

**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 of 1500 watts or less. Installation of the well is not included.

**2. PUBLIC AND PRIVATE UTILITIES**

Utilities are defined to be public or private, overhead and underground power or communication lines, and any pipelines. The landowner/operator/contractor shall conduct their own search and discovery for utilities in order to lessen or avoid potential damages, injuries or loss of life. During planning, the owner/operator should complete a TX-ENG-80A UTILITIES INVENTORY to document known utilities. The owner/operator or their representative shall complete TX-ENG-80B, COOPERATOR CONFIRMATION OF THE ONE-CALL UTILITY SAFETY SYSTEM to comply with State law prior to any ground disturbance and return it to a USDA-NRCS representative.

**3. QUALITY CONTROL**

Quality Control of all materials and construction procedures is the responsibility of the landowner and contractor. NRCS will make periodic review(s) of the work for the benefit of the agency which will include the final construction check.

**4. EQUIPMENT**

- a. **Pump and Motor:** The pump and motor shall be capable of delivering the required daily capacity at the total head shown in the construction details. The pump and motor shall have minimum 2 year warranty.
- b. **Solar Panels:** Panels 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. Panels must also be certified to withstand winds of 130-km/h (81-mph) or greater. Each Panel 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. Panels shall be assembled with seals capable of remaining watertight over a temperature range of -20oF to +120oF. The manufacturer shall warrant each Panel for a minimum period of ten years against power degradation in excess of 10% of the rated power.

- c. Mounting Structure: The solar panel array shall be mounted on a new commercially manufactured or a professional engineer certified mounting structure. A mounting structure must be capable of supporting the solar Panel 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. Array Technologies, (Powerfab), Kaneka, Direct Power and Water, Grundfos, Ironridge (Two Seas), UniRac, or Zomeworks are approved for use at issue date. Any structure designed, certified, signed, and sealed by an engineer licensed to practice engineering in the state of Texas shall be submitted to NRCS for approval prior to installation. As a minimum, the structure shall have a tilt angle from horizontal that ensures optimum utilization of the solar energy. A mounting structure that tracks the sun is recommended.
- 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 manufacturer. A controller that is capable of providing flow or level control with the addition of a remote pressure or level control switch is recommended.

A DC rated switch or circuit breaker shall be provided as a means for disconnecting the array from the system. The disconnecting device shall be located near the system controls and housed in a grounded weatherproof enclosure within visible site of the well head.

- e. Wiring: All wire material shall be copper. Solar Panel to Panel 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 Panel wiring. Panel 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.
- f. Grounding: Grounding conductors shall be installed per manufacture's recommendation and any safety codes.
- g. Protective Structure: The solar powered system shall be enclosed by durable fencing or other protective structure. The enclosure must exclude livestock and allow access to all system components for service and maintenance.
- h. Drop Pipe: The drop pipe, not to exceed 2" nominal size, shall be one of the following:
- (1) Galvanized steel drop pipe consisting of joints of reamed galvanized pipe, threaded and complete with long couplings having a quality equal to the pipe. The pipe shall be Schedule 40 and meet ASTM-A-53. Total pumping head shall not exceed 72% of the pressure rating of the pipe.
  - (2) Polyvinyl chloride (PVC) pipe shall be PVC 1120, Schedule 80 or 120 conforming to ASTM-D-1785. Total pumping head shall not exceed 72% of the pressure rating of the pipe. The pipe shall have threaded couplings having a strength equal to or exceeding the pipe.

- (3) Polyethylene (PE) pipe shall comply with one of the following specifications: ASTM D-2239 (SIDR-PR) or ASTM D-3035 (SDR-PR). Polyethylene (PE) pipe fittings shall conform to manufacture's recommendations. The pipe and fittings shall have a pressure rating equal to or greater than following:
- a. For Total Pumping Head of 0 to 100 ft the minimum pressure rating shall be 125 psi pipe.
  - b. For Total Pumping Head greater than 100 ft the minimum pressure rating shall be 200 psi pipe. A minimum of 3/16" diameter Type 304 stainless steel cable shall be used to support the pump. Total pumping head shall not exceed 72% of the pressure rating of the pipe and shall not exceed 450 ft.

All drop pipes shall meet NSF requirements.

