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Shaft Keyways and Keys – Do they affect balance and vibration?

The answer is yes, they do. I'm sure you've done it, as we all have. Since there appears to be no reason to use a key that's 6" long for a coupling that's only 3" long, we'll just cut the key in half. That way we'll have a spare for another motor, or another time. The manufacturer has to provide a key that long in case we have a coupling that long. Sounds reasonable, right?

Unfortunately, this is one of the more common mistakes we make when placing a motor, or other rotating equipment, in service. Yes, the manufacturer provides a key which is that long in case you have a coupling which is that long. However, that also means the rotating assembly was probably balanced based upon the use of this length of key.

So, does that mean we should just use the same length of key as the one that came with the motor? Well, not necessarily. Consider this: If the rotor was properly balanced, it will have been balanced with the keyway filled, but not with a full sized key. For example, a rotor shaft with a 7/8" wide X 6" long keyway will be balanced with a 7/8" X 7/16" X 6" long key. It's what we call a half key. In other words, the rotor is balanced as if it has no keyway at all.

Couplings and pulleys are also balanced as if they have no keyway at all, using a similar procedure. Taking all of this into consideration, we then have to make sure we use a key which, not only is the proper size, but also the proper length. Otherwise we can cause an imbalance which creates damaging vibration levels in the rotating equipment.

Let's look at a recent case as an example:

A 150 Horsepower, 1800 RPM motor had to be cleaned and reconditioned, including balancing the rotor. Initial set up in the balance machine was performed based upon the use of a 3" long 7/8" key, which is what the customer was using.

The unbalance condition was as follows:
Shaft end: 3.71 mils @ 185 degrees.
Opposite end: 2.51 mils @ 350 degrees.

Here are the results based upon the use of a full length (6") key, without making any other adjustments:
Shaft end: .03 mils @ 242 degrees.
Opposite end: .4 mils @ 255 degrees.

As you can see, this completely solved the unbalance problem.

We also must realize that if our coupling is only 3" long, and our keyway is 6" long, we can't effectively use a 6" key either. We must adjust the key length based upon the amount of unused keyway. So, in the above case the unused keyway is 3". Half of that length, or 1.5" should be removed from the key.

Disclaimer: The above procedure only applies if the rotating equipment has been properly balanced using industry standards.

Do you know what standards were used in the manufacture and/or repair of your rotating equipment?