

LatheCity

Safely Working with Benchtop Lathes - Booklet I

Featuring the Sherline System

Booklet 1 – Thread Cutting in a Lathe

by Uwe Burghaus



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The author is not a professional machinist or engineer. He is a hobby machinist as you probably are. In fact, the author holds a PhD in physics and teaches physical chemistry at a college. Therefore, no information provided herein represents professional advice or best practices in machining. All information is provided to help hobbyists and other non-professionals gain a better understanding of using a miniature benchtop (tabletop) lathe for hobby type work.

This book features in particular the Sherline lathe and accessories. However, none of the statements or procedures may coincide with Sherline Inc.'s opinion or interests.

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Booklet 1

⇒ 1. Required safety notes



Fig. 1.1: Safety glasses. Use versions with ANSI Z87 label. ANSI is short for American National Standards Institute. Chemistry goggles, as also shown here, are not recommended for metal work, since they may block the vision too much.

Please note that **initially you may be at a higher risk** than folks doing this for living since you will be on your own. Typically hobbyists do not attend safety classes or safety briefings. Therefore, at least read the following.

When it comes to safety the “buddy system” is essential. Actually, nobody should work alone with power tools. This is obviously difficult to organize for a hobbyist. Therefore, you are at a higher risk and have to manage the risk yourself.

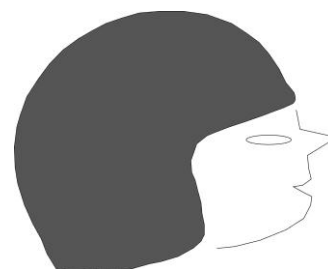
However, everyone can learn how to work safely with power tools. Otherwise I would not offer this type of textbook. In one of the safety briefings I attended, the instructor, a professional machinist, outlined almost proudly how many accidents he had throughout his career ... well ... I still have all my fingers and would like to keep it that way. What about you? Therefore, **READ** the following general safety notes and hints about how to prepare yourself before switching on your lathe. **PLEASE, take this seriously it only takes 20 minutes.**

Specific safety notes for every procedure are part of every subchapter. Naturally the notes in the beginning are more extensive and become shorter towards the end of the book since I assume that you learn safe working practice along with the operation of your power tools. (In addition, safety concerns are often similar for different procedures.) This is one of the main goals and part of the title of this hobby machinist primer: “Safely working ...”

Working at a public university myself, I have to participate regularly in safety classes and I am at present (2011) in fact the safety liaison for our chemistry department. However, again I am a hobbyist myself when it comes to metal work. I

still have all 10 fingers and two eyes, but there is no legal guarantee that the following notes are complete or even correct. **Read the disclaimer note above.**

- **Use goggles / safety glasses** (see Fig. 1.1). Chemistry goggles, which are also shown here, have the disadvantage that they may block your vision too much which again can generate a safety hazard. You need comfortable glasses and perfect vision. You need to look around. Glasses approved for metal would need to be closed all around the face (at the top, sides, and bottom) and in the U.S. they have the label **ANSI Z87** on them. Some versions additionally block UV light which was interesting to me, since I also work with glass pieces, using glue hardened by a UV lamp. In any case, a UV filter is better for our eyes, I believe.
- At most safety briefings you may come across the term “**situation awareness**”, as a general strategy to reduce risks. Knocking over a leg of a storage rack when walking through a metal shop, which carries 500 pounds of steel, would not be it. Heavy footwear is unfortunately very uncommon except in an industrial setting. (We also don’t want to overdo it in a hobby shop.)
- Let someone know that you are working in your garage and/or basement. Why? First, you are setting up “a buddy system” in doing so. Second, you are making sure that nobody disturbs you at a critical moment, startling you from behind.
- Have a working phone in reach. Check if your cell phone is working properly in your basement. Where is the closest hospital/emergency room? Emergency number in the U.S. is? Right, 911. At some locations the number may be different.
- Make your shop kid safe. Talk to your kids about the risks. Make sure that they do not sneak around a corner and surprise you when the lathe is running, etc. They often don’t see the difference between “playing” and “safe working practices.”
- Read the application notes and manuals that came with the tools and/or accessories before starting to use them. Learn the applications and limitations as well as the specific potential hazards of every tool.
- Don’t use a tool for a purpose it was not designed for.



