14-77 brazed plate heat exchanger or equal. The plate type heat exchanger shall be constructed of multiple plates of 316 stainless steel. The plates shall be

frame-mounted and copper brazed at the edges. The ports shall be arranged so that flow between the alternating channels between plates is in a true counter-current flow.

1.3.1.2 Integral Heat Exchanger

The storage tank shall have an integral heat exchanger consisting of copper tubing wrapped around and secured to the tank. Heat exchanger shall be double walled and vented for positive leak detection.The collector feed and return connections for the storage tank's integral heat exchanger shall be on the front of the tank. The integral heat exchanger shall be suitable for operation up to 150 PSI.

1.3.2 Pumps

1.3.2.1 Pumps - 120V Systems

The circulating pumps shall be 120 volt AC, motor-driven, single-stage, centrifugal type. The pumps shall be supported by the piping on which it is installed. The circulator pump construction shall be of the cartridge-type such that all moving parts may be replaced in a field serviceable cartridge. Pumps shall have non-metallic impellers and shall have bronze casings. The ceramic shaft shall be supported by carbon sleeve bearings. The pump design shall require no mechanical seal. The motor shall be supplied by the pump manufacturer and shall be integrally-mounted with the pump. The pump will have sufficient power for the service required and will be controlled by suitable switches that can be activated by either the differential temperature controller or by manual override (Hand-Off-Automatic).

1.3.2.2 Pumps – DC systems

The circulating pumps shall be 12 volt, direct current (DC) motor-driven, single-stage, centrifugal type. The pumps shall be supported by the piping on which it is installed. The circulator pump construction shall have the motor directly mounted on the pump housing. The motor shall have a permanent magnet spherical rotor that requires no shaft seal. Pumps shall have non-metallic impellers and shall have brass housings. The rotor-impeller shall be integral parts and supported by a ceramic bearing that is lubricated and cooled by the pump media. The motor shall be supplied by the pump manufacturer and will have sufficient power for the service required. The pump unit will be controlled by suitable switches that can be activated by either the differential temperature controller or by manual override (Hand-Off-Automatic).

1.3.3 Pipe Insulation

Pipe insulation shall be Armacell Armaflex foam pipe insulation or equal.

1.3.4 Heat Transfer Fluid

Solar collector loop fluid shall be uninhibited non-toxic propylene-glycol and shall be mixed with distilled or demineralized water to form a 50 percent by volume propylene-glycol solution.

1.4 CONTROL AND INSTRUMENTATION SUBSYSTEM

1.4.1 Differential Temperature Control Equipment

Differential temperature control equipment shall be supplied as a system by a single manufacturer. Controller shall be solid-state electronic type complete with an integral transformer to supply low voltage, shall allow a minimum adjustable temperature differential (on) of 8 to 20 degrees F, a minimum adjustable temperature differential (off) of 3 to 5 degrees F, and shall include a switching relay or solid state output device for pump control. Thermostat shall operate in the on-off mode. Controller accuracy shall be plus or minus 1 degree F. Controller shall be compatible with 10K Ohm thermistor temperature sensors. Differential control shall provide direct digital temperature readings of all temperatures sensed. Control shall indicate visually when pumps are energized. Control ambient operating range shall be a minimum of -10 to 120 degrees F.

1.4.2 Thermistor Temperature Sensors

Temperature sensors shall be 10K Ohm thermistors supplied by the differential temperature controller manufacturer, with an accuracy of plus or minus 1º F at 77 degrees F. Operating range shall be minus 40 to plus 400 degrees F. Temperature sensors shall be the bolt-on type and shall have the wiring connection sealed against moisture.

1.4.3 Sensor and Control Wiring

20AWG minimum twisted and shielded 2, 3, or 4 conductor to match analog function hardware. Wiring shall be PLTC Belden #9320 or equal.

