

Basic Machine Shop Safety - Team 885

1.0 Introduction

- Each student and adult member of Green Mountain Robotics, Inc. Team 885 is required to read the following document and attend at least one safety training each year in order to use **any power tool or hand tool**. A record of attendance at the training will be retained to verify a team members' eligibility to work in the shop. Team members will be responsible to adhere, at all times, to the information that follows. Failure to do so could result in dismissal from the work area and possibly require the member to take the training again.
- Please understand that we only have one chance at a safe work environment and each member should be constantly looking for unsafe practices and looking to correct the unsafe activity.
- At various times through the build season an assigned Mentor may spot check the safety knowledge of the team members, members must demonstrate sufficient knowledge and/or perform a "look up" of deficient knowledge.

2.0 Safety Begins At Home

Prior to leaving home for a work session take a few moments and look at your clothing.

- We will have safety glasses available, but we recommend that you get your own pair. Bring your safety glasses with you.
- Restrain long hair (or beards). People have been very seriously injured when hair has become entangled in a machine tool.
- Do not wear open-toed shoes. Your shoes should be, sturdy, properly laced and tied.
- Do not wear loose fitting clothing (baggy pants, loose shirt sleeves, neck ties, or "hoodies"); ensure your shirt is tucked in. Do not wear jewelry. Watches should be removed. Short sleeves are recommended.
- Be honest with yourself, are you feeling all right? Are you taking any medications that are making you feel drowsy, or are you too tired for any other reason?
- For such a short build season one might feel inclined to work through a cold or an ailment. Please use your best judgment and think of safety and the health of others.
- Refrain from running a machine if you are not in top shape.

3.0 Shop Safety

3.1 Age Limitations (VTC requirements)

- No child under the age of 14 is to operate a machine tool (Bridgeport, small mill, lathe, band saw, drill press). However, younger children may help clamp the part, install the cutters, take measurements, etc. Just can't actually run the machine.
- No child between the ages of 14 to 15 is to operate a machine without **direct** adult supervision - a qualified adult in the **immediate** vicinity.
- No student team member, regardless of age, is permitted to operate a machine without an adult in the work area. **Adult mentors only** are allowed to operate the small lathe.

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3.2 General Shop Safety and Conduct

- All team members must demonstrate knowledge of the safety requirements prior to operating a machine.
- Always wear ANSI approved safety glasses with side shields **in all areas where work is being done** - NO excuses. Refer to the Workshop Rules for limited exceptions.
- Locate the emergency stop button (if equipped) for each machine **before turning the machine power on**. Locate the on/off switch.
- Always have a properly supplied first aid kit ready. Know the location of the closest fire extinguisher.
- No horseplay, no pushing, no shoving, or other inappropriate behavior.
- If you are not sure, ASK FIRST! Never be in a hurry; slow down and be safe.
- **Never** leave a machine running unattended.
- **Never** attempt to measure or touch a part while the machine is running or **any** motion still exists.
- Make sure that all guards and covers are in place before operating a machine.
- Always use a brush to remove chips from a part, not your hand; the tool/part may have sharp edges. **The machine must be stopped**. Use a brush or squeeze bottle to apply coolant.
- Listen to others working around you, if their machine is making a noise you are not used to hearing, then more than likely something is wrong. Ask if they need help or advice.
- Always deburr a part before placing it in a machine and immediately following a cutting operation. Burrs can be sharp.
- Immediately clean up any coolant or lubricant that falls on the floor.
- Never use compressed air to clean chips from a machine; it is bad for the machines and creates projectiles. The preferred method is to use a brush and rags as much as possible, then finish with a vacuum cleaner. Try to prevent sucking up coolant and oil into the vacuum cleaner.

