

Parting Operations on the Lathe – Tips and Techniques

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Parting was absolutely the most challenging and frustrating operations in my first couple of months with my PM-1340GT mid-sized lathe. I decided to dig into this topic deeply and see if I couldn't overcome the challenges. I do a lot of work with stainless steel - one of the more difficult materials to part because it is so gummy. I also work with several of other metals, but stainless is by far the most difficult, and I simply had no choice but to master parting that material, or the lathe was going to become a boat anchor. In the process of digging my way through this, I learned several things that I will share here in hopes it will be useful to others.

Alignment of the parting tool is the first thing to check and correct. It must be exactly perpendicular to the centerline of the spindle rotation, and by "exactly" I mean exactly. Assuming you are using a Quick Change Tool Post, one method that is usually "precise enough" is to use the flat face of the lathe chuck as a reference surface, and rotate the QCTP so that the toolholder side is coplanar to the chuck face as shown in the photo below.



For really demanding materials such as stainless steel, parting tool may need to be indicated in, not just eyeballed or registered against the chuck using a technique similar to the setup shown below. A magnetic base with dial indicator is mounted to the carriage, indicating up to the side of the parting tool, and then moving the cross slide in and out. The tool is aligned when the indicator shows no variation as the cross slide is moved in/out.

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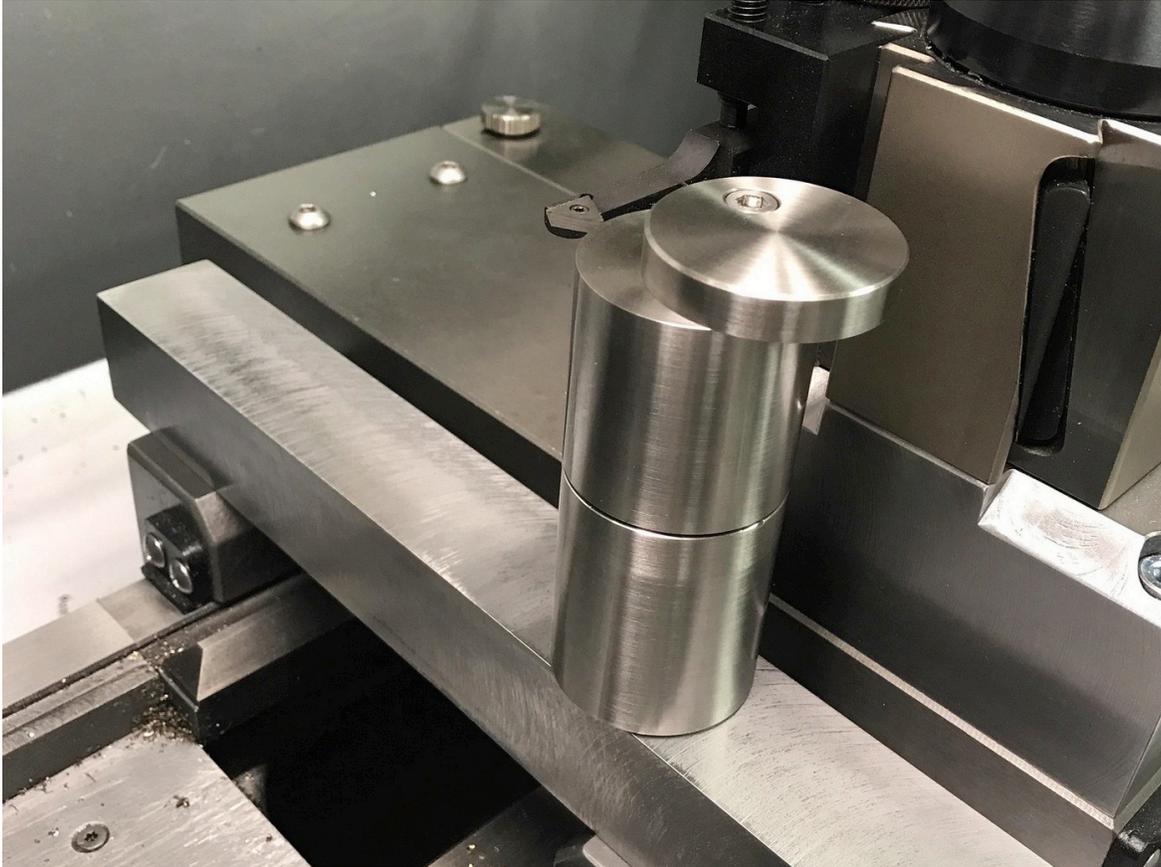
The cutting tip of the tool height must also be exactly at the centerline of spindle rotation - indicate this in as well (more on that below). If you have a QCTP like Aloris/Dorian, once the tool height is set properly, it should repeat when removed and remounted - unless you move the cutting tool in the holder. For this latter reason, I prefer indexable parting tools rather than HSS parting blades since I rarely have to take the tool out of its holder. And some of the conventional parting blade tool holders are angled in a way that when the blade is moved forward or backward in the tool holder, or sharpened while mounted in the tool holder, the tool height is altered, which means you have to realign the tool height every time the blade is sharpened.