- Don't modify a tool yourself.
- Don't push a tool beyond the limits it was designed for. A mini metal lathe is designed to work on small metal stock.
- Don't modify the electrical connections of your tools. Electrically ground all tools. If a tool is equipped with a three-prong plug, then it should be plugged into a three-hole receptacle. If an adapter is used to accommodate a two-prong receptacle, the adapter wire must be attached to a ground connection.
- Don't remove safety guards. Keep guards in working order. (I could tell you stories where a student did exactly that to "save time" and lost several fingers in the process. This is not a joke, but I will spare you the details. Fortunately, I was not involved in this accident, in this case, at a chemistry lab abroad ...) Don't remove safety guards. However, the little safety shields that sometimes come with a lathe provide only very limited protection. Use always goggles, in any case.
- Make it a habit of checking to see that keys and adjusting wrenches are removed from the chuck before turning on any machine/lathe. In the case of a lathe, turn the spindle by hand before turning on the lathe making sure that it runs freely. Don't underestimate the power and torque generated even by a benchtop/tabletop lathe. A key left behind in a chuck can easily fly off traveling at a significant speed for 10 ft (3 meters) or more. Full size lathes used to train students professionally are often equipped with **spring lock chuck keys (self-ejecting keys)**. These pop out of the chuck when not pushed down, i.e., it's impossible to leave them in the chuck unintentionally. Typically the chuck key would hit the instructor rather than the student running the lathe which may explain why this feature is eagerly installed in training metal shops. (Don't put your nose over the spindle anyhow.) In any case, just kidding I do like all instructors, safety first. Unfortunately, this type of system is typically not available for benchtop lathes, as far as I know.
- Cluttered work areas and benches are a safety hazard. This is indeed true.
- Do not use power tools in damp or wet locations. This can be an issue for garage or basement shops. Solve the problem if it exists at your location.
- Keep work area well illuminated. This is extremely important for safety issues and any proper work. Do you need new glasses?
- All visitors should be kept at a safe distance from the work area.
- Again make your workshop kid proof. Use padlocks, master switches, remove starter keys. This is of particular concern for hobby work, correct (?) I would in principle encourage you to awaken the interests of young adults for practical and creative work. Fortunately, perhaps in this case, many of them prefer to

play dull computer games instead. However, teaching young adults to work with metal tools is particularly difficult and a major safety hazard for everyone involved in this process. At least don't do this in the very beginning. You must be very confident yourself, first. Make sure that they are old enough and have no access to the tools alone.

- Again, do not force tools or attachments to do a job for which they were not designed. Use the proper tool for the job.
- Avoid loose clothing, necklaces, gloves, or jewelry that could become caught in moving parts. We all know this, but taking care of it every day is another thing.
- By the same token, fluffy cloth appears to attract small cut off metal pieces like a magnet. They stick deep in the fabric and can scratch/cut you fingers and skin.
- Wear protective head gear to keep long hair styles away from moving parts! If you would like to see a sad story in this regard, go to:

<http://blog.makezine.com/archive/2011/04/yale-student-killed-in-lathe-accident.html>

It takes milliseconds to pull you into the running chuck if something gets caught in the chuck. A benchtop system is safer in this regard than a full size system, I guess, but ... (A lathe running at 1600 RPM makes 26 RPsec or ~40 milliseconds = 0.040 sec for one revolution.)

- Use safety glasses i.e. goggles designed for metal work. Yes, this is on the list more than once.
- Use a face or dust mask if cutting operation is dusty.



Fig. 1.2: Full face shield with plastic foil that need to be peeled off.

- When using a metal grinder you will generate sparks. Use a full face shield and goggles for these operations. Make sure not to have lots of cardboard boxes, gas containers for you snow blower / lawnmower, paint, solvents, etc. in your basement or garage hobby shop. The sparks generated by grinders or metal saws can ignite a fire. It may start to burn long after you left the shop ... Full face shields often have a plastic foil on the shield which needs to be peeled off. Otherwise the shield may not be transparent (Fig. 1.2) – just a note in case you didn't realize. (I have seen students running around ...)

