Cathodic protection of tank bottoms resting on concrete pads

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The use of cathodic protection for tanks resting on concrete pads and slabs has been utilized since cathodic protection has been used on tanks. Most owners or operators have not been aware this has been occurring, due to the thought cathodic protection currents will not pass through concrete. The carbon steel rebar in many state highway concrete bridge decks has been cathodically protected for decades, as have many parking garages throughout the world. Concrete is an electrolyte that will conduct current. The fact that the rebar corrodes in the concrete should be evidence enough that concrete is an electrolyte, just like tank pads that are specified per NACE SP0193-2016 and API 651 Rev. 4. It is not uncommon for the electrical resistivity of sand pads, as recommended by NACE and API, to be several hundred-thousand ohm-cm to over 1 million ohm-cm. Concrete, depending on the moisture content, will be in the same resistivity range as tank sand pads.

It is common for condensation to form on tank bottoms resting on concrete pads and slabs when there are differences in the temperature of the product in the tank and the outside air temperature, so even a tank that may have a coned-up bottom to the center of the tank can still have corrosive condensation form on the tank/concrete pad or slab interface. The accumulation of condensation on the tank pad will lower the resistivity of the concrete pad. Cathodic protection will be especially beneficial for the tank bottom when condensation is accumulating on the tank.

A tank bottom that rests on a concrete pad or slab will be receiving cathodic protection currents to the locations where the tank bottom contacts the concrete slab or pad. If the tank has butt-welded tank bottom plates, then essentially all of the tank bottom will be in contact with the concrete slab or pad, allowing for nearly complete cathodic protection. Where lap-welded plate construction of the tank bottom is utilized, 90-plus percent of the tank bottom should be in contact with the concrete slab or pad. NACE SP0193-2016 suggests the use of a thin layer of select sand meeting the specified sand requirements on top of the concrete pad or slab for improved contact between the tank bottom and concrete pad or slab.

A tank bottom that rests on a concrete pad is commonly referred to as "El Segundo." They began to be used in the 1990s on double-bottom tanks in El Segundo, California, and are still being used today. New methods have been recently developed in which the use of a conductive liner or release prevention barrier (RPB) can be used over the old tank bottom to allow cathodic protection current to pass right through the old tank bottom, conductive liner and concrete to cathodically protect the new tank bottom in an "El Segundo" tank. Adding cathodic protection to an "El Segundo" double-bottom tank will be a significant improvement for this type of double-bottom tank construction.

How do you monitor the cathodic protection?

Both NACE SP0193-2016 and API 651 Rev. 4 describe the use of cathodic protection for tanks resting on concrete pads or slabs. The main issue with determining if cathodic protection is effective is the monitoring of cathodic protection levels, not if the cathodic protection gets through the concrete to the tank bottom. It is absolutely critical to use very high variable input resistance voltmeters when testing tanks resting on concrete pads or slabs. NACE SP0193-2016 specifies the use of variable impedance measurements to correct the errors that often occur when measuring tank-to-soil potentials for tanks resting on sand or concrete pads/slabs.

Increased internal inspection intervals

Tanks that rest on a concrete pad or slab, which combine the use of cathodic protection that is monitored and tested in accordance with NACE SP0193-2016 and API 651 and utilize variable input resistance voltmeters, qualify for extended internal inspection intervals for adding cathodic protection in accordance with API 653.

Louis Koszewki is the current chairman of API 651 and NACE SP0193.

For more information, email lou@ustankprotectors.com or call (630) 719-9754. ●