Here is a link to a good video on setting tool heights: <https://youtu.be/1Mrjnlcscxl>

And below is a picture of the tool height setter I made for my PM-1340. This one is fancier than Joe Pie's but if you want to make one, description of how it's made and dialed in is here <https://flic.kr/s/aHskXpa6Yc> Read the descriptions below each photo and you'll get a good idea how to build one and how to establish the height.

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Bud Beets (@BladesIIB on Hobby-Machinist) has also made one similar to mine which is discussed on H-M at this link: <https://tinyurl.com/4yyhp8vw> He also made a video about his version you can view here: https://youtu.be/z_1wKU3EyLE

Speeds and Feeds are important. Running at high RPM's is a quick way to destroy the parting tool or the part you're machining. For steels, I generally run 250-450 RPM for OD's in the 0-3" range with steel and stainless, maybe twice that with aluminum. The larger the OD, the slower the RPM. You can get more specific if you use a Feed/Speed calculator targeting a recommended SFM for parting the specific material. But my point is to go slower than you'd like. At least until all the other bugs are worked out of your techniques.

Jerky feed rate is another cause of parting failure. A hand-fed tool is more likely to be advanced at an inconsistent rate, and when the rate increases, the tool digs into the part and can cause the insert to fracture, or the tool to flex and bend as the material tries to climb on top of the cutting edge - it can also force the part out of the chuck if it isn't well gripped.

As a result, I employ the power feed of the cross slide for parting operation, usually at the slowest feed rate of the gearbox - that way I know the tool is advancing at a consistent rate into the material. The published literature from the top tooling/insert suppliers recommend backing off on the plunge rate as the diameters drop to a few millimeters – my own analysis suggests this can be a very useful technique, simply because as the diameter of the material being parted-off goes below 3-5mm diameter, the material being cut by the parting tool tends to want to climb up onto the top of the cutting tool, and when this happens, it's very likely the cutting tool will deflect and bend, or the insert will fracture. So be careful as you approach smaller diameters – disengage the power feeding the carriage and slow down feed rates as the tool finishes the parting operation. This is especially true of difficult materials like stainless. If the element being parted off is going back into the chuck, flipped around for a facing operation, I often just retract the parting tool, stop the lathe and wiggle the off-cut until it snaps loose.

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It is entirely possible to run the spindle too slowly in parting – this is especially the case as the parting tool approaches the centerline of the part. I outfitted my 1340 with a VFD, so I actually dial up the speed (the way a CNC lathe would), as I get closer to the center of the part. But my approach is certainly not scientific. What generally happens is that part will try to climb on top of the parting tool if the RPM's are too low - it actually starts to tear the material rather than cut it. I use the term "aggressive enough" with caution here because parting is not a place to start getting aggressive in general, but you do want to keep the tool cutting as consistently as possible, or the material being cut starts to chatter or deflect and climb on top of the tool. A lot of this is material specific - brass is a lot different from stainless steel, just to pick two extreme cases.

Lube is your friend. I used to think "I didn't need lubrication to face or turn the OD with a carbide tool, so why would I need it in parting?" WRONG! You might be successful parting without lube, or by using a mostly-dry acid brush with some kind of lube, but you're taking a big risk doing so. I have two squeeze bottles with 1mm drip tubes - one with cutting oil, the other with WD40 - that I hold over the cutting operation dripping a consistent amount of fluid throughout the parting operation. I use cutting oil with ferrous materials, and WD40 (or denatured alcohol) with aluminum/bronze. I shoot for a drip rate of 1 drop per 2 seconds right on top of the cutting action where the tool meets the material.

Rigidity is just as critical as parting tool alignment. A lot of my early problems stemmed from lack of rigidity. Choke up on your cutting tool as much as possible - especially if you're using a blade-type tool - make the stick-out just enough to get through the material depth required.

The compound of a medium-sized lathe is not the most rigid platform to begin with, but if you have the compound cranked out in a cantilevered manner, it is going to flex more during a parting operation than if the tool post is pulled back and directly over the base of the cross slide. Think about the pressure on the cutting tool - it's being forced downward by the rotating material, and if the compound flexes downward even 1/1000th of an inch, the cutting edge of the tool is no longer on center, the tool starts digging in, downward forces increase, and the material being cut wants to crawl on top of the parting tool which will surely fracture the insert, may bend the parting tool or blade, or even cause the material to be pulled free of the chuck jaws.

