NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE SPECIFICATION

PUMPING PLANT, ELECTRIC SUBMERSIBLE PUMP

CODE 533-D

1. SCOPE

These construction specifications cover the materials and installation of electric submersible pumps.

2. EQUIPMENT

The Installer shall furnish the NRCS representative written certification from the manufacturer that the installer-furnished electric submersible pump, motor starter, pump cable, check valves, and electrical control equipment conform to the requirements of this specification. Submittals shall conform to the guidelines shown under Practice Specification 533A.

a. Submersible Pump: The submersible pump and motor shall have stainless steel, plastic, or bronze impellers, and shall be capable of delivering the design GPM at the head shown on the drawings.

b. Conventional Electric Motor: The motor shall be a 220-volt, 60-hz, single or three-phase motor, NEMA Standard MG 1, and rated at the HP shown on the drawings. The motor shall have sufficient power to efficiently and continuously operate the pump at the listed capacity and head without exceeding the normal horsepower rating. The service factor shall apply to infrequent short overloads. It shall not be allowed during normal operating conditions. The motor shall also be provided with a watertight plug-in-type lead connector.

c. Accessories:

(1) The motor controller for single phase motors shall be the product of the pump motor manufacturer and shall be designed to function with the associated motor.

(2) Lightning arrestors shall be either separately mounted or an integral part of the motor.

(3) The power cable supplying the motor shall be of a type suitable for the application, with adequate strength for the length of cable vertically supported in the well. The cable shall be furnished in one continuous length within the well, and it shall be new neoprene-jacketed vulcanized submersible pump cable. The conductor insulation (Type RHW) shall be bonded to the conductor. The cable shall be sized to limit the voltage drop to no more than 3 percent at the motor terminals, and shall be not less than AWG No. 12 cable.

(4) Pressure switches shall be equal to products of the Square D Company.

(5) Drop Pipe: The drop pipe diameter, type, and length shall be as shown on the drawings, and the type shall be one of the following.

(a) Galvanized steel drop pipe that has been reamed and threaded and is complete with long couplings having a quality equal to the pipe. The pipe shall be Schedule 40 and meet ASTM A 120.

(b) Polyvinyl chloride (PVC) pipe, PVC 1120, Schedule 80, conforming to ASTM D 2241.

(c) Polyethylene (PE) pipe, PE 3406, Class 160, conforming to ASTM D 2239.

(6) Sanitary Well Seal: A spilt-base, two-hole type for submersible pumps will be used. The seal will be of suitable strength to support the specified drop pipe and pump weight.

(7) Check valve(s) shall be Flow-matic No.

80 or equal.

(8) Torque arrestor(s) shall be Harvard TA 48 or equal.

(9) Pitless Adapters: The outside section of the adapter shall connect onto the well casing below the frost line. The adapter shall be connected to the casing by clamp-and-gasket or by welding. The casing shall extend above the ground a minimum of 18 inches. The Installer shall cut a hole in the casing at the location specified for the horizontal discharge line or adapter.

(10) Pitless Unit: The Installer shall cut off or remove the upper part of the casing and connect the outside of the unit directly to the casing, as shown on the drawings.

3. INSTALLATION

a. Submersible Pump: The pump shall be installed in accordance with the manufacturer's recommendations. Submersible pumps which are not immersed in water shall not be energized for more than 3 seconds at not less than 10-minute intervals, unless written approval is obtained from the manufacturer to do so.

b. Conductors:

(1) General: The Installer shall install the required wiring, controls, and junction box, complete from the junction box to the pump.

(2) Splicing: No splices will be permitted in the drop cable between the motor splice and the surface control unit. Splices at other locations shall be as recommended by the manufacturer.

(3) Clamps: A stainless steel clamp shall be used below each drop pipe joint, to tie the electrical conductors to the drop pipe. The Installer shall protect the conductors at each stainless steel clamp with a 3-inch-long piece of polyethylene plastic, split on one side and placed around the drop pipe between the cable and clamp.

(4) Taping: The conductor shall be taped to the drop pipe with ¾-inch plastic tape at intervals not to exceed 7 feet. The Installer shall use a minimum of four turns of tape at each joint.

(5) The Installer shall carefully lower the drop pipe, taking care not to drag the conductors over the casing or allow the conductor to become pinched. As the drop pipe is lowered into the well, the Installer shall check continuity and resistance at each joint with an ohmmeter.

c. Check Valve: Average spacing shall be 100 feet (not equally spaced), and a check valve shall be installed one length of drop pipe above the pump.

d. Centering Guides: Install one centering guide on each length of plastic drop pipe.

e. Torque Arrestor: Install one torque arrestor on each length of plastic drop pipe.

f. Concrete Well Platform: Construct a concrete platform around the well, as shown on the drawings, extending it 6 inches above finished grade. Finish concrete with a smooth, wood-float finish. The top of the casing shall be cut off to the elevation as shown on the drawings. Concrete construction shall be in conformance with NRCS Specification 614, Watering Facility.

g. Sanitary Well Seal: The well seal shall be fitted securely on the well casing and adjusted to insure a good seal. Special attention shall be given to the installation of the seal to provide a suitable anchor for the suspension of the drop pipe and power cable.

h. Pump Controls: Install, connect, and adjust controls to operate the submersible pump according to the manufacturer's recommendations and as shown on the drawings.

i. Flow Testing: After installation is completed, the Installer shall operate the pump, at design capacity, in the presence of the Contracting Officer's Representative (COR), for a period of at least 2 hours. If the power source is not

available, the Installer shall supply a compatible power source, at his expense, for the required testing. The Installer shall also provide temporary lines for the safe discharge of the test water, as approved by the COR.

j. Insulation Testing: After installation, the Installer will test insulation resistance between windings, and between each stator winding and frame. Insulation values less than ½ megohm are not acceptable.

k. Motor Current Testing: The Installer will measure the motor current in each phase conductor with the motor operating at the highest normal load to which it may be subjected, and compare current readings to the nameplate full-load-current ratings. The Installer will report to the COR readings higher that the nameplate rating.

l. Sanitary Protection of Well: The Installer shall protect the well during the construction period to prevent vandalism, tampering, or seepage of contaminated water, petroleum products, or other contaminants into the well from the ground surface.

m. Correcting Contamination: If the installer contaminates the well, corrective work including the supplying of seals, sterilizing agents, or other materials as may be needed to prevent contamination of the aquifers, shall be performed at the installer's expense.

4. OPERATION AND MAINTENANCE

This practice requires periodic operation and maintenance to ensure satisfactory performance. The following are some recommendations to assist in developing a good operation and maintenance program.

- Maintain all pumps, agitators, piping, valves, and other electrical and mechanical equipment in good operating condition and follow the manufacturer's recommendations.
- Maintain grounding rods and wiring of all electrical equipment in good working condition.
- Drain all exposed piping and valves that are subject to freezing. Portions that cannot be drained shall consider the use of non-corrosive antifreeze solution.
- Do not allow ponding to occur around the well head.
- Repair any vandalism and vehicular or livestock damage that may occur.

5. MEASUREMENT

Measurement of each submersible pump installation will be on a completed job basis.