- Use clamps or a vise to hold work. It is much safer than using your hand and frees both hands to operate the tool. This is more of an issue for the use of a drill press, milling machine, or saws than for a lathe, but it must be included here.
- Keep your proper footing and balance at all times. Wet floor? Cable? This is dangerous.
- Keep tools sharp and clean for best and safest performance. Follow instructions for lubrication and changing accessories. A sharp knife is dangerous, indeed. However, a dull lathe cutting tool may be even more dangerous. (Why? It does not cut properly. It will over-heat, etc.)
- Use only recommended accessories. Read the manual carefully and completely. Use of improper accessories may be hazardous.
- Unplug tool before servicing and when changing accessories such as blades, bits or cutters. Definitely.
- Make sure switch is "OFF" before plugging in a power cord. Double check.
- Again turn spindle by hand before switching the motor of the lathe on. This ensures that the work piece or chuck jaws will not hit the lathe bed, saddle or cross-slide, and also ensures that they clear the cutting tool.
- It is not recommended that the lathe be used for grinding. The fine dust that results from the grinding operation is hard on bearings and other moving parts of your tool. For the same reason, if the lathe or any other precision tool is kept near an operating grinder, it should be kept covered when not in use. I do occasionally use a polishing sponge (safer than sandpaper) to polish pieces, but I don't overdo it.
- Make sure that all locking and driving attachments are tightened. However, also be careful not to over tighten these adjustments. They should be just tight enough. Over tightening may damage threads or warp parts, thereby reducing accuracy and effectiveness.
- Don't allow long stock pieces to stick out far in back of the spindle of the lathe. Long, thin stock that is unsupported and turned at high RPM can suddenly bend

- I did read the safety notes.
- I did understand them.
- I did read and accept the disclaimer statement.

and loop around. This WILL indeed happen. You may be amazed that an aluminum or steel rod bents like nothing.

- Wear proper safety glasses. All folks working for living in metal shops can unfortunately tell you stories such as this one: a piece of metal hit the backside of glasses (somehow) and the reflected piece hit the eye of the machinist. They had to pull the piece out of his eye in a hospital. This is not a joke. You need safety glasses specified for metal work, even if you wear optical glasses. You need glasses fully closed at the sides, the top, and bottom. Goggles that fit over optical glasses are often not very comfortable and restrict the vision. These are better than nothing, but you can purchase goggles with optical lenses. If you work every day in your shop, then invest the money to purchase really comfortable and safe glasses. Your eyes are worth the investment.
- This may sound as a talk to a teenage girl/boy, but ... you need proper eye protection before you switch on the lathe for the first time. Safety glasses are perhaps the most important safety feature in a metal shop. Don't start without them with any work on a lathe. Any home improvement store carries them. (These glasses should come together with any lathe package. Unfortunately, they don't.)
- Don't work when you are tired. Rushing home, having a heavy dinner and a few beers, then going down to the basement shop in your house ... obviously not a good idea. Don't do it. Metal work requires your full attention, even if it is a hobby.
- You may realize that the fingers of the machinist are really close to the spindle when cutting certain shapes, in particular when you eventually polish pieces. The edges of the chuck are sharp and turn at perhaps 1800 RPM. It would cause very serious injuries when hitting the rotating chuck with your fingertips. Sherline also offers a tool post for polishing (P/N 8976) which I did not, however, use myself. Polishing operations on the Sherline lathe are, by the way, not recommended by Sherline, mostly due to issues of metal dust which may end up in the motor controller box causing shorts. In addition, a dust mask is generally required for all sanding/polishing operations. Using a sanding sponge is somewhat safer than using sand paper for polishing since you can even touch

This is a long list, but don't blame me if you did not read it and end up in a hospital.

the chuck with the sponge and the fingertips are still at an o.k. distance. Sanding sponges are available in any home improvement store.

- One last thing. Please be aware of that you will carry chips (small cut off metal pieces) with you all over your house. Don't ask how – chips stick to everything, somehow. Aluminum chips are "rather" soft and probably often (but not always) "harmless", but steel chips are sharp as razor blades. Never clean up chips with your bare fingers, never.
- This kind of list can never be complete. Read the disclaimer statement.

Safety notes can also be found on various web sites, a few links are given here:

http://www.mini-lathe.com/Mini_lathe/lathe_safety.htm






<http://www.zeraware.com/>

http://www.americanmachinetools.com/how_to_use_a_lathe.htm

http://www.fricknet.com/lp/safety_posters.php?gclid=CPTW6ZfFhaYCFQTNKgodFQoIpA

Safety products can also be purchased on-line, for example, perhaps look at e.g.:

http://www.envirosafetyproducts.com/product/magnifying_safety_glasses_magnifying_safety_glass

	safety notes
	summaries
	trouble shooting
	notes not too important in the beginning
	projects