The single best thing I have done to improve rigidity was to make a solid block tool post mount. It's amazing the difference, and unless I'm cutting a taper, my compound sits in a drawer. Here are some resources that might help you understand the concept of a solid tool post and how to build your own if you'd like:

Robin Renzetti's Solid Tool Post: <https://youtu.be/pG3YSfqyJPI>

Stefan Gotteswinter's Solid Tool Post: https://youtu.be/HfcU_cWs1Dg

David Best's Solid Tool Post: <https://flic.kr/s/aHsm1cKjPB>

Good Parting Tools Help a LOT. I feel like I have purchased and tried every type of parting tool commonly available. I've tried T-shaped and wedge-shaped HSS blades, making my own HSS parting tool by grinding 1/2" square tool steel into the perfect narrow blade shape at the end. I've tried wedge-style insert parting tools, and several insert parting tools with screw-down clamps for the insert.

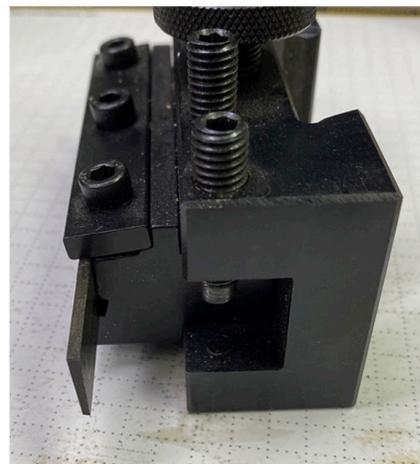
Shown below is a typical setup for a blade type parting tool – take notice how the tool cutting height will change if the blade is sharpened while still mounted in the tool, or will change if the blade is moved in/out.

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You could fix that angled blade problem by using a special block for holding the parting blade horizontal in a standard QC tool holder. Shown below is one likely setup for that, but observe that the blade is hung out to the side in a cantilevered manner which is really bad practice if you're trying to improve rigidity. That parting blade will likely chatter and flex under the downward pressure of the material being cut, and the parting operation will fail. Also notice that some kind of shim at the bottom and side area of the blade is required to make the tool stand vertically since the blade is wider at the top than bottom (more on this below).



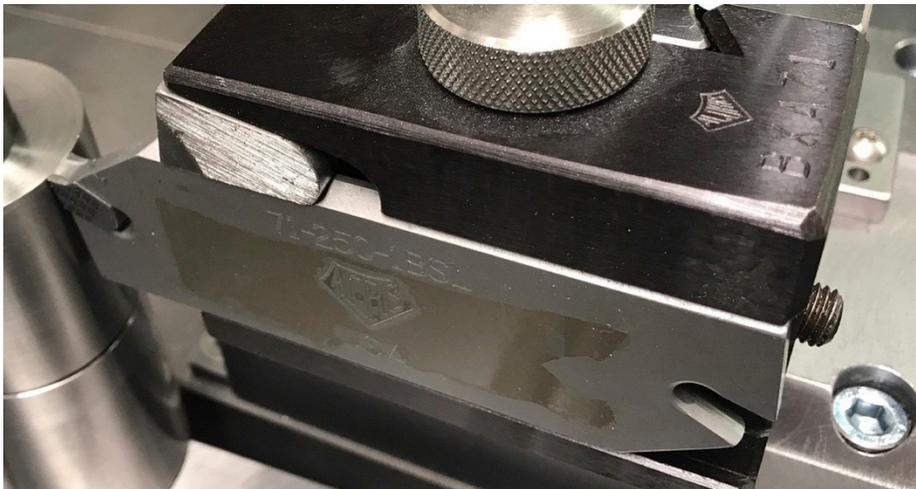
There are special tool holders and blades for wedge-type inserts, where the insert is held in place by friction. Shown below is one example where the blade is held close-in to the tool holder, but the tool holder only accepts a proprietary blade like the one shown, not a HSS T-shaped or wedge-shaped blade. In my experience many of these wedge-insert blades do not do a very good job keeping the insert seated, and if the tool isn't exactly aligned and height just perfect, the insert can be forced out of the blade, breaking the insert, bending the blade, or both. This Dorian blade holder is next to useless IMO. It's one of the reasons I discourage people from buying the Dorian starter kit that comes with it. Much better to buy just the Dorian tool post and pick individual tool holders.

