Pump ED 101

The Benefits of Pump Restoration and Coating – Part 2

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The Restoration Process – Before and After

As reported last month, restoration consisted of mechanical refurbishment (replacement of wear rings, bearings and shaft sleeves), sandblasting, application of a metal filler (if required) and two coats of epoxy coating.

Several types of coatings were considered for the project but, brushable, ceramic filled epoxy coatings were the final choice for several reasons. The MCWA wanted coatings that could be applied in house without sophisticated tools. They also wanted coatings with good adhesion and abrasion characteristics. Finally they had to be NSF-61 approved and available at a reasonable cost. The coatings selected for the study were Henkel / Loctite Brushable Ceramic Grey, Belzona 1341 Supermetalglide and Enecon Chemclad XC.

Figure 1 shows a typical pump's internal condition prior to sandblasting. This particular pump is a 600 hp model that was installed in the mid 1980's. As shown, the interior exhibits both surface corrosion and tuberculation. Figure 2 shows a better view of the tuberculation. In certain areas of the casing and cover, tubers were larger than one half inch.

Figure 3 shows the interior of the pump after sandblasting. After sandblasting the surface was evaluated to determine if application of metal filler was required prior to coating. This particular pump exhibited a significant amount of surface pitting and those pits were filled prior to the coating process. Figure 4 shows the same pump after application of the metal filler and two coats ceramic filled, epoxy coating.

Brush On Coating Durability

As the project progressed, one of the most frequently asked questions was "how long will the coatings last?". Hopefully, that question will not be fully answered for many years but, a greater understanding is achieved as time goes on. MCWA tests all of the pumps every six months for performance changes that could indicate premature coating failure. They also remove the upper casings annually and inspect the coating integrity. This detailed monitoring will continue to provide the information necessary to fully answer that question.

Figure 5 is an example of information gained by periodic visual inspection. It shows the interior of a pump cover after four years of operation. At first glance it appeared that the coating was beginning to fail but, when it was examined closely the discoloration was found to be due to "rust staining". The staining was caused by a small portion of the uncoated, machined surfaces between the upper and lower casing of the pump that were exposed to water. The coating remained smooth to the touch and did not flake off at its edges. After cleaning with an SOS pad, (Figure 6) the coating returned to its original, post coating appearance.

Cost Versus Pay Back

The table shown in Figure 7 summarizes the restoration costs, energy savings and payback periods for all of the pumps in the study. It assumes that the pumps operated nearly continuously prior to restoration.

Energy savings are based on a demand charge of $10/kW and an energy charge of $0.085/kWh.

As shown, the estimated total post restoration annual energy savings for all sixteen pumps is $122,190.00 versus a total restoration cost of $101,461.00. The payback period ranges from 0.47 to 2.84 years while the average for all pumps is 0.83 years. The total power reduction exceeded 1.3 million kWh.

Restoration Cost, Energy Savings & Pay Back Period

Pump	HP	Restoration Total Cost	24/7 Annual Energy Savings	24/7 Energy Payback (yrs)	24/7 Annual kWh Savings
Echo 2	600	$12,722	$23,849	0.53	278,411
Echo 3	600	$13,121	$17,904	0.73	202,850
Echo 1	500	$6,999	$7,420	0.94	81,884
Behan 1	300	$8,028	$15,740	0.51	163,015
Behan 2	300	$8,274	$16,462	0.50	172,168
Scribner 2	200	$7,821	$2,976	2.63	41,907
Scribner 3	200	$7,478	$3,909	1.91	50,135
Harris 1	75	$4,043	$3,021	1.34	31,594
Harris 2	75	$4,421	$3,066	1.44	32,170
Morgan 1	75	$4,567	$2,979	1.53	32,309
Morgan 2	75	$4,051	$7,204	0.56	75,085
Riga 2	60	$4,243	$2,586	1.64	29,716
Scottsville 2	60	$3,700	$1,303	2.84	14,959
Woodcliff 1	40	$3,687	$7,905	0.47	91,533
Buffalo 1	30	$4,193	$2,959	1.42	38,416
Buffalo2	30	$4,117	$2,907	1.42	35,065
	Totals	$101,461	$122,190	0.83	1,371,227

Relationship of Specific Speed (Ns) and Efficiency Increase

A European study published in 2001 suggested that lower specific speed pumps would show a greater increase in efficiency after coating than would higher specific speed pumps. MCWA's results showed a similar pattern. Pumps with a Ns between 1000 and 1200 saw an increase of about 12% while those between 2000 and 2500 increased by about 8%. As Ns approached 2800 the increase dropped to about 5% and at 3900 it hit a low point of 2%.

These results may be somewhat skewed since some of the pumps did not exhibit the same degree roughness prior to restoration and a roughness variable was not developed for efficiency comparisons.

Project Conclusions and Recommendations

The MCWA's goal was to prevent or significantly delay the inevitable decline of pump performance due to internal corrosion. MCWA believes that it achieved its goal and their conclusion is that restoration and coating offers multiple benefits including increased efficiency, head and flow. The study showed that sandblasting and coating results in higher initial and long term efficiencies than sandblasting only and, to date, the coatings have shown no signs of failure. MCWA recommends that new pumps be coated by the manufacturer or a coating vendor selected by the manufacturer prior to pump delivery. Internal coating is now a part of their specifications for new and replacement pumps.

There is much, much more to this study than I have had space to present here. If you have questions or would like a copy of the complete WEFTEC presentation, please contact Paul Maier at his email address below.

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