Sparklopedia

Spark Makerspace

last update 10/25/2025

7 Union St. New London CT - www.sparkmakerspace.org

Table Of Contents:

Click on the document you're looking for!

Electronics

- Basic Lasercutting Steps
- 3D Printer Certification

Woodshop

- Rules & Policies
- Non-Member Policies
- Air Tools
- Bandsaw
- Close-Up Cam Cart
- CNC Router Handout
- Compound Miter Saw
- Drill Press
- Jointer
- Lathe & Bench Grinder
- Planer
- Portable Power Tools
- Scroll Saw
- Table Saw

Click on the document you're looking for!

Screen Printing at Spark

TOOLS

- Printing clamps/hinges + tables
- Community silk screens
- Squeegees
- Scoop coaters
- Emulsion, emulsion remover, & gray room
- 4-color press
- Power washer
- Inks
- Paper
- Transparencies & tracing paper
- YUDU units

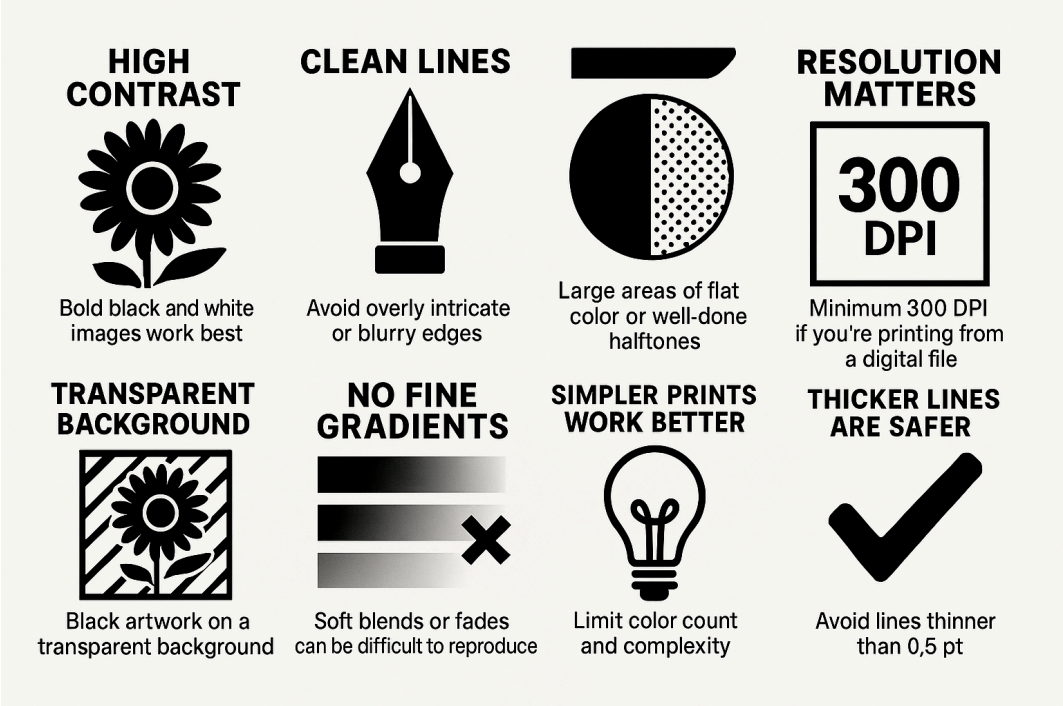
RULES OF THE PRINTSHOP

- No oil-based ink/mediums can be used in the Printshop.
- No caustic supplies should be used.
- ALL Screens must be labeled with your name and the date the screen was coated (before coating), with RED masking tape.
    - Any screen that is not labelled is free for you to wash out/coat/print
- Screens can be used up to 2 weeks at a time.
- Put things back where you found them/ where they belong, always
- All in-kind donations should be cleared by a lead. Please email printshop@sparkmakerspace.org
- The Print Shop does not have tiered access; anyone can use the space, BUT printers needing the space for printmaking do have priority.
- Damaged tools should be taken out of service and kept out of service, should reported to the lead & be labeled ASAP!
- You are responsible for reclaiming your screen after printing.
- Spark is not responsible for the safety of personal screens left at Spark.
    - Personal screens are best not left at Spark

    - If left (at your own risk) it will follow all the rules of the Printshop (must label/date/2 week limit)
- Use the Give-Back Bin when using Spark consumable materials. Buying your own ink and material is encouraged (especially when doing large jobs).
- Be cognizant of others' workspaces & their limited time here.
- Personal tools and materials left in the shop will be considered public property.

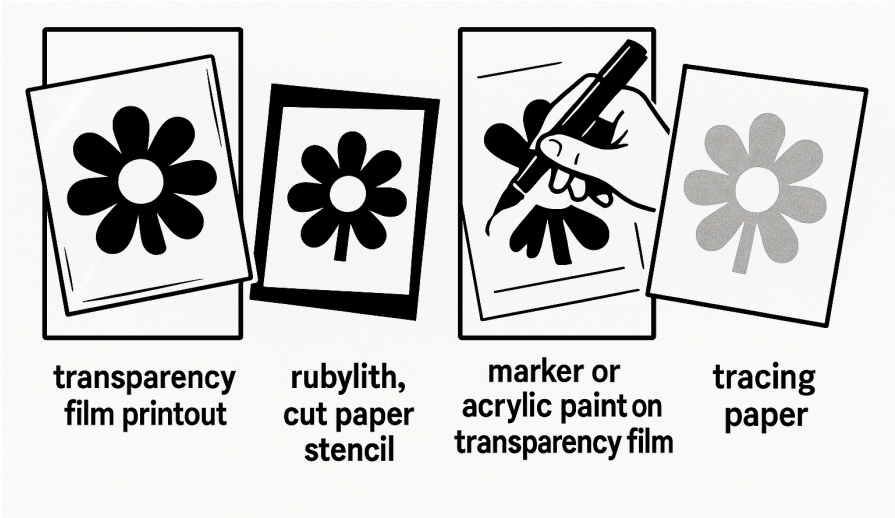
IMAGE (What makes a good image?)

- High contrast: Bold black and white images work best (grayscale or low-contrast designs may not burn clearly)
- Clean lines: Avoid overly intricate or blurry edges—sharp, clear outlines will transfer best
- Solid areas or halftones: Large areas of flat color or well-done halftones print better than soft gradients
- Resolution matters: Minimum 300 DPI if you're printing from a digital file
- Black artwork on a transparent background: For burning screens, your artwork should be solid black on a clear film or transparency
- No fine gradients: Soft blends or fades can be difficult to reproduce—use halftones instead if you need tonal variation.
- Simpler prints work better: Limit color count and complexity for a cleaner, more successful print—especially for beginners.
- Thicker lines are safer: As a general rule, avoid lines thinner than 0.5 pt unless you're using 220 mesh and printing on paper.



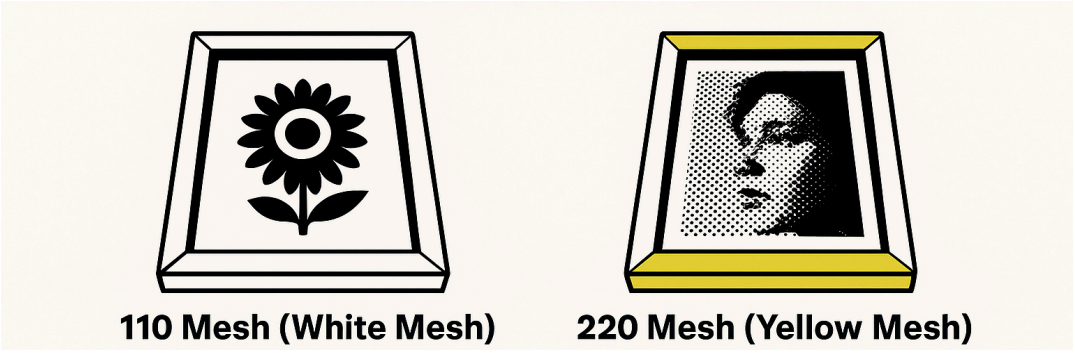
COMMON TYPES OF STENCILS

- transparency film printout
- rubylith, cut paper stencil
- marker or acrylic paint on transparency film
- tracing paper



PICKING YOUR SCREEN

- In the Spark Printshop, screen mesh color denotes mesh count. White mesh screens are 110 mesh count. Yellow mesh screens are 220 mesh count.
- About 110 Mesh (White Mesh)
    - Wider mesh openings allow thicker ink to pass through
    - Great for fabric printing (e.g., t-shirts, tote bags), good on paper
    - Easier to coat, burn, and print with—ideal for beginners
    - Good for general printing/most printing done in the shop
- About 220 Mesh (Yellow Mesh)
    - Finer mesh openings for thinner, more detailed ink deposits
    - Best for paper or flat surfaces where crisp detail is needed
    - Best for designs with fine lines and small text
    - More sensitive to coating and exposure errors
    - Requires smoother, more even ink application
    - Not recommended for heavy or thick inks
- Make sure the screen you choose is large enough for your image- it should be at least 2 inches less on each edge of the frame.

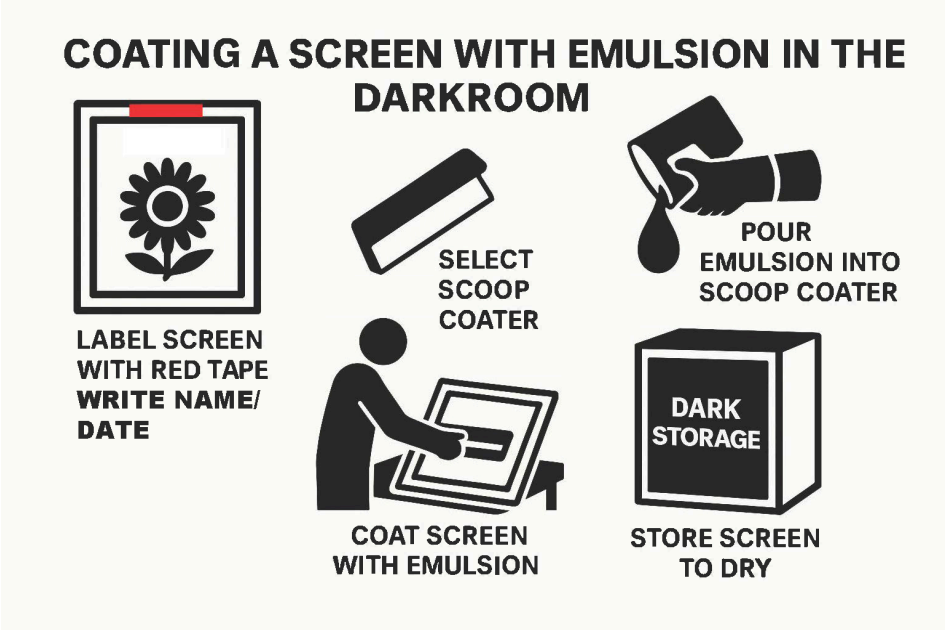


110 Mesh (White Mesh) **220 Mesh (Yellow Mesh)**

COATING A SCREEN WITH EMULSION IN THE DARKROOM

- Clearly label and date your screen before coating (use RED tape)- screens can be kept for your future use for up to 2 weeks.
- The screen should be bone dry and free of dust, and make sure the scoop coater is dry and free of debris as well.
- Choose your scoop coater
    - Should not have any nicks on its edges
    - Make sure the scoop coater you choose is large enough for your image, but not wider than the frame- it should be at least 2 inches less on each edge of the frame.

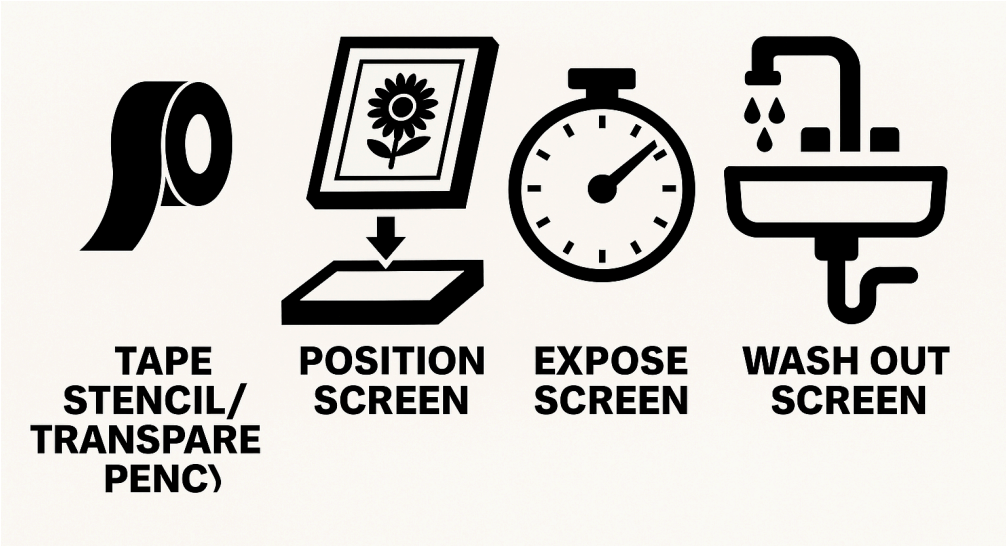
- Get ready to enter the darkroom- grab your screens, a clean rag, a flat edge, the scoop coaters, spatula, gloves, aprons... whatever you're going to need. Make sure the workspace in the darkroom is free of dust, etc, and set yourself up before starting to coat.
- Find the emulsion and carefully pour an even amount into the scoop coater
- Set your screen up at a comfortable height and angle; you don't want it to slip.
- Carefully, and with plenty of space from the top and bottom edges of the frame, coat your screen evenly and lightly to avoid drips.. Make sure to use the sharper edge of the screen coater to apply emulsion (as opposed to the rounded edge)
- Use a spatula to scrape all remaining emulsion from the scoop coater back into the emulsion bucket.
- Close the bucket tightly.
- Put the coated Screen in Dark Storage to dry.
    - Make sure not to leave Dark Storage ajar/let light in. Light exposes the screen and will ruin all screens in Dark Storage.
- After coating your screen, it needs at least 24 hours to dry
- Trying to burn your screen before 24 hours will create exposure/wash-out errors
- Using just water and a rag/sponge, wash the scoop coater and spatula completely- no blue emulsion should remain anywhere!! Wipe dry and place on the rack by the sink to dry.



EXPOSING A SCREEN

- Tape your stencil/transparency, right reading (not backwards), onto the exposure unit.

- Position your coated screen flat side down over the stencil/transparency (so the mesh is touching the table) and weigh it down.
- Turn on the exposure unit
    - Make sure both bulbs are on
    - Time: Expose 110 mesh (white mesh) for 13 minutes. For 220 mesh (yellow mesh), expose for at least 15 minutes.
- Wash out the screen in the sink until you see your image, and the mesh is clean elsewhere
- Remove/clean any tape left on light table

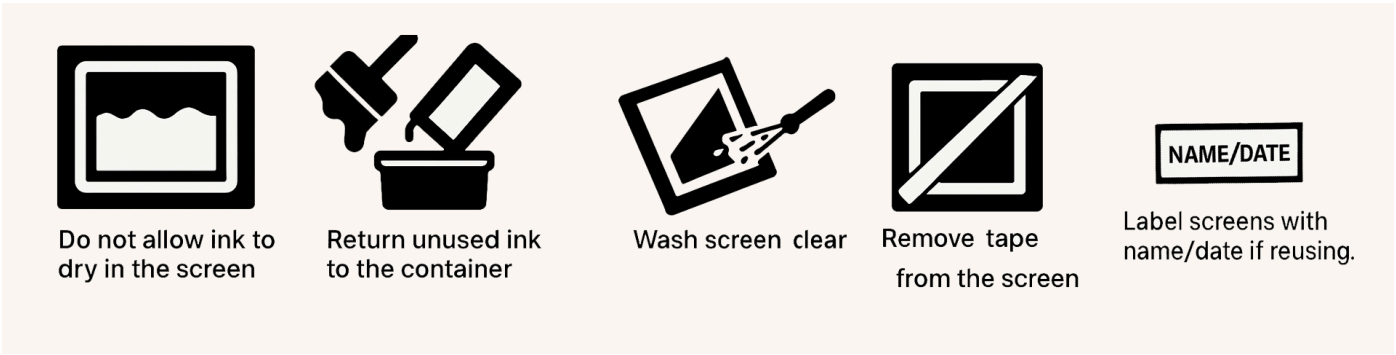


PRINTING

- Tape the edges of your screen with white low-adhesion tape to prevent/block ink from open areas.
- Gather ink, squeegee, spatula, rag, wet rag, and scrap paper before starting.
- Feel free to use a designated small “dirty table” to put your ink, squeegee, spatula, rags, etc.
    - This is a way to separate potential accidental ink stains/smudges away from your project
- Keep the ink away from the frame's well (inside edges of the screen).
- Pay attention to ink thickness and consistency to avoid bleeding or smudging.
- WHEN PRINTING ON A FLAT SURFACE
    - Use the Printing table with butterfly clamps
    - Secure your frame in place with the clamps
    - Clamps can be moved on the track by loosening bolts
- PRINTING ON A SHIRT
    - Best done on the 4-screen press (even if only one color

WASHING UP AFTER PRINTING:

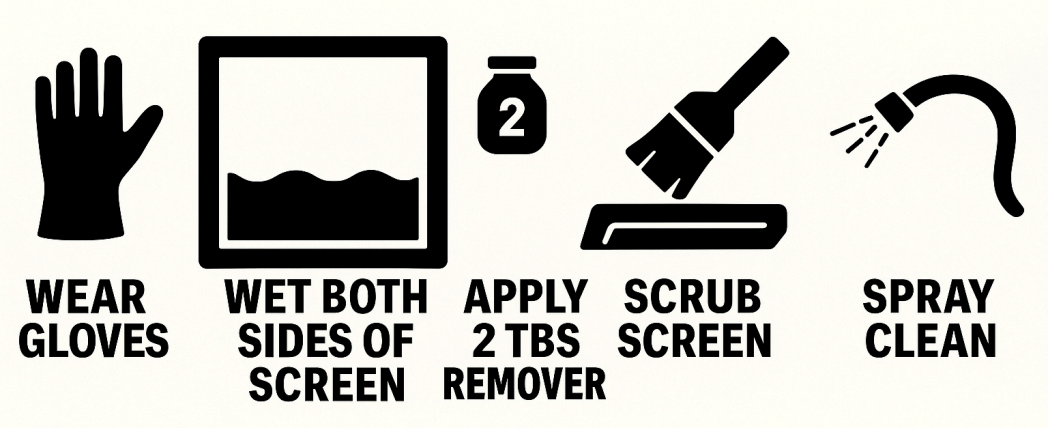
- Do not allow ink to dry in the screen.
- Return unused ink to the container (ink not mixed).
- Remove the white tape from the screen.
- Wash spatulas, squeegees, and work surfaces thoroughly.
- Label screens with name/date if reusing. Unlabeled screens are free to reclaim



REMOVING EMULSION (reclaiming a screen)

- Use gloves
- Lightly wet both sides of the screen
- Use only 2 tablespoons of Rhinoclean emulsion remover

- Using the designated brush, scrub both sides of the screen
- Do NOT leave the brush sitting in the cleaner, dip it, then apply
- Let it stand for a minute, scrub as much emulsion off as you can before using the spray hose. This conserves both cleaner and water.
- Spray/ scrub THOROUGHLY until the screen is completely free of any emulsion, including pinholes. Be diligent and use light to check for pinholes. This is one of the most important parts of screen longevity!



