Alignment Supplies, Inc.

National Distributor For EASY-LASER®

Laser Alignment ROI

Whenever you decide to add a new or an additional tool to your maintenance program, it is important to understand your return on investment. How fast will this tool pay for itself, how can you justify it and how do you start saving money for your maintenance program?

A strategy that can start paying for itself immediately is precision alignment. Precision alignment is a process that ensures that machinery is installed in a precise manner to maximize its operational life. It should be performed on every installation of rotating equipment, no matter how small, no matter how critical.

Precision alignment will lead to reduced maintenance and operational costs, and increased product quality. There are a number of ways that this process will save money.

First, misalignment is the leading cause of bearing failure. Misalignment destroys bearings, seals and couplings long before they reach their life expectancy. When a motor fails (the most likely component to fail) it can cause secondary damage to the driven machine (pump, fan, compressor, etc.), increasing the cost of the failure as much as 10 times.

Here's a quick formula:

Motor repair + bearing replacement + seal replacement + coupling replacement + damage to driven machine + reinstallation = $???

Add to that the cost of the downtime associated with the failure!

Add to that any product that had to be scrapped!

How much does a precision alignment cost at the time of installation? Prevention of one major failure will more than justify the cost of precision alignment tools.

According to a report published in the Journal of the Technical Association of the Pulp and Paper Industry (TAPPI), "precision alignment resulted in extending bearing life by a factor of eight in a large class of rotating machines. Other reported benefits were a seven percent savings in overall maintenance costs and a twelve percent increase in machine availability. Machine breakdowns attributed to misalignment were cut in half."

Precision alignment also reduces vibration in the machine. Excessive vibration can result in early machine failure and, sometimes, poor product quality. That results in production

material being scrapped. Vibration can affect the quality of paper and steel due to hammering of misaligned rolls.

We also stated that every installation should be aligned as part of a best practice, so what if the failure did not cause any downtime? Every time a machine fails it causes the maintenance team to be pulled into a repair that might have been avoided. How many small machine failures to you have per year? How many were aligned at installation? How many could have been avoided, saving time and money for predictive and preventative maintenance tasks?

Will precision alignment eliminate all of your machine failures? Of course not. But it will improve your odds by over 50%.

So, you've heard all of this before. Alignment saves bearings, seals and couplings. How else does precision alignment help me save money?

Motor efficiency in a precisely aligned machine increases. Increased motor efficiency equals less power equals lower energy bills for your facility. At today's energy prices, those savings can be significant. Precision alignment ensures the smooth, efficient transmission of power from the motor to the driven machine. Stresses inside a misaligned machine are caused when it to pulls against pipes, ducts, hold down bolts, etc. These stresses are transferred internally to rotors and stators causing more energy to be used to turn the motor.

Let's look at the energy cost savings from a precision alignment program. The US Department on Energy has calculated the amount of energy savings for motors from a 1% improvement in efficiency. You can see that these numbers are based on a cost of ~.05 per kWh. According to the US Energy Information Administration the average cost of an industrial kWh in the US is 7.42 cents and it's as high as 15.25 cents in some states. How many of motors do you maintain? Do your own math. How much could you save each year if you could get 1% more out of every motor. Based on these numbers, every motor, regardless of size or criticality, should be aligned to ensure optimum efficiency. Alignment is not the only way to increase motor efficiency. Visit the Department of Energy's Best Practices web site to learn more.

Table 1. What is an extra point of motor efficiency improvement worth?

	Full-load motor efficiency (%)		Annual Savings	
Horsepower	Original Efficiency	Final Efficiency	Annual Energy Savings (kWh)	Dollar Savings ($)/year
10	89.5	90.5	605	$ 30.00
25	92.4	93.4	1,420	$ 71.00
50	93	94	2,803	$ 140.00
100	94.5	95.5	5,431	$ 272.00
200	95	96	10,748	$ 537.00

Note: Based on purchase of a 1,800 rpm totally enclosed fan cooled motor with 8760 hours per year of operation, 75% load and an electrical rate of $0.05kWh.
DOE – Motor Systems Tip Sheet #3 – September 2005

The savings from 20 200 horsepower motors will more than pay for precision alignment tools in the first year!

Now we can look at some actual cases where alignment saved energy dollars from day one.

This is a case study that was performed by Damalini, Inc. The motor was found to be aligned to within 25 thou. The amp draw in this state was measured at 12.2 amps. The motor was aligned to within 2.5 thou and the amp draw was then measured at 11.8 amps – a 3.28% power reduction. It doesn't sound like much, but just a 1% overall improvement in energy consumption, this plant could save almost $6000.00 in energy costs – more than enough to justify the purchase of laser alignment tools.

Plant Size	1180kW
Cost of Power (2001)	$ 0.0566
Machine Operating Time	24 X 365 = 8760 hours/year
Total cost of power in 1 Year	1180 X 0.0566 X 8760 = $585, 063
Power savings	11.8kW

This next application was undertaken by Benchmark Maintenance. Benchmark was asked to align a long jack shaft on a cooling tower at a steel mill. The shaft was found to be grossly misaligned and drawing 174 amps. After the alignment was complete, the current draw was measured again and had dropped 19 amps to 155 amps – an improvement of over 10%. This cooling tower runs 24/7 for half the year. This plant was able to save 78,735kWh. At .07 per kWh, that's a $5,500 cost savings for one machine. Better yet, the carbon footprint for this plant was reduced by 54 tons of carbon dioxide.

Cost of Power (2007)	$ 0.0700
Measured power drop	19 Amps
Machine Operating Time	24 X 182.5 =4380 hours/year
Power savings per year	78,735 kWh
Cost Savings per year	$5,511.44

Once again, we have enough power savings from one machine to justify precision alignment tools.

Precision tools can be laser alignment tools or dial indicator kits. Both can do the job. Laser alignment tools have the advantage of being easier to teach and learn, so more of your maintenance staff can use them more often. Laser alignment tools also have the advantage of being less prone to (human) error. You can perform precise alignments with dial indicators, but not without a lot of training and experience.

Now you know the some of the justification and ROI for a good precision alignment program. It's time to start one or grow the one you have!

References:

DOE Best Practices
http://www1.eere.energy.gov/industry/bestpractices/

Damalini, Inc Sweden
http://www.damalini.com/Home-622.aspx

Benchmark Maintenance Services
http://www.withinspec.com/

Energy Information Administration
http://www.eia.doe.gov/cneaf/electricity/epm/table5_6_a.html

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