

SECTION S968 - CATHODIC PROTECTION TEST STATION

S968-1 DESCRIPTION

Work consists of the installation of cathodic protection test station and associated wiring to monitor corrosion of metallic water main pipe or fittings, as required in the Contract Documents and as directed by the Project Manager.

Work is to be in conformance with the requirements of Section S900 General Water Provisions.

S968-2 MATERIALS

S968-2.01 Cathodic Protection Test Box - Unpaved Area

Cathodic protection test box shall be 2 feet long, have a 6 inch diameter molded plastic shaft flared at bottom, with cast iron rim and cast iron flush fit drop-turn locking lid with the words "WATER TEST" cast on top of lid. A non-conductive terminal board designed for minimum of seven stainless steel terminal connections shall be attached to inside of lid.

S968-2.02 Cathodic Protection Test Box - Paved Area

Cathode protection test box located in paved area shall be a non-conductive terminal board designed for a minimum of seven stainless steel terminal connections installed within 7 inch diameter valve box. Valve box shall be minimum 4 feet long cast iron, screw type with arched base, with word "WATER" cast on the top of lid.

S968-2.03 Reference Electrode

Permanent underground reference electrode shall be of the saturated gelled element type, prepackaged in a backfill mix to retain moisture and minimize migration of contaminants from the surrounding soil and shall have a minimum design life of 30 years. Electrode elements shall have a stability range of plus or minus 5 mV with a current drain of 0.01 micro-amperes at continuous operation. Each reference electrode shall be fabricated with 50 feet of #14 AWG stranded HMWPE insulated copper wire.

Copper/copper sulfate reference electrodes are generally required where soils have a chloride content of less than 500 parts per million and shall be furnished with red lead wire.

Silver/silver chloride reference electrodes are generally required where soils have a chloride content of 500 parts per million or greater and shall be furnished with yellow lead wire.

S968-2.04 Magnesium Anode

Magnesium anode shall be in conformance with Section S966 Magnesium Anode, size and number as noted in Contract Documents. Minimum length of anode lead wire shall be 20 feet.

S968-2.05 Wire

Lead wire shall be a single uninterrupted length of wire which is long enough to reach from test box station terminal board to required item, with an additional 3 feet long coil of wire left over. Splicing of wire shall not be permitted except as otherwise noted. Crimp-on lug wire connectors shall be installed on the end of all wires before connecting wire to the test box station terminal board. All hardware shall be stainless steel or nickel-plated brass and copper for electrical conductivity and atmospheric corrosion resistance.

Wire for connecting test box station terminal board to water pipe shall be #12 AWG stranded type 600-volt THHN or THWN blue insulated stranded copper wire.

Wire for connecting test box station terminal board to reference electrode shall be as furnished with reference electrode.

Wire for connecting test box station terminal board to magnesium anode shall be as furnished with anode.

S968-2.06 Thermite Weld Equipment

Attachment of copper wire to metallic pipe or fittings shall be by made by the thermite weld method. Thermite weld materials shall consist of wire sleeves, weld molds and weld cartridges according to the weld manufacturer's recommendations for the specific wire and pipe sizes and materials. Weld materials from different manufacturers shall not be interchanged. Weld molds shall be graphite molds. Ceramic "one-shot" molds will not be acceptable.

S968-2.07 Conduit

Lead wires from pipe or fitting to base of test station shall be installed in 2" PVC Schedule 40 conduit.

S968-3 CONSTRUCTION DETAILS

Test boxes shall be installed in locations where they will not be disturbed by vehicular traffic and will not interfere with trees, plantings or other utilities.

Two test station lead wires shall be attached to the top of the water main pipe or fitting, 12 inches apart, by using the thermite weld method. Thermite welding shall be performed in accordance with the manufacturer's specifications.

Using a mechanical grinder, remove the minimum area of coating from pipe or fitting surface required for placement of weld mold on the pipe, creating a bright, shiny surface.

To attach test wires to water mains that are encased in a polyethylene tube, the Contractor shall first cut back the polyethylene tubing to expose the pipe. The Contractor shall make an "X" shaped cut in the polyethylene and temporarily fold back the polyethylene at the point where the test wires will be attached to the pipe. After the test wires have been attached to the pipe the Contractor shall repair the polyethylene. The Contractor shall use polyethylene compatible adhesive tape to repair the tubing. The polyethylene shall be folded back against the pipe and the repair tape shall be applied on all four sides of the test wires. The repair tape shall completely cover the area of the polyethylene tube that was cut and shall completely cover all exposed metallic pipe or fitting material.

Prepare test wire for thermite welding by assuring that cable is absolutely dry. Test wire shall be free of dirt, grease and other foreign materials. Cut test wire in such a way as to avoid flattening or forcing out of round. To prevent deformation of test wire, cut with wire cutters. Remove insulation in a manner that will avoid damage to strands. Install adapter sleeves for all test wires as recommended by thermite weld manufacturer prior to welding. Hold wire at an approximate 30 degree angle to the pipe surface when welding.

