**BALANCING TIP # 104**

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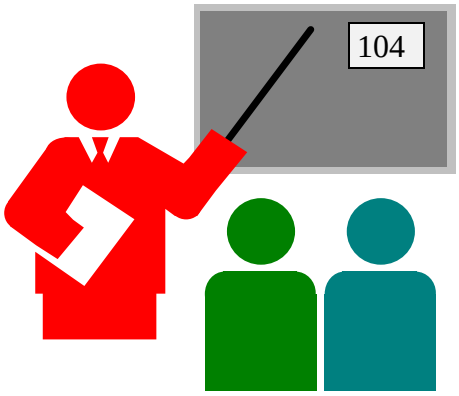
## REDUCING THE NUMBER OF BALANCING RUNS WHEN REMOVING WEIGHT BY GRINDING




One of the most time consuming segments in balancing a rotor happens when weight needs to be removed by grinding. The enclosed Tip will help in reducing the number of balance runs required. If the metal being removed is different, but similar to the examples, chose the closest like metal, or better yet, look up the density of the specific metal and use the formulas provided.

The most time consuming method of weight correction is when weight needs to be removed by grinding. All other methods allow for weighing correction weights or calculating depth of drilled holes. Since grinding doesn't begin with a measurable quantity, this results in a considerable number of balancing runs and extended time to balance. The following Tip can reduce the number of corrections runs in half by presenting a meaningful starting point for weight removal. Examples for several different metals are shown. The formula and techniques that are used in this Tip can also be applied to other metals or composites by securing their density in ounces/cubic inch.

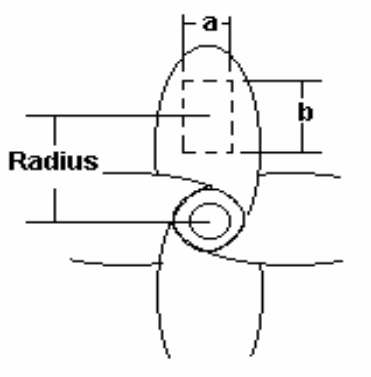
## DISCUSSION

When correcting for unbalance in a rotor by removing metal by grinding, the normal approach is to say "let's grind a little off and see what the new readings are". This procedure is followed on the second, third, fourth and more runs until finally the unbalance tolerance has been met. Unfortunately, weight removal by grinding is difficult since there is no measurable quantity for the metal removed but there is a better starting point that can reduce the number of correction runs.

The density of various metals and their composites can be found in many Engineering Handbooks. The following are some of the more common ones.

| METAL | DENSITY |
|---|---|
| Aluminum | 1.5815 ounces/cubic inch |
| Brass | 4.866 ounces/cubic inch |
| Cast Iron | 4.16 ounces/cubic inch |
| Copper | 5.1364 ounces/cubic inch |
| Steel | 4.5056 ounces/cubic inch |
| Titanium | 2.592 ounces/cubic inch |

These numbers can be used in the following examples as we correct on one blade of a multi-bladed impeller as shown in the following sketch.




**STEP 1.**
After the weight callout is recorded on the balancing machine instrumentation, sketch an area on the blade where weight can be removed. Measure the length and width of the area and record. a = _____ inches b = _____ inches.

**STEP 2.**
After sketching the area, adjust the radius of correction to the center of the area sketched. This will change the correction weight callout on the balancing machine instrumentation if the radius is different from the setup radius. If the instrumentation does not adjust after initial setup, make sure the radius entered at the beginning will be the center of the grinding area.

For instrumentation utilizing calibration weights rather than dimensions, make sure that the calibration weights have been added in the center of the correction area.

**STEP 3.**
Assuming that the fan is Aluminum, the weight callout was to remove 1 ounce and a = 2 inches and b = 4 inches, then;

$$\text{Depth of grind(c)} = \frac{\text{Weight to be removed}}{a \times b \times \text{Weight of Aluminum (oz/cu.in.)}}$$

$$= \frac{1 \text{ ounce}}{2 \times 4 \times 1.5815}$$

= .079 inches or a little over a 1/16”

This approach is also helpful to judge the area needed for removal of metal. For example, if 1/16” depth was not acceptable, then the area for grinding would need to be expanded.

If all the calculations were the same, except that this example was a brass pump impeller then:

$$\text{Depth of grind} = \frac{1}{2 \times 4 \times 4.866 \text{ (See above)}}$$

= .026 inch or a little less than 1/32”

Keep in mind that this Tip is to reduce the number of balancing runs when grinding is the means of correction. It is not meant to provide for correction in one run. This approach has reduced the number of correction runs required by one half.

Also, there are many different composites and other metals that have densities different than the standard ones provided. When the densities are available, use them for improved accuracy.