1.4.4 Expansion Tank

A pressurized, diaphragm style expansion tank shall be installed in the closed loop system. The tank shall be of all welded construction and will have a butyl diaphragm. The tank shall have a maximum operating temperature of 240º F and a maximum working pressure of 100 PSI. The tank shall be factory pre-charged to 12 PSI. Tank will be an Extrol expansion tank as manufactured by Amtrol Incorporated or equal.

1.4.5 Thermometer

Bi-metal thermometers shall be provided to monitor the temperature of the collector array supply and return lines. The thermometers shall have a dial diameter of 2 ½ inches and a temperature range of 32º to 250º F. The thermometers will be installed into brass thermo wells. The thermo wells will be immersed in the heat transfer fluid.

1.5 PAINTING AND FINISHING

All equipment and components, when fabricated from ferrous metal and located inside the building, shall be painted with the manufacturer's standard finish.

PART 2 EXECUTION

2.1 INSTALLATION

2.1.1 Collector Subsystem

2.1.1.1 Collector Array

Solar collector array shall be installed at the tilt angle, orientation, and elevation above roof as determined by the manufacturer. For collectors mounted on pitched roofs, the back of collectors shall be installed a minimum of 1 inch above roof surface. Each solar collector shall be removable for maintenance, repair, or replacement.

2.1.1.2 Array Piping

The collector array piping shall allow the individual collectors to be installed with a collector to collector spacing of 2 inches. The pipe connections between collectors shall be compression unions so that no soldering of piping is required.

2.1.1.3 Array Support

Array support shall be installed in accordance with the recommendations of the collector manufacturer. Structural members requiring welding shall be welded in accordance with AWS 01.2 for aluminum and welders should be qualified according to AWS B2.l.

2.1.2 Storage Subsystem

Solar storage tank connections for hot water outlet and cold water inlet shall be at the top of the tank. The internal penetration for the cold water inlet shall extend downward to near the bottom of the storage tank. The connection from the collector array return line shall be at the top of the storage tank's integral heat exchanger and the return from the integral heat exchanger to the collector array supply line shall be from the bottom of the integral heat exchanger. The connections for the solar array lines shall be at the front of the storage tank for easy access.

2.1.3 Transport Subsystem

2.1.3.1 Flow Rates

Flow rate in the collector loop shall be based on the manufacturer's recommended collector flow rate. Storage loop flow rate shall be 1.25 times the collector loop flow rate. All flow rates shall be below 5 feet/second.

2.1.3.2 Pumps

Additional pipe supports shall be provided for close-coupled in-line pumps. All in-line pumps shall have straight pipe between the suction side of the pump and the first elbow. The length of this pipe shall be a minimum of 10 times the diameter of the pipe size on the suction side of the pump.

2.1.3.3 Piping, Valves, and Accessories

Piping shall be installed in accordance with applicable local codes, except where noted otherwise. Piping shall be coded with fluid type and flow direction labels. All components (pumps, valves, tanks) shall be labeled with an identifying label and with a label stating required set points or operating limits. Air vents shall be installed at the high points of the collector array and in the equipment room.

2.1.3.4 Valves

Valves shall be installed where required for the proper functioning of the system. Valves shall be installed with their stems horizontal or above. Gate or ball valves shall be installed in the collector array supply and return lines to allow the system to be charged with the correct proportion of non-toxic polyglycol and water. A check valve shall be installed at in the collector return line to prevent thermo siphoning.

2.1.4 Control Subsystem

2.1.4.1 Differential Temperature Controller

The collector temperature sensor shall be provided by differential temperature controller manufacturer and shall be of the bolt on type. The collector manufacturer shall mount the sensors on the collector outlet piping and on the collector return line.

2.1.4.2 Sequence of Operation

The differential temperature controller sensing temperature difference between the fluid in a solar collector and water in the storage tank shall start solar collector loop pumps when the temperature differential (Delta T -ON) rises above 15 degrees F, and shall stop the pump when the differential (Delta T -OFF) falls below 5 degrees F.