- i. Check Valves: Check valve(s) shall be spring-loaded, stem or cage poppet-style.
- j. Torque Arrestors: Torque arrestor(s) shall be constructed of PVC or rubber material and field adjustable to hold pump centered in well. Stainless steel clamps shall be used to securely fasten the torque arrestor to the drop pipe.

## 5. **INSTALLATION**

- a. Pump: The installation of the pump, motor, drop pipe and other pump accessories shall conform to 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>.
- b. Solar Panels: The solar Panel array shall be located as needed to ensure optimum utilization of solar energy, with its orientation and tilt angle set as specified by the manufacturer. The solar panels should be covered with an opaque material during installation to prevent electrical shock.
- c. Mounting Structure: The solar Panel 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, lightning arrestors, and wiring shall be installed in accordance with NEC requirements and manufacturer's recommendations. The array mounting structure and all other metal components of the system shall be grounded using a copper grounding rod. 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 Panel array mounting structure.

- (1) Conductors (Power Cable):
  - a. *Splicing:* The power cable shall be furnished in one continuous length within the well where possible. A maximum of two water tight electrical splices within the well will be allowed. Splices may be completed using water tight wire connections or water proof taping.
  - b. *Clamps:* A stainless steel clamp may be used below each drop pipe joint to tie the power cable to the drop pipe. The installer shall protect the cable at each stainless steel clamp with a 3 inch long piece of polyethylene plastic, split on one side and placed around the drop pipe. Clamps shall be spaced a maximum of 22' apart.
  - c. *Taping:* Four turns of  $\frac{3}{4}$  inch plastic tape at each joint can be substituted for the stainless steel clamps specified above in (2). However, the Installer shall also tie the power cable to the drop pipe with four turns of  $\frac{3}{4}$  inch plastic tape equally spaced between joints not to exceed 10-feet. Maximum spacing between tapings shall be 10 feet.
- (2) Check Valves: Average spacing shall be 200 feet (not equally spaced) and a check valve shall be installed a maximum of 21' above the pump provided an internal check valve is not present in the pump. If needed for water quality protection a horizontal check valve will be installed in the discharge pipe.
- (3) Centering Guides: Install centering guides at a maximum of 42' apart throughout the entire drop pipe.
- (4) Torque Arrestor: If plastic drop pipe is used a minimum of three torque arrestors shall be installed. Place one immediately above the pump, one 10 feet above the pump and another 20 feet above the pump.
- (5) Flow Testing: After installation is complete, the Installer shall operate the pump for a period of 1 hour. The Installer shall also provide facilities for the safe discharge of the test water.
- (6) Sanitary Protection of Well: The installer shall protect the well during construction period to prevent vandalism, tampering, or seepage of contaminated water, petroleum products or other contaminants into the well from the ground surface.

## 6. CERTIFICATION

The Installer shall furnish the owner/operator a written certification (with a copy provided to USDA-NRCS) that the installed solar unit, appurtenances, and groundwater protection conform to the requirements of this specification and 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 Panel manufacturer and its model and serial number(s); the pump unit manufacturer and model, the kw/hp of the pump, pump setting depth and drop pipe size & material details. The Installer shall also certify that they are licensed by the State of Texas as a pump installer unless exempted by TAC 16, Chapter 76, Section 76.300.

**7. GUARANTEE**

The Installer shall provide the landowner a written guarantee (cc to USDA-NRCS) that all equipment, materials and installation against any defective materials or workmanship, for a period of one year from the date of completion.

**8. MEASUREMENT**

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

**9. CONSTRUCTION DETAILS**

- a. The average daily pumping capacity shall be \_\_\_\_\_ gpd at a total head of \_\_\_\_\_ ft. during the month of \_\_\_\_\_. The average daily pumping capacity shall be calculated based on a maximum 8 hour solar day.
- b. The pump installer shall provide a manufacturer’s design or head-capacity table or chart certifying that the installed system will provide the required gpd at the design location.
- c. Recommended Solar Panel Tilt Angle\_\_\_\_\_.
- d. Other specific items to job installation:

Attachments:  
Certification sheet  
TX-ENG-80B  
O&M Plan

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

\_\_\_\_\_  
Landowner/Producer

\_\_\_\_\_  
Date