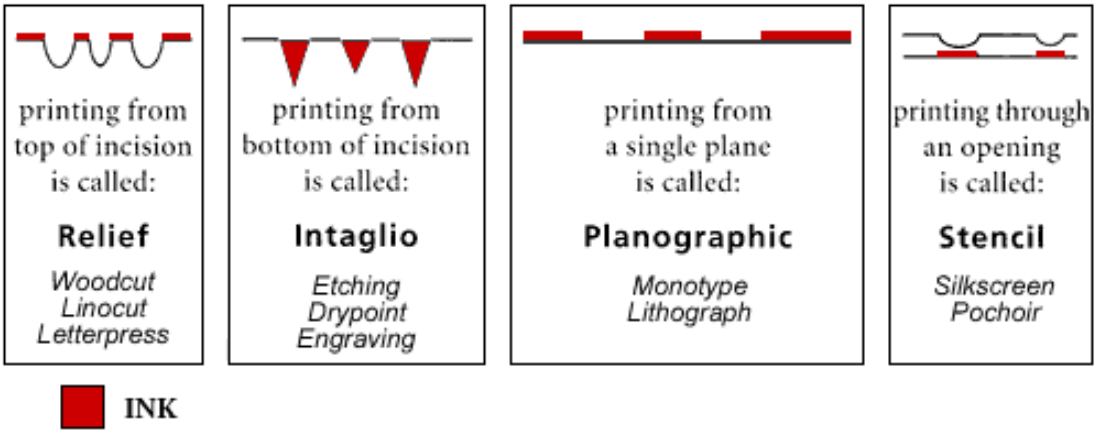
Relief Printmaking 101: Linocut

In this class you will carve and print a single-color linocut print of your own design and receive an orientation to the print shop. Upon successful completion, you will be certified to use the print shop and printing press without supervision. Please listen carefully and ask questions. Email additional questions to the print shop leads at printshop@sparkmakerspace.org.

Definition of Relief Printing

Relief printing involves carving away parts of a surface to create a design. The remaining surface is inked, leaving the recessed surfaces ink-free. If you've ever used a stamp, you've made a relief print!

Ways of Making Fine Art Prints



Welcome to the Spark Print Shop

The print shop uses only non-toxic, water-soluble inks; caustic supplies are not permitted. Today, you can access a variety of inks that clean up with soap and water. If you aren't sure if the ink you want to use is permitted, please check with a lead.

Amateur printmakers are encouraged to use the communal ink. If you are printing multiple pieces, please make a donation to the print shop so we can replenish our supply of ink. If you run out of ink, dispose of the container and email us at printshop@sparkmakerspace.org.

Regular users of the print shop are encouraged to bring your own ink to use and store it either in your cubby or bring it home with you. If you wish to donate leftover ink, please leave it on the table with a note.

The print shop is set up for the following types of printmaking:

- Linocut
- Woodcut
- Wood Engraving
- Drypoint
- Collagraph
- Monotype
- Cyanotype
- Silkscreen

Our library has several books on printmaking, and our leads have additional resources for those who are interested. Take the time to invest in your education! You won't regret it.

Pablo Picasso, Danseurs et musicien (Dancers and musician), 1959

An Introduction to Relief Printmaking Tools

- **Writing Implements.** Pencils to draft a design and transfer it onto the block, and permanent markers (optional) to make the design easier to see and carve.

- **India Ink.** A traditional writing ink used to prepare the carving block to make it easier to differentiate the surface of the block from areas that have been carved away. (If the carving block is made of plywood, use acrylic paint diluted with water to stain the block.)

- **Carving Block.** Linocut blocks come in traditional linoleum, vinyl, and rubber. Each varies in terms of ease of carving and the level of detail it can hold. (If you're making a woodblock print, use ⅜" or ½" shina or cherry plywood.)

- **Tracing Paper.** A low-opacity paper used to trace your design with a graphite pencil and transfer it onto the carving block. (If you are carving a woodblock, you will want to reverse the image and use carbon transfer paper and a pencil to transfer the design.)

- **Bunishing Tool.** A tool used to transfer your design from the tracing paper to the carving block. You may use a bone folder, the heel of a gouge, or the edge of a baren.

- **Stropping Tool.** A simple tool used with honing compound to polish, deburr, and maintain gouges, it should be used before every carving session.

- **Gouges.** Tools used to carve linoleum and wood for printmaking.

- **Bench Hooks.** Wooden or metal work areas that hook onto a table and provide a stop against which the carving block can be firmly held so it doesn't slip.

- **Relief Printing Ink.** Water-soluble block-printing ink for printing your design on paper or fabric. Printing on fabric requires fabric-specific inks.

- **Palette Knife.** A tool used to remove ink from a container and place it on the inking plate. It can also be used to mix inks to modify the original colors.

- **Inking Plate.** A piece of tempered glass onto which you place and prepare your ink, rolling it out with a brayer so you can transfer it onto the printing block.

- **Brayer.** A small hand roller used to thinly and evenly apply ink onto a printing block. Brayers should be stored out of direct sunlight.

- **Newsprint Paper.** A low-cost, non-archival paper used for test prints, as a barrier to protect the printing press blankets, and to remove ink from your tools and blocks.

- **Printing Paper.** There are a wide variety of papers available for printmaking. If you're hand printing, lighter papers let you see when the image has transferred. If you're using a press, experiment with heavier papers, including cotton and handmade papers.

- **Registration Grid.** A simple make-it-yourself tool that provides an easy way to ensure that your paper and printing block are lined up correctly.

- **Washi Tape.** A type of brightly-colored masking tape that sticks to most surfaces and is easy to remove without causing damage.

- **Baren.** A small burnishing tool used to apply pressure to the back of a sheet of paper to transfer ink from the printing block to the paper. Some printmakers use a wood or metal spoon for the same purpose.

- **Printing Press.** A simple machine with a solid press bed that slides between two rollers. The top roller is adjustable. Printing blankets ensure that the pressure is applied evenly across the paper as it presses into your printing block.

- **Drying Rack.** The drying rack is an efficient use of space that allows you to dry multiple prints at once. When using the drying rack, make sure you label your work with your name and date of completion. Please do not monopolize the racks, and make sure you remove your work as soon as possible. If the rack is needed, printed work will be relocated to a pick-up bin. Completed work must be picked up within three weeks, or it will be given away, repurposed, or recycled.

Brayer

Baren

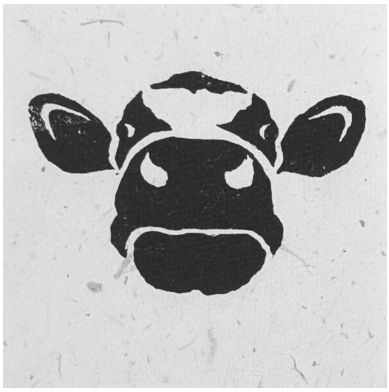
Gouges

Bench Hook

Step 1: Preparing Your Image

As a beginner, you will be learning the basics of relief printmaking, including how to use the gouges safely while making a successful print. Keeping your design simple will help you avoid frustration and allow you to focus on the fundamentals. A beginner design features:

- A bold image.
- Thick lines.
- No fine details.



Step 2: Choosing Your Carving Block

Linocut blocks come in several forms. Each type of block is suited to different purposes:

- Linoleum is a harder substrate that holds fine details well. It can dry out over time, making it crumble. The more gently you wash it, the longer it will last.
- Vinyl is easier to carve than linoleum, holds details fairly well, and is not likely to dry out over time, so it is very resilient and easy to wash.
- Rubber is very soft and easy to carve but does not hold fine details as well. It is best used for handprinting on fabric.

Linoleum

Vinyl

Rubber

Step 3: Transferring Your Image to the Block

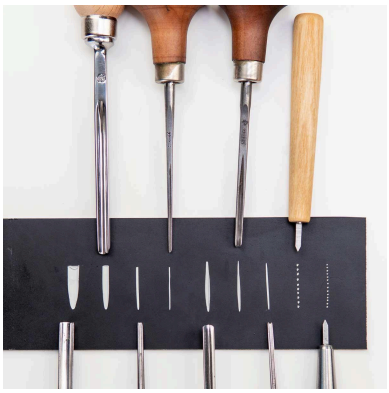
There are several ways to transfer your image to the block, but one of the easiest is to use tracing paper and a graphite pencil and follow these steps:

- Trace your design onto tracing paper using a graphite pencil.
- Place the tracing paper onto the carving block, pencil-side down, and secure with tape.
- Use a burnishing tool to apply pressure to the pencil lines.
- Lift a corner of the paper to make sure the design is transferring to the block.
- You may wish to go over the lines with a Sharpie and stain the block with India ink.

Step 4: Carving Your Image

There are several gouges on the market, and each set has several carving blades. Each blade makes a different mark. Before you carve your block, experiment with each of the tools on a piece of scrap linoleum. Get used to using them and understand the marks each makes. A typical set includes:

- A knife.
- U-shaped gouges.
- V-shaped gouges.
- A flat chisel.



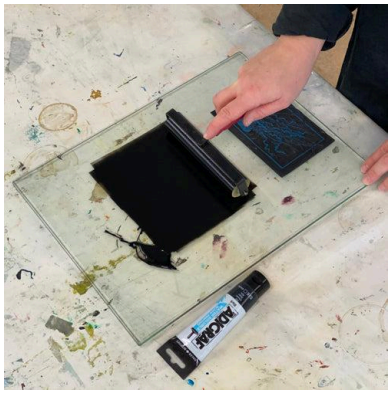
It will take time to get comfortable using the gouges. Here's how to use these tools safely:

- Never cut towards yourself.
- When cutting curves, turn your lino.
- Allow the tool to do the work.
- You don't need to dig into the linoleum. A shallow carve is best (and you can always go over it if needed).
- Once you are finished carving, use a stiff paintbrush to remove leftover pieces of linoleum.

Step 5: Inking Your Block

Before you select your ink, make sure your work area is clear of all dirt and debris. Once the area is clear, take out the printing plate and brayer, and follow these steps:

- Select your ink and paper.
- Transfer a 1½” line of ink to the plate.
- Pull the brayer through the ink, first going down the plate and then across, in a small square about the size of the brayer. (Your goal is to cover the brayer evenly.)
- Continue rolling the ink until you hear a slight Velcro sound and the ink resembles citrus peel. Now you’re ready to print.



Step 6: Making a Print

Each step of the printing process is an experiment. How you lay the ink, the amount of ink you use, your ink coverage, and the pressure you apply to print your work all affect the results you get. Don’t get discouraged if your print doesn’t come out perfectly. To print your block:

- Once the brayer is evenly covered in ink, roll it onto the block.
- Ink the brayer to transfer more ink to the block. Cover the block evenly.
- Once the block is inked, place the paper on top of the block.
- With a baren or spoon, apply pressure to the paper, moving in circles.
- When you think the ink has transferred to the paper, continue to burnish the paper for another 10 seconds.
- Peel a corner back to check your print. If it looks good, keep peeling. Otherwise, continue burnishing.
- Place the finished print on the drying rack and repeat the process.

Step 7: Finishing Your Printing Session

Maintaining the tools and cleaning the block, brayer, and studio is essential to the Spark Makerspace community and the print shop. This is a communal studio, and we are all responsible for taking care of it. To finish your printing session, follow these steps:

- Wash the inking plate, brayer, and lino block in the sink. Use hand soap or dish soap if needed. Wipe each dry with a towel and return the plate and brayer to the shelf.
- Make sure the covers to the ink are on tightly and return to the appropriate drawer.
- Wipe down the tables using the brown spray bottle of soap and water near the sink. Spray the soapy water onto the table and clean up with paper towels.
- Repeat this step until you don't see any ink on the tables or the paper towel.
- Use the SlipStrop and honing compound to maintain the gouges.
- Spread honing compound on the flat leather side of the strop. Place the outside beveled edge of the gouge against the strop and pull across the strop to deburr the edge.
- To hone the inside edge of your gouge, find the strop profile that fits the tool. Drag the gouge gently down the strop profile to remove any burrs.

The Flexcut SlipStrop is used to maintain the gouges. If you're not sure how to use it, ask a lead to show you!

Instruction Handout for Setting an Etching Press for Intaglio and Relief Printmaking

Introduction

This handout will guide you through setting up an etching press to safely and effectively print both intaglio and relief plates. By following these steps, you'll ensure consistent results, protect the press, and maintain your safety.

Supplies

- **Etching press** (commonly available in studios or universities)
- **Printing blankets** (1.5mm, 3mm, and 6mm sizes recommended)
- **Runners** (made from lino, plywood, or cardboard)
- **Newsprint paper** (for testing and adjustments)

Setting the Press for Relief Printmaking

Relief printing transfers ink from the raised surfaces of the block.

Step 1: Use Runners

- Place **runners** (lino, plywood, or cardboard strips) on either side of the plate. The runners should match the height of your printing block.
- This ensures even pressure and prevents the roller from dropping at the edges.

Step 2: Adjust Pressure

- Lower the spindles evenly until the roller touches the runners and plate. Tighten slightly further to apply enough pressure for printing.
- Adjust with layers of newsprint to fine-tune the pressure.

Step 3: Custom Runners for Unusual Heights

- Create runners using scrap cardboard. Layer the cardboard as needed to match the plate height.
- Test the setup with a pressure check and add or remove layers until the height is correct.

Tips for Safe and Effective Press Use

Do:

- Raise and lower both spindles evenly to maintain roller alignment.
- Use appropriate blankets for intaglio prints and runners for relief plates.
- Test pressure with scrap paper before printing.
- Maintain press cleanliness by placing a clear plastic sheet on the bed.

Don't:

- Adjust only one side of the roller; this may damage the press.
- Apply excessive pressure without testing incrementally.
- Neglect cleaning the press bed, as debris can affect prints.

Glossary of Terms

- **Etching Press:** A machine applying pressure to transfer ink from a plate to paper.
- **Intaglio:** Printing technique using recessed grooves to hold ink.
- **Relief Printing:** Printing technique using raised surfaces to hold ink.
- **Blankets:** Felt layers for cushioning and even pressure in intaglio printing.
- **Runners:** Strips ensuring even pressure for relief blocks.
- **Registration Sheet:** A guide for aligning plates and paper.
- **Newsprint:** Paper used for testing and packing.
- **Roller and Spindle Screws:** Components adjusting pressure in the press.

Lino on the Printing Press:

IF PRINT IS TOO DIFFICULT TO PUSH THROUGH, **DO NOT FORCE IT.** YOU WILL BREAK THINGS Stop and loosen the press. If there is resistance when setting the pressure, stop and tell a lead. *Do not use mounted linoleum.*	**WEAR GLOVES/WASH YOUR HANDS,** **DO NOT GET INK ON BLANKETS**
For linocut, be aware of blanket thickness; **use the thinnest blanket only** for linocut	Check your pressure when printing; Lino does not need a lot of pressure! • **Make sure the roller is level!** • Just enough so that when you turn the crank, it all moves through
Wipe down the bed with **soap and water** between uses	Extra paper adds pressure and protects the blanket; Cardboard around the block helps roller move across heights ○ Start and stop on the cardboard ○ Do **NOT** roll off the cardboard ○ Can use a piece of tape to mark where to stop

New Member – FIBER – Orientation

Revised 7/27/2025

1) Welcome to Spark MakerSpace.
    a. Hi, my name is Sherri and I am one of the leads in the Fiber Studio here at Spark. Our other Fiber Lead is Teresa. If you have any questions, run into any issues or have any requests PLEASE don't hesitate to contact us at Fiber@MakerSpace.org
    b. Here we are in the front lobby. Your key fob will get you in the front door.
    c. Follow the ORANGE markings to the Fiber Arts studio. The restrooms are located here in the hallway

2) Welcome to the Fiber Studio
    a. The light switch is located right here at the entry. There are also hooks on the wall for hanging your coat & bag, if desired
    b. Members accessing Stained Glass and Electronics will pass through the Fiber Studio to get to those studios.
    c. All studios are shared by many members. As such, it's very important that you leave the space clean and uncluttered.
    d. Behind the door is a mirror
    e. Here on the left is where you will find consumables. The cubicles are clearly labelled with their contents – thread, trims, zippers, and other notions. Here you will also find pins, needles, and machine attachments. These items are available free for general use. With consumables we always say "don't be greedy, use what you need, and give back when you can!" If you need to consume large quantities of something you should be providing your own supplies. Donations are always greatly appreciated.
    f. On top are additional irons as well as interfacing and fusible web. You can find our manuals online on our wiki at wiki.sparkmakerspace.org/
    g. You can get water for the irons in the restrooms. It is IMPORTANT that when you are done using the iron you
        i. DRAIN ALL WATER from the water vessel and
        ii. Leave the COVER for the water vessel in the OPEN position. Not doing this could result in any remaining water damaging the irons.
        iii. And make sure the iron is cool to the touch before leaving

    h. Notice the large clean work table. This is a perfect place for laying out your fiber project, for cutting, for organizing, etc. This table is on locking casters. The casters can be unlocked to allow you to move the table away from the wall for access all around. The surface is not heat-resistant, so do not place hot iron/other heated tools on this table.
    i. Under the table is storage for pattern drawing paper, multiple sewing machines (some you can borrow!) and other supplies that don't fit in the cubicles.
    j. If you would like to borrow one of these machines to bring home for use email fiber@sparkmakerspace.org to make arrangements with one of the Fiber Leads.
    k. Above the table is a display of several projects / classes
    l. To the right you will see scissors and rotary cutters hanging on the wall.
        i. Rotary cutters are extremely sharp, and are used with the cutting mats hanging on the wall and placed on the large cutting table. Do not use the large green mat on the table for rotary cutting, use the smaller mats, so we can extend the life of the table-sized one.

m. At the end of the cutting table we have a quilting setup. The quilt is clipped into the frame and you move the machine to do the quilting. At the end of the room are the embroidery machines – these do not 'sew', they are embroidery only and a separate certification is required once you pass the Fiber Arts studio / sewing machine certification.

n. The window display is changed regularly to show off some of the things that Spark members are working on. If you have an idea for a display and/or would like to display some of your work, reach out to a Fiber Arts lead or speak to the Spark executive director.

o. Beside the ORANGE shelf unit are additional ironing boards. In the orange shelf unit you will notice a large quantity of various fabrics. These are available for general use. There is no additional charge for use of any of the fabrics and supplies. They were all received as donations from a wide variety of sources. Although they are available for general use, there are a few considerations that should be noted here
    i. The quantities you use should be reasonable – if you need a large quantity of anything, you should purchase your own supplies
    ii. Please consider making donations of supplies to Spark to help replenish those used or supplies that you may have on hand at home but no longer have use for.

p. Along the wall, you will notice cutting mats are stored hanging on the wall. You will also notice a few small work tables – which contain sewing machines. You are welcome to use any of these machines or change them out for ones that are stored under the large work table. The small tables are height-adjustable and on lockable casters. Use the hand crank on the right hand size to raise/lower.

q. We have several different Pfaff machines that operate quite similarly. In the certification you will learn how to use them, wind a bobbin, change the needle, etc. We also have a straight-stitch only Janome (and a similar Pfaff on the quilting frame). These take different bobbins and needles, just ask if you have any questions.

r. If you are certified to use a sewing machine, refer to the manual for the specific machine you will be using to ensure proper threading and proper use of that specific machine. As always, if you encounter any problems or have questions, email Fiber@SparkMakerSpace.org for help. If a machine is not working / broken, use one of the tags on the wall to indicate that it is out of service and email us with details on what seems to be wrong so we can take a look at it.

s. OK, let's wrap up our tour of this room with the serger. The serger is simply another sewing machine but has a very specific use. It will finish the edges of your fabric so that they will not fray. You must be "certified" to use this machine. Contact a lead or attend a station orientation to obtain certification.
    i. NOTICE THAT THE MACHINE IS ALREADY THREADED. DO NOT UNTHREAD THE MACHINE OR ATTEMPT TO CHANGE THE THREAD. THIS IS A COMPLEX PROCESS AND NOT TO BE DONE BY ANYONE
    ii. If you encounter ANY issues, have questions (including requesting the change of thread color), email Fiber@SparkMakerSpace.org.

