CONSTRUCTION SPECIFICATION
CS-OR-238 PHOTOVOLTAIC (PV) POWER SUPPLY FOR PUMP

238.1 SCOPE

The work shall consist of installing PV panels, power controller, and electrical connections for powering a water pump as per the manufacturer's instructions.

238.2 COMPONENTS

The PV system shall conform to the most recent or currently adopted provisions of the National Electrical Code (NEC). As per Oregon Electrical Law (ORS 479), all components (PV panels, wiring, and electric motor) of an electrical system must be tested and listed by an Oregon-approved testing lab. All major components shall be warranted by the manufacturer to be free from material or workmanship defects for a minimum of one year.

PV Modules. Each module shall be labeled by the manufacturer with rated open-circuit voltage, operating voltage, maximum permissible system voltage, operating current, short-circuit current, and maximum power. Modules must be assembled with seals capable of remaining watertight over a temperature range of -20 degrees F to +120 degrees F. The manufacturer shall warrant each module for a minimum period of ten years against power degradation in excess of 10% of the rated power.

The modules must be certified to withstand the impact of 1-inch diameter hail at a minimum velocity of 51 mph (23 m/s) without major visual defects by a nationally recognized testing lab in accordance with IEC 61215, or IEC 61646. Modules must also be certified to withstand winds of 81 mph or greater.

Module junction boxes shall be moisture resistant and shall have sufficient space for addition of bypass diodes. Boxes that accept conduit are preferred. Junction boxes shall be mounted to the PV module frame and not to the PV module surface.

Mounting Structure. The PV array mount shall be constructed from materials protected from corrosion as suitable for the environment at the site. The mount shall have a tilt angle range of 20 degrees to 60 degrees from horizontal, as a minimum. The mounting structure must be capable of supporting the array under the appropriate wind and ice loads per applicable building codes.

Electronics. When available, electronic components shall be UL listed, (or equivalent). PV systems shall be fused as required by NEC. A controller, of the type recommended by the pump manufacturer, that is capable of protecting the pump from common faults, including low water (dry running), overload, and electrical short circuits shall be provided. The controller should be capable of providing flow or level control with the addition of a remote pressure or level control switch.

Other electronic components specified in the design shall be installed in accordance with manufacturer's recommendations and NEC requirements. Electronic components shall be located in a weatherproof enclosure with strain relief entrances, and they shall be mounted at a level for convenient access on the PV array mounting structure.

Wiring. All wire material shall be copper. Module to module wiring shall be in conduit or be rated sunlight and weather resistant. In-line splices are not permitted in the module wiring. Module wiring connectors must be crimp ring lugs and wiring terminals or compression terminal blocks. Wire nuts shall not be used. Each wire termination shall be adequately marked to identify the circuit conductor. The marking shall be consistent with the identification included on the wiring diagram.

A DC rated switch or circuit breaker shall be provided as a means for disconnecting the PV array from the system, per NEC requirements. The disconnecting device shall be located near the system controls and housed in a grounded weatherproof enclosure that is easily accessible.

238.3 INSTALLATION

All manufacturer's and testing lab installation instructions shall be followed during installation of the PV system and pump. All equipment shall be installed so as not to void manufacturer's warranties. All fasteners and hardware shall be torqued to the manufacturer's specifications. All electrical work shall conform to requirements in the current edition of the National Electrical Code (NEC). All plumbing work shall conform to the requirements of appropriate state and local regulations, and be performed in a workman like manner.

PV Array. The array shall be located as needed to receive the maximum amount of sunlight, with its orientation and tilt angle set as specified in the operation and maintenance plan. When the mounting structure is to be set in concrete, the concrete shall be placed at least 24 hours before the array is attached. The array shall be disabled until all electrical work has been completed.

Electronic Components and Wiring. Electronic components shall be installed in accordance with NEC requirements and manufacturer's recommendations. The negative PV conductor, the array mounting structure, and all other metal components of the system shall be grounded directly to earth.

238.4 PERFORMANCE

The photovoltaic array and pumping plant shall be tested for proper operation. The test shall document the open circuit voltage, array short-circuit current, voltage to load, and pump flow rate in gallons per minute.

238.5 ITEMS OF WORK AND CONSTRUCTION DETAILS FOR THIS PROJECT