ESTABLISHING YOUR OWN FIELD BALANCING GROUP

by

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Why would a company want to establish its own balancing group? You will have to answer that based on your own company's situation. Depending on how involved you wish to become, doing your balancing may be less costly than contracting an outside consultant to do it for you. You should be able to have the group organized so that they can offer you faster response time than waiting for experts to be imported when you are waiting to get a critical piece of machinery back on line. Over a period of time, your balancing group should be able to establish and maintain a history of a machine's performance which may not be otherwise available. Because those technicians and engineers also "own" that piece of equipment, a pride of ownership can develop where those working on it realize that it is their own careers and reputation at stake. Your own balance group has a limited market for which they have to perform well or lose their positions.

Let us assume that you do not currently have your own balancing crew. You have done an economic survey of what your consultant costs have been over the past few years and based on your anticipated needs, you have justified dedicating manpower and capital dollars to get into the balancing business. There are many types, brands, models, and configurations of equipment available on the market today to help your new crew get out in the field and balance your rotating equipment. Do not underestimate the capabilities of the more basic units. A balance instrument that can be used to trigger a strobe light and tell you the vibration amplitude through a transducer or pick-up will get your crew started. In fact, that type of instrumentation is often the only thing carried by contractor crews who have to travel light to some far off oil rig or pumping station. Within your own plant, a vast majority of machines can be balanced using that same instrument.

As your needs and capabilities become more sophisticated, the instrumentation is available to fill your needs. "Tracking filters" or "vector filters" are available which can electronically lock onto the dominant vibration frequency, and when coupled with a once-per-turn electronic signal or "keyphasor," the tracking filter can give you amplitude and phase readouts directly without having to read phase marks on a shaft with a strobe light. Tracking filters are especially convenient when used with permanently mounted vibration pick-ups such as eddy-current probes attached inside a bearing cap or machine case. It allows you to obtain vibration information that may not otherwise be accessible when the machine is running.

Other instrumentation will help verify and document your balancing work. An oscilloscope is a fundamental way of confirming your progress. A popular way of viewing the balance problem is to look at the shaft "orbit" within its bearing. This is done on the oscilloscope by setting up the horizontal eddy-current vibration signal on a bearing versus the vertical vibration signal on the same bearing. The resultant trace is representative of the shaft movement within the bearing.

Tape recorders can be used to document the response of the rotor as it comes up in speed to running condition. If all the information is not determined during the start-up or shutdown, it can be replayed — through an oscilloscope, a spectrum analyzer, or a tracking filter — until you have reduced the data to fit your needs. Photographs can be taken or an X-Y plot of the data can be made on a plotter for documentation.

Of course, none of this equipment is going to do your company any good unless you have some competent people to operate it who are dedicated to minimizing the unbalance on your rotating machinery. An ideal background for a vibration technician or engineer would include some experience working on the machinery they are asked to balance. It requires a good understanding of basic math principles and logic to understand unbalance and know how to correct for it. Many times in the field, meticulous patience and thoroughness are required to be sure that the complete data set has been obtained correctly during the trial runs.

With this background, your vibration crew will still need some formal training and the opportunity to gain experience. The training can be done in-house or accomplished at any of the well presented formal seminars held periodically by equipment manufacturers, educational institutions, professional societies, or engineering consulting services throughout the country. The experience can be gained in the lab by working on rotor kits to simulate unbalance problems or in the field by starting on the less complicated rotor systems — perhaps a motor-pump system that the production unit can afford to let your crew start-up and shutdown conveniently to try their correction moves.

Just as important as having the proper instruments to do their work, your crew should have different balancing techniques in its repertoire to call upon as needed. Among these techniques should be:

1. How to balance without phase. This is a multi-run balancing method that is seldom used today, but can be indispensible if you have an instrument failure in the middle of nowhere and have no means of obtaining the phase angle of the unbalance. If the instrument were to fail completely, some balance improvement can be made with the "piece of chalk" technique.