3) As a reminder, anything that you take out, you should replace it to its storage space.
4) Before you leave the room, be sure that anything you plugged in is unplugged and turn off the light.
5) As we walk from the Fiber Room to the co-working space, notice the cubbies and lockers here. These are available for member storage. If you would like to use an unoccupied cubby or locker, be sure to label it with your name. If you wish to lock a locker, you will need to provide your own lock. Note that Spark takes no responsibility for any supplies or work that you leave on site. Although our membership

is comprised of wonderful, caring and generous people, it is still your responsibility to secure your own belongings

6) In the back area here is storage of additional Fiber Arts consumable supplies
7) Also in this space is located a refrigerator for storing any snacks as well as snacks and beverages available for a donation.

Thank you for joining me on this tour of Fiber Arts. I hope you found it useful.
If you encounter ANY issues, have questions or requests, email Fiber@SparkMakerSpace.org.

We look forward to a time when we can be together and please safely enjoy Spark MakerSpace.

Introduction to Sewing Machine class

Agenda - General Intro / Information

- Manual
- Machine Parts
- Thread
- Needles
- Bobbins
- Tension
- Accessories
- Basic Operation
- Safety
- Troubleshooting
- Maintenance
- Serger

Manual

- All machines are different – keep manual handy, refer to it for guidance
- All Spark machines have manuals available

Machine Parts

- Power Switch (if applicable)
- Light
- Hand Wheel – turn toward you
- Take Up Lever – moves the thread through the machine
- Presser Foot Lever – up to place / remove fabric, down to sew
- Tension Dials – upper tension – adjust as needed for thread, fabric, stitch, etc
- Feed dogs – move the fabric through the machine
- Throat Plate
- Thread Guides – support the thread along the machine
- Thread Cutter
- Bobbin case & bobbin – front / side, top / bottom (impacts needle as well)
- Needle – various types, sizes dependent on project / fabric. Eye of needle faces bobbin housing
- Stitch Settings & Reverse – variety of settings, generally reverse at beginning and end of seam

Thread

- Generally use good quality Polyester or Cotton (or blend) All-Purpose thread
- Don't use the really "cheap" stuff or old thread
- Specialty thread (quilting, upholstery, embroidery, metallic, etc) requires changes in needle and other settings

Needles

- Size dependent on fabric type & thickness
- Ball point vs. regular point depending on fabric type
- Generally use standard point size 10-14
- Make needle isn't nicked or bent and is sharp
- Changing the needle – change often (generally after a couple of projects)
- Groove on needle shaft
- Direction of needle eye corresponds to location of bobbin (can be front or side-loaded).

Bobbins

- Don't use purchased, pre-wound bobbins – poor quality, likely issues
- Bobbin location (front or side)
- Generally – bobbin to spin clockwise (unless manual says otherwise)
- Bobbins - style / size (refer to manual)
- Winding a bobbin

Tension

- Don't adjust bobbin tension
- As needed adjust top tension (some newer machines don't have)
- What a properly adjusted tension looks like on fabric
- Tension setting will vary based on fabric, thread, stitch, etc If tension is way off, it is more likely a threading issue rather than a tension dial issue.

Accessories – guides, feet,

- Different feet – straight, zigzag, zipper, gathering, buttonhole, LOTS of others
- Seam guides

Basic Operation – speed, stitches

- Select stitch setting – straight, zigzag, etc. Make sure you are using an appropriate throat plate.
- Select stitch length – long for basting, medium for general use
- Select stitch width – 0 for straight stitching, various others for different stitches
- Lift presser foot to place fabric
- Lower presser foot before stitching
- Moderate, rhythmic speed
- Generally reverse at beginning and end of seam to secure it
- End with needle at HIGHEST position to free thread and allow removal of fabric – always turn the hand wheel towards you when raising the needle
- Lift presser foot to remove fabric
- Leave at least 4" thread tails behind the needle to prevent the needle from becoming unthreaded when you start the next seam.

Safety

- Always test sew on a scrap before you start on your project – consider that the person sewing before you may not have needed the same needle that you need, check that and replace as appropriate
- DO NOT stitch over pins or other objects
- Keep stitch speed moderate
- Do not operate while under the influence of substances
- Keep body parts away from moving needle
- Unplug or turn off prior to changing needle or otherwise working with the machine
- Keep dangling hair, jewelry, clothing, etc away from moving parts on machine

Troubleshooting (in no particular order)

- Check to verify plugged in and light turned on (and if applicable power turned on)
- Check to verify machine is threaded properly and threaded with proper thread
- Check to verify bobbin is properly wound and correctly seated
- Check needle – properly installed, not nicked or bent and is sharp
- Check to verify tension is properly set
- Check to verify machine is clean and oiled
- Report issues – tag out and email us as directed on the tag.

Maintenance

- Use a soft brush to sweep away any remaining dust or lint – these are located in the top drawer of each table
- Refer to manual for oiling instructions. Apply ONLY sewing machine oil to moving points of contact or oil points (if applicable)
- Replace needle frequently – not just when it breaks – every 8 hours of sewing time or any time you hit a pin/zipper/ other metal object.

Serger

- Raise the thread guide pole
- VERIFY that thread isn't obstructed in ANY way
- Leave a long chain of stitching to prevent accidentally unthreading machine
- Does NOT have a reverse
- Don't adjust tension
- Report issues

Additional Notes:

Introduction to the Spark Makerspace
Stained Glass Studio

The studio is a fully-equipped coldworking art glass area, accommodating first-timers as well as advanced-level glass artists. It is a fun and colorful space where members learn the skills to work with art glass. Take a class, upgrade technical skills, try out new techniques, or teach and support others.

The studio is equipped with cutters, grinders, soldering irons, metals and chemicals in a large assembly area. Generously donated art glass is available to members and class attendees.

Projects made in the studio include window and door panels, suncatchers, lamps, boxes, 3-D ornaments and mosaics.

Classes occur regularly to introduce tools and techniques to both members and non-members. There are “first-timer” workshops, a members’ certification class, 6-week beginners course, 1-day and weekend workshops, and skillshare demonstrations. Once “certified’, Spark members may use the studio at any time.

The most commonly asked questions about the area are below. There is an experienced Studio Lead to help you learn to use the space safely and enjoyably.

Who is the studio lead?

I want to get into the studio. What’s the FIRST thing I have to do?

The first step in accessing the stained glass studio is viewing the “Stained Glass Studio Orientation Video” reading through the document “Stained Glass Studio Orientation, Safety & Policies”.. Once you’ve read through them, **e-mail** the leads. We’ll schedule a time to sit down, answer questions, discuss the shop, and sign off on shop access. We will also be scheduling regular safety orientations in the upcoming months - keep an eye on the Spark member emails.

Ok, but that only gets me access to the basic hand tools! I want to . . .

. . . learn to use the power tools.

Classes and instruction are available in the shop on a regular basis. Classes are open to both members and non-members, and can be found on the Spark Eventbrite page. New classes are announced on the Spark website, the Spark Facebook page, and through mailings from the Spark ~~Fearless Leader~~ Executive Director, Casey Moran. Class descriptions will usually identify which tools you will get approved for use on. We try to offer classes that cover the interests and needs of our members, so if you have an idea for a class that you'd like to see us offer, let us know.

. . . get access to power tools I already know how to use.

If you already have experience with woodworking tools, you can bypass the classes by demonstrating to use that you are competent and safe. The first step is to review the Spark rules for the tools, which are found on the Spark Woodshop website. Because Spark has a wide range of both equipment and users, we have some requirements and restrictions which may not apply to a job site or home shop. Once you've read through the Spark rules, e-mail the Woodshop Leads with a list of the specific tools you'd like to be approved to use. We'll set up shop visit, and if you can convince us that you are a safe operator on the tools, we'll sign you off for use of those tools.

. . . do a project, but don't know how to use all the tools I need.

If you have a particular project you'd like to work on, but need additional instruction on one or two tools, let us know. We'll try to help you learn the tools or techniques you need to finish the project at hand. Please keep in mind that the Leads have full-time jobs and obligations outside of Spark, so expect some delay before we are able to find time for instruction.

. . . ask a question which is not answered here.

If you have any other questions, the e-mail address for the Woodshop Leads is woodshop@sparkmakerspace.org. You can also check the Spark Website or the Spark Wiki, below.

Spark Website:
https://www.sparkmakerspace.org/

Woodshop Wiki:
https://wiki.sparkmakerspace.org/index.php?title=Woodshop

We look forward to seeing you in the shop!

STAINED GLASS STUDIO
ORIENTATION, SAFETY & POLICIES

- **PERSONAL SAFETY**
  - **Safety glasses** are **required** when scoring glass, soldering, or using powered saws.
  - **Dust masks** are **required** when using saws.
  - **Closed-toe shoes** are **required** at all times in studio. Shorts are not recommended due to risk of solder spatter.
  - **Gloves** are recommended when applying flux or patina.
  - **Small fan** use is recommended when soldering to ensure adequate ventilation.
  - **FIRST-AID KIT** is located on wall above light switch. Band-aids are also located on upper shelves.
  - **Fire extinguisher:** wall-mounted next to street exit door.
  - **If you are, or suspect you may be pregnant, working with lead came or solder is contraindicated.**

- **SOLDERING**
  - Use caution when removing irons from shelf. Avoid tangled cords.
  - Never “knock” or “tap” iron to remove solder!
  - Fully saturate sponge in iron holder. Clean tip frequently as shown using quick, light swipe on wet sponge or twisting in brass wool.
  - Do not lay iron down on table. Always place it back in stand.

- **Avoid breathing solder fumes directly.** Use fan or fume extractor to ensure adequate air movement and dissipate fumes. A dust mask is not an effective barrier for this. Use flux sparingly.

- **GRINDERS**
  - **First and always, make sure the water reservoir is full.** Wait until sponge is fully saturated and ensure it is making contact with grinder bit. NEVER GRIND DRY.
  - Safety glasses must be worn and grinder shield in place.
  - If grinder bit is excessively worn, use a different grinder and notify studio lead for maintenance.

- **CHEMICAL HANDLING, STORAGE, DISPOSAL**
  - Flux: Do not use flux directly from bottle. Pour minimal amount into shot glass: approx. 1 teaspoon. Add small amounts as needed. .
  - Pour unused flux down the drain with running water. NEVER pour unused flux back into bottle.
  - Apply flux using flux brush or q-tip. Avoid contact with skin. Gloves may be worn.
  - Minimize flux contact with tools as it is corrosive. Handle with care - avoid spills.
  - Patina: pour needed amount into small jar. Do not use directly from bottle. Wear gloves when applying. To avoid contamination, NEVER pour patina back into bottle.
  - Excess patina can be poured down drain with running water.

- **LEAD HANDLING AND DISPOSAL**
  - Do not use lead materials if you are or suspect you may soon become pregnant.
  - Place unused lead came in labeled jar on shelf.
  - Placed excess used solder in labeled jar on shelf.
  - Do not dispose of lead came or solder in trash.
  - Do not touch eyes, nose,mouth or consume food when handling lead. Wash hands after use.
  - The glass studio is an open area with adequate ventilation for soldering safely. If increased air movement is desired, a small fan is sufficient. Avoid breathing solder fumes directly.

- **MINI-TABLE SAW, MINI-CHOP SAW, RING SAW**
  - **Additional/separate training and certification is required by studio lead before using these saws.**
  - Dust mask and safety glasses **must** be worn during use.

- **WORK TABLES**
  - Closed beverage containers may be placed on shelves or file cabinet. No drinks on work tables. Consume food/snacks outside of studio, please.

- **PROJECT STORAGE**
  - Members may store 1 project board at a time, in the studio on a space available basis with max dimensions of 22”x25”.

- Label project with name and date and pin it to board. Do not use tape on homasote boards.
- Projects may be stored up to 3 months; if more time is needed, speak with studio lead.

TOOLS AND MATERIALS AVAILABLE FOR MEMBER USE (including, but not limited to):

- -glass cutters, running pliers, breaking pliers, breaker-grozers
- -grinders
- -donated glass
- -fids, files, foiler, layout blocks, homasote project boards, etc.
- -sal ammoniac tinning block, wire brushes, adhesives and glues
- -Mosaic nippers, wire bending tools, utility knives
- -glass squaring rulers, lead came tools, Morton board system
- -Mini-chop saw, mini-table saw (additional certification needed for these.)

- **CONSUMABLES**
- Community members are expected to provide their own materials for their personal projects. Consumable materials in the studio (glass, solder, flux, copper foil, grinder bits, came, patina, wire, polish) are intended for class instruction. Contact the area lead regarding purchase of supplies or online resources. When they're gone, they're GONE, so please consider replenishing consumable materials or make a donation to fund their replacement.

DEMONSTRATION OF SAFETY AND COMPETENCY

- Every user of the glass studio will be instructed in the use, safety and maintenance of specific tools, equipment and materials. Each person will be required to demonstrate safety and competency to the instructor/area lead in order to use the area without direct supervision. Training sessions will be scheduled as needed or requested. A record of safety, access and skills competency will be provided to you and retained with Spark including but not limited to:
- -grinder use and maintenance
- -soldering safety and tool maintenance
- -mini table and chop saws, Taurus ring saw
- -glass cutting tools and their care and maintenance
- -lead disposal
- -chemical handling and storage
- -compliance with closing checklist

CLEANLINESS

Flux corrodes metal (ie: it kills tools, copper foil and soldering irons!) Wash any hand tools used with soapy water to neutralize the effects of acid flux. Dry before putting away. At the end of a work session, return all tools to proper locations, brush off table, dispose of glass shards in scrap bin or trash. Sweep floor if needed.

ADDITIONAL COMMENTS:

Scheduled classes have priority in exclusive use of the studio. Be sure to check events calendar to ensure that the studio is available for open use by members.

QUESTIONS? (Better to ask than break something or get hurt!)

Call or text Valerie: 860-912-2020

Email Valerie: val.gilson@sparkmakerspace.org

Cleaning the Stained Glass Grinder

Expectations of Studio Users:

Makers are expected to clean up before leaving the studio. Please make this a priority and schedule it into your time in the studio. Cleaning your grinder is a mandatory part of the cleaning procedure.

Tools Needed:

- Trash can
- Small shallow plastic bin
- Plastic scraper
- Flat plastic burnishing fid

Process

- ☐ Turn off power switch
- ☐ Remove face shield and set aside
- ☐ Pry off white grid by inserting beveled edge of scraper at either front corner and GENTLY twisting to lift and remove grid
- ☐ Place shallow bin under drain opening on left side
- ☐ Remove silicone plug, allow water to drain into bin (**DO NOT put glass dust or "mud" down any drain. EVER)**
- ☐ Once emptied, replace plug **securely.**
- ☐ Blot up remaining water in reservoir using paper towels.
- ☐ Gently scrape up remaining "mud" using plastic scraper.
- ☐ Wipe reservoir clean, refill with water (just below overflow notch)
- ☐ Wash white grid, bit insert, and face shield with soap (**Use soft side of cleaning sponge only**)
- ☐ Rinse grinder sponge thoroughly.
- ☐ Snap white grid back into place
- ☐ Replace bit insert (**Make sure it sits flush with the grid)**
- ☐ Put back sponge. (Bottom of sponge should be immersed in water and sponge should make contact with grinder bit).
- ☐ Return face shield and turn power switch back on.

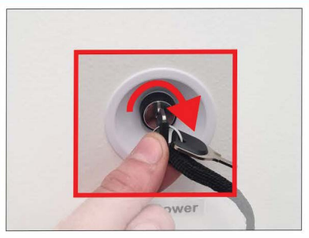
—-Good to Know—----
—- Troubleshooting—----

Click Here -> Table Of Contents

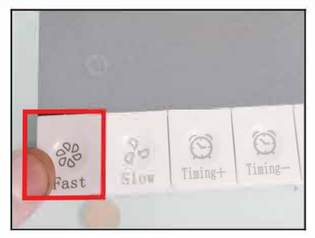
Basic Laser Steps

!!! This is a process reminder for the laser cutter. Members must take the class to use this machine! !!!

1. Turn on Laser and Ventilation

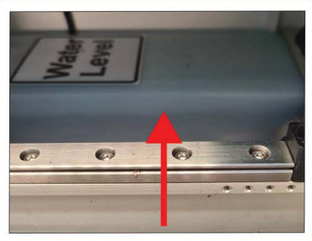


Find the key with the orange flashlight attached to it. Put it in and turn.



Turn on ventilation (fast). You should hear it.

2. Check Water Level



Open the lid and check water level on the right side of the bed. It should be almost full.

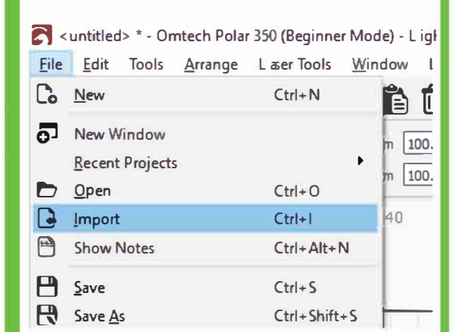
If less than half full, do not run the laser. Ask a lead to fill the tank.

3. Place Material

Place the flat on the surface.

