Pump ED 101

The Benefits of Pump Restoration and Coating – Part 1

Joe Evans, Ph.D http://www.PumpEd101.com

Last April I received an email from Paul Maier of the Monroe County Water Authority (MCWA) in Rochester NY. Paul attached a copy of a presentation that he presented at WEFTEC in 2009 and wanted to know if I might be interested in using it as the basis for one of my Pump Ed 101 articles. The subject was a detailed study that quantified the benefits of mechanical refurbishment and internal coating of horizontal split case pumps. After reading it, I knew that the information that it contained could be extremely beneficial to our Pumps & Systems readers. This is the first of a two part series on the study that MCWA performed. This month we will review the steps taken in the study and the overall gains in efficiency due to those steps. Part two will go into more detail about the service steps with before and after photos of some of the pumps. It will also review the energy savings that resulted and the payback analysis for several pump installations.

The authors that contributed to the WEFTEC presentation are listed at the end of my column. Paul's email address is also available in case you have specific questions about the study.

Project Overview

The project was designed to measure the increase in pump performance that resulted from mechanical refurbishment and coating the interiors of horizontal split case pumps (HSC) with brush on ceramic epoxy coatings. It was funded by a grant from the New York State Energy Research and Development Authority (NYSERDA) and began in 2003.

The study included nineteen HSC pumps ranging in size from 20 to 600 hp. Pump restoration was usually broken down into two steps - - mechanical refurbishment and sandblasting & coating. On four pumps a third step evaluated the benefits of coating a pump's impeller.

Regardless of which step was performed first, pumps were reassembled and reinstalled between steps for field testing. The first step was either

mechanical refurbishment (rings, sleeves, bearings, etc.) or sandblasting & coating the interior casing of the pump. Except for the four pumps that underwent step three, impellers were coated during mechanical refurbishment. After field performance testing, the pumps were then disassembled a second time and either sandblasted/coated (if the first step was mechanical refurbishment) or mechanically refurbished (if the first step was sandblasting/coating). Field performance testing was again performed to measure the performance enhancement from the second step of the process. The same procedure was followed on the four pumps that had their impellers coated as an independent third step.

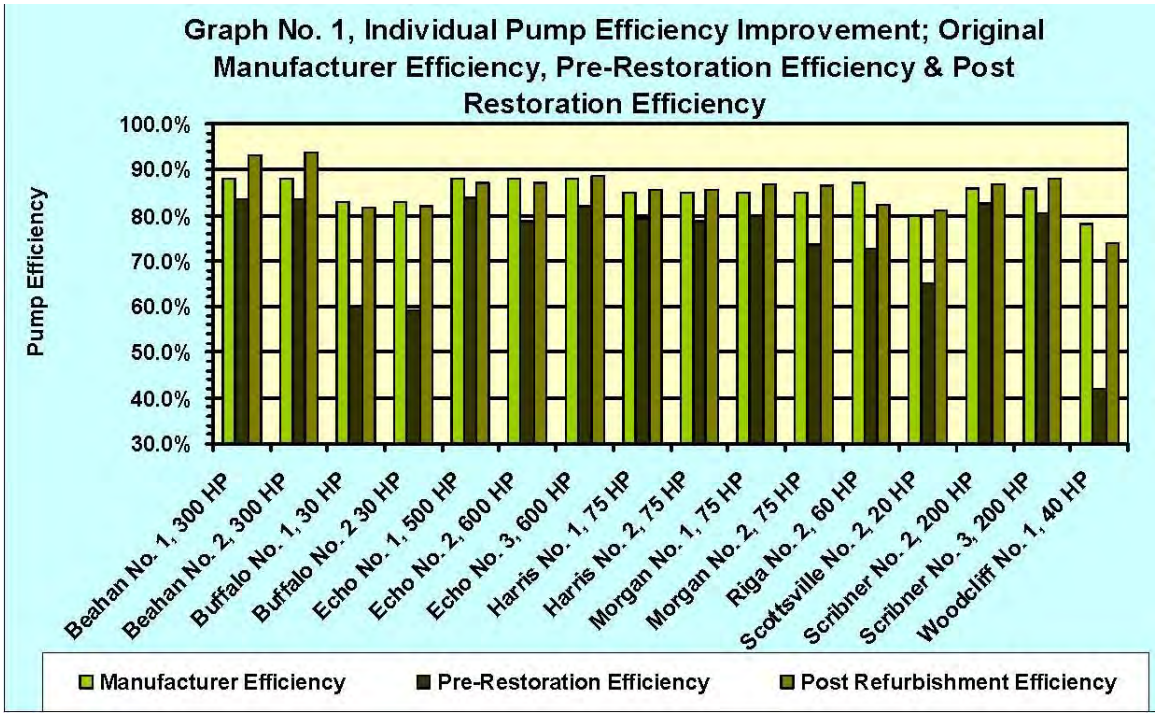
Additionally, three sets of identical pumps were selected where one pump in each set was just sandblasted and left uncoated. The goal was to see if both sandblasting and coating pumps had a greater effect on performance and efficiency compared to just sandblasting. It also allowed evaluation of how quickly the performance of an uncoated pump declined when compared to a coated pump.

Overall Results

The results of the study showed that sandblasting and coating a pump increased efficiency by an average of 6.2% and significantly increased pump head and flow. Mechanical refurbishment increased pump efficiency by an average 5.4%. The average increase in pump efficiency from impeller coating was just 1.5%. The study concluded that regardless of how much a pump's performance had declined over time only 50% of the return back to manufacturer specifications could be achieved through mechanical refurbishment. Restoring the remaining 50% requires sandblasting and coating the interior of the pump.

