Benefits of Dynamic Electric Motor Testing as a Component of Predictive Maintenance

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Predictive Maintenance is the newest "buzz" word being voiced by maintenance engineers and plant operators at many industrial, commercial and even marine facilities. Predictive Maintenance Programs (PMP) includes vibration analysis, oil sampling, thermography, and motor circuit analysis which are all trended on a routine basis with an educated diagnosis of the recorded data. Electric motor circuit analysis includes both static (off-line) and dynamic (on-line) data collection. The cost of organizing, implementing, and maintaining a good PMP is most often offset by the savings realized due to early detection and the ability of the customer to schedule down-time.

Foundation

Suncoast Electric Motor Service, Inc. in Tampa, Florida, offers PMP services to both industrial and marine customers. William Bannar, the owner, has over 30 years motor shop experience and currently serves as the Florida State Director of EASA, the Electrical Apparatus and Service Association. Mr. Bannar uses only the finest quality materials available and has maintained excellent quality control by overseeing all aspects of his business. He surrounds himself with highly trained technicians in all areas and continues to advance his company's place in the market with the latest education and tooling. Mr. Bannar believes in quality and maintains the highest level of integrity by continually upgrading test equipment, attending pertinent training seminars and educating himself and his staff regarding new materials and equipment.

Predictive Maintenance Programs provide Suncoast's customers a unique advantage and distinguishes Suncoast as a full service motor shop. Tracking and trending customer's motors allows for early detection of potential problem areas and permits the opportunity to make needed adjustments or repairs before more severe problems arise.

Case History

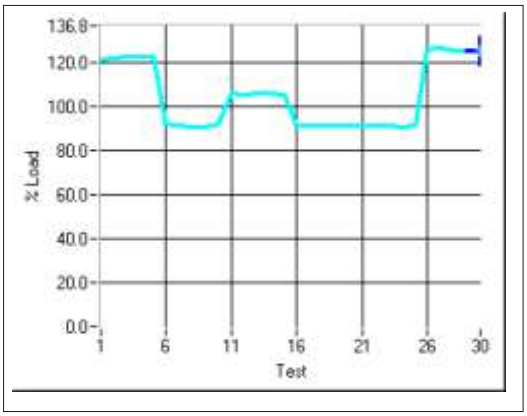
Suncoast technicians have become remarkably successful identifying problem area and assisting customers in adjusting their motors and equipment to operate properly. One large customer, the Hillsborough County Water Department's Wast Water Treatment division has seven major facilities and over 600 remote pumping sites. Suncoast has worked closely with Don Labadie, the Maintenance Supervisor who is currently heading the county's Predictive Maintenance Program, with Tom Vena, Manager, and with many facility SPPOs, operators and maintenance personnel. Mr. Labadie has over 33 years experience in the electrical trade and has spent the past 16 years developing and tweaking the PMP at his facilities. He has accumulated an extensive file on hundreds of motors and related equipment, studying their behavior and operation while trying to improve the consistency of his facilities.

Working with the Explorer for Hillsborough County Water Department, Suncoast technicians found multiple situations that offered cost savings. During routine testing, Suncoast located numerous situations where motors were over-sized, undersized, operating with tremendous harmonic distortion, erratic torques and unhealthy loads.

At one large facility, the technicians tested six continuous duty Internal Recycle Pumps that move incoming materials to various treatment tanks. These expensive pump/motors are difficult to repair. This complex configuration

continually moves the raw materials stored in large storage tanks. Prior to February 2002, these pumps were being pulled for routine cleaning on a quarterly basis regardless of operating conditions. Many failed after less than a year and the rate of failure increased once a motor was rewound and returned to service. A new motor runs over $14,000.00 and Motor Shop repairs often exceeded $5,000.00 each. Add the cost of downtime, the mechanics and electricians and the results are staggering.

The Internal Recycle Pumps were engineered for "clean" water. Once properly cleaned, they would operate at approximately 90 percent load. Inspection found the tanks had large amounts of semi-solid materials that routinely clogged the pumps no matter how much screening and protection was provided. Consequently, the motors became overloaded quickly and often would reach 125 percent load within a week. Solving the root cause of these motors' frequent failures, more stringent and more frequent cleaning was initiated.



The "Load History" charge obtained with the Explorer, covers testing performed on one pump during a four week period. The initial tests, 1 thru 5, found this pump load operating at 120 percent. Immediately after these tests were recorded, this pump was stopped, removed, inspected, cleaned and replaced into service. Test results 6 thru 10 were recorded immediately following the restart and clearly showed the motor operating at just over 90 percent load. Tests 11through 15 were taken one week later and indicated that the load had risen to over 105 percent. The pump was cleaned and tests 16 through 25 prove the motor will operate at near 90 percent load when properly cleaned. Testes 26 through 30 were recorded two weeks later and indicate that the motor was not cleaned the previous week as scheduled.

Table 1: Low (Normal) and High (Over Loaded) horsepower requirements of the six pumps.

	Normal	Over Loaded
Pump 1	13.0	21.1
Pump 2	9.5	18.4
Pump 3	11.3	18.9
Pump 4	12.7	17.7
Pump 5	11.0	15.5
Pump 6	11.2	19.2
Average	11.5	18.5

Note: The Low Hp and High Hp values were taken from recorded information as gathered during routine trending.

The Explorer has captured important data for Mr. Labadie and it has proven to him the need to closely monitor the maintenance schedule for these and all motors at his facilities. He has saved money in operating costs, reduced unplanned outages and the need to purchase new motors to replace failed motors.

A quick estimate on the energy savings for this case study follows: An average loss of 7hp between average load demands of clean pumps compared to the average load demand of the pumps when not cleaned is calculated. At 746 watts per horsepower, we have 5222 watts of lost energy every hour. Multiply that loss times 8760 hours per year yields 45,744 kWh/year. At .07 per kWh the average annual losses per motor is $3,202.00 or $19,212.00 for the six motors. If you consider the damage being conflicted on these pumps by the severely over-loaded condition, the cost of a properly organized Predictive Maintenance Program is easily offset by the resulting savings.

The pumps are still being trended with great success. Failure rates have dropped tremendously and operating costs have been reduced. The cost of two mechanics spending two hours weekly cleaning these pumps easily offsets the cost of repairing or replacing even one pump. Mr. Labadie is very confident knowing the overall cost of implementing and operating his Predictive Maintenance Program is saving the County money and down time.