Before proceding, ensure that the material is safe to cut! Refer to the list of approved cutting materials

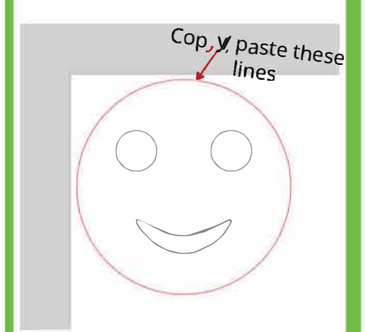
4. Import File into Lightburn



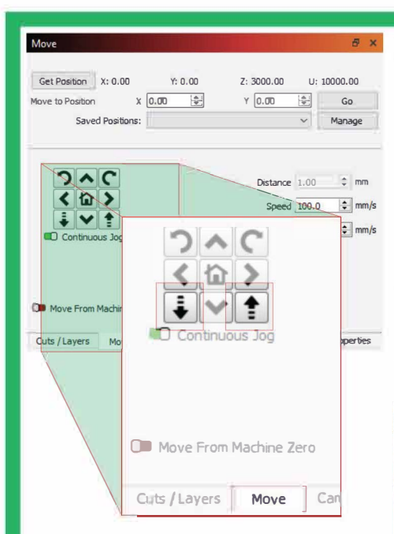
Go to file => import to bring in a DXF / SVG / AI / DWG, or one of many other types.

OR

Copy-Paste the vectors from your favorite graphics program.

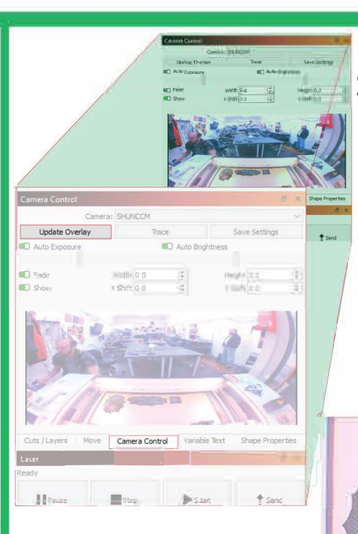


5. Set Z-Axis / Cut Location



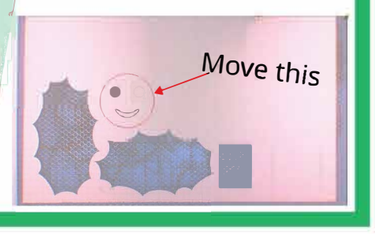
In the "**Move**" tab, move laser head over your material using the arrow buttons.

Place L-shaped focus gauge on platform and use up/ down buttons in Lightburn to set the correct depth.

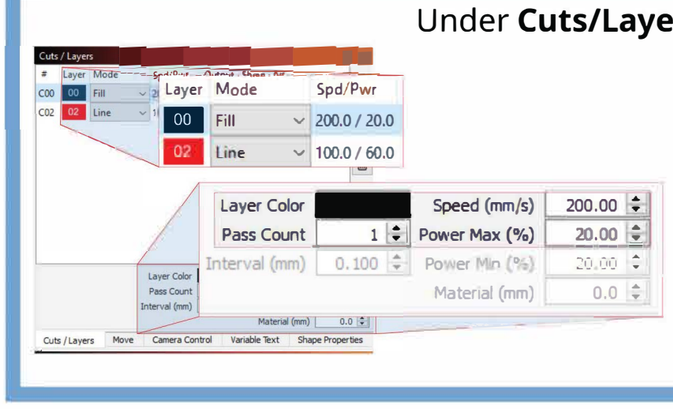


Set the cut / location in **Camera Control**"

Click "**Update Overlay**", and move design to where you want to make cuts.



6. Set Color / Power / Speed



Under **Cuts/Layers**, assign cut parameters to colors, and assign order of those cuts

Fill / Offset Fill: burns inside of a shape (Offset Fill burns spiral pattern)

Line: burns boarder of a shape / curve / line

Speed: max speed laser head will travel (mm/s). Decrease to cut deeper.

Power: % of 50W max output of laser. Increase to cut deeper.
To extend life of laser, please do not cut > 80% or < 10% power.

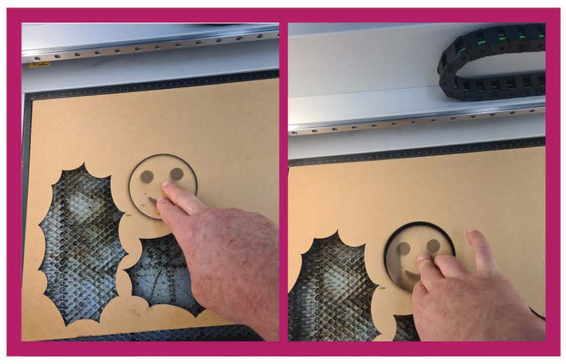
Pass Count: # of times laser will run color (please keep at 1).

7. Send Design and Cut

Hit **Start**!

Do not walk from the machine during cutting, and watch for flare-ups!

8. Check the Cut



SYMBOL KEY

Danger to Self / Others

If you miss this step, you could hurt yourself or others in the lab

Danger to Machine / Tool

If you miss this step, you could damage the machine

Danger to Your Project

If you miss this step, you could ruin your project or waste resources

Spark Makerspace

3D Printer Certification

3D printing is a type of additive manufacturing that creates objects layer by layer. There are several different types of 3D printers, but at Spark we only use plastic filament Fused Deposition Modeling (FDM) printers. Sometimes you'll see the acronym FFF which stands for Fused Filament Fabrication. Other types of printing might use liquid resin or a powder and lasers, and so the process is messier and more hazardous.

The process to make something on one of Spark's 3D printers involves these high-level steps:

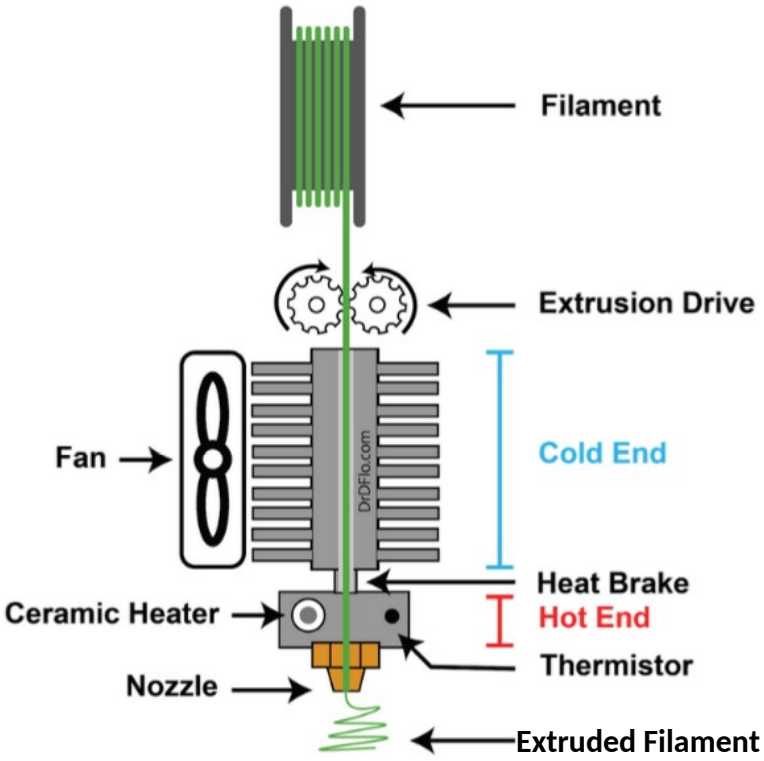
1. **Prepare** the 3D printer - clear the build plate, load the desired filament, inspect for anything that looks unusual
2. **Slice** an .stl or .3mf model into G-code
3. **Send** the G-code to the printer
4. The printer **extrudes** plastic in layers to create the object
5. Wait for the printer to cool off ~5 minutes and pop your print off the build plate. Leave the build plate clean and ready for the next person

There's also a section in this guide about what to do when things go wrong.

We'll go into these steps in more detail during the certification so you can see how they all work.

How does a 3D printer even work?

Okay. Let's start at the end of the process and talk about how the printer actually does its thing. 3D printing using plastic filament involves heating the plastic until it's melty and pushing it through a small opening in a brass nozzle. The plastic that's extruded will lightly bond to the printer's build plate or strongly bond to the previous layer of plastic that was extruded. Doing this layer by layer, the 3D printer constructs the object.



[Image from https://www.drdflo.com/pages/Guides/How-to-Build-a-3D-Printer/Extruder.html]

The 3D printer is instructed how to build the object by reading commands one at a time from a gcode file. These commands are not easy to read and could be something like "G1 X23" which means move the nozzle 23 mm in the X direction. Thankfully, we don't have to be able to read or write gcode to use a 3D printer.

Step 1: Prepare the Printer

The first main step is to prepare the printer.

1. Clear the build plate - double check for the “priming line”, which can sometimes look like a line painted on the build plate.
2. If you want to use a different color than what’s loaded, you’ll need to unload the current spool and load the desired one. See dedicated sections below.
3. Lastly, generally inspect the printer. Look for anything that seems “off” or “wrong”
4. Now the printer’s ready for the next print!

Unload the Filament

Important! Don’t let the free-end of the filament spool go. This risks a tangle in the future and potentially equipment damage!

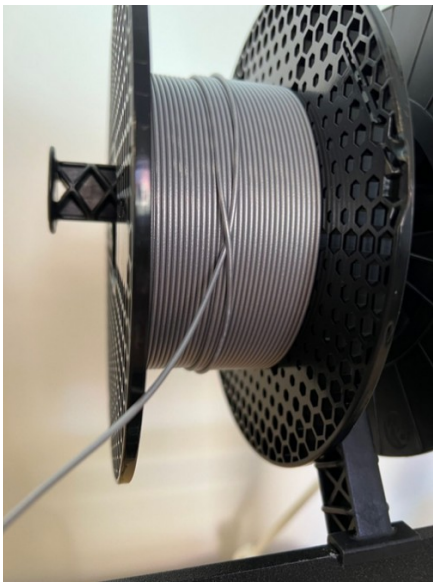
1. Heat the printer to **200C (for PLA and PLA+/Pro)**
2. Rotate the extruder knob counterclockwise until the filament is free
3. Open the filament dry box and remove the spool – hold onto the free end of the filament!
4. Rewind the slack onto the spool and secure the free end into holes in the spool
5. Store the spool in an airtight bag with a pack of dessicant
6. **Cool** the hot end

Load Filament

Important! Don’t let the free-end of the filament spool go. This risks a tangle in the future and potentially equipment damage!

1. Heat the printer to **200C (for PLA and PLA+/Pro)**
2. Remove the spool from the storage bag
3. Place the spool in the dry box and feed the free end of the filament through the dry box’s feed tube
4. Feed through the dry box’s feed tube and then close up the dry box
5. Feed the free end of the filament through the filament sensor and into the extruder – you can always trim the end of the filament if it’s “messed up”
6. Rotate the extruder knob clockwise until the filament catches then keep turning until you can see filament coming out of the hot end
7. **Cool** the hot end

This is what a tangle looks like in case you ever see one



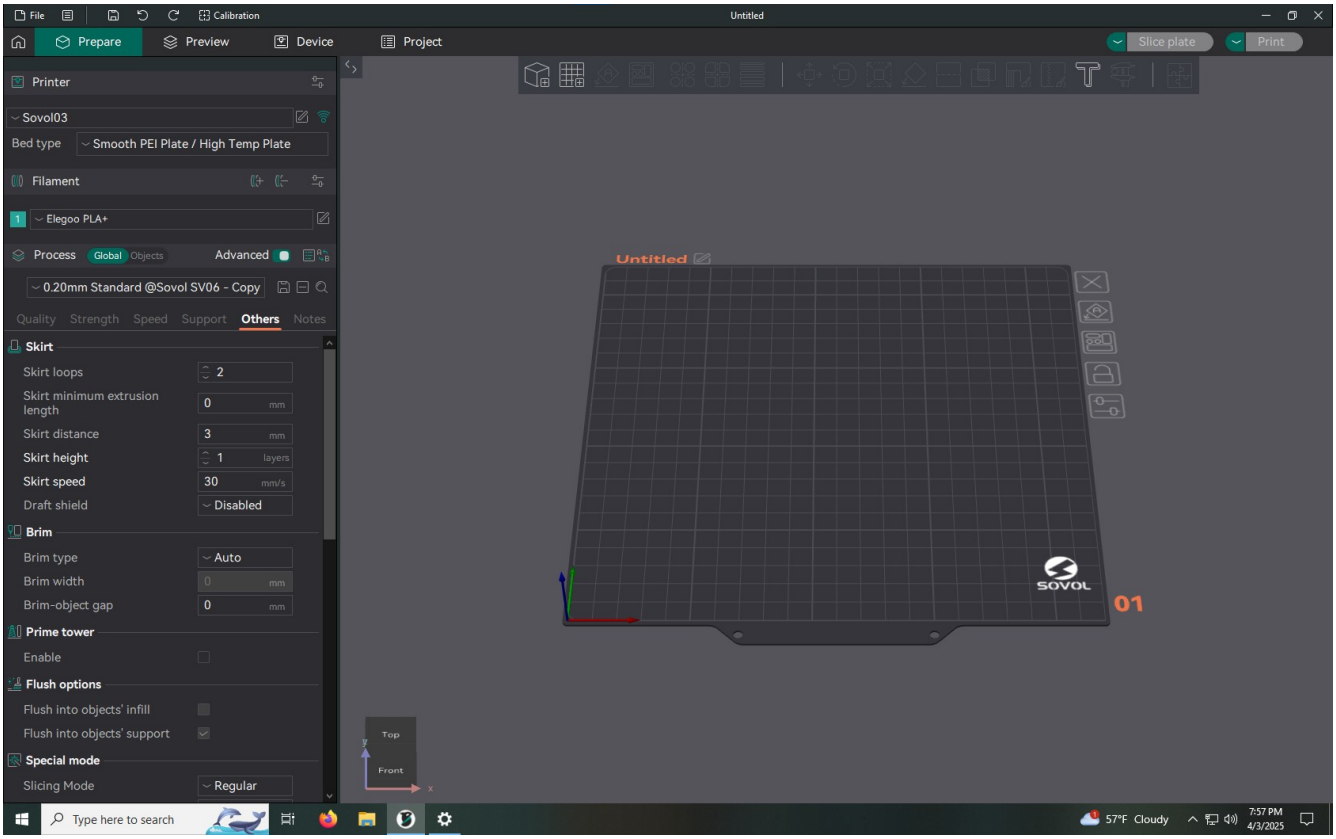
[Image from https://forum.prusa3d.com/forum/original-prusa-i3-mk3s-mk3-hardware-firmware-and-software-help/filament-tangles-and-ruins-print/]

Step 2: Slice your 3D Model

Open Orca Slicer if it's not already running.

If it is already running, start a new project to reset all of the settings. If asked to save whatever was open, choose Cancel.

Orca Slicer's interface



First, a little tour of Orca Slicer

On the left side of the window are a whole bunch of settings. Don't feel too overwhelmed, there are only a few that you need to change depending on what you're printing and where you're printing it.

Most of the window shows you the object(s) you're going to print.

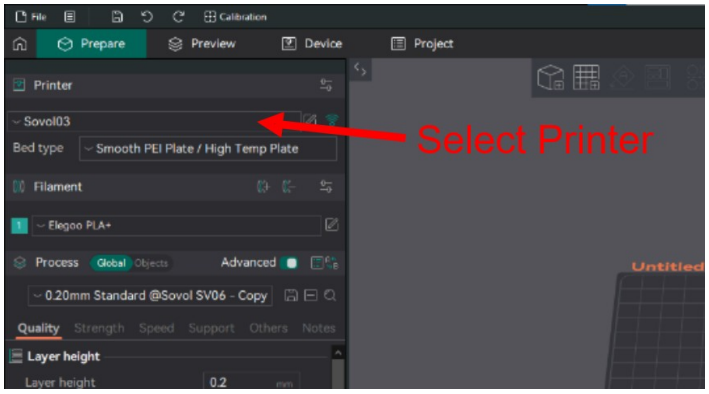
There are tabs at the very top of the window. These tabs represent different steps involved in printing.

Prepare	Preview	Device	Project
This tab allows you to place and arrange objects for slicing. You can move, resize, and rotate things freely.	This tab shows you what the sliced G-code looks like. Things aren't editable here. Like a Print Preview when 2D printing.	This tab shows you the controls for the printer. Here, you can pause a print, cancel a print, or make adjustments while printing.	Apparently, you can create a project with multiple prints or something. I've not used this.

Okay! Now on to slicing!

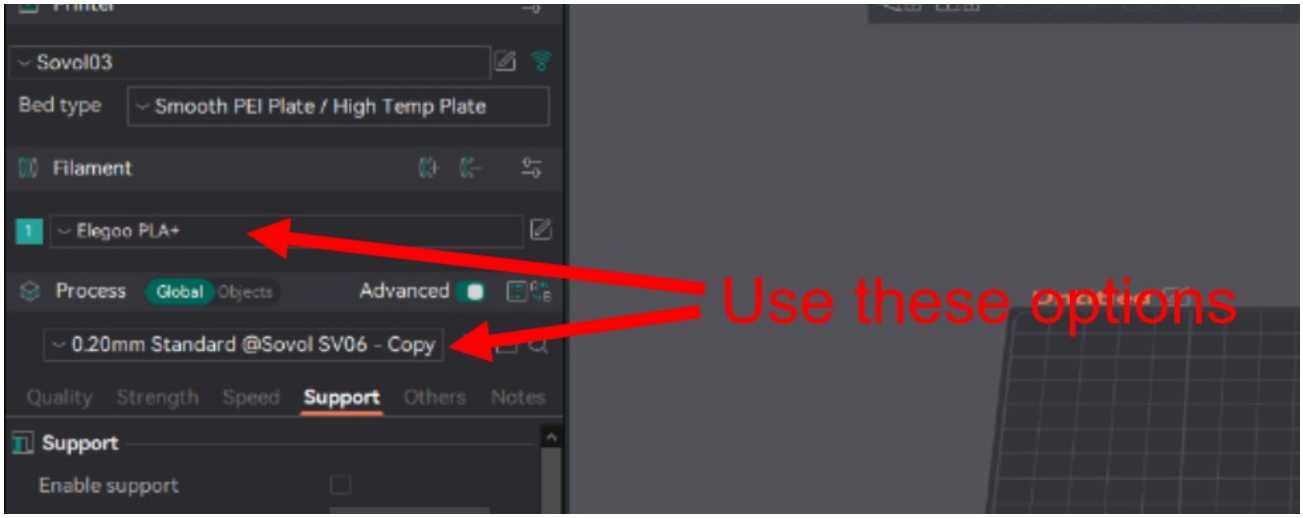
The first place to start is to figure out which printer you want to print to and select it.

Which printer you select is up to you. There are name plates in front of each printer on the shelving unit so you know what's what.



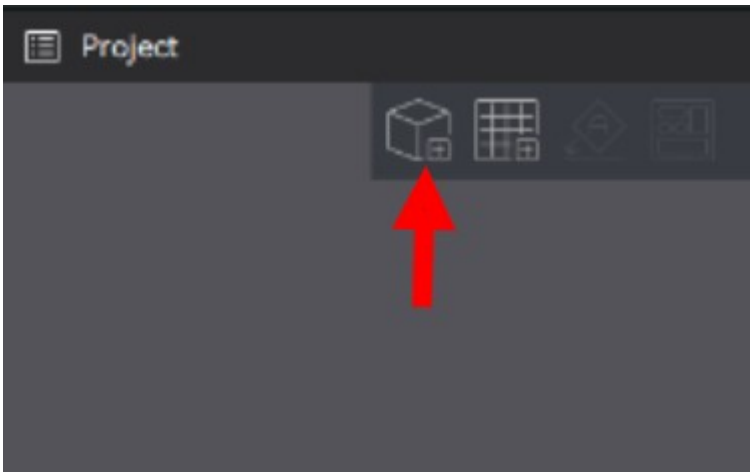
Next, let's make sure you're using the right starting settings. This guide assumes that you're printing with PLA+, which is the filament material normally used on our printers. If you're using a different material, you'll need to choose different option.

