

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE GENERAL SPECIFICATIONS
Texas**

**PUMPING PLANT
LIVESTOCK WATER SYSTEM – PHOTOVOLTAIC (SOLAR) POWERED PUMPING UNITS
(No.)
Code 533C**

1. SCOPE

These construction specifications cover the materials and installation of photovoltaic (solar) powered pumping units. They do not include the installation of the well.

2. PUBLIC AND PRIVATE UTILITIES

Utilities are defined to be overhead and underground power or communication lines, and pipelines. The contractor should conduct their own search and discovery for utilities in order to lessen or avoid potential damages. The owner/operator shall complete TX-ENG-80A, Utilities Inventory, during planning and return it to the NRCS representative. The owner/operator shall also ensure that TX-ENG-80B, Cooperator Confirmation of the One-Call Utility Safety System is completed and returned to the NRCS representative prior to layout or any ground disturbance.

3. DESIGN DOCUMENTATION

Design documentation from the Installer or equipment vendor(s) shall be submitted to USDA-NRCS for approval no less than 10 working days prior to the planned installation date. The design shall document that the solar powered system is capable of meeting the daily livestock water requirements at the total head on the pump. The design shall include as applicable a site plan, site specific mounting structure details, wiring details, site specific computations, and equipment manufacturer's literature. Equipment manufacturer's literature shall include installation and operating instructions, warranty documentation, maintenance requirements and any other applicable information. Failure to submit all the above design documentation 10 working days prior to installation of the solar powered pump, could result in the installation not meeting USDA-NRCS specifications and loss of financial assistance.

4. EQUIPMENT

- a. Pump: The pump, motor, drop pipe and other pump accessories shall conform to USDA-NRCS General Specification; GS-533B - Pumping Plant for Water Control - Livestock Water System - Electric Submersible Pumping Units dated March 2005. See attached General Specification, GS-533-B.
- b. Solar Modules: Modules shall be tested and listed by Underwriters Laboratories (UL) to meet UL 1703; or tested and certified to withstand the impact of 25-mm (1-inch) diameter hail at a minimum velocity of 23-m/s (51-mph) without major visual defects by another nationally recognized testing lab in accordance with IEC 61215, or IEC 61646. Modules must also be certified to withstand winds of 130-km/h (81-mph) or greater. 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 shall be

<p>Conservation practice general specification are reviewed periodically and updated if needed. To obtain the current version of this standard, contact your Natural Resource Conservation Service <u>State Office</u> or visit the <u>electronic Field Office Technical Guide</u>.</p>

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assembled with seals capable of remaining watertight over a temperature range of -20°F to +120°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. 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 solar module frame and not to the surface of the module.

- c. Mounting Structure: The solar module array shall be mounted on a new Array Technologies, Direct Power and Water, Grundfos, Ironridge (Two Seas), UniRac, or Zomeworks mounting structure; or a structure designed, certified, signed, and wet stamped by an engineer licensed to practice engineering in the State of Texas. Mounting structure designs from engineers shall be approved by USDA-NRCS prior to installation.

A mounting structure that tracks the sun is recommended but not required. As a minimum, the structure shall have a tilt angle from horizontal that ensures optimum utilization of the solar energy. As a minimum, the tilt angle shall be adjustable from the local latitude plus 15° in the winter to the local latitude minus 15° in the summer. The mounting structure must be capable of supporting the solar module array under loads caused by 130-km/h (81-mph) winds and ice loading of 25-mm (1-inch) thick minimum over all exposed surfaces.

- d. Controller and Electronics: A controller, of the type recommended by the pump or solar system manufacturer, which is capable of protecting the pump from common faults, including low water (dry running), overload, and electrical short circuits, shall be provided. Electronic components shall be UL listed, (or equivalent). Solar systems shall be fused as required by the NEC. A controller that is capable of providing flow or level control with the addition of a remote pressure or level control switch is recommended but not required.
- e. Wiring: All wire material shall be copper. Solar module to module wiring shall be in conduit or be rated sunlight and weather resistant (USE, type TC or equivalent). 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 array from the system, per NEC requirements. The disconnecting device shall be located near the system controls and housed in a grounded weatherproof enclosure.

- f. Protective Structures: The solar powered system shall be enclosed by fencing or other protective structures. The enclosure must exclude livestock and allow access to all system components for service and maintenance.

5. **INSTALLATION**

- a. Pump: The installation of the pump, motor, drop pipe and other pump accessories shall conform to USDA-NRCS General Specification; GS-533B - Pumping Plant for Water Control - Livestock Water System - Electric Submersible Pumping Units dated March 2005.

- b. Solar Modules: The solar module array shall be located as needed to ensure optimum utilization of solar energy, with its orientation and tilt angle set as specified in the design. The array shall be covered with an opaque covering material until all electrical work has been completed.
- c. Mounting Structure: The solar module array mounting structure shall be installed and anchored in accordance with the manufacturer's instructions and these specifications. When the mounting structure is to be set in concrete, the concrete shall be placed at least 24-hours before the array is attached.
- d. Controller, Electronic Components and Wiring: The controller, electronic components, and wiring shall be installed in accordance with NEC requirements and manufacturer's recommendations. The negative solar module conductor, the array mounting structure, and all other metal components of the system shall be grounded directly to earth. The controller and other electronic components shall be located in a weatherproof enclosure with strain relief entrances, and mounted at a level for convenient access on the solar module array mounting structure.

6. CERTIFICATION

The Installer shall furnish USDA-NRCS a written certification that the solar powered pumping unit and installation conform to the requirements of this specification and to the Texas Administrative Code; Title 16 Economic Regulation; Part 4 Texas Department of Licensing and Regulation (TDLR); Chapter 76 Water Well Drillers and Water Well Pump Installers Administrative Rules, <http://www.license.state.tx.us/wwd/wwdrules.htm>.

The certification shall also provide the name of the solar module manufacturer and its model and serial number(s); the pump unit manufacturer, model and serial number, and the horsepower of the pump. The Installer shall also certify that they are licensed by the State of Texas as a pump installer.

7. GUARANTEE

The Installer shall provide USDA-NRCS guarantee that all equipment, materials and installation against any defective materials or workmanship, for a period of one year from the date of completion. If any equipment, materials or workmanship prove to be defective within one year, they shall be replaced or repaired by the Installer.

8. MEASUREMENT

Measurement of each solar powered pumping unit installation will be on a completed job basis. An onsite check of the completed installation will be performed by a USDA-NRCS representative.

9. CONSTRUCTION DETAILS

This construction specification, attached construction details and the requirement for completion of a TX-ENG-80, UTILITIES INVENTORY have been reviewed with me and I agree to install my solar powered pumping unit according to these construction specifications.

Landowner/Producer

Date