Run Out Sources & Corrections

The Musclechuck has several advantages over other quick-change chucks that will become apparent once this article is reviewed. However, first I would like to discuss run out and the proper mounting of the Musclechuck.

Mounting the Musclechuck might seem a little tedious at first but if the procedure is followed it will minimize run out. There are many contributing factors that cause run out such as, imperfectly ground spindle, worn bearings, high and low spots in plating, chuck bore size, chuck clamping technique, and finally, quality of machined parts. Mounting a solid chuck instead of a collet is slightly more critical because the chuck doesn't conform as well to the defects that might be present in the spindle. Older spindles or ones that have been used a lot don't usually suffer from this problem as much as new ones because over time the spindle will wear down and thus become more concentric. Just perform this simple test, remove and replace your standard collet and indicate the run out with a dial indicator, you might be surprised with the results. In order to minimize run out, mount the Musclechuck in the router spindle tighten the nut to no more than 12 ft-lbs. If you don't have a torque wrench, Finger tighten the nut until its snug. Then use a wrench to tighten it no more than a quarter of a turn. That should get you fairly close. Place a small cutter in the Musclechuck then set up a dial indicator to measure the run out. Rotate the spindle and record the run out. With a magic marker put parallel marks on the body of the Musclechuck and the router spindle. Next loosen the nut and rotate the body of the Musclechuck 90 degrees and again finger tighten the nut. Check and record the run out. If the run out again increases, rotate the body in the opposite direction and continue to check the run out. If the run out begins to decrease, continue to rotate the body in that direction. With decreasing amounts of angle, continue to repeat this procedure until a minimum is found. Then mark the body and spindle so that the next time the Musclechuck is removed and replaced finding the point of minimum run out will not be as tedious. If high accuracy is required, this procedure should be follow every time the Musclechuck is used. I have performed this procedure on many different routers and each one of them yielded different results. I have found that the larger the spindle taper angle, the more critical it becomes to use this procedure.

If one would purchase a device with a very high quality spindle it would be very expensive. Unfortunately, all of these routers are mass-produced and although they are very good, their spindles are not perfect. Usually the spindles contain high and low spots in the ground surface. So, when mounting a collet and then a tool in the collet that extends out two or three inches beyond the spindle, run out can occur. The smallest defect in the spindle can lead to significant run out. I have had to sand the taper of some router spindles in order to get the standard collet to repeat when mounted in the spindle. This doesn't occur all of the time because some routers are produced with higher quality than others.

Worn bearings can cause not only run out, but in some cases, severe vibration. Many years of use spinning long cutters with heavy side loads is the usual cause for the ware.

When using larger diameter cutters you can use the same procedure to find the angular point of minimum run out with the cutter itself after the Musclechuck has been mounted. The main cardinal rule is, the more connections that are made, the more run out that can occur.

The Musclechuck has an electrolysis nickel coating. This not only protects against corrosion but puts a hard coating on the Musclechuck to prevent abrasive wear on its exterior. However, plating is not an exact science, there are many parameters that can allow an uneven layer to be deposited on the metal surface. We are only talking about .00005 inches at the most but this can lead to some run out. The coating also protects the conical surface against wear so it remains accurate. However the more it is mounted, the flatter it will become due to ware and thereby reduce the high spots.

The bore size has to be able to accommodate several shank sizes. Most ½ inch tool shanks can measure as small as .4990 to .5oo2 inches. Since the Musclechuck has a fixed bore of from .5002 to .5007 inches some run out can occur. A standard collet can expand or contract to accommodate these different sizes so it wouldn't contribute to run out. However, if the exact size of the tool shank is known, the Musclechuck bore can be made to fit the size within .0002 of an inch. So, if the customer requests, higher accuracy, it can be obtained for a small price difference. Be aware that if the engagement length is approximately 1½ inches, approximately .0002 of an inch is needed to be able to fit the bore. Again if attention to detail is practiced high levels of accuracy can be obtained.

Clamping technique also leads to run out and stability. It takes six points in three-space to define a cylinder. For those of you who are not mathematicians, it can be said another way. In order to draw a three dimensional cylinder or tin can in our three-dimensional world you need two circles of known diameter. Three points on the circle's circumference define the diameter, hence six points. Lets examine a typical cam chuck. The bore has to be slightly larger than the shank of the tool. When the cam is tightened it pushes the shank of the tool up against the bore of the chuck. So, they come in contact in a single line. The cam tip comes into contact with the tool shank in a single point. A line can be defined in two points, so since there are only three points of contact, the tool shank is free to move around. This can lead to not only run out, but vibration as well. It is known that under severe operating conditions cam chucks have released the tool shank, which leads to unsafe operating conditions.

The Musclechuck does a far superior job of holding on to the tool shank due to several factors. When the Musclechuck is tightened the finger distorts ever so slightly that captures the tool shank circumferentially. The bore is slightly larger as in the case of the cam chuck but instead of all the force being applied at one point, the finger on the Musclechuck intersects the tool shank in several points. This not only allows superior clamping of the tool shank but greater stability as well. So, larger cutters can be used under severe conditions with much more safety. For all you mathematicians out there, when the finger distorts it forms a distorted ellipse on one side while the bore remains circular on the other. Since the tool shank is circular, the tool shank intersects the bore in a line the same as a cam chuck but on the finger side the elliptical surface intersects the tool shank in at least two lines. Therefore there are at least six points holding on to the tool shank, hence the superior griping force. The Musclechuck far out performs any cam chuck and does it without the fear of any damage to the tool shank. We were so impressed with the clamping performance of our chuck, we decided to call it the Musclechuck.

Of course, the quality of the machined parts is always most important. Musclechucks are manufactured with very high quality cnc machines. They are hand honed to insure accuracy and tested before they leave the factory. This will insure high quality and pride being manufactured in the USA with the finest of materials. I hope this has been helpful and if you have any questions, please don't hesitate to give us a call.