Choose the “Elegoo PLA+” filament settings and then the process preset of “0.20mm Standard @Sovol SV06 – Copy”. These are sane starting points. Never save over these presets – which is not covered in this guide anyway.



Add models, orient, and arrange them

At this point, you’re ready to grab your model and add it to the build plate. If you don’t yet have a model to print, check out one of the 3D model repositories in the Resources section. OR you can design your own. Check out one of our intro to CAD classes to get started with CAD.



Find your file either in the Downloads folder or on a flash drive and open it. Orca Slicer will put it in the middle of the build plate.

If you selected more than one file, they’ll all be placed in the center of the build plate – overlapping! Make sure you separate them from each other manually or use the arrange button.

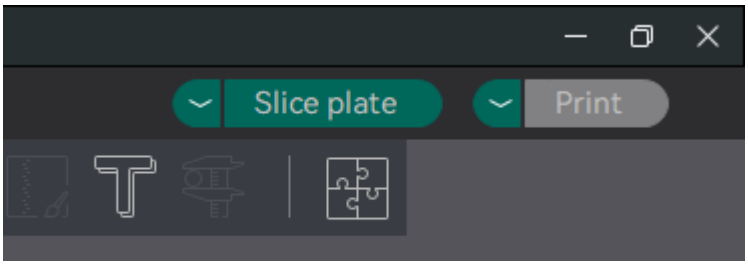
The Auto-Orient button and the Arrange button

These two buttons can get you out of a lot of trouble. The Auto-orient button will rotate an object so that it's most likely to print well with the smallest amount of support material. Support material is plastic that is printed to support parts of the object that are just hanging in free air. It's stuff that you'll have to break off after the print is done.

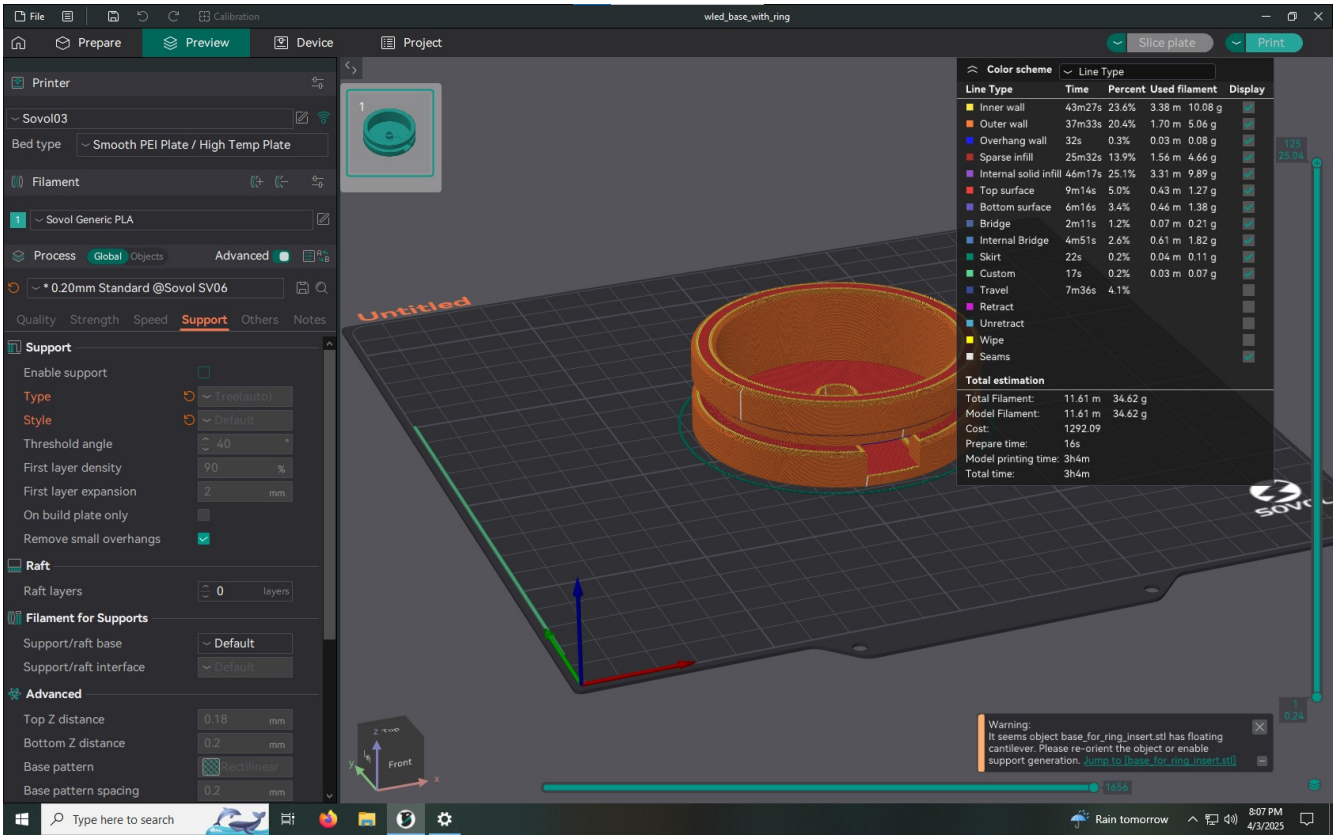
The Arrange button will allow you to automatically spread out multiple objects near the center of the build plate.

Slice

To slice, click the "Slice plate" button. This will automatically move you to the Preview tab. Once it's done, you'll see how the 3D printer would extrude plastic to make your models.



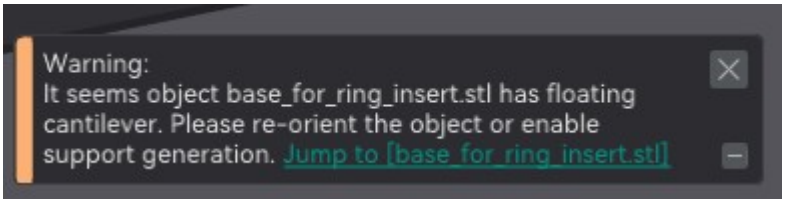
A sliced model in the Preview tab



Let's explore the things you can see on this tab. In the middle is a 3D representation of the generated G-code. There are check boxes that allow you to toggle on or off specific features. You'll also see estimates of the amount of material and the print time.

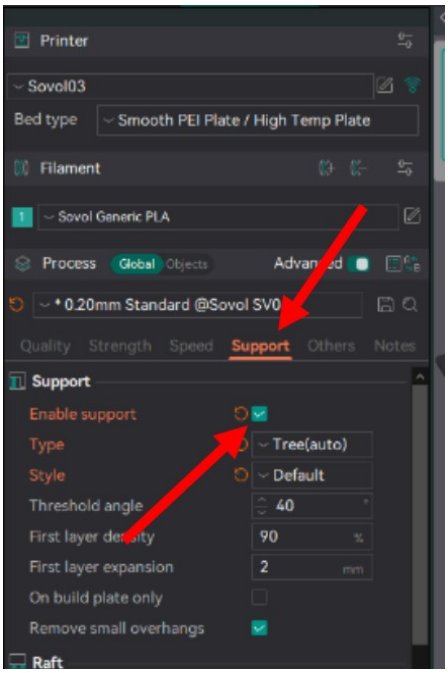
In the bottom right corner is an area where you might see warning messages. Pay close attention to these.

This warning says that there are floating areas of the model that need support. If you were to ignore this message, your print will certainly fail.

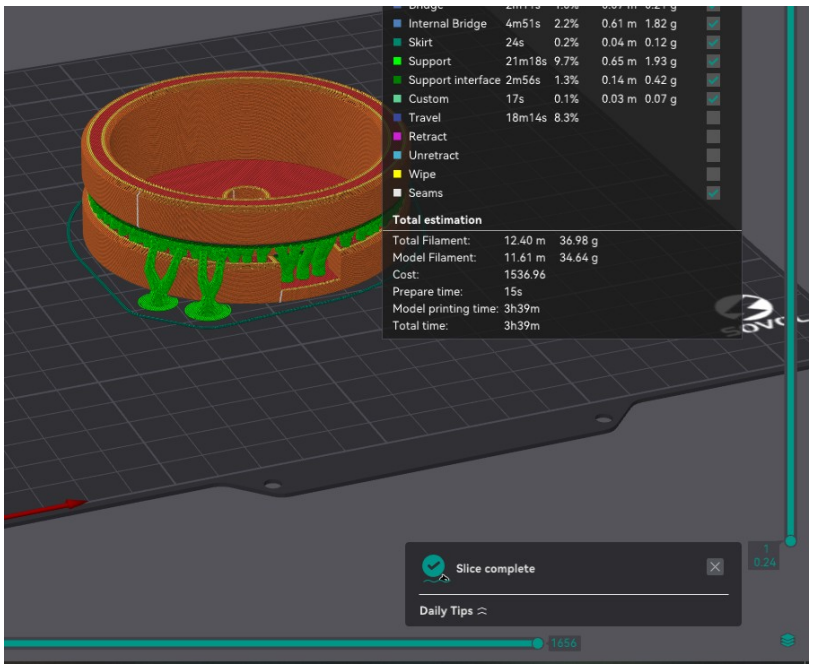


To support floating areas, you need to turn on support material. You'll find this checkbox in the Support tab of the settings.

The Enable Support checkbox



Annoying support material, but at least there's no warning!



Any time you change print settings, you'll need to hit the "Slice plate" button again. Once everything looks good, you're ready to...

Step 3: Send the G-code to the Printer

This step is just two clicks. Click on the "Print" button at the top right of the window. Then "Upload and Print". You can switch to the Device tab to see the process begin and so you're prepared to cancel the print if something goes wrong.

Step 4: Actual Printing

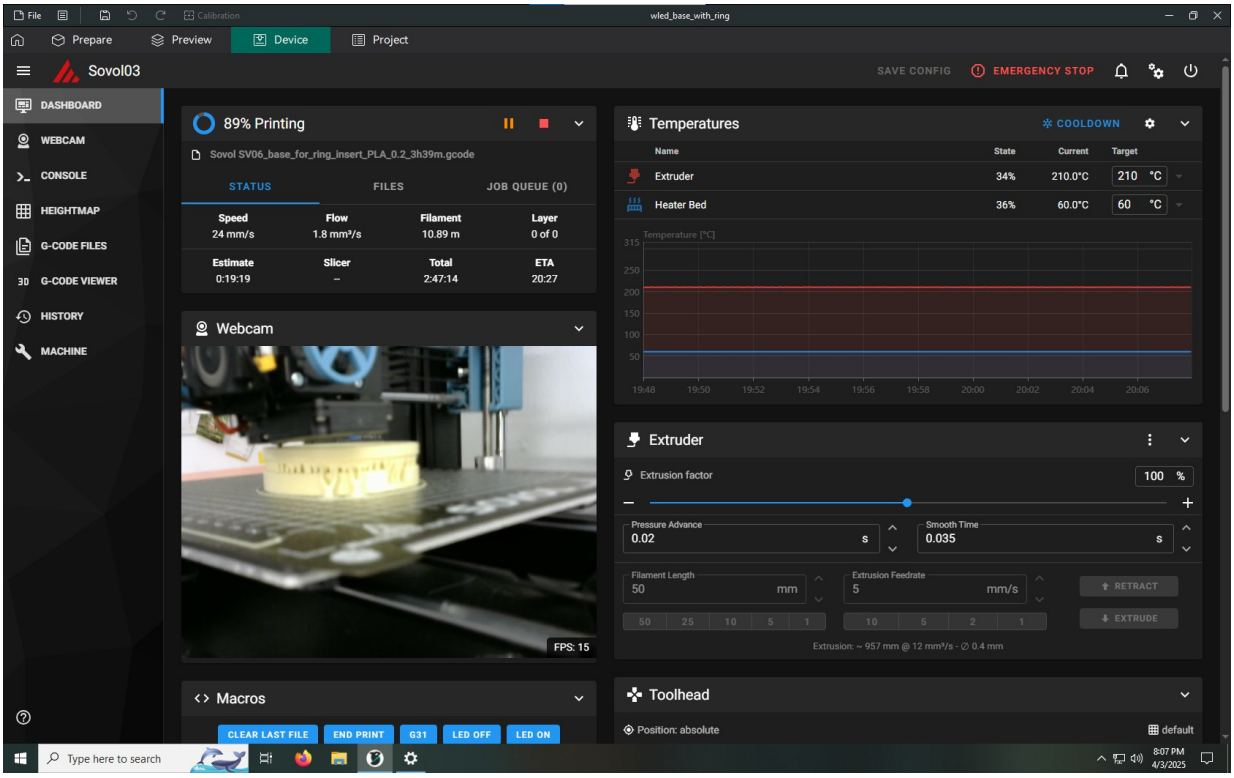
At this point, the printer should start whirring and moving.

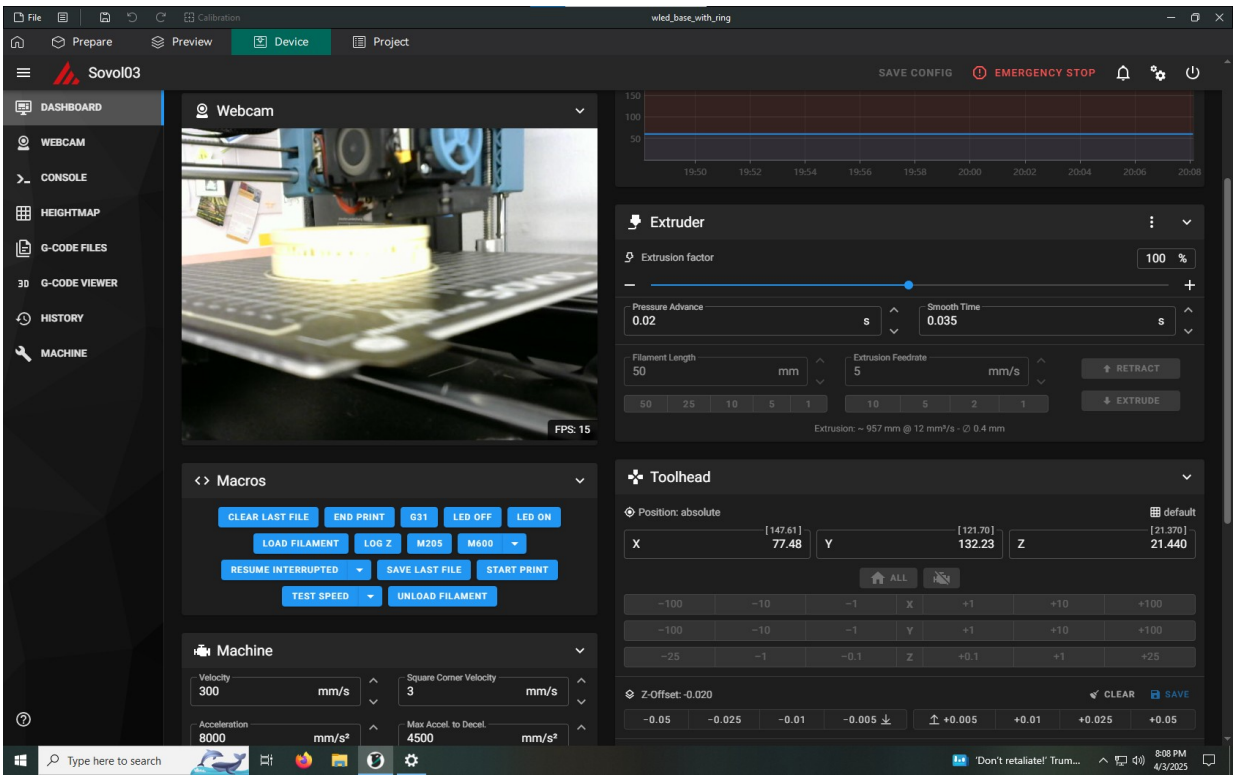
A Tour of the Device Tab

This tab looks very different from the rest because you're actually looking at a web page hosted by the printer. The dashboard is the only view that you need to print, so this guide won't cover the other tabs on the left side. Additionally, there are a lot of controls on this page that you shouldn't touch, so I'll only go over the parts you might use.

Click Here -> Table Of Contents

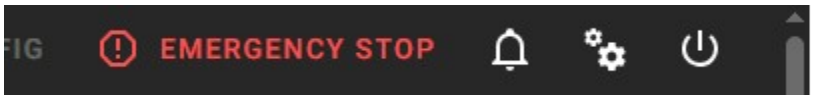
The Device Tab





The Emergency Stop button

This button is in the top right corner of the Device tab. It will immediately stop the printer and cool it down. **This is the button to hit to stop the printer if the printer might damage itself or if someone is in danger.** Using this button will cause the printer to enter an unusable state until the firmware is restarted.



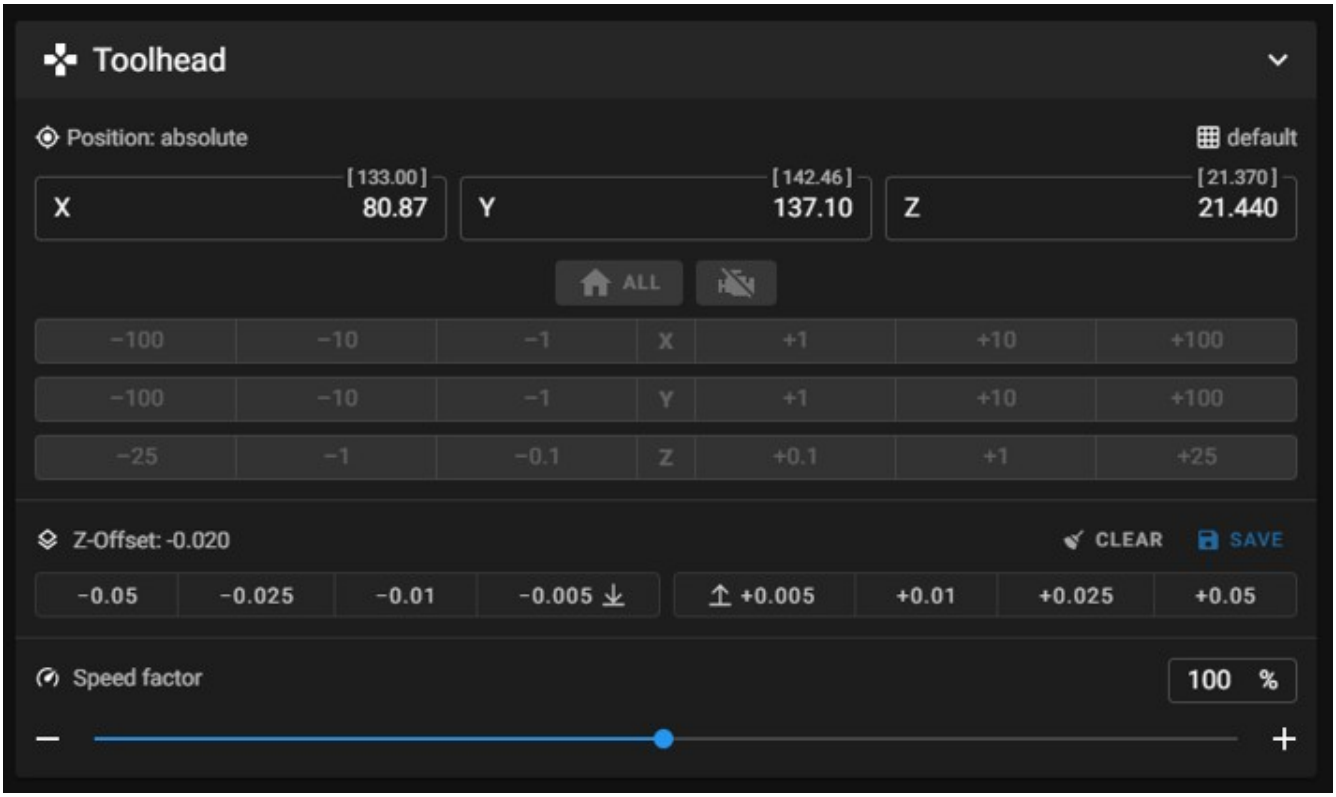
For other ways to stop the printer, see the **Pause** and **Stop** buttons in the Status Panel and **Uh Oh!** section further on.

