A Machined In Place Precision Lathe Chuck Reference, Version 1.0

By R. G. Sparber

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Ever heard of Joe Pieczynski? If not and you enjoy learning new metal working skills, I enthusiastically suggest you subscribe to his YouTube channel. Recently I watched his video "A Simple Chuck Modification to Improve Parallelism of Your Parts" (https://www.youtube.com/watch?v=U3x8H1Xb-jg). Joe presents an elegant way of backing up parts in a lathe chuck so the thickness of the part is held to high tolerances. The accuracy you achieve is really a function of the play in your lathe bearings. Given a perfect lathe, this method would produce parts with perfectly parallel surfaces.

There is only one minor catch. You have to drill holes in the face of your 3 jaw chuck. Ouch. Can I get the benefit of Joe's idea without risking my chuck? For parts less than 2 inches in diameter, the answer is yes. For larger parts, there is a compromise.

My variation is to have an aluminum cylinder clamped to the face of the spindle. The part to be machined contacts this cylinder and is then secured with the jaws of the chuck.

Accuracy is achieved by taking a light cut across the cylinder before use.

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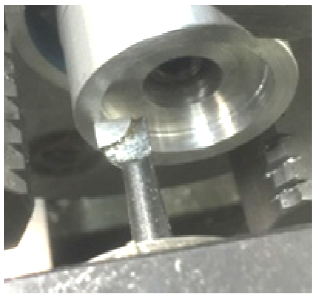
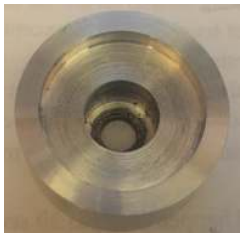


This cut makes the stop essentially a "soft stop" since it is in the same family as "soft jaws[2]" which are machined in place for maximum accuracy.

I'll show you the steps needed to use this attachment. Since the diameter of the cylinders and their lengths are a function of your chuck, there is no point in providing shop drawings.

My machined in place stop relies on an attachment I made[3] in 2014, A Spindle Mounted Stop for a 12″ Atlas/Craftsman Lathe. I'm using it as a draw bar this time.

You can see that my cylinder is actually made from two pieces. The forward end of the larger cylinder has been machined flat. Then I drilled and tapped it ¼-20. The smaller cylinder has a flat rear face.



The front face has a pair of concentric recesses. The smaller recess holds a ¼-20 socket head cap screw so the head is below the surface of the larger recess. That through hole passes the body of the screw. None of these dimensions are critical.

The back end of the larger cylinder was drilled and tapped to accept the draw bar but also has a generous tapered opening. The taper makes it easier for me to slide the draw bar into the threaded hole.

[2] For more on soft jaws, see http://rick.sparber.org/Articles/sj/sj6.pdf

[3] See http://rick.sparber.org/smsp.pdf

First I carefully clean the bore of the 3 jaw chuck and the end of the spindle. No swarf should be in this area.

Then I slide the draw bar assembly into the back of the spindle.

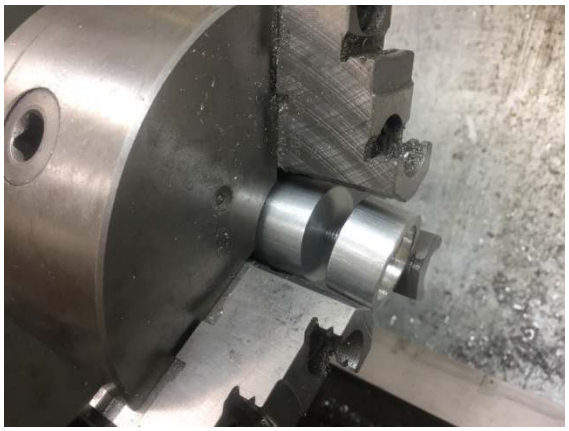
I advance the draw bar until it is visible at the front of the chuck. Check again for swarf.

Since the bar is only supported at the back end of the spindle, it flops around a bit. This is where that tapered hole in the back of the large cylinder comes it. It is much easier to guide the draw bar into the cylinder with that taper.

With the chuck jaws loosely holding the large cylinder, I thread it onto the draw bar until it bottoms out. The smaller cylinder is loosely held on with that ¼-20 screw.

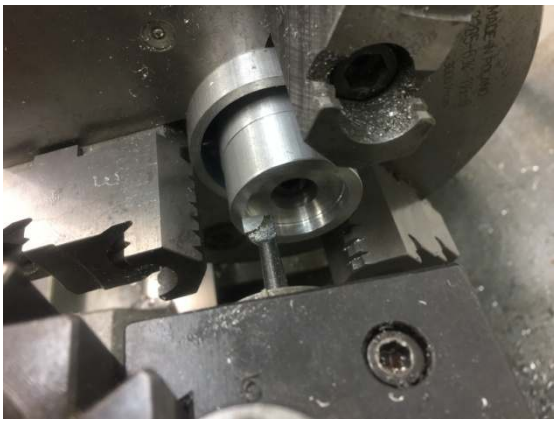
Next I spin the take up nut to draw in the cylinder. When tight, the bottom of the cylinder locks onto the end of the spindle.