3.3 Daily Cleanup

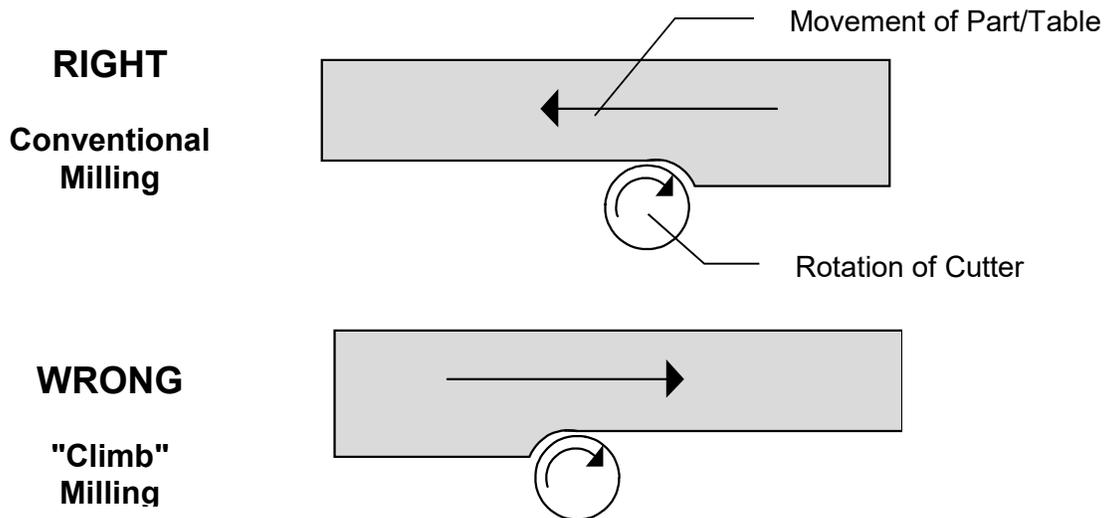
- It is everyone's responsibility to return tools to their proper locations and clean the shop before going home (even if you are leaving before everyone else for the evening).
- Oily rags should be given to an adult mentor for proper disposal; do not put in regular trash.
- At the close of the work session unplug the power cord to all cord-connected machines. Turn off the power at the disconnect, if there is one. Lock up Team 885 tools and supplies.
- Remove and put away any bits, cutters, etc. Do not leave bits in the chucks of tools.
- Last person to leave, **make sure** the outside door is locked. If you need help locking up call VTC Security - 728-1292.

4.0 Milling Machine (Bridgeport)

- Make sure the cutter is good. If you did not install the cutter yourself, carefully inspect the cutting edges for damage. Never use a damaged cutter.
- Make sure the cutter is properly installed and tight. (Do not over tighten).

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- Before turning the power on, **make sure the wrench has been removed from the nut** that tightens the cutter to the collet! A wrench that remains in place will fly away from the machine with high energy.
- Make sure that you have selected the proper RPM (speed) for material being cut and the cutting tool diameter. (1,000 rpm is a typical speed for aluminum.) To change speed, turn off the power, unplug, and adjust the belts.
- Make sure the milling vise is securely attached to the machine. Properly secure the part in the vise before turning machine power on.
- Make sure the cutter is actually rotating clockwise! Jog the switch briefly to determine the direction. Don't trust the label on the switch.



- Be sure that you are conventional milling and not "climb" milling. With climb milling it is easy for the part to be grabbed by the cutter and damaged, or pulled out of the vise with high energy. Cutters can be damaged. Climb milling should only be used to smooth a cut.
- Do not attempt to make too deep a cut. Make a shallower cut if the machine appears to "labor."
- Turn power off and let the mill coast to a stop. Do not use your hand to stop the machine.
- Remove cutting tools before cleaning the machine when done for the day. Do a good job cleaning the milling table and **knee**.

5.0 Small Mill

The instructions for the Bridgeport apply to the small mill with the following additions:

- Make sure the guard is covering the belt drive; do not operate with exposed belts.
- Make sure to lubricate first thing in the day, and periodically if the machine is in heavy use. This machine is not permanently lubricated.

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6.0 Large Lathe (South Bend)

- Make sure the lathe chuck is securely tightened on the spindle.
- Make sure the part is securely tightened in the chuck. **Your hand must remain on the chuck key at all times while securing the part in the chuck.** At **no time** should the chuck key be in the chuck unless your hand is on the key. **Never** start the lathe with the chuck key still in the chuck. A key that remains in place will fly away from the machine with high energy.
- Do not operate the lathe unless all guards and covers are in place.
- Clamp the tool bit as short as possible, prevents chatter and/or breaking of the bit.
- Ensure tool bit is on or slightly below center for best cutter performance.
- Ensure quick release handle is tight before engaging cutter to the part.
- **Never** file on the lathe without a handle on the file; the tang on the file can cut or puncture if "grabbed." File with the file on the left side of your body (so if you slip you will not fall into the chuck). Stay out of the way in case the file is "grabbed."
- Never use gloves to remove stringy chips; chips can be sharp. Stop the lathe and use a hook or brush to remove the chips. Adjust feed rate or speed to prevent the stringy chips.
- **Never** attempt to take measurements with the part rotating.
- Remove cutting tools before cleaning machine when done for the day.