Booklet 1

2. Cutting threads

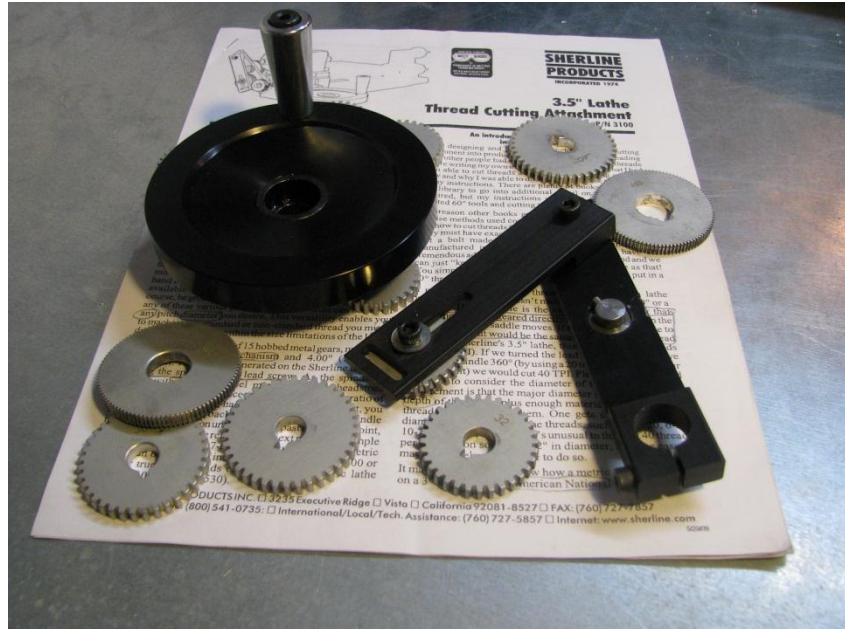


Fig. 2.1: Components of the gear-cutting accessory for the Sherline lathe from Sherline.

Object: Cutting various thread types very precisely can be accomplished with a lathe. Unfortunately, on the Sherline system this is a purely manual procedure using a hand wheel. This chapter provides only the essentials (and a few curiosities) in a practical fashion since I doubt that you will use this accessory very often. However, the description given in the following is fairly complete and includes outlines about left-hand threads and multiple-start threads. Also, using the accessory for making unusual thread types may be the main application. In addition, the system can provide a good introduction into typical thread-cutting procedures. Plan for a rainy weekend to try this out – it’s a somewhat more demanding procedure than others. Trying to accomplish this in 20 min would only result in frustration. How to set up the tool and try it out are described in sections 2.6 and 2.7.

⇒ I am not aware of any safety concerns since this is a purely manual operation on the Sherline lathe using a hand wheel. However, on a full size system cutting threads can be very dangerous, i.e., it is not too hard to jam the tool post into the rotating chuck.



Uwe Burghaus, born in West Berlin, Germany, obtained his education in Physics and Physical Chemistry at the Free University of Berlin. He obtained a PhD in 1995, after conducting his graduate studies in surface science at the Fritz-Haber Institute of the Max Planck Society in Berlin. After postdoctoral positions in Genoa (Italy) and Santa Barbara (USA), he went back to Germany to complete a habilitation/tenure in Physical Chemistry. Now at North Dakota State University, he started to establish a surface chemistry group in 2003 and obtained tenure in 2009. His group is currently focusing on studies about nanostructured catalysts.

His hobbies include machining furniture from metal and glass as well as occasionally manufacturing pieces for his research group by himself. He is not a professional machinist by training. However, his hobby developed into a small part-time business in 2012. LatheCity currently sells books about metal working and software tools and accessories as well as affordable jewelry: everything that's fun to make and may find customers. The strength of the business is custom-designed pieces including accessories for scientific instruments.

Acknowledgements

Proofreading of this Booklet by Scribendi (Canada) is acknowledged.

I will continue to update and improve on the texts over time. These updates will be made available to our customers as a free newsletter – assuming that one of the textbooks was purchased from LatheCity. Go to the customer's corner and use the password provided with your purchase. We will not bother you with e-mails, but the updates can be downloaded from our website.

Writing a book about metal working typically does not improve the reputation of a scientist (some prefer not to get dirty fingers...) and chemistry college teacher. Therefore, many thanks in advance to open-minded colleagues. However, in the UK, there is apparently a "tradition" to write your own book about "gardening" – the LatheCity books would be my version of this, I guess.

Synopsis. Detailed is the thread cutting accessory for the popular Sherline metal lathe. Obtain a fair but critical and independent opinion about often pricy accessories. The author is a hobby machinist as you probably are.

How to cut threads on a metal lathe is described in detail, including curiosities such as cutting double lead screws or left hand screws. The author focusses here on practical procedures and troubleshooting (tips & tricks). Indeed it is shown how all of this can be done on a benchtop lathe. We have not seen this type of information as concise as it is here anywhere else in a hobby type machining book. The descriptions focus on practical and doable procedures, but include also the engineering background.

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