Rotating Machinery Balancing – Why And How To Do It

In a previous editorial we looked at the importance of balancing rotating machinery (motors, pumps, fans, mixing vessels etc.) To summarise, unbalanced machines require a lot more energy to run and at the same time cause damage to their bearings. Essentially, by running machines that are out of balance, not only are you unnecessarily wearing out your bearings faster, but you are also paying EXTRA to do that!

But how do you know when a machine is out of balance? Basically, you will see a high level of vibration at the machine's running speed. But what constitutes a high level of vibration? Fortunately, the International Standards Organisation (ISO) has drawn up a set of guidelines for acceptable levels of machine vibration. Modern low-cost vibration analysers like the TPI 9075 Bluetooth Wireless Smart Vibration Sensor (pictured) are available, pre-programmed with the ISO levels, to give a traffic light system of colour coded vibration readings. Basically, if it's in the red it needs balancing!

There are two techniques commonly employed in balancing. The no-phase balancing technique (a.k.a. the 4-run method) allows you to approximately balance a machine by using a series of four runs, three of them with a specified trial weight attached to the rotor. The sensor (e.g. TPI 9075) attached with a magnet, stays in the same place for each run. By positioning the trial weight around the rotor's circumference in 120-degree increments and measuring the resulting vibration, the balancer software can automatically calculate the location and equivalent weight of the "heavy spot" around the rotor's circumference. It then calculates what weight, and at what position, will re-balance the motor, pump or fan. This is then done either by adding the weight to the rotor at a position opposite the heavy spot or sometimes easier still, by drilling holes to remove the equivalent weight adjacent to the heavy spot. The balancer software can also calculate how deep to drill for any given drill bit size.

For machines that require more precise balancing or for dual-plane balancing (e.g. for longer rotors that need to be simultaneously balanced at both ends) we require more precise measurement of the unbalance. This is done by providing a reference position on the rotor's circumference, known as a "key-phasor" input. Often this can very easily be obtained from the machine's tacho signal or alternatively, simply by affixing a piece of reflective tape to the rotor and using a low-cost laser tacho (e.g. TPI 505L) to give a reference pulse, once per revolution. This reference pulse is then used by the balancing software to more accurately determine the location of the heavy spot around the 360 degrees of rotor circumference and calculate precisely how to counterbalance it.

It doesn't take very much to unbalance a machine, e.g. dirt build-up on fan blades or a chipped pump impeller. Thankfully, it also doesn't take much to re-balance it either, provided you have the right instrument. These days that's not a problem, as simple to use, low-cost, precision field balancers are now available that take you through the process on an easily followed step-by-step basis. For example, TPI's Ultra App is now available for use on smartphones or tablet PC, with both no-phase and single/dual plane key-phasor balancing. For the latter, the 3-channel TPI 9043 Wireless Vibration Analyzer with included TPI 505L laser tacho (as pictured) can be used with the TPI Ultra App to precisely re-balance the motor, pump or fan.

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