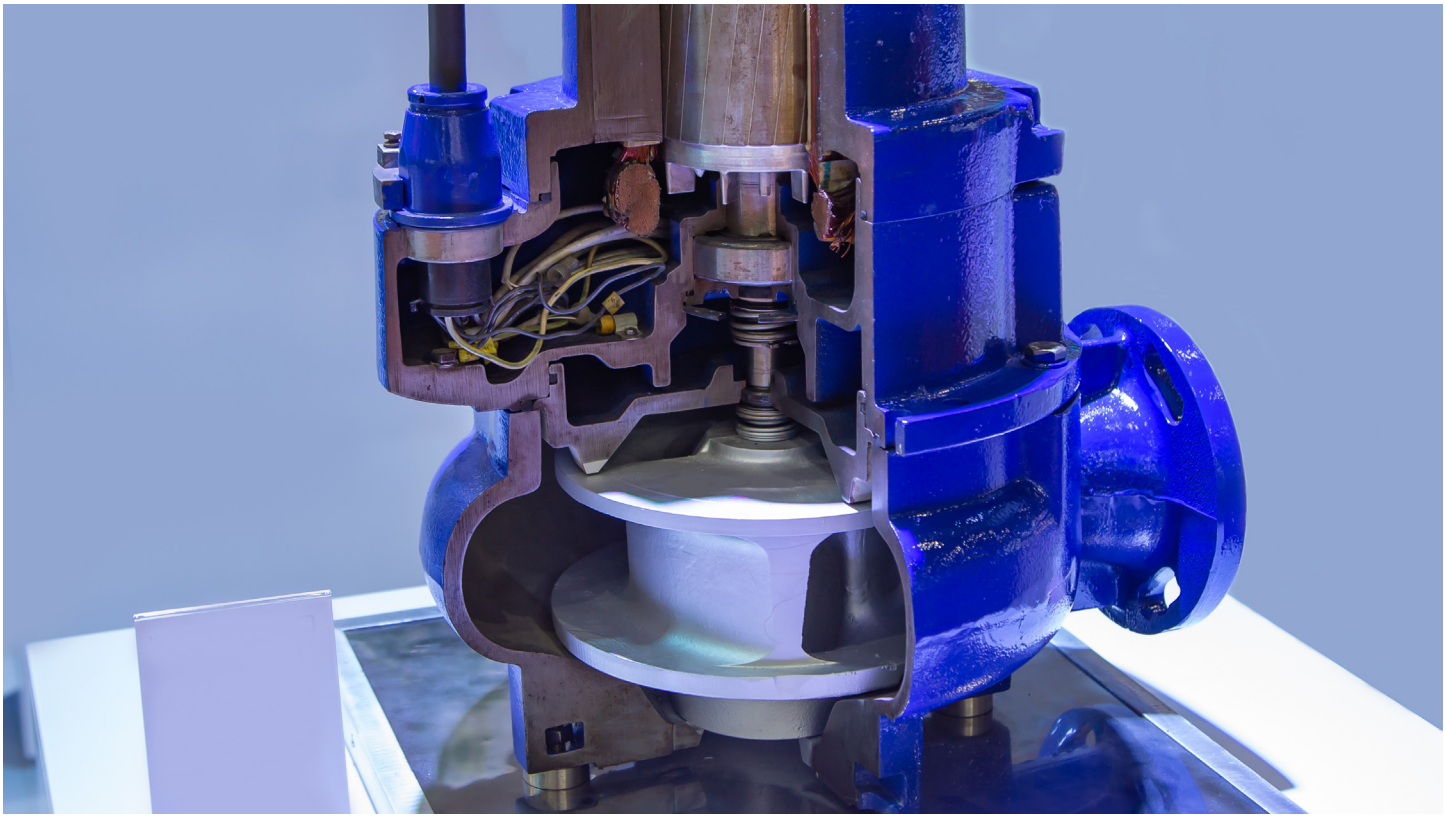
MAGNAPLATE
COATINGS ENGINEERED FOR YOUR SUCCESS

CASE STUDY

Coatings Increase Service Life Of Pumps Operating In "Aggressive" Water Environments



The high silt and gravel content of local water wells in parts of Illinois and Wisconsin causes scouring, corrosion and shortened lives for the pumps operating in those wells. However, the application of General Magnaplate coatings to key parts has increased the service life of both new and refurbished deep-set pumps installed by Layne-Christensen Company.