When weld has cooled, remove weld slag and test weld for strength by striking a sharp blow to the weld with a hammer while pulling firmly on the wire. Reweld unsound welds and retest weld. Thoroughly clean mold and mold covers after completion of each weld to assure that no slag will penetrate into next weld. After soundness of weld has been verified, thoroughly clean with a stiff wire brush and brush coat entire weld area with an approved bitumastic coating. Lift wire away from pipe or fitting and apply bitumastic coating completely around, on top and underneath the wire. Push wire back down on the pipe.

The reference electrode shall be installed in native soil 2 feet from the side of the water main pipe or fitting near the location where the two test wires connect to the pipe and at an elevation slightly below the spring line of the pipe. Prior to backfilling, approximately 5 gallons of clean fresh water shall be poured onto the reference electrode and allowed to soak into the pre-packaging. The reference electrode shall then be backfilled with native soil up to 12 inches above the electrode, compacted to standard specifications. The remainder of the trench shall then be backfilled.

Magnesium anode(s) shall be provided and lead wires connected directly to test box station terminal board. Magnesium anode(s) shall be installed in conformance with Section S966 Magnesium Anode, except that anode lead wire is not to be attached directly to the water main pipe section or fitting being tested. Size and number of magnesium anodes will vary, and will be as specified in Contract Documents. When the anode lead wire is not long enough to reach the test station, the lead wire may be lengthened by splicing on an additional length of lead wire. Splice shall be made using an approved splice connector suitable for buried applications.

Test station wires shall be installed together in a single 2" diameter PVC schedule 40 conduit and at a minimum depth of 4.5 feet from finished grade. Test wires shall be installed in a continuous length. Test wires shall be provided with sufficient slack at the pipe and at the test station box to prevent the test wire from being unduly stressed or broken during backfilling operations and future excavating. Sufficient test wire shall be provided to coil below ground within the test box so that the terminal board and test wires can extend approximately 3 feet above ground level.

Test wires shall be handled with care. Damage to wire insulation shall be repaired by spirally wrapping (minimum of 50 percent overlap) with two layers of high voltage rubber splicing tape and two layers of vinyl electrical tape or using an approved splice connector suitable for buried applications..

The terminal end of the lead wire for reference electrodes shall be color coded as indicated on the drawings depending on the type of element required for the soil conditions. If necessary, color coding shall be achieved by wrapping colored vinyl tape several times around the end of the lead wire.

Test boxes located in paved road areas shall be housed inside a valve box. Wires from the test box shall pass through the arch of the valve box base.

All test boxes shall be installed on a solid concrete block foundation.

Sand embedment shall be required around the wires and conduit. There shall be a minimum of 6 inches along each side, top and bottom of the wires and conduit.

Cushion sand shall be backfilled around the water main so that the sand covers the pipe to a minimum depth of 12 inches on top, and along both sides of the pipe. The excavation shall be backfilled in stages using select granular backfill (water) free from stone, rocks, roots, organic material, trash or other debris. Backfill shall be carefully tamped to ensure that no voids exist and that wires and reference electrode are not damaged.

Upon completion of the work, the Contractor shall check all wiring for electrical continuity. The test box/valve box shall be backfilled with the top being flush with the surrounding finished grade and the surface restored.

S968-4 METHOD OF MEASUREMENT

The quantity to be measured for payment shall be the number of cathodic protection test stations installed.

Magnesium anode will be paid for under Section S966 Magnesium Anode.

S968-5 BASIS OF PAYMENT

The unit price bid shall include the cost of: furnishing and installing cathodic protection test box including cover lid with terminal board; wire; conduit; concrete block foundation; thermite weld equipment and materials; reference electrode; repairs to pipe coatings and polyethylene pipe encasement; hardware; electrical continuity testing; and furnishing all labor, material and equipment necessary to do the work.

Valve boxes will be paid for under separate bid items or included in the price bid for the item as indicated in the item description.

Magnesium anode, excavation, rock excavation, furnishing and placing of bedding and select granular backfill, temporary pavement, and surface restoration will be paid for under separate items.

Payment will be made under:

ITEM NO.	ITEM	PAY UNIT
S968.01	Cathodic Protection Test Station – Unpaved Area with Copper/Copper Reference Electrode	Each
S968.02	Cathodic Protection Test Station – Unpaved Area with Silver/Silver Reference Electrode	Each
S968.03	Cathodic Protection Test Station – Paved Area with Copper/Copper Reference Electrode (Including Valve Box)	Each
S968.04	Cathodic Protection Test Station – Paved Area with Silver/Silver Reference Electrode (Including Valve Box)	Each

REVISED October 24, 2013