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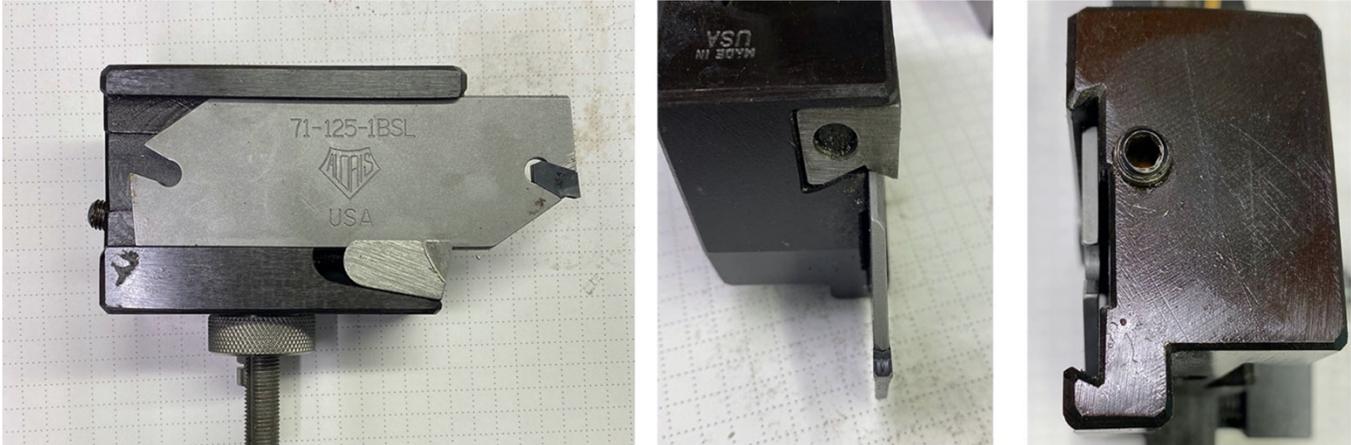
One of the wedge-insert systems that does work fairly well is the Aloris BXA71 with the taller style blade that takes GTN inserts - the tool is held horizontally, so changing its position does not disturb cutting height, and is plenty rigid not to flex. It will hold the insert securely, but this particular blade takes GTN 6 inserts that are a full 1/4" (6mm) wide. Shown below is the GTN 6 blade holder in the Aloris BXA-71. This is such a wide insert that it's not very handy for general parting operation as the cutting forces are substantial and require lots of power and rigidity.



I often get asked about using HSS or braised-on carbide-tipped parting blades can be held in a holder like the Aloris 71. Look closely below at how this tool holder secures the parting blade in position. Notice that the blade clamping top and bottom is wedge-shaped to force the blade against the side of the cavity. The side of that cavity is parallel to the side of the tool post when mounted. Many of the HSS and braised-on carbide parting blades are not flat profiles - they are a wedge or T-shape to provide relief at the cutting edge, and in this holder they will align at an angle relative to true vertical. So, you can't put a blade in the Aloris 71 that is not flat in profile without some kind of shim on the narrower bottom part of the blade to space it out. There are flat profile parting blades with braised on carbide that would fit in the Aloris - but you'd have to find one this is a full 1 1/2" tall which I haven't seen.

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There are better insert-style parting tools, but before investing in a high-end tool, it might be good to start with something more basic. The most useful parting setup for establishing good practices before moving to a more expensive insert tooling would be the Aloris #71 tool holder with the Aloris 71-125-1BSL parting blade that takes GTN size 3 inserts as shown above. You can source import GTN 3 on eBay for about \$2 each in packets of 10, and this combination is probably a good setup. This Aloris 71 setup with the GTN 3 sized blade is exactly what I used to get my head around this topic. The GTN 3 cuts 1/8" wide (3mm), and that blade, being 1/8" thick, is rigid enough to stand up to lots of abuse.

After you have built confidence in your parting capabilities, the best tool choice is an insert tool with screw-down clamping for the insert. For the budget minded enthusiast, the following indexable parting tool to begin with. The primary disadvantage of this tool in contrast to other more expensive alternatives is the depth of cut limitation of 0.669" (17mm). Using this tool, you are limited to parting off solid material with a diameter of 1.398" diameter or less. This toolholder has a 5/8" square shank so it will fit the XL tool holders for BXA QCTP, and is available here: <https://www.latheinserts.com/5-8-PARTING-GROOVING-TURNING-TOOL-431000755.htm>



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Parting can be intimidating even for the most experienced, but with the right tools and techniques, it is possible to overcome the challenge and become confident and successful. I hope this article is helpful and useful to some. If anyone is interested, I document most of my shop activities at the following link.

<https://www.flickr.com/photos/davidpbest/albums>