If the cylinder does not solidly seat, check for swarf at the contact surface.



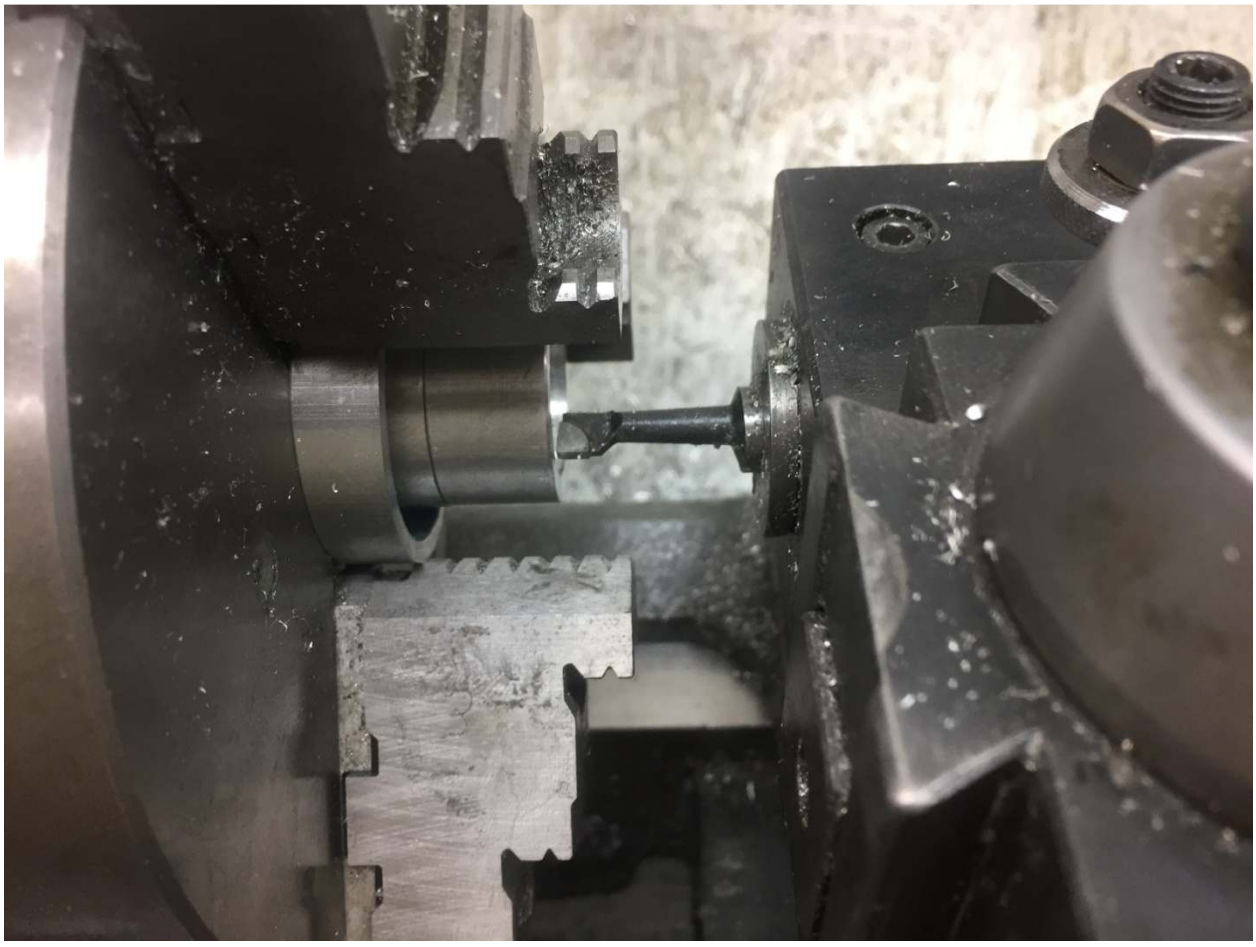
With the large cylinder locked in place, I can now tighten down the ¼-20 screw.

Next I back out the jaws and insert my safety ring. It insures the jaws are a safe distance from the end of my small cylinder plus puts tension on the jaws. With no tension, there is a chance the chuck scroll could spin and send jaws flying away as it turns at high speed.