The Status Panel

This area provides information about the current print and two buttons: one to pause the print and one to stop the print. If you pause the print, you can then resume it, but this may ruin your print. The Stop button will cancel the current print.

The Toolhead Panel

During a print, all of the buttons on this panel are grayed out except for the Z Offset buttons. These buttons allow you to move the nozzle up or down slightly to adjust the SQUISH. More on that in a little bit. There's also a slider to adjust how fast the printer is printing.

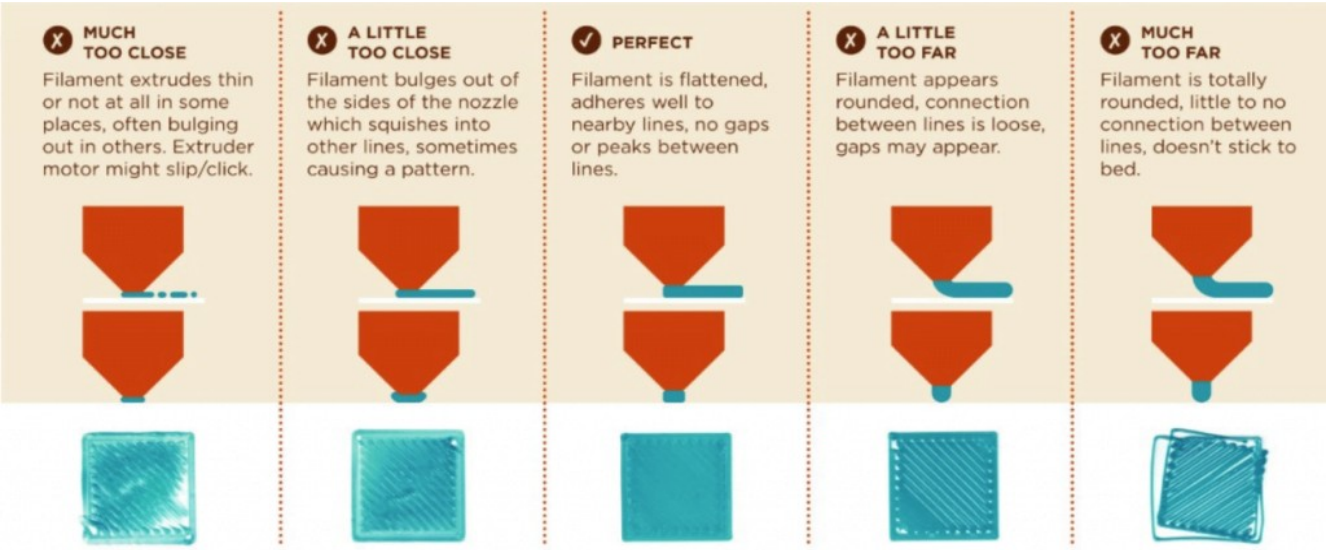


What You Need to Do While the Printer Prints

The first thing you need to do is watch and listen. If the printer is making any sounds or movements that seem "wrong", then you should probably hit the e-stop button. Especially if it continues to make that sound/movement.

While the printer is printing the first layer, you should watch and adjust the Z Offset if it seems off.

Squish Guide



This setting should normally in good shape, but if it's off at all you can use the +/- 0.01mm adjustment and then the +/-0.005mm for fine adjustment. **Be careful not to adjust the Z Offset too low or you may gouge the build plate.**

Most prints that will fail if the first layer doesn't print well, so you are required to stay and monitor the first layer for problems. Cancel the print if things go wrong with the first layer.

After the first layer is done and if it looks good, you're free to leave the printer by itself. If the first layer shows any signs that it's not printing well, stick around for another layer or two until things get worse or things get better.

For more on what can go wrong during a print and what to do about it, see **Uh Oh!** a bit later.

Step 5: Get your Part and Clean Up

Your print finished and you want to take it. WAIT! You should wait for the build plate to cool down a bit. Taking the print off too soon can cause the bottom of it warp. After about 5 minutes or longer, you can pick up the build plate and flex it to pop off your print.

Make sure to also remove the priming line. Then wipe the build plate with some alcohol so it's clean and ready for the next print.

Uh Oh! Something Went Wrong!

3D printers, like 2D printers, are finicky, spiteful, and vengeful things. To operate correctly, they need two things: filament, and a user's fear that it'll start producing large amounts of unwanted plastic spaghetti. As soon as you assume it'll work correctly and stop worrying, that's when things will go wrong.

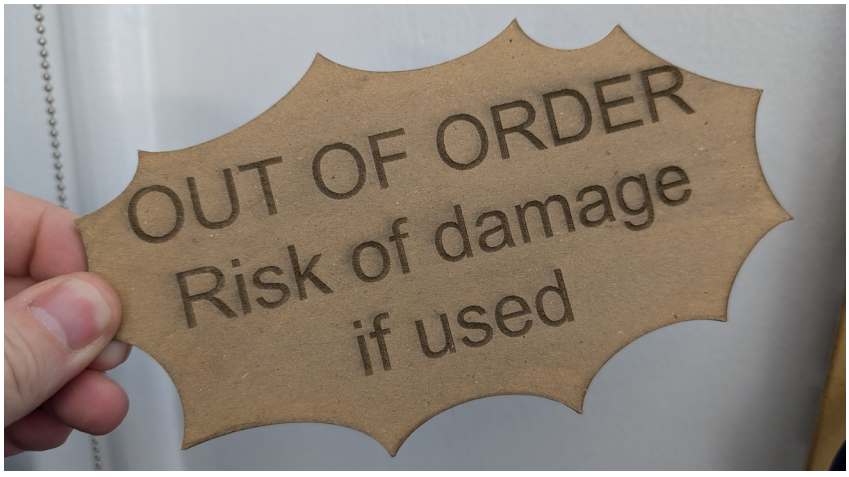
Always be looking out for behaviors and sounds that aren't normal. If something does mess up, find the relevant section below and follow the instructions.

If a printer seems to be broken, put an OUT OF ORDER sign on it and email the electronics leads at electronics@sparkmakerspace.org or send a message in the #electronics-and-tech-lab on Spark's Discord server.

Send us an email

Join the Discord

Uh oh, there's an OUT OF ORDER sign on the printer!



Obviously, you shouldn't use the printer if this sign is on it. If you do, you risk permanent damage to the printer and/or creating a dangerous situation. Only leads may remove this sign when they've ensured that the printer is ready for service again.

If you need to mark a printer as OUT OF ORDER, please let the leads know via email or Discord.

Uh oh, the first layer isn't sticking to the build plate!

There are a couple of reasons why this might happen. First, the build plate might have oils or residue on it and need to be cleaned. Stop the print, clean off any plastic stuck to it, and then wash the plate with soap and warm water. Fully dry the plate before reinstalling on the printer. Try to avoid touching the build plate because that can deposit oils from your fingers.

The second reason may be that the nozzle is too far away from the build plate. Use the Z Offset buttons in the Toolhead panel on the Device tab to make small adjustments during your first layer. Be careful to only make small adjustments or you might end up gouging the build plate.

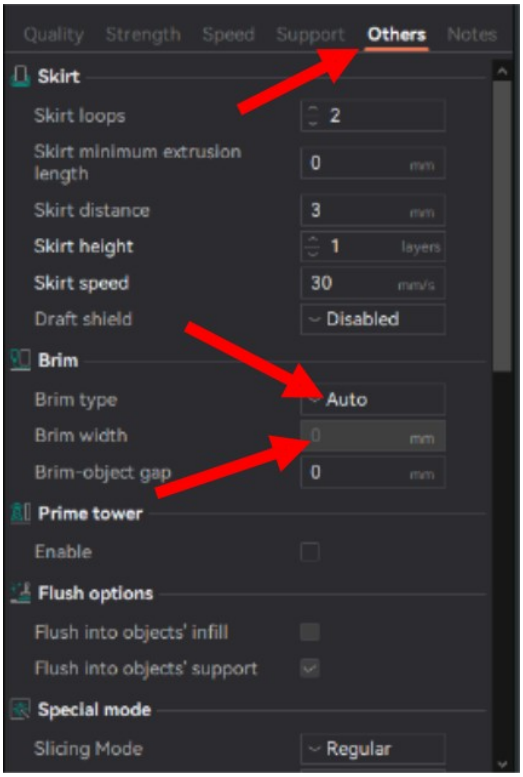
Uh oh, the first layer has ridges and blobs!

This is the opposite of the last problem. The nozzle is probably too close to the build plate. Use the Z Offset buttons in the Toolhead panel on the Device tab to make small adjustments during your first layer. Be careful to only make small adjustments or you might end up gouging the build plate.

Uh oh, the print has come loose and is being dragged around with the nozzle!

Once it happens, things can only get worse. Stop the print immediately. Clean all the plastic off the build plate and then wash the build plate with soap and water and then dry it and reinstall. This helps with build plate adhesion because it removes any oil or residues. Other things that can help with build plate adhesion is to print with a brim. A brim add plastic around the edge of the first layer to increase surface area in contact with the build plate.

Find the brim settings in the Other section on either the Prepare or Preview tabs.



Uh oh, the corners of my print have lifted!

If you can live with the warping and it doesn't seem like the whole print will come loose, you can let the print continue. Otherwise, you should stop it and try the suggestions in the previous Uh Oh.

Uh oh, nothing's coming out of the nozzle!

The nozzle is probably clogged. Stop the print and place an OUT OF ORDER on the build plate. Email or Discord message the leads to let us know.

Uh oh, something else bad has happened!

In general, if it seems like the printer might be damaged, use the emergency stop. If you just need to make some adjustments and try again, stop the print and make your adjustments and try again. If something seems broken, let us know and throw an OUT OF ORDER sign on it.

Bonus ways to cancel a print or E-stop the printer!

Logistics

Available Filament

You can use any filament in our collection of partial spools or new spools, although we'd love to get through more of our partial spools before opening more. The open spools of filament can be found in plastic bags in the bin on the bottom shelf. The new spools are found on the top shelf and are usually boxed. As of when this guide was written, Spark only stocks PLA+/PLA Pro (they mean the same thing) and some limited quantities of PLA.

What Filament to Buy and When to Buy it

We have quite a collection of various spools that have been donated, so feel free to use what we have. When we start to get low on the donated open spools, we'll ask that users of the 3D printers purchase and supply new spools for community use "when you start to feel guilty about the amount of plastic you're using".

Feel free to purchase whatever colors you need for your projects. Check out the Resources section for some brand suggestions.

Our printers will only print filament with a diameter of 1.75mm. We don't have the ability right now to print with abrasive filaments, but we could install an upgrade if users want it enough. Send us a message if that's you.

You may also want to use a color or material we don't have available. As far as materials go, we recommend for most applications that you use PLA+ or PLA Pro. The upsides are:

- Very easy to print with
- No off-gassing of toxic fumes
- No need for heated enclosure
- Will degrade quickly in uncontrolled environments (I guess that's a positive and a negative)

The downsides are:

- Creepage, which is when plastic permanently deforms due to constant stress
- Will not hold up to warm temperatures – so no prints for car interiors
- Hard to post process – need to wet sand and it's sloooowww

When considering other materials, you'll need to work with the leads to make sure that we can print it at Spark and then we need to develop a profile for the material.

Waste Filament Disposal

Place PLA in the bin labeled “PLA Only” and place PLA+ or PLA Pro in the bin labeled “PLA+ Only”. If you’re not sure what it is, use the “PLA+ Only” bin. We don’t have definite plans for when these bins fill up… there may be some filament recycling facilities that would accept it.

There are folks on the internet who pelletize scraps and heat them in silicone molds to make stuff. There are other folks who heat press them into plates and use them as a material for future crafts. Still others have figured out how to reheat and re-extrude scraps into recycled filament.

We welcome any/all ideas especially if someone has the drive to follow through and make it happen.

Maintenance

The leads take care of necessary maintenance, but if you spot an issue, make sure you let us know.

Resources

Preferred PLA+ / PLA Pro Brands

Our printers will only print filament with a diameter of 1.75mm. We don’t have the ability right now to print with abrasive filaments, but we could install an upgrade if users want it enough.

- Polymaker PLA Pro
- Inland PLA+
- Elegoo PLA+
- Printed Solid Jessie Premium PLA
- eSUN PLA+
- Bambu PLA Basic

Free CAD Software

Name	Type	Platform	License	Ease of Use	Notes
OnShape	Parametric	Web-hosted	Commercial	8/10	Free accounts only allow creation of public projects. Projects are stored in the cloud.
Autodesk Fusion	Parametric	Windows	Commercial	8/10	Free hobbyist accounts have advanced features locked. Projects are stored in the cloud.
FreeCAD	Parametric	Win/Mac/ Linux	Free Open Source	4/10	Free and open source, but complicated to learn/use.
OpenSCAD	Code-based Parametric	WIn/Mac/ Linux	Free Open Source	3/10	If you love code and can visualize how to combine shapes and operations to produce an end product, then you'll like this. Can be used to create or modify fully parametric models.
Blender	Mesh / Sculpting	Win/Mac/ Linux	Free Open Source	6/10	More useful for artistic work than engineering.
TinkerCAD	Solid Modeling	Web-based	Free Closed Source	9/10	Easy to use, but less powerful than parametric CAD. Combine basic 3D shapes using various operations to create your model.

3D Model Repositories

- Thangs.com
- Printables.com
- Thingiverse.com
- Cults3d.com

SPARK Woodshop Rules and Policies

woodshop@sparkmakerspace.org

Last Update: 4 August 2024

You must agree to abide by all the rules and requirements in this document before entering the shop space.

1. **Safety**
    a. **Attitude**:
        i. YOU ARE RESPONSIBLE FOR YOUR OWN SAFETY
        ii. Do not operate tools under the influence of any form of alcohol or drugs (prescription, over-the-counter, or otherwise) which may affect judgment or reaction time
        iii. Give all attention to the operation at hand; do one thing at a time.
        iv. Get approved for use on all power tools before attempting to use them
        v. Obey all tool-specific safety rules
        vi. If you are unsure of any policy, procedure, process, or project, ask one of the Woodshop Leads for help
        vii. Notify the Woodshop Leads of any damaged, missing, or non-functional equipment
            1. Particularly if it broke while you were using it. We don't want to yell at you, we just want to make sure no one gets hurt and it gets fixed as soon as possible
            2. Non-functional tools shall be marked or tagged to prevent further use
        viii. Seek first aid immediately for any injury
            1. A shop phone has been installed near the west entrance to the shop for emergency calls. The Spark address is above the phone.

    b. Attire:
        i. Safety glasses must be worn, even if just passing through the shop space
            1. Face shields are not a substitute for safety glasses. They are available for additional protection and are required for use of certain tools
        ii. Closed toe shoes are required at all times in the shop space
            1. Shoes with low or no heel are required when operating power tools or climbing ladders
        iii. Remove all baggy or loose clothing, wired headphones, or jewelry before operating any tools.
        iv. Long hair must be tied back before operating any tools
        v. Gloves may not be worn while operating any power tool
        vi. Dust masks or respirators are encouraged
            1. Dust from certain types of wood may cause irritation, especially after repeat exposure

SPARK Woodshop Rules and Policies

2. Spark has a limited supply of dust mask available; regular users SPARK Woodshop Rules and Policies SPARK Woodshop Rules and Policies are encouraged to invest in a quality respirator for comfort and safety
3. Use the dedicated dust collection systems and the wood shop air filtration system to limit dust buildup.

vii. Hearing protection is encouraged
1. Spark tries to maintain a supply of earplugs and muffs for shop use. Please do not hoard the earplugs; they are a community commodity

viii. Long pants are encouraged

c. Other Shop Users:

i. Do not distract other shop users from their work
1. Move into line of sight of other shop users before attempting to attract their attention
2. Stay clear of areas where other shop users may move unexpectedly without checking for your presence
3. No photographs to be taken while classes are occurring without permission of the instructor

ii. Notify other shop users of pending loud noises or movements

iii. Assist other shop users in case of injury

d. Materials:

i. Get permission from the Woodshop Leads before bringing any solvents, coatings, finishes, adhesives, or other chemicals into the woodshop
1. Proper storage is required for all flammable chemicals. Flammable chemicals that are stored at Spark must be cleared with the Woodshop leads and stored in the designated cabinet when not in use.
2. Oil based finishes and other high VOC finishes and solvents are prohibited in the woodshop
3. Water based finishes may be used in the shop once permission has been granted by a Woodshop Lead.
    a. If finishes being used have an appreciable odor, shop windows should be opened. Note that power tools cannot be operated with the windows open due to New London Noise Ordinance (see 1.e.iv, below).
    b. If HVAC is operating in the shop, HVAC shall be shut off while the windows are open.
    c. Windows shall be closed when leaving the shop for the day. If the HVAC was shut off, it shall be turned on again before leaving.

ii. No pressure treated lumber may be brought into the shop.

iii. Check all raw materials for nails, screws, staples, or other contaminants before use.

