

CHAPTER 13C

SOLAR ENERGY SYSTEMS

13C-01 GENERAL REQUIREMENTS

a. This chapter covers the installation and testing of solar energy systems consisting of the following:

(1) Solar Energy System for Domestic Hot Water Heating (Liquid Collectors)

(2) Solar Energy System for Domestic Hot Water Heating and Space Heating (Air Collectors).

(3) Solar Energy System for Domestic Hot Water Heating and Space Heating (Liquid Collectors).

(4) Solar assistant Heat Pump System for Domestic Hot Water Heating and Space Heating (Liquid Collectors).

(5) Solar Energy System with absorption chiller cooling, Domestic Hot Water Heating, and Space Heating (Liquid Collectors).

(6) Heat Rejection System, Fan Coil.

(7) Heat Rejection System, Extended Surface Radiation.

(8) Heat Rejection System, Pipe immersed in open water tank.

b. Work in this chapter will be coordinated with chapters 5A for Structural, 5B for Welding, 15A-G for Mechanical, and 16A and NEC-70 for Electrical.

c. The contract drawings indicate extent and general arrangement of the solar energy system. Approved shop drawings will provide necessary details for installation and erection of the system. The contractor is responsible for coordination and verification of dimensions. The contractor will inform the Contracting Officer of any discrepancy prior to performing any work.

d. Welders shall be performance qualified in accordance with Section IX, ASME Boiler and Pressure Vessel Code. Each welder shall place his identification symbol near each weld he makes, as a permanent record. Structural members will be welded in accordance with specification section: welding, Structural. Welding and non destructive testing procedures are specified in Specification Section: Welding Pressure Piping.

13C-02 MATERIALS

a. Submittals

(1) All materials or equipment are specified to comply with requirements of UL, ARI, or ASME. Proof of such compliance shall be submitted.

(2) Manufacturer\*s certificate of compliance shall be submitted by contractor on construction of collector, performance data for collector and 30 day degradation test data.

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(3) Shop drawings will consist of illustrations, schedules, performance charts, instructions, brochures, diagrams, and drawings necessary for the installation of solar equipment, associated equipment, and for piping, wiring, and related foundations. Shop drawings shall include details of storage device, air handling equipment, heat transfer equipment, liquid circulating equipment, and controls and instrumentation. Drawings will indicate clearances required for maintenance and operation.

(4) Spare parts data will be provided for each different item of materials and equipment specified.

(5) Operating and Maintenance Instructions will be provided for system start-up and operation and maintenance.

(6) Performance Test reports in booklet form will be provided. Each test report shall indicate the final position of the controls.

b. Delivery and Storage

All equipment placed in storage will be protected from weather, humidity, temperature variation, dirt, dust, or other contaminants

13C-03 ERECTION AND TESTING

a. Installation

(1) All work shall be installed as specified and indicated and shall comply with the applicable sections of HUD 4930.2 and NBSIR-76-1187 or NBSIR-78-1526, except as otherwise noted.

(2) Absorption water chillers shall be installed in accordance with Chapter 15G.

(3) Air Supply Distribution System shall be installed in accordance with Chapter 15B.

(4) Ductwork shall be sealed in accordance with Table 1-1 in SMACNA Low Pressure Duct Construction Standards.

(5) Automatic control equipment shall be installed at the location shown under the supervision of the control manufacturer and in accordance with the manufacturer\*s instructions.

(6) Thermal Insulation shall be installed in accordance with Chapter 15C.

(7) Vibration isolation shall be provided for fans and air handling units in accordance with specification section: Air Supply and Distribution System (for A/C System)

(8) Check solar collector array for meeting approved shop drawings. Check to see that each solar collector will withstand the minimum indicated wind and snow load.

(9) Check piping for solar collector array for specified size, type of material, use of fittings to make turns and connections, specified support, automatic pressure and temperature relief valve specified. Check adjustment of valve for proper opening pressure and temperature.

(10) Insulate unprotected fluid-carrying lines and components in accordance with Chapter 15C.

(11) Cover plates for flat plate solar collectors shall be completely replaceable from the front of the collector without disturbing the piping or adjacent collectors.

(12) Protective cover plates shall be reinforced fiber glass, reinforce safety glass, acrylic or polycarbonate and shall withstand hail or similar impact loads.

(13) Check heating, air supply distribution and heat transfer systems to see that they are in accordance with approved shop drawings, plans and specifications. Advise supervisor of any deviation in equipment or installation.

(14) Check piping, valves, and accessories for meeting contract requirements and for type of service intended.

(15) Check expansion tank and liquid storage tanks for size and arrangement against approved shop drawings, plans, and specifications. Check for specified lining in liquid storage tank.