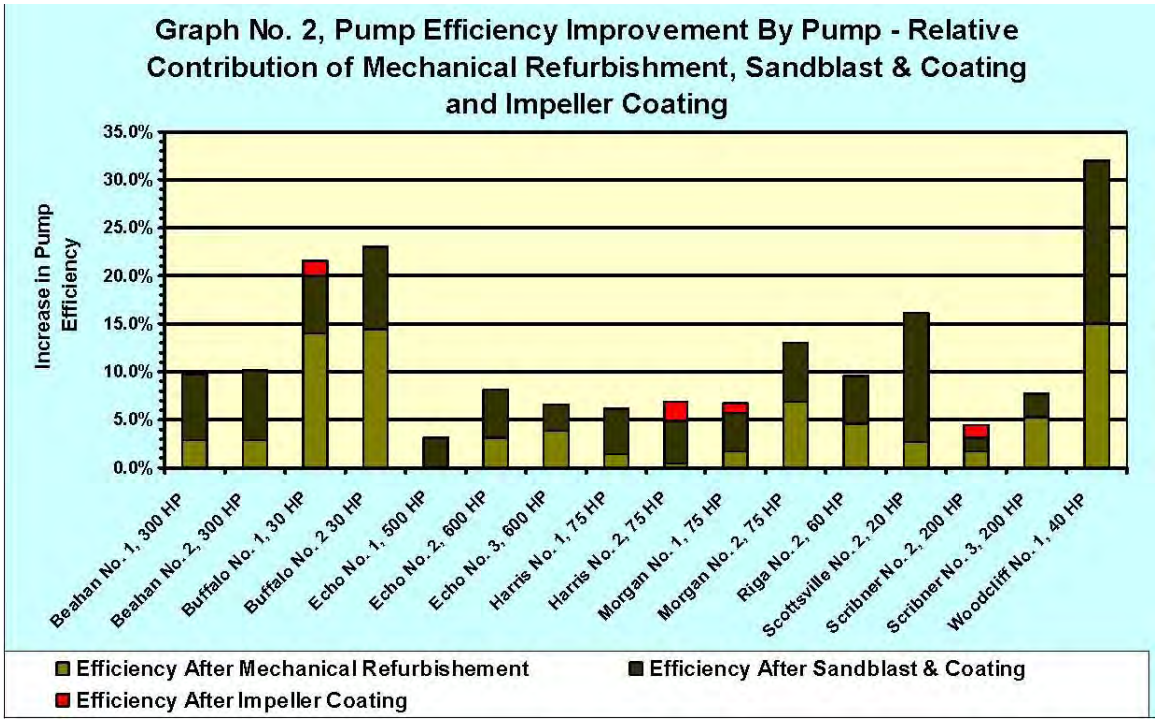
Energy savings estimation from pump restoration revealed similar results. On average 50% of any energy savings associated with pump restoration can be attributed to sandblasting and coating. The energy savings payback period, based on the cost of restoration, for pumps that run nearly continuously is often less than one year. The pump sandblasting & coating comparison to sandblast only showed on average that the sandblasted & coated pumps had initial post restoration efficiencies 5.4% higher than that of the uncoated pumps. Additionally, in two of the three uncoated pumps,

efficiency dropped greater than 4% two years after being put back in service, while the coated pumps remained at more or less their post restoration levels of efficiency dropping less than 1% over the same time period. Subsequent inspections of the epoxy coatings on the inside of several of the first pumps coated has shown that although the coatings are often rust stained, the coatings have adhered well and remain in good shape without any significant signs of failure even after being in service for four years or more.



The graph shown in Figure 1 compares the manufacturer's efficiency, pre-restoration efficiency and the post-restoration efficiency of sixteen of the pumps in the study. All received mechanical refurbishment and sandblasting / coating. Ten of the sixteen had a post-restoration efficiency that exceeded the manufacturer's efficiency and all show an increase over pre-restoration efficiency. These results suggest that sandblasting and coating could be effective on new pumps as well. Even if they did not, coating of new pumps significantly delays the onset of efficiency reduction due to corrosion. On average post-restoration efficiency is 11.6% greater than the pre-restoration efficiency.

The graph shown in Figure 2 compares the contribution of mechanical refurbishment and sandblasting / coating on the increase in efficiency of the same pumps. Four of the pumps also underwent the separate step of impeller coating and were tested before and after the third step. Impeller coating contribution is also shown for those pumps. On average, mechanical refurbishment increased pump efficiency by 5.4% while coating contributed 6.2%. Impeller coating increased the efficiency of the four pumps, tested before and after step three, an average of 1.5%. It is assumed that impeller coating contributes a similar amount to the mechanical refurbishment efficiency of the other pumps shown in the graph.



WEFTEC Presentation Authors

Paul Maier, Randy White, Steve Connell, Chris King, PE & Richard Metzger PE

Monroe County Water Authority, Rochester, New York

Email: paul.maier@mcwa.com

Joe Evans is responsible for customer and employee education at PumpTech Inc, a pumps and packaged systems manufacturer and distributor with branches throughout the Pacific Northwest. He can be reached via his website www.PumpEd101.com. If there are topics that you would like to see discussed in future columns, drop him an email.