I then use a boring bar to lightly face the end. Since this counterbore is so large, there isn't much to remove. Yet I do get the maximum diameter contact area for the part to be machined.

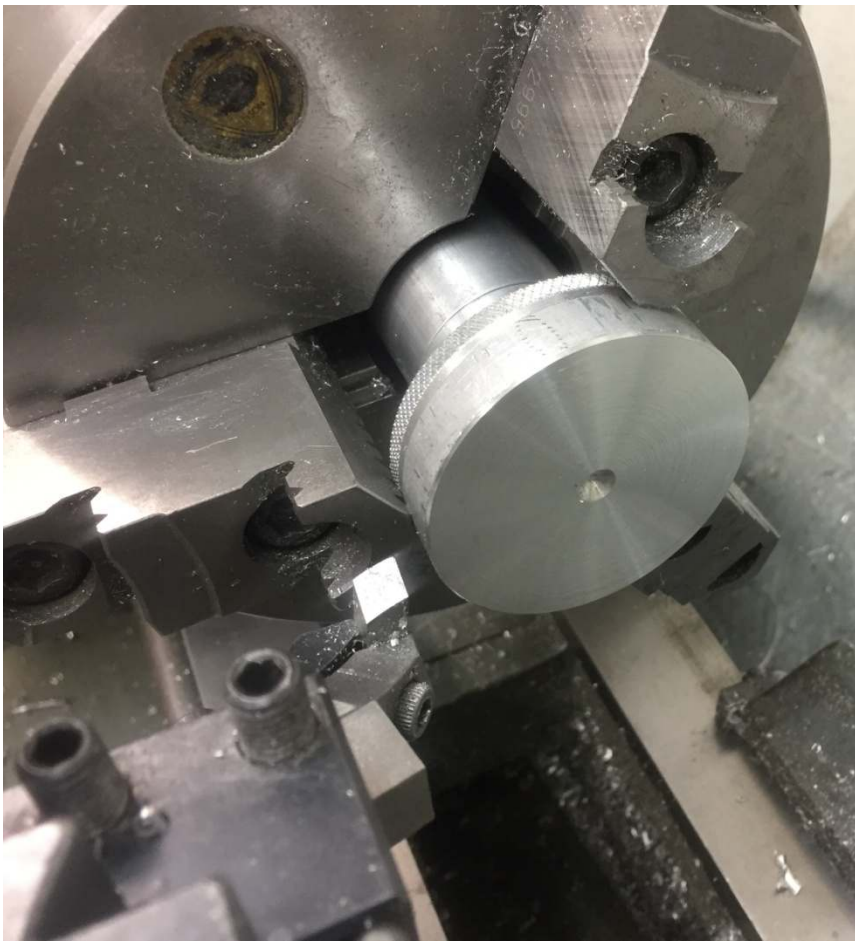
By having the small cylinder as my sacrificial piece, I can save the large cylinder and just make a new small one. I only make a light truing cut each time I mount the stop so it should last a long time.



You can see that by using the boring bar and safety ring, there is plenty of room.

Note that the burr generated by this cut is radial so won't interfere with my reference surface.

Time to install the part to be machined. With all contact surfaces clean, I use the tailstock to apply pressure to the part so it will be in full contact with the face of the small cylinder. Then the jaws are tightened. Slide back the tailstock.



I then take my facing cut on the part. Back out the jaws, wipe the surface clean, flip it over, and use the same procedure to insure the part is in full contact with the face of the small cylinder. Then I take the second facing cut.

So how did I do?

I marked three location around the test piece about 120° apart. My mic was zeroed at location 1.

At location 2 I see the thickness is about 5 tenths low.

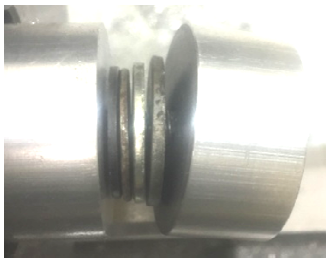
Location 3 is essentially the same as my reference location.

These measurements says my two surfaces are parallel to

$$0.00005 - (-0.00045) = 0.00050\ inches \text{ or } \pm 2.5 \text{ tenths}$$

over about 2 inches. That is a slope of about ±1tenth per inch assuming the surfaces are flat.

What do these measurements really indicate? The play in my lathe bearings. It is not a reflection on Joe's procedure, not that this degree of accuracy is something to be ashamed of…



Having the small cylinder as a separate part provides an easy way to adjust its position. I can stack up washers between the cylinders

and tightened the screw. Then I take my truing face cut.

Acknowledgments

Thanks to Joe Pieczynski not only for this idea but for all of the great wisdom he has shared.

I welcome your comments and questions.

If you wish to be contacted each time I publish an article, email me with just "Article Alias" in the subject line.

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