7.0 Small Lathe

The small lathe **may only be used by adult mentors** until such a time as the motor is made to be self-starting.

- Make sure to lubricate first thing in the day, and **frequently** during use. Check especially the two oil cups for the spindle bearings; this machine is not permanently lubricated and failure to keep it lubricated will ruin it.

8.0 Band Saws

- Make sure the blade guide is adjusted so as to not hit the part but close enough to properly support the blade.
- Ensure that you have the correct speed for the material being cut. Too fast a speed will reduce blade life. Make sure you are using a suitable blade for the material. Metals require a fine-tooth blade. General rule of thumb for band saws: 2 teeth should engage the part at all times for soft metals (like aluminum) and for steel 3 teeth. If you can not maintain this rule of thumb then change the blade or do not use the band saw.
- Use a push stick behind the workpiece if there is any possibility that your hands could slip into the blade.
- When making square cuts on the horizontal band saw, check that vise is square to the blade before putting the part in the vise.

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- If the blade breaks or jumps off the pulley while cutting turn power off and let the saw coast to a complete stop. Unplug the power cord before installing a blade.

9.0 Drill Press

- Inspect the cutting edge on the drill bit before using; never use a damaged drill bit.
- Make sure the drill is securely tightened in the chuck. **Your hand must remain on the chuck key at all times while securing the part in the chuck.** At no time should the chuck key be in the chuck unless your hand is on the key. **Never** start the drill press with the chuck key still in the chuck. A key that remains in place will fly away from the machine with high energy.
- Do not hold the part in your hand; use a vise or clamp. The exception is for large parts and small drills. Otherwise, use the vise or clamp. For large bits, secure the vise to the table with bolts or a clamp to prevent the vise from spinning.
- Prick punch or use a center drill to start a hole, this will prevent the drill bit from walking.
- Remove stringy chips with a hook or brush but never with gloves; **the tool must be stopped.**
- Use cutting fluid to keep the drill bit cool.
- Ease up on feed pressure as the drill bit gets ready to break through the part to prevent "grabbing.". Do not use excessive feed pressure. Change your speed or use a smaller drill before the final diameter. When drilling a deep hole withdraw the drill bit frequently to clear chips and lubricate the bit.
- Never place a tapered shank drill bit in a drill chuck.
- Remove all bits before cleaning the drill press.
- When adjusting the belts be very careful when rotating the sheaves by hand. It is very easy for fingers to get caught in the sheaves with potential for severe injury.

10.0 Bench Grinder

- Stand to the side when starting a grinding wheel, wheels are most prone to breaking during acceleration.
- Tool rests should be adjusted to no more than a 1/16 of an inch from the wheel.
- Remove and discard a wheel that has been hit or dropped, even if it appears to be all right.
- Minimize grinding on the side of a grinding wheel but if it must be done use gentle force.
- Grinding wheels should be dressed often.
- Never grind aluminum; aluminum dust can be explosive.
- Use extreme caution when grinding non-ferrous materials as they will clog the wheel and cause them to run off balance, possibly causing the wheel to break.

11.0 Welding

If welding is necessary, special arrangements will be made.

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12.0 Portable Power Tools

- The tool is portable, therefore, it is your responsibility to make sure that everyone around you is wearing safety glasses and will not be hit by debris.
- Inspect the power cord for damage. If damaged do not use. Do not use if the ground plug is gone or being bypassed.
- Do not run extension cords across walkways if at all possible; if unavoidable, tape the cord to the floor.
- Do not use the tool if you will be standing on a wet floor.
- Make sure part is securely clamped so as to prevent movement.
- Do not use the tool unless you know how to do so.

Revised December 17, 2016.