Free Safety Booklet

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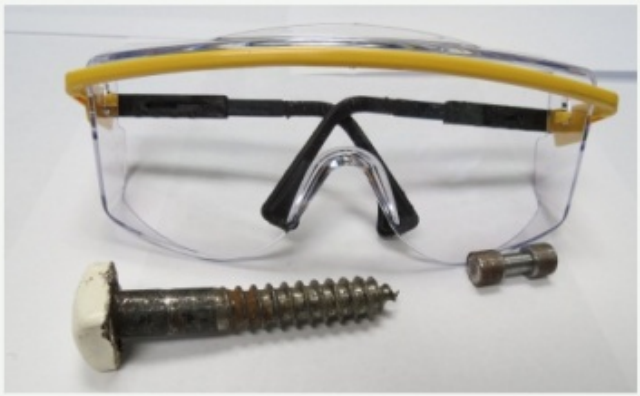
Working Safely with Benchtop Lathes and Mills



LatheCity

Safety Booklet

4th Edition

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Disclaimer

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The author is not a professional machinist or engineer. In fact, the author holds a Ph.D. 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 mini benchtop / tabletop lathe for hobby type work.

The benchtop tools book series features in particular the Sherline lathe and accessories. However, none of the statements or procedures may coincide with Sherline Inc.'s opinion or interests. The author is not an employee of, or agent for any of the vendors referenced in the text and does not sell or represent any of the third party products discussed.

Web addresses are given without any warranty or guarantee, web sites may be infected by a computer virus and/or may not provide the best service. Computer codes are provided without any warranty or guarantee of correctness. They are intended for private and non-commercial use only. You will perform all operations described in the benchtop / tabletop tools book series, booklet, and manuals at your own risk in any regard. Neither LatheCity nor its owner (U. Burghaus) shall be liable for damage arising herefrom.

In the following, a few safety rules are provided as a free service to our customers. These may, however, not be complete. Neither LatheCity nor its owner shall be liable for damage arising herefrom. Special tools and accessories may require special safety precautions which may not be covered in the following.

Safety Notes

The following text is included in all LatheCity books

Very first steps – safety first

Fig. 1: Safety glasses. Use versions with ANSI Z87 label. ASNI 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.

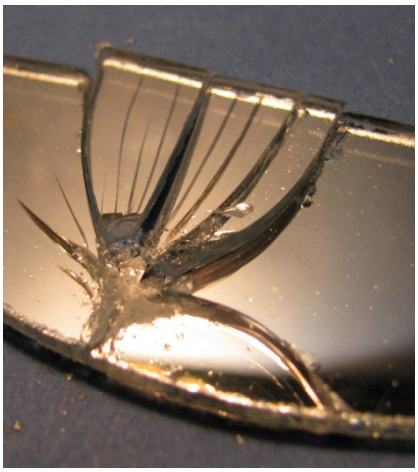
Please note that **initially you may be at a higher risk** than folks doing this for living since you will be on your own. Typically hobbyists do not attend safety classes or safety briefings. Therefore, at least read the following.

When it comes to safety the "buddy system" is essential. Actually, nobody should work alone with motor 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 motor 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 toward the end of the book since I assume that you learn safe working practice along with the operation of your motor 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: "Safe 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). 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.

- **Do NOT use untrue running cutting tools. If an end mill or drill bit does not run true, it can generate unstable working conditions. This can be dangerous. Dispose end mill holders or Morse type adapters which do not run true.**
- 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 a with 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 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 self-ejecting chuck key is typically not available for benchtop lathes, as far as I know.

Do NOT work on large diameter and/or long stock pieces without using a center. In any case, this is not advisable on a small benchtop lathe.

- 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 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 milli seconds 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. 2: Full face shield with plastic foil that needs 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 your 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. 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.
- Use only recommended accessories. Read the manual carefully and completely. Use of improper accessories may be hazardous.

□ **I did read the safety notes.**

□ **I did understand them.**

□ **I did read and accept the disclaimer statement.**

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

- 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/mill. Any home improvement store carries them.
- 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 the chuck with the sponge and the fingertips are still at an o.k. distance. Sanding sponges are available in any home improvement store.
- Do NOT use untrue running cutting tools. If an end mill or drill does not run true it can generate unstable working conditions. This can be

dangerous. Dispose end mill holders, Morse type adapters, any adapters which do not run true.

- 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 mostly "harmless", but steel chips are sharp as razor blades. Never clean up chips with your bare fingers, never.
- **Tailstock drilling:** Some Jacobs drill chuck adapter allows for using a somewhat larger Jacobs drill chuck in a small benchtop lathe. Therefore, somewhat larger diameter drill bits can be used on a small lathe. However, don't over-do it! Mounting a huge drill bit in a huge Jacobs drill chuck can result in unstable (dangerous) working conditions on a small lathe. **The lathe tailstock can be damaged beyond repair. When using large drill bits, it's not too hard to jam the drill bit in the work piece**, i.e., use the correct RPM and plenty of cutting oil. The larger the diameter the smaller the RPM. Use a small feed of the drill bit and remove chips frequently. When pulling back the tailstock make sure not to pull the work piece out of the chuck.
- This kind of list can never be complete. Read the disclaimer statement.

Milling specific L/M

- In simple terms, lathe cutting tools cut metal because of the pressure generated when pushing the turning tool into steel. Therefore, lathe cutters are actually not that sharp. Mill cutters work more like a saw (in simple terms): they are very sharp. Don't touch mill cutters with your bare hands, use a rag.
- The cutting tool and not the work turns on a mill. Therefore, a mill will generate metal-chip-shrapnel to a much larger extent than a lathe. This is most evident when using a so-called fly-cutter. Long sleeve shirts and safety glasses provide some protection.

CAUTION – LASER operation

A number of even hobby type tools come in the meanwhile with strong light sources or LASER pointers build in. Also LatheCity has these accessories.

- Read and obey the operation instructions from the manufacturer of the LASER pointer that came with the LASER pointer. See the label printed on the LASER pointer and the instructions card. In addition, consider the following.
- A LASER pointer is not a toy. Keep out of reach of children and mentally handicapped people as well as pets.
- Do not stare into LASER light beam. This will cause damage to your eyes.
- Do not direct the LASER light beam towards the eyes of another person or animal.
- Remember that a LASER light beam reflected from an object will be as dangerous as the primary LASER beam.
- Remove batteries if the LASER is not in use for an extended period of time in order to prevent corrosion.
- Do not disassemble or try to repair the LASER pointer. The LASER pointer does not contain replaceable parts.
- Protect against water, dust, heat, and sunlight.
- Do not direct the LASER pointer towards the sky or streets. This can interfere with traffic, airplanes, etc.

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

Internet

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

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

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Modifications to the 1st edition include the following: changes to the layout, coloring, LASER and milling notes were added, and a cover page was added.