SPARK Woodshop Rules and Policies

1. Cutting heads interacting with unexpected metal pieces can damage both tool and user

e. Tools

i. All shop users must be signed off on any power tool before use
   1. Only the Woodshop Leads and delegated Instructors can approve users for tools
   2. See the posted lists to determine which users are approved for which tools
   3. Vacuum cleaners are exempted from this requirement

ii. Inspect all tools before use
   1. Damaged tools should be taken out of service and reported to the Woodshop Leads.
   2. “Broken, Do Not Use” signs should be used to notify other members that a tool is broken

iii. Inspect cutting edges or blades before use
   1. Dull or damaged cutters should be reported to the Woodshop Leads.
   2. Get permission from Woodshop Leads before sharpening Spark tools.

iv. Shop windows must be closed before using power tools to prevent violation of New London noise ordinance.

v. Disconnect power before making any changes to tool configurations (if allowed, see User Levels)

vi. Safety guards on tools may not be removed without permission from the Woodshop Leads

vii. Stock shall be kept clear of all cutting blades while blades are coming up to speed.

viii. Shop users must remain at tools until all cutting blades come to a complete stop

ix. Shop users are responsible for cleaning the tools and surrounding space before leaving the shop

2. **Shop Policies:**

a. User Access:

i. All users must be cleared for shop access. Users who have agreed to abide by this document shall be granted door access to the woodshop.

ii. Woodshop access is controlled via keyfob or badge access at both entrances. Only members approved for woodshop access shall be granted keyfob access to the woodshop.
   1. Emergency overrides are present at both doors. They are to be used only to allow emergency personnel access to the shop in the event of an emergency.
   2. Members or other persons caught using the emergency access for non-emergency purposes will be banned from the shop.

iii. Use of the Spark woodshop is reserved using the online booking software.
   1. When not booked, any authorized user may use the tools or spaces.

SPARK Woodshop Rules and Policies

2. Bookings take precedence over other uses. Users are encouraged to check the online booking software before visiting Spark.
3. Courtesy is strongly encouraged. Please limit bookings to the minimum time required, so others may use the space.

iv. Unapproved access:
   1. Members or non-members who have not yet been approved for shop access may not use any of the tools (hand or power) and must be escorted by an approved user at all times.
      a. Unapproved individuals may assist in handling stock materials for the purpose of moving it around the shop. They may not assist in tool operation.
   2. Spark members who are not approved for shop access may use shop tools under the following circumstances:
      a. Having received and agreed to the Non-Member Safety Rules
      b. Under the direct supervision of a Woodshop Lead at all times
   3. Non-Spark members who are not approved for shop access may use shop tools under the following circumstances:
      a. Having received and agreed to the Non-Member Safety Rules
      b. A signed non-member safety waiver for each session or instance
      c. Under the direct supervision of a Woodshop Lead at all times

v. Levels of tool access:
   1. General Woodshop Access
      a. Signed shop safety rules agreement
      b. Can access and utilize the hand tool wall
      c. Allowed to assist approved users, but not allowed to operate any power tools
   2. Trained User
      a. Has been approved to use a specific tools in base configuration
      b. Not allowed to change tool configuration or change or sharpen the blade on the tool
   3. Advanced User
      a. Has been approved to use a specific tools in all configurations
      b. Will be approved on a case-by-case basis per the discretion of the shop leads
   4. Instructor
      a. Has been approved to use tool in all configurations
      b. Has been approved to change tool configuration
      c. Has been approved to sign off other users on tools
      d. May repair tools with permission of Woodshop Leads
   5. Woodshop Lead
      a. Approves all user levels
      b. Has responsibility to maintain space and tools

vi. Training

SPARK Woodshop Rules and Policies

1. All persons using the wood shop shall have agreed to the shop safety rules (this document) before use of ANY tools
2. Classes will be made available for all members for training on power tools
3. At the end of each class, the Instructor will evaluate each student for safety and ability to use tools.
4. It is the Instructor's prerogative to require further training before signing off on any student using any tool.
5. A record will be kept of all user approvals.
6. Woodshop Leads and Instructors may also be available for one-to-one training and signoffs. Contact the Leads for further information

b. Tools:

i. All tools shall have a tool-specific operational manual at or near the tool.
   1. Safety rules
   2. Instructions for use
   3. Identification of baseline configuration

ii. All tools shall be returned to baseline configuration after use

iii. All tools shall be cleaned after use

iv. All tools must be returned to their proper location after use

v. Buddy System: For certain tools, a second person must be present in the Woodshop.
   1. The second person must verbally agree to be the "buddy", to act in case of emergencies. This person must be capable of hearing the tool operator. If the "buddy" leaves the area, use of listed tools must cease.
      a. If the second person is not a Spark member, they must sign a non-member liability waiver in the presence of one of the Woodshop Leads or the Spark staff. The liability waiver will be kept on file at Spark. *(updated 8/4/2024)*
   2. Tools for two-person rule:
      a. Table Saw
   3. While the buddy system is only required for the tools listed above, it is encouraged, whenever possible, for all shop users operating power tools

vi. Personal hand or cordless power tools may be brought into the space, as long as they are used safely.
   1. Larger tools require permission from a Woodshop Lead before being brought into the shop
   2. Personal tools left in the shop will be treated as public property. Users are encouraged to store personal tools in Spark lockers or their vehicles to prevent misuse and possible damage.

vii. Tool Lending
   1. Woodshop tools shall not leave the Spark woodshop except under the following circumstances:
      a. All tool loans are approved by the Woodshop Leads

SPARK Woodshop Rules and Policies

b. All tools lent are part of the dedicated lending pool
c. Borrower has signed all applicable lending agreements for liability and financial responsibility

c. General Space:

i. Stock and Materials:
1. Material labeled “Spark” is earmarked for classes or Spark improvement projects, and should not be used for any other purpose
2. Material labeled “Ask” is Spark supplied, but may be used by shop users with permission from the Woodshop Leads. Permission will be given on a project-by-project basis.
3. All personal raw stock and projects shall be labeled with the following information:
    a. Name
    b. Phone number
    c. Date
4. Any material left unlabeled shall be available for use by any shop user or disposed of

ii. Project Storage
1. Spark has limited storage space available for personal projects. Therefore, members are required to limit the quantity of materials that are stored at Spark
    a. There are two sets of shelving and three demarcated wall bays available for member use on the northern wall of the shop. Only one space (bay or shelf) may be used by a member at a time
    b. Utilization of more than one designated space for material storage requires prior written approval from the woodshop leads
    c. Members shall not store any material outside the designated areas without prior written approval from the woodshop leads
2. Members are required to mark, on the whiteboard labels, their name, phone number, and project start date (date material is dropped off)
    a. Failing to meet all marking requirements constitutes a violation of this policy
3. Member projects may be stored for no more than two weeks per project unless prior written approval has been given by the Woodshop Leads
    a. Written approval requests shall include an expected project end date
    b. Blanket approvals without end dates will not be given
4. Violations of these project storage policies will lead to removal of materials from the shop
    a. Return of the materials, as a result of a policy violation, requires discussion with the leads contingent on their availability

iii. Donations

SPARK Woodshop Rules and Policies

1. All donations of materials or tools should be approved by a Woodshop Lead

iv. Enforcement
   1. Safety violations:
      a. First violation: verbal warning
      b. Second violation: shop user will be removed from the shop for the remainder of the day
      c. Third violation, or at the discretion of the Woodshop Leads: shop user will have all shop access revoked *(updated 8/4/2024)*
      d. Safety violations will be logged and reported to the Spark Board of Directors. *(added 8/4/2024)*
   2. Shop access restoration: *(new section 8/4/2024)*
      a. If shop access is revoked, shop user access will be reset.
         i. Shop users will be required to retake the general woodshop access orientation. Additional discussions with the Woodshop Leads may also be required.
         ii. Shop users will be required to recertify on all tools.
   3. Non-safety violations:
      a. Repeated violation of Woodshop policies may result in a revocation of shop access, as approved by any one Woodshop Lead and the Spark Executive Director

SPARK Woodshop Safety Rules and Policies for Non-Members

woodshop@sparkmakerspace.org

You must agree to abide by all the rules and requirements in this document before entering the shop space.

1. **Safety**
    a. YOU ARE RESPONSIBLE FOR YOUR OWN SAFETY
    b. Do not operate tools under the influence of any form of alcohol or drugs (prescription, over-the-counter, or otherwise) which may affect judgement or reaction time
    c. Give all attention to the operation at hand; do one thing at a time.
    d. Non-members may only operate tools under the supervision of the instructor.
    e. Obey all tool-specific safety rules
    f. If you are unsure of any policy, procedure, process, or project, ask the instructor for help
    g. Notify the instructor of any damaged, missing, or non-functional equipment
    h. Seek first aid immediately for any injury

2. **Attire:**
    a. Safety glasses must be worn, even if just passing through the shop space
        i. Face shields are not a substitute for safety glasses. They are available for additional protection and are required for use of certain tools
    b. Closed toe shoes are required at all times in the shop space
        i. Shoes with low or no heel are required when operating power tools or climbing ladders
    c. Remove all baggy or loose clothing, wired headphones, or jewelry before operating any tools.
    d. Long hair must be tied back before operating any tools
    e. Gloves may not be worn while operating any power tool
    f. Dust masks or respirators are encouraged
        i. Dust from certain types of wood may cause irritation, especially after repeated exposure
        ii. Spark has a limited supply of dust mask available; regular users are encouraged to invest in a quality respirator for comfort and safety
        iii. Use the dedicated dust collection systems and the wood shop air filtration system to limit dust buildup.
    g. Hearing protection is encouraged
        i. Spark tries to maintain a supply of earplugs and muffs for shop use. Please do not hoard the earplugs; they are a community commodity
    h. Long pants are encouraged

SPARK Woodshop Rules and Policies

3. **Other Shop Users:**
    a. Do not distract other shop users from their work
        i. Move into line of sight of other shop users before attempting to attract their attention
        ii. Stay clear of areas where other shop users may move unexpectedly without checking for your presence
        iii. No photographs to be taken while classes are occurring without permission of the instructor
    b. Notify other shop users of pending loud noises or movements
    c. Assist other shop users in case of injury

4. **Tools**
    a. Non-members may only use tools during classes.
        i. Non-members may only use tools under supervision from the instructor.
            1. Vacuum cleaners are exempted from this requirement
    b. Workpieces shall be kept clear of all cutting blades while blades are coming up to speed.
    c. Shop users must remain at tools until all cutting blades come to a complete stop
    d. Shop users are responsible for cleaning the tools and surrounding space before leaving the shop

All non-member shop users must sign a liability waiver before each class.

Any shop user failing to obey all safety rules and directions from instructor(s) will be asked to leave the shop. Class fees will not be refunded.

AIR TOOLS GUIDE

(updated 12/29/20)

Safety Rules

1. Wear proper personal protection equipment (safety glasses, hearing protection)
2. Do not bypass any safety devices
3. Keep hands clear of nail exit points and paths
4. Do not bump-trigger ANY nailer
5. Drain the compressor after after each use
6. If something is broken or breaks, notify one of the wood shop leads at (woodshop@sparkmakerspace.org).

Air Tool Summary

1. Tool Location in Shop
2. Uses for Tools
3. Safety
4. Compressor Parts
5. Compressor Setup
6. Nailer/Stapler Parts
7. Nailer/Stapler Setup
8. Operation
9. Shutdown & Cleanup

Instructions for Use

Uses for Tool:

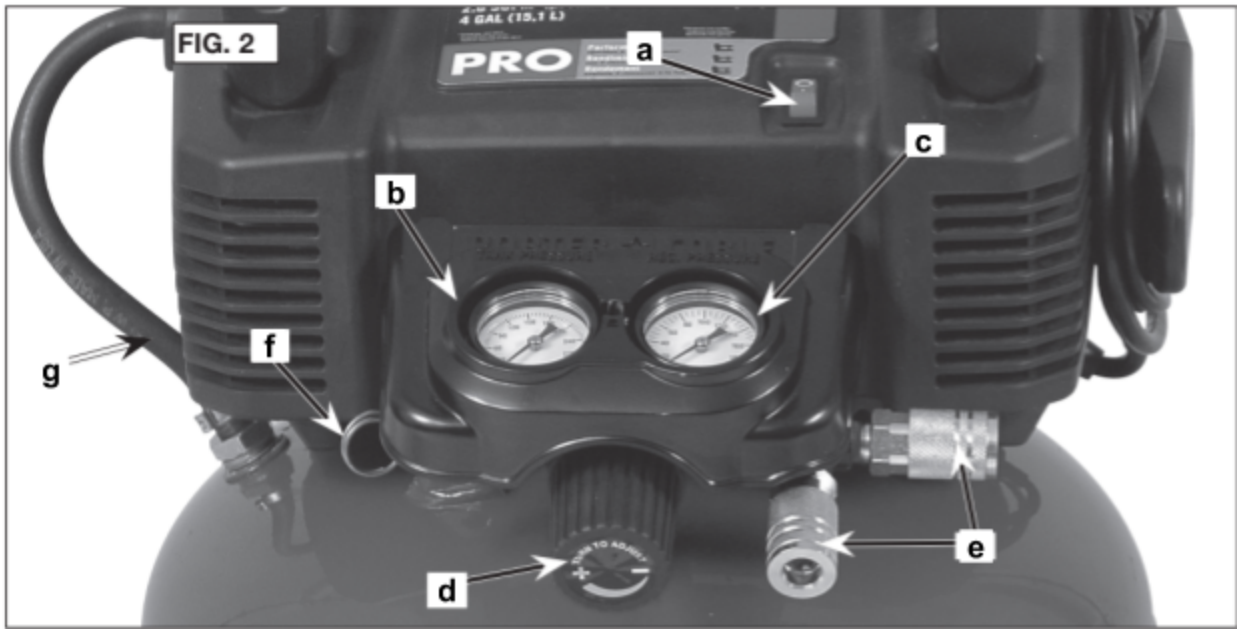
1. Compressor:
    a. Feeds compressed air to air nailers, blowgun, tire chuck, etc
    b. Should not be used for breathing air
2. Nailer:
    a. Good for:
        i. Wood and engineered lumber (plywood, particle board, MDF, etc)
        ii. Attaching small or light parts to other larger parts
        iii. Finish work; small heads easily covered
        iv. Holding pieces together while glue dries
    b. Bad for:
        i. Large pieces
        ii. Strength
        iii. Metal, ceramics, plastics, composites, glass, or anything else but wood
3. Stapler:
    a. Good for:
        i. Wood and engineered lumber (plywood, particle board, MDF, etc)
        ii. Small parts assembly - stronger than nailer
    b. Bad for:
        i. Surface finish - leaves larger hole in surface
        ii. Metal, ceramics, plastics, composites, glass, or anything else but wood

Safety

1. Wear personal protective equipment.
    a. Safety glasses
    b. Hearing protection is recommended.
    c. Tie long hair back.
2. Compressed air can propel particles and debris. Care should be taken when connecting and disconnecting fittings.
3. Compressed air, if pressed directly against the skin, can force air bubbles into the bloodstream. The resulting air embolism can have significant adverse health effects.
    a. Point outlets, nozzles, sprayers, and vents in a safe direction. Do not use compressed air to clean off clothes while being worn.
4. Nailer should be connected to air pressure before loading fasteners and disconnected when making adjustments.
5. Nailer should not be triggered except when in contact with workpiece.
    a. “Bumping” the nailer by holding down the trigger and using the contact safety to actuate the nailer is unsafe.
    b. Users found bump-triggering air nailers will have their tool use approval revoked.
6. Keep hands clear of fastener exit direction; fasteners may be overdriven, may not drive straight, and may exit the back side of the workpiece at unexpected angles.

Compressor Parts

1. Compressor consists of low volume, high-pressure air pump on top of compressed air tank.
2. Air tank is rated to 150 PSIG.
3. Fig 2, taken from manual, shows the following parts:
    a. Power switch - turns the compressor on or off. Even when powered off, the compressor may have air left in the tank, which must be bled at the end of use.
    b. Tank pressure gauge - indicates pressure currently in the air tank. The compressor attempts to keep this pressure between 120 PSIG and 150 PSIG automatically. If this pressure is constantly falling while not using the tool, the drain is open, or there is a leak in the system.
    c. Regulator outlet pressure gauge - indicates the outlet pressure being fed to the tool. This is adjusted by part (d), the regulator knob.
    d. Regulator control knob - used to set the outlet pressure of the regulator, which is hidden under the plastic shroud. The regulator is turned clockwise to raise the outlet pressure, and counterclockwise to reduce the pressure. The regulator will maintain the outlet pressure feeding the tool.
    e. Outlet connections - quick-connect fittings used to connect the air hose.
    f. Safety relief valve - prevents overpressure of the tank in case of failure of the automatic control pressure switch. It may also be used to vent the compressor tank by pulling on the ring.
    g. Compressor to tank connection tube - may get hot under heavy cycling of the compressor



4. Other important parts include:

a. Power cord - found on the side of the compressor head.
b. Tank drain - used to drain water from the tank. Found underneath the tank. It should be closed during operation and opened to drain as part of the shutdown procedure.
c. Pressure switch - internal to the compressor head, this switch turns the air pump on and off depending on the tank pressure.
d. Cooling fan - internal to the compressor head, this fan moves a significant amount of air through the head to cool the compressor. Vents on the head should be left clear at all times to allow sufficient airflow.

Compressor Setup

1. Check compressor switch is off.
2. Check regulator knob is unloaded and spinning easily.
3. Plug in compressor.
4. Turn on compressor.
    a. Compressor will loudly start to fill the air tank.
    b. The tank pressure gauge will start to move to indicate pressure in the tank.
5. Determine required outlet pressure.
    a. A table of the most common applications is shown below.

Tool	***Suggested Set (PSIG)***	***Pressure Range (PSIG)***
Finish/Brad Nailer (BN200SB, BN138)	80	70-100
Narrow Crown Stapler (IFN328K0AV)	65	60-100
Blowgun	25	0-30
Air Chuck	Desired tire pressure	-

    b. For fastening applications, start at the low end of the range and gradually increase pressure if the fastener is not being completely driven.
    c. Do not exceed 30 PSIG with the blowgun, for safety.
6. Set outlet pressure.
    a. Wait until the tank pressure has increased above the desired outlet pressure.
    b. Gradually turn the regulator knob clockwise until the regulator outlet pressure gauge reads the desired outlet pressure.
        i. The outlet pressure gauge reading will lag behind the regulator knob setting, particularly if the hose is attached. This lag can be minimized by turning the regulator knob very slowly as the gauge needle approaches the desired pressure.

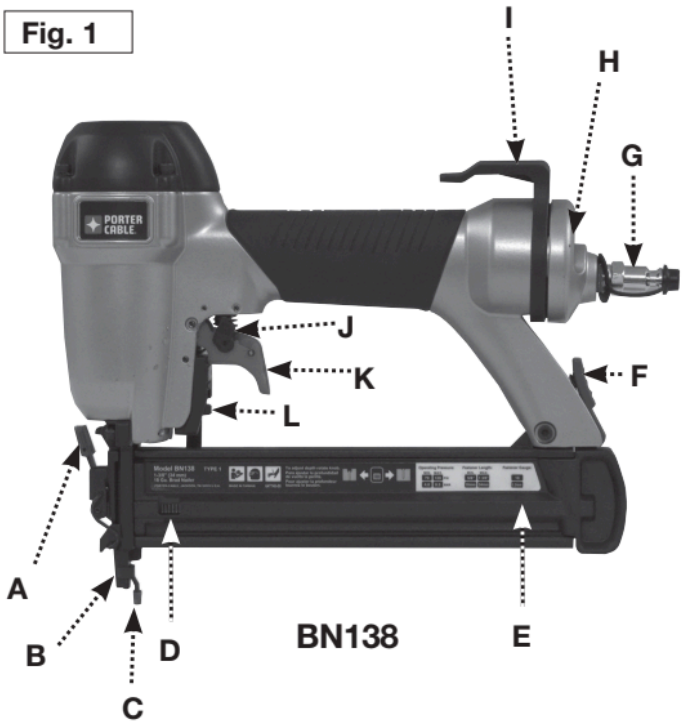
c. Leave regulator knob in position.
d. If the desired outlet pressure is exceeded, turn regulator knob counterclockwise.
    i. The outlet pressure will not reduce, as the current regulator is not self-venting. It will be necessary to vent the downstream pressure. This may be done by partially inserting a tool into one of the outlets quick connect (or hose, if attached) and briefly venting the trapped air. Care should be taken to prevent the escaping air from driving dust or particles towards the operator.