According to Layne's senior engineer/metallurgist, deep-set pump life in Wisconsin and Illinois water wells increases two-fold (from the typical 5 - 6 years to 10 - 12 years) when parts are coated by this method. Traditionally, when corroded cast iron parts failed, they were replaced with brass, bronze, or stainless steel. Layne's use of "synergistic" coatings enables the worldwide water well pump, sales and service company to extend pump lifetime and saves the cost of using expensive alloys.

Bowls, Shafts, and Impellers Coated

The cast iron bowl assembly's outer casing houses the "business end" of the pump. It contains the impeller and bears the brunt of the aggressive water chemistry and sand impingement. Layne discovered that when it coats the bowl assembly with nickel-based NEDOX from General Magnaplate, it imparts a hardness of Rockwell C 62-70 to the part. Layne also coats shafts, impellers and many other pump components used in wells that contain "agressive" water.

Their senior engineer also reported that the coefficient of friction (COF) of NEDOX-coated surfaces is significantly lower than the uncoated surfaces. These super-smooth surfaces permit the pumps to run at higher efficiency, resulting in additional costs savings.

Inexpensive

The NEDOX surface enhancement process is "inexpensive and quick," he says. It adds only 40% to 50% to the price of the cast iron bowl assembly while the alternative of replacing the assembly with brass or bronze costs four times as much. A stainless steel bowl assembly adds six times or more to the cost. The NEDOX coating on cast iron adds only about 6% to the overall cost of a 200hp submersible pump, but provides significant cost savings over bronze or stainless steel components.

So the NEDOX coating adds only about 6% to the total cost of the pump!

As an example of the coating's efficacy, Layne coated the top three of 15 stages of its high capacity test pump it uses to test water wells. Their engineer reports that after several well tests, the top three (NEDOX) stages were in good condition, compared to the uncoated stages.

Cures Surface Problems such as Graphitization and Dezincification

Grey cast iron has been the stable and reliable metal used in water well pumps for over 100 years. Because of its low casting temperature, excellent fluidity and casting properties, good machinability, and resulting low cost, it will continue to be the mainstay of the pump industry in the future. The main drawback of grey cast iron is that solidification yields a two-phase metallurgical structure. The components are graphite and iron, with graphite distributed uniformly throughout in a spider web type configuration. This graphite is cathodic to the iron, so in an electrolyte (water), a galvanic couple exists and the iron dissolves. This leaves the inert graphite as the only remaining structure. This is called "graphitization" and the cast iron turns soft and weak without changing dimensions.

According to the engineer, the NEDOX coating completely seals the surface, preventing graphitization of cast iron pump parts and dezincification of bronze and brass parts. Both actions are surface problems.

He explained, "Just about all water well pump corrosion problems and mechanical failure problems can be traced to surface reactions. These include crevice corrosion, pitting, erosion corrosion, graphitization, dezincification, wear, fretting and fatigue. If you can seal the surface, you've got it made. The NEDOX 'synergistic' coating seals the surface with an inert high-hardness material, knocking out these corrosion mechanisms."

One other property of grey cast iron that creates problems under flow conditions is its poor resistance to erosion/corrosion. The flow of water over the surface erodes the "powdery" graphite of the cast iron; deep pits result. NEDOX coating seals the graphite.

Searching for Protection

Layne's engineer searched said he searched unsuccessfully for years for a way to protect downhole pump parts from corrosion. "Porcelain enamel spalls off and is not uniform. Enameling with paint didn't last long. Epoxy coating was tried and it performed a little better. However, when a part gets scratched, a 'holiday' develops, leading to corrosion. A file-hard Nedox coating will not scratch."

He said he first read said he first read about NEDOX coatings in a trade magazine. "We tried it on one pump part and did some hardness tests. Under the microscope, I liked the way it looked metallurgically. We conducted other short term, high concentration tests in acid and chlorine. The surface enhancement coating held up nicely."

Coating Process

Layne has NEDOX surface enhancement coatings applied to both new pumps and to overhauled pumps from many manufacturers. Layne sandblasts the parts to bare metal, then sends them to General Magnaplate's Racine, WI plant for coating. The engineer notes that Magnaplate can also coat parts such as pipe sections up to 10" long. "Very shortly, we plan to have steel pipe columns coated by Magnaplate, to replace the epoxy coating in some wells where the pipe encounters aggressive corrosion."

He reports that "the use of Magnaplate's hard, corrosion resistant coating is not limited to cast iron. It solves corrosion problems on brass, carbon steel, stainless steel, aluminum and other metals and alloys. It can be used on all pump components."