



On the bottom of the slide is an example of this formula being used on a stock 350 Chevrolet V8, 70lb crankshaft that runs at 5,000 rpm, so we have the tolerance in ounce inches is equal to 2.4 times the 70lbs times 16 ounces divided by the rpm which is 5,000. The exact answer is .5376 ounce inches or equivalent to .5 ounce inches total tolerance. If we are doing a two plane job, we just divide by 2, depending on what kind of machine you have. We do know by experience that usually stock engines are balanced down to .5 ounce inches per plane and that racing engines should be .2 or .3 ounce inches per plane. We can always go back to the above formula and prove our tolerances.

On our next subject, what about the shop you're competing with a mile away. He claims that he zero balances all his work and he has the latest high tech machine, is that possible, zero balance? I just want to say that we always have unbalance left, .01 ounce inch, .001 ounce inch, .0001 ounce inch. What we want to do is quality work as stated before. Figure out the weight of the part, the speed it runs and bring it down to the proper tolerance.

Last I just want to briefly touch on how to check your machine to see if the calibration is correct. This is not a standard calibration arbor, it's just something that most

automotive shops can do to check their machinery. We can take this next slide showing a standard automotive flywheel. On a flywheel arbor this will give us a good indication of what the machine should be reading, (before you mount your flywheel arbor be sure the tooling is down to a low tooling tolerance), about .1 ounce inch or lower and as I've shown on the slide follow the dimensions and add the normal weight. I really think this is very important, we all get very busy, maybe 2-3 men running the shop or just yourself and it's just a real good thing from time to time to either have the shop foreman or owner take the time to check the machine especially if it is being used a lot. It is just a good procedure to set some time aside, even once a month take a look at your machine and make sure that everything is in good working order.

John Bianchi, do you want to finish now?

I think many of you have seen this example before. This is done with a $\frac{1}{4}$ of an ounce or 7 grams at 4 inches from center, about the same size as a counterweight on a Chevrolet crank. At 2,000 rpms, 7lbs trying to get out of that engine, trying to get away from that crankshaft, 4,000, lbs and it goes up from there. Most of us know that we are not going to turn that automotive engine 8,000 rpms for practical purposes but, it is a great example because on the industrial side you are going to run into items that are going to run 18-20,000 rpms, and the same rules apply depending on the weight and the rpm.

I think one of the greatest services that we could provide to the membership is understanding how to achieve tolerance. So often a customer will bring a rotor into one of our shops and we will accept it and balance it and we will maybe take it to .5 or .2 $\frac{1}{2}$ thinking we are doing the right job. Often the job is correct and will run well, but how much time did we waste in the meantime. If we had taken the weight and the rpm and use the formula that Gary showed us and is available on the handouts when you leave, maybe that only needed to come down to .8 or .9 and the rest of the time you're just entertaining yourself and you are not giving your customer back anything better than the original .8 would have given him. Maybe we could entertain some questions and go along that line.

Questions

- Q. One of the most common questions I get is when I take off my crankshaft and remove the bob weights and put it back on, and they don't repeat exactly on your machine?
- A. You finish the job, you take it off your machine and you rotate your bob weights to 180 degrees and what we are showing is just so important is that everybody would love to have beautiful perfect tooling. I have seen from racing, take Mazda, they may spend \$50 dollars on a set of bob weights and they are so precise you could do that. All the manufacturers that make bob weights, make them as best as possible within the confines of the cost.