2. Single plane balance. This is the easiest method available with today's instrumentation and applicable in many situations. Be sure your crew understands the logic of why balancing corrections work — i.e., can they plot the elementary vectors to make their corrections or are they dependent on a programmable calculator?
3. Two plane or multi-plane balancing. This method is finding wide use today especially with canned programs available on pocket calculators which eliminate much of the error and save time between correction moves. Multi-plane balancing finds application on rotors which must maintain a good balance tolerance throughout a defined speed range.
4. Balancing with polar plots. Use of the phase and amplitude of the vibration during start-up also helps pinpoint problems with rotors that misbehave as they turn through critical speed ranges.

The other thing that every balancing crew must have is a good safety attitude. They must be consciously trained in how to work around rotating equipment. For all the machinery your plant has in its production facility, most people don't go near any of it unless it is shut down to be worked on. The balancing crew has to be right on top of it while it is running — especially on units that don't have permanent intrumentation. While your company may require much stricter guidelines, at least consider these few common sense safety areas:

1. Do not allow the crew to work around running machinery with loose clothing or long hair.
2. Do not allow them to wear rings or gloves which might get caught.
3. Be absolutely sure that instrumentation cables and power cords are routed so that they won't catch or be blown into the rotor, or contact hot surfaces such as machine cases or piping.
4. Require all personnel to stand clear of being in-line with bearings, rotors, and impellers during start-up when centrifugal force could shatter components and throw off projectiles.
5. Make provisions to guarantee that when a unit is shut down for balance corrections that there is absolutely no way that it could accidentally be started while the balance crew has their hands and bodies in the way.

You now have the basis of a well-equipped, well-trained, safety-oriented balance crew, and you have a machine out in a production unit that is about to shake off its foundation. What is the first thing they should do? DETERMINE IF THE PROBLEM IS UNBALANCE!

Just because you have a permanent monitor on a machine train and the vibration goes up so high that an alarm sounds in the control room, it does not mean that the balancing crew can come in and take care of all your trouble. However, that same crew — equipped with the same instruments and some additional training — is not only expert at balancing, but also vibration analysis! By analyzing the vibration signals, they will be able to narrow the possibilities of what is causing the vibration. Misalignment, bent shafts, loose components on the shaft, bad bearings, loose metal on an armature, poor lubrication, unstable foundations, and incorrect clearances are just some of the possible problems along with unbalance that can cause a machine to vibrate. Your vibration crew, working with the maintenance machinists, operators, and engineers can determine what the problem is.

If the problem is unbalance, there are still some criteria to be met before the vibration crew can be of any help:

1. The machine must have a firm foundation.
2. There cannot be any loose parts on the rotor.
3. There must be a place on the rotor where correction weight can be added or removed. It would help tremendously if there was access to the shaft to determine the phase angle of the unbalance — either visually or electronically.
4. The vibration crew must be able to have the machine shut down. That might seem obvious, but it is surprising how often a production unit will determine that they cannot afford to stop a machine long enough to make balance corrections.

Your vibration crew can be even better utilized. Besides diagnosing problem machines and making balance corrections when appropriate, the crew can take routine surveillance measurements on all your critical machines, even the ones that are not vibrating badly. The technicians can maintain documentation and establish a baseline of a machine's vibration history. By periodically comparing new data with the baseline, the vibration group can warn the production plant of upcoming problems. Plotting these periodic data thus provides a manual trending of the machine's performance history.

The vibration analysts can train the plant maintenance personnel in identifying problem machines and determining which ones might need permanent monitoring. They could suggest particular instrumentation and help in its selection along with making sure it is installed correctly on the machine. They could continue to be a clearinghouse for this type of information and stay up to date on technological developments.

The question should not be whether you can afford to start your own balance crew, but whether you can afford to be without your own vibration analysts — knowledgeable in machinery diagnostics and possessive enough to want your company's machinery to run as long and as reliably as it can.