(16) Check for specified insulation with smoothing coat of finishing cement for tanks located inside of buildings.

(17) Check for specified insulation protective covering for underground tanks.

(18) Check for specified cathodic protection system for steel water tank. See Chapter 13D and 16B.

(19) Check hot water storage heater tank against approved shop drawings and contract plans and specifications. Provide insulation for interior tanks and insulation protective covering for underground tanks with cathodic protection as indicated.

(20) Exact location of automatic control devices will be as recommended by the control manufacture - see shop drawings.

(21) Dampers shall be sized and fabricated by the automatic control manufacturer, compare with shop drawings.

(22) Instrumentation for monitoring solar system performance shall be mounted so as to be easily readable.

(23) Check approved sequence of automatic controls, including shut off controls on high and low limits.

(24) Solar system\*s automatic controls will be integrated with building\*s automatic control system and the EVAC systems.

(25) Check specifications for painting and finishing requirements. Repair factory finished coatings where possible. Provide field painting of surfaces that were prime coated only at the factory. See Section Painting, General, of the Contract Specifications.

(26) Cutting or other weakening of the building structure to facilitate pipe installation will not be permitted without written approval.

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(27) Horizontal supply mains shall be pitched up or down in the direction of flow as indicated. The grade shall be not less than one (1) inch in 40 feet.

(28) Tin antimony solder (95-5) shall be used throughout the collector loop and in the whole system when a silicone heat transfer fluid is used.

(29) Welding electrodes shall be stored and dried in accordance with AWS D1.1 or as recommended by the manufacturer. Electrodes that have been wetted or that have lost any of their coating shall not be used.

(30) Dielectric unions shall be provided between ferrous and non ferrous piping to prevent galvanic corrosion.

(31) Swing joints or offsets shall be provided on all branch connections, mains, and risers to provide for expansion and contraction of the pipe.

(32) Check branch line for pitch, as indicated. Connections shall be made to insure unrestricted circulation, eliminate air pockets and permit drainage of the system.

(33) Supply and return lines shall provide for expansion by changes in direction of run of pipe, by expansion loops, or by expansion joints as indicated.

(34) Check for strainers at the inlet of each pump, heat exchanger, heating coil, and cooling coil.

(35) Check that valves are installed where shown.

(36) Check valve stems to see that they have been installed either horizontal or above.

b. Cleaning of Pipe

(1) Prior to flushing piping, all metering devices and orifices shall be removed. Temporary by-passes shall be provided for all solar collectors, coils, heat exchangers and equipment.

(2) Pipes shall be cleaned free of scale and thoroughly flushed of all foreign matter.

(3) Strainers and valves shall be thoroughly cleaned.

(4) After the hydrostatic pressure tests have been made and prior to operating tests, piping shall be cleaned again by filling the system with clean water and an alkaline detergent. The solution shall be circulated at the indicated flow rate for a period of 48 hours. The system will be drained and flushed thoroughly with fresh water.

(5) The system shall be drained and dried before filling with silicone fluid.

(6) Fill system with specified fluid and necessary inhibitors added.

(7) The initial cleaning and final filling shall be supervised by a technically qualified representative of a reputable water treatment organization.

c. Testing

(1) Factory Tests:

Check shop drawing submittals to determine if required factory tests were made and recorded.

(2) Field tests shall be as follows:

(a) Piping - after cleaning, water piping shall be hydrostatically tested at a pressure equal to  $1 \frac{1}{2}$  times the total operating pressure for a period sufficient for inspection of every joint in the system and in no case less than 2 hours. No loss of pressure will be allowed.

Leaks found during testing shall be repaired by replacing pipe or fittings. Caulking of joints will not be permitted.

Concealed pipes shall be tested in place before being concealed.

The system will be drained and dried before filling with silicone fluid.

(3) Balancing and adjusting - shall be in accordance with Specification Section: TESTING ADJUSTING AND BALANCING OF HVAC SYSTEMS.

Adjust flow through each collector by measuring either the pressure drop or the temperature rise across the collector.

Temperature measurement shall be made by means of platinum resistance or thermocouple measuring devices.

Pressures shall be measured through inlet and outlet pressure taps with U-tube manometers.

Balancing valves shall be adjusted and set for the indicated flow through the collectors.

(4) Performance

(a) After completion of pressure testing, cleaning, balancing and adjusting, and installation of all systems and prior to acceptance, tests shall be conducted to demonstrate that system and all components are operating in compliance with contract performance requirements.

(b) The tests shall be conducted by a competent experienced engineer and shall cover a period of not less than the specified days for each system.