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Is shaft alignment still a source of problems for your rotating equipment? With all of the tools, technology, and training sold in the past decade, why are there still a large number of equipment component failures that can be traced directly to poor alignment practices?

This article will identify some of the sources of the problem and offer a few suggestions as to how to dramatically reduce the reoccurrence of failures due to misalignment.

Pre-alignment preparation

The amount of time spent going through a pre-alignment checklist directly affects the longevity of the equipment. Lists may range from a single sheet of paper with 10 items used at a wastewater treatment facility to a 100-pg document at a nuclear power station. It is important that each item on the list be addressed before attempting to perform an alignment on any piece of rotating equipment.

Soft foot correction

This is the most overlooked step in preparing to perform an alignment. If this step is neglected, hours can be spent trying to achieve the alignment tolerance required for the equipment. Time spent here will greatly speed up the alignment job and will contribute to the life of the machine.

Soft foot has been called machine frame distortion, coplanar correction, and several other names. The bottom line is that if *all* of the feet of *both* machine components do not rest firmly on the top of the baseplate, when the hold down bolts are tightened movement occurs.

The issue of torque wrenches also needs to be addressed. If craftspeople are spending an inordinate amount of time working on alignments and are getting frustrated with those moves that calculate out to add 0.005 in. and then remove 0.006 in., it is probably a good time to invest in a couple of good quality torque wrenches. If consistency cannot be achieved when tightening bolts, a lot of time and money is wasted.

Hardware setup

After each point on the list has been examined and all corrective action has been completed, alignment hardware can now be attached. It is always good practice to make sure that the tool is ready to perform its function. When using dial indicators, make sure the stem moves smoothly in and out, the bezel turns, and it is easy to read. If it is possible, bring an extra one along to the jobsite. Accidents do happen.

When using a computer- or a laser-based system to assist in obtaining measurements and calculating the needed corrections, make sure the batteries are in good condition and are fully charged. Dead or leaking batteries can cause serious problems and make the job take longer to complete.

Check the chains, rods, nuts, thumbscrews, etc., for rust and freedom of movement. Some of these tools sit on the shelf for long periods of time between uses. A quick shot of lubricant can help avoid a stuck or cross-threaded part.

Make sure to collect all the accessories and tools needed before going out to the jobsite. If the method or system has not been used for a while, make a quick review of the correct procedures. It can save a lot of time and frustration in the field.

While in the process of taking readings, make sure the readings are repeating. If the values are changing every time a set of readings is taken, there may be a problem with the hardware, in the bearings, or in the coupling. In addition to being repeatable, the readings also should be reproducible. Measurements should be reproducible to within 0.0005 in. to instill confidence in the installation. If they are not, a deeper investigation needs to be made as to the cause of the inconsistency.

Use the proper tools the right way

After obtaining a set of readings and determining that corrective action is required to achieve proper alignment tolerances, use the right tools.

When vertical corrections are called for, use pre-cut shims. Most shims available are made to close specifications and generally measure to within a half thousandth of the thickness indicated on the shim. It is always a good practice to check the shim before

inserting it under a foot to be sure it is the correct thickness and to insure that one shim is not stuck to another, especially when using thin shims.

When raising the machine to insert shims, be careful. Personal safety is more important than anything else. A prybar can slip out from under the foot or the case and cause an injury. Parts can break off or bend. Lifting the machine with a chainfall or hoist is better. Hydraulic rams or mechanical jacks also can be used to lift or move the machine.

Horizontal movement of the machine is easier, but there are some things to watch for. If there are jackbolts present on the base of the machine, check to make sure they are lubricated and will turn smoothly. The bolts may be rusted in place and could require the use of a tap and die to restore freedom of movement.

Maintaining control and accurately measuring the amount of movement are essential. It is difficult to make precise moves with a sledgehammer, not to mention what that might do to bearings, seals, and couplings that were not designed to take heavy impacts or shocks.

Documentation

Always keep a record of the alignment work done. It is a good practice to record a set of as-found readings before making any corrections on the machine. After the alignment has been completed to within the manufacturer's or the facility's tolerances, make and keep a set of "as-left" or final alignment readings. These can be used the next time an alignment check is performed to see if any movement has occurred. A documented history of the work done on a pump and motor can be valuable in determining the life expectancy and overall operating condition of rotating equipment.

Record keeping forms and charts are available from most manufacturers and distributors of alignment hardware. Some have software packages that work in conjunction with their systems to provide a record of alignment jobs. Others also have the capability of downloading directly to a printer or to a personal computer to assist in generating documentation for future reference.

There are also several good maintenance management programs available that provide

space for documenting alignment information along with vibration, infrared, ultrasonic, and lubrication analysis information.

The final argument

What is the response to "But you don't understand the people I work for. They will never give me the time to do all the things you have talked about."? Do the best possible job with the tools available, the level of knowledge available, and the amount of time given to perform the task. Most likely there will be the chance to work on that particular piece of equipment again in the not-too-distant future. For each opportunity, correct as many of the problems as possible and eventually everything on the list will be corrected. **MT**

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