7. The air compressor is now ready for use. No further operator interaction is required during use unless parameters need to be changed.

Air Nailer Parts

1. Nailers and staplers will differ in details but generally, have similar layouts and parts. For simplicity, the term “nailer” will be used throughout these directions. Staplers operate in near identical fashion, other than loading the magazine.
2. Major parts are labeled below:
    A. Jam clearing latch - allows partial disassembly of the nose of the nailer, to allow jammed fasteners to be removed. Air should be disconnected from the nailer before using this latch. May not be present on all nailers.
    B. Contact safety - prevents the nailer from actuating unless the contact safety is depressed. This should be done by placing it firmly against the workpiece.
    C. Rubber pad - prevents contact safety from damaging the workpiece. May not be present on all nailers.
    D. Nail window - allows the user to check magazine status. If fasteners are not visible through this window, the magazine is empty or nearly empty. May not be present on all nailers.
    E. Magazine - holds fasteners. Ensure the fasteners are appropriate for the tool before inserting them in the magazine, or the tool may be jammed or damaged.

Fig. 1



F. Magazine release - allows opening of the magazine to load fasteners. Position will vary between brands and models but is usually somewhere on the rear of the magazine.
G. Air inlet - connects the nailer to the compressor air hose. Incoming air should be within the limits of the tool, generally found somewhere on each nailer.
H. Air exhaust - air outlet of tool. Puffs of compressed air will exit this location during tool use. On larger nailers, the exhaust is often atop the nailer's head and will have an adjustable, directional vent guide. Vent should be turned away from the user for safety.
I. Belt hook - may not be found on all nailers. Intended for job-site applications; not required for most uses at Spark.
J. Trigger lock - prevents accidental actuation of the nailer. May not be found on all nailers.
K. Trigger - triggers actuation of nailer. Fingers should be kept clear of tigger until nailer is positioned and ready for fastening.
L. Depth adjustment wheel - acts as stop for fastener depth. Allows for fine tuning of the depth to which the fastener is driven. Location may vary with model and brand of tool; often found on front of nailer.

Air Nailer Setup

1. Inspect tool for loose or damaged parts.
    a. Report any tool issues to a Woodshop Lead
2. Open magazine, ensure no fasteners are loaded, and reclose magazine.
3. Holding tool with the air intake up, put one or two drops of air tool oil into the air fitting.
4. Set up compressor to desired pressure. Pressure ratings for each tool are found on the tool. The chart in the Compressor Setup section may also be used for guidance.
5. Connect the air hose
    a. Male quick connect fittings should just need a single firm thrust to lock into the female fittings. However, it is often necessary, particularly on the larger fittings used at Spark, to pull back slightly on the female quick connect collar to ease insertion. As soon as air movement is heard, the collar should be released.
6. Open the magazine and load the appropriate fasteners.
    a. Fasteners must be matched in style, width, and length to the nailer. For brads or finish nails, the width will be measured in a wire gauge. Higher numbers indicate thinner nails. For staples, the nailer will indicate the width across the top, or “crown,” of the staple.
    b. Fastener length should be determined by the application. The fasteners should not be long enough to exit the far side of the workpiece(s).
7. Close the magazine firmly until latched.
8. The nailer is now ready for operation. Keep fingers away from the trigger until the nailer is in position against the workpiece.
9. During use:

a. If the depth of the fastener must be adjusted, disconnect the air line from the nailer before adjustment.
b. All fasteners should be removed from the magazine before reconnecting, as accidental actuation of the nailer is possible upon connecting to the air supply.

Operation

1. Safety:
    a. Keep fingers clear of the trigger until the nailer is in contact with the workpiece and ready for use.
    b. Nailer should only be triggered in contact with workpiece, and the trigger fully released after each fastener.
        i. “Bumping” the nailer by holding down the trigger and using the contact safety to actuate the nailer is unsafe.
        ii. Users found bump-triggering air nailers will have their tool use approval revoked.
    c. User body parts should be kept clear of the working area, on both sides of the workpiece. Strong grain patterns or knots may direct the fastener in an unexpected direction.
    d. Fasteners should not be driven at extreme angles, as the nail or staple may not penetrate the workpiece. This will propel the fastener in an unsafe direction.
2. Place nailer in position required for fastening
3. Pull and release trigger.
    a. Nailer will actuate, driving nail into work piece.
4. Inspect nail position to confirm correct depth.
    a. Two adjustments are possible to ensure the nail is being driven to the correct depth.
        i. There is a depth stop on each tool, adjusted by the depth stop adjustment wheel. If the nail is not being driving to this depth, increase the outlet pressure on the compressor.
        ii. If depth stop adjustments are needed, disconnect air supply before moving the depth adjustment wheel.
5. Proceed with further fastening, as required.

After Use

1. Air Nailer:
    a. Disconnect the air hose from the nailer.
    b. Remove all fasteners from the magazine, and return them the correct box or case.
2. Compressor:
    a. Turn the compressor off.
    b. Disconnect the tool from the hose .
    c. Unplug the compressor.

        i. Compressor cord should be wrapped onto the appropriate location on the side of the compressor head.
    d. Turn the regulator knob counterclockwise until it is unloaded. At this point, it will spin with very little effort. It is not necessary nor desirable to spin it all the way out.
    e. Pull the relief valve ring until the tank pressure gauge reads approximately 20 PSIG.
    f. With the compressor in the upright position, open the tank drain valve on the underside of the tank. Allow the tank to vent water and pressure until the tank gauge reads zero.
        i. NOTE: extended use of the compressor may result in significant water collection in the tank, particularly in humid weather. This water should be dealt with appropriately; it should not be left as a puddle on the shop floor.
    g. Close the tank drain valve.
3. Coil air hose neatly and hang on cart
4. Clean surrounding area

Baseline Configuration Identification

1. Regulator set to zero
2. Compressor drained and unpressurized
3. Compressor power cord unplugged and wrapped
4. Compressor hose wrapped on cart
5. Tool magazine empty
6. Tools disconnected and on cart

Air Tool Competencies

Trained User Competencies

Setup
- Oil Tool
- Set Compressor Outlet Pressure
- Load Air Tool

Operation
- Safely
- Clearing Jam

Changes and Adjustments
- Depth Stop Adjustment
- Connect/Disconnect Tool

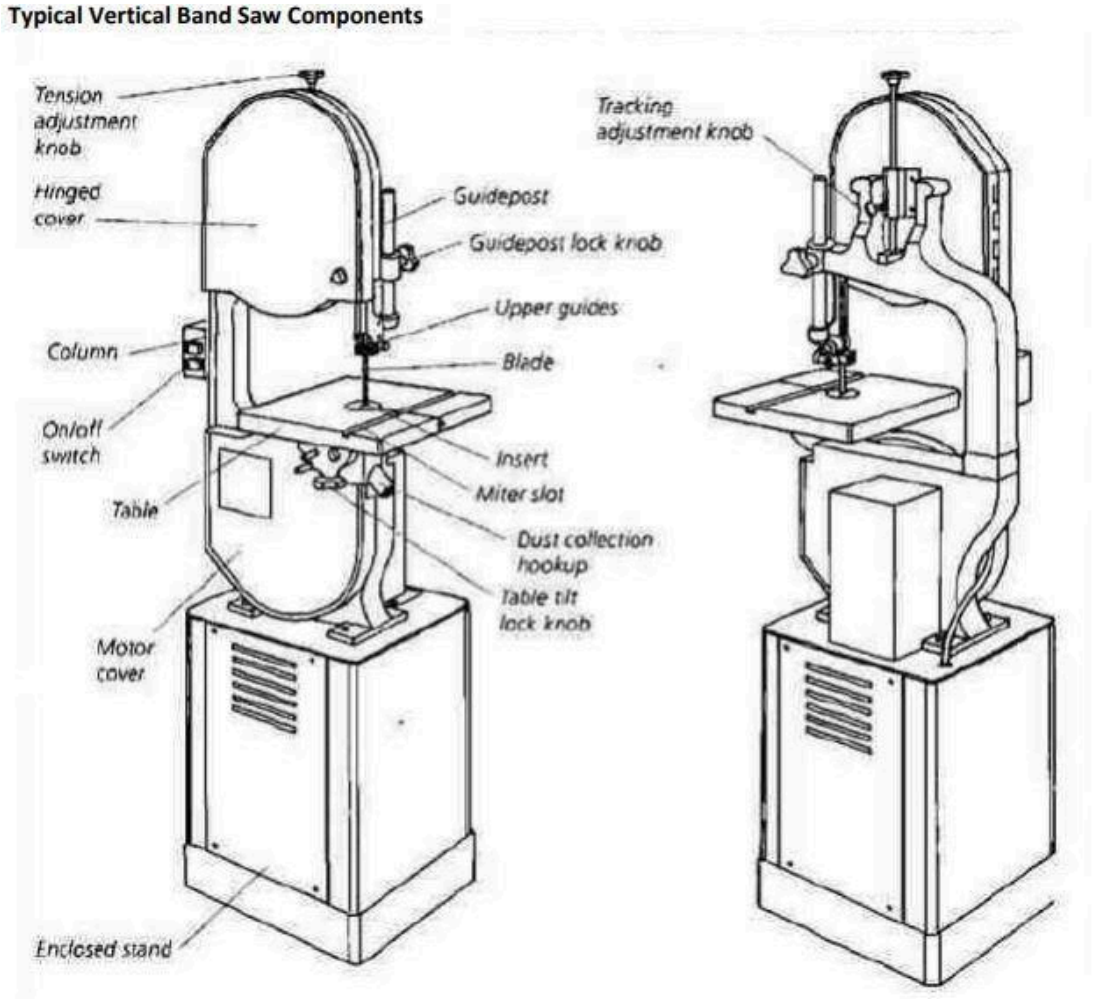
Maintenance and Care
- Clean Space
- Coil Hose
- Drain Compressor

BANDSAW GUIDE (updated 12/29/20)

Bandsaw Safety Rules

1. Wear proper personal protection equipment (safety glasses required, hearing protection highly recommended).
2. Do not bypass any safety devices.
3. Keep hands clear of the moving saw blade and the cut path.
4. Keep loose clothing, hair, and jewelry away from the saw blade.
5. Adjust the blade guides to support but not pinch the blade.
6. Let the saw blade do the cutting. Do not force the wood into the blade.
7. Do not cut a tighter radius than the blade permits (see Instructions for Use).
8. Do not clear small pieces close to the blade until the blade has stopped moving.
9. Let the blade stop prior to leaving the tool.
10. If something is broken or breaks, notify one of the woodshop leads at (woodshop@sparkmakerspace.org).

Bandsaw Parts (generic)



Bandsaw Summary

1. Tool location in shop
2. Possible uses for tool
    a. Good for:
        i. Curved cuts
        ii. Smaller workpieces
        iii. Variety of materials
    b. OK for:
        i. Straight cuts (blade wobble)
    c. Bad for:
        i. Large workpieces (limited table size)
3. Parts of a band saw (refer to diagram)
4. Important variables:
    a. Blade tooth count
        i. Higher tooth count for thinner materials
        ii. 3-tooth engagement rule of thumb
    b. Blade width (gullet to spine)
        i. Wider blades require larger radius of curvature for cut
5. Important setup steps:
    a. Cutting plan
    b. Blade guide height
        i. Blade guide should be just higher than the height of the material
    c. Workpiece guidance
        i. Push-stick
        ii. Fence
        iii. Jig
6. Operation guidance
    a. Lining up a cut (drift angle)
    b. Cutting a curve
    c. Relief cuts
    d. Backing out of a cut
7. Cleanup

Bandsaw Instructions for Use

Before Use

1. Wear personal protective equipment
    a. Safety glasses
    b. No gloves may be worn while operating the bandsaw
2. Inspect the bandsaw blade for damage (bent blade, missing teeth, etc.)
3. Check that the bandsaw blade has the correct number of teeth per inch for the piece being cut (see Table 1).
    a. Blade tooth count should allow at least three (3) teeth to be engaged in the workpiece at all time
4. Check that the bandsaw blade is the correct width for the intended cut.
    a. The minimum radius that can be cut with the bandsaw blade is based on the blade width. Do not attempt to cut a tighter radius than the blade can handle (see Table 2).
    b. Blades are measured from the base of the teeth (gullet) to the spine of the blade
5. Check the blade tension. The blade should be able to deflect, but it should not be loose.
    a. If the bandsaw has a tension guide, use the guide as a starting point and adjust as needed.
    b. The width of the blade is measured from the back of the blade to the back of the gullet (space between teeth).
6. Check that the bandsaw blade is tracking on the center of the wheels.
    a. Test should be done by briefly powering up the saw, and insuring the blade is not drifting forwards or backwards
    b. Blade tracking adjustment should be done with the saw powered off and unplugged.
7. Check the upper and lower blade guides.
    a. The thrust bearing should have about 1/32” spacing between the bearing and the backside of the blade.
    b. The side bearing should have about 1/64” spacing between the blade and each bearing.
    c. The side bearing should not extend past the bottom of the teeth gullet.
8. Check the bandsaw table, and make sure the lock knob is secured. The table should be level in its baseline configuration. If an angled cut is desired, tilt the table to the appropriate angle.
9. Adjust height of the upper blade guide to be just above the thickness of the workpiece.
10. Determine the location and angle(s) of cuts required. Mark lines clearly on the workpiece.
11. Prepare a cutting plan
    a. Determine if relief cuts are necessary.
    b. Determine if push blocks are needed.

Useful Tables

Table 1: Correct Blade Selection

TPI	Minimum Material Thickness (inches)
32	3/32
24	1/8
18	5/32
14	1/4
10	5/16
8	3/8
6	1/2
4	3/4
3	1
2	1 1/2

Source: “How-To’s for all Bandsaw Blades” Olsonsaw

Table 2: Minimum Cut Radius

Blade Width (in)	Minimum Cut Radius (in)
1	7
3/4	5 1/2
5/8	4
1/2	2 1/2
3/8	1 1/2
1/4	5/8
3/16	5/16
1/8	3/16

Source: “How-To’s for all Bandsaw Blades” Olsonsaw

During Use

1. If the bandsaw has a dust collection port, attach the appropriate dust collection system, and turn on the dust collector
2. Prior to turning on the tool, ensure that no material or parts are in contact with the blade
3. Turn on the bandsaw and let the blade come up to maximum speed prior to starting the cut.
4. Listen for unusual or unsteady sounds. If these sounds are heard, stop the blade and notify a Woodshop Lead.
5. If a complex curve is being cut, start by making relief cuts in the piece of wood.
    a. Users should not attempt to back out of a curved cut. Relief cuts prevent potential jams.
6. Feed the material into the saw blade while maintaining even pressure. Let the saw blade perform the cutting, and do not force the piece of wood into the blade.

   a. Users should listen to the machine during operation. Changes in machine pitch often indicated overloading.
   b. Use push blocks, miter guide or appropriate scraps of material in order to maintain a safe distance from the blade.
7. If the wood is not cutting, there are several possible causes:
   a. The wood may be very hard.
      i. There is no resolution for this issue. Slow down and be patient. Give the saw and blade occasional breaks to prevent overheating.
   b. The currently installed bandsaw blade may be inappropriate for the material and thickness.
      i. Talk to a Woodshop Lead
   c. The bandsaw blade may be dull
      i. Talk to a Woodshop Lead
8. The bandsaw blade will twist slightly under load while cutting, leading to a certain amount of drift angle during the cut. The angle will vary with saw, blade, setup, and workpiece. The user will have to compensate by presenting the piece at a slight angle to the cut line.
10. As the piece is being cut, avoid applying excessive lateral or twisting pressure on the blade.
11. Be aware of material pinching the blade. This can overload the saw, damage the blade, and burn the material.
12. As the cut progresses, maintain safe hand positions.
13. Once the cut is almost complete, ensure that hands are clear of the region where the saw blade will exit the piece.
    a. Use a push stick or guide as required
14. Once the piece is cut, turn off the saw and wait until the blade comes to a complete stop before leaving the tool unattended.
15. Turn off the dust collection system.

After Use

1. Return the tool to the baseline configuration (see Baseline Configuration Identification).
2. Clean up the sawdust around the tool.
3. Replace the tool in its storage position (if applicable)

Bandsaw Baseline Configuration

Jet Bandsaw

1. Table level at 90 degrees to the blade
2. 1/4" blade with 6 tpi
    a. Tension set properly for blade
    b. Guide bearings set properly for blade
3. All offcuts and cutting debris removed
4. Stowed against the wall

Powermatic Bandsaw

5. Table level at 90 degrees to the blade
6. 1/2" blade with
    a. Tension set properly for blade
    b. Guide bearings set properly for blade
7. All offcuts and cutting debris removed
8. Stowed against the wall

Bandsaw Competencies

Trained User Competencies

Setup
- Blade Type Check
- Blade Tension Check
- Blade Tracking and Guide Check

Operation
- Straight Cuts
- Curved Cuts

Changes and Adjustments
- Adjust Blade Guide Height

Maintenance and Care
- Blade Inspection
- Dust Removal

Advanced User Competencies

Operations
- Miter Cuts on Bandsaw

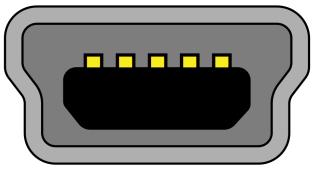
Changes and Adjustments
- Table Angle Adjustment
- Removing and Changing Blade
- Blade Tensioning
- Blade Tracking Adjustment
- Guide Bearings
- Thrust Bearings

Maintenance and Care
- Table Waxing

Spark Close-Up Cam Instructions

Cart Preparation:

Ensure the GoPro is charged before instruction starts. The GoPro camera does not have sufficient space to connect both the power cable and the video cable at the same time. The camera is charged by inserting the USB charging cord into the larger port on the side of the camera. The USB charging cord end looks like the picture to the right; it does not visually match the contour of the port on the camera, but it does operate correctly.



Cart Startup:

1) Plug in orange extension cord
2) Ensure power strip is on
3) Turn on monitors
    a) Power button is on lower right corner of frame
4) Unplug GoPro camera from charger (if applicable)
5) Plug long black HDMI cord (hanging under cart) into smaller, upper port on the side of the GoPro camera
6) Turn on the camera by pressing the power button on the front of the camera once.
    a) A red light will flash and the camera will beep
7) If video does not display on the video screens, turn each monitor off then on again.
8) If video still does not display, the GoPro camera will need to be reset to video mode.
    a) Press the settings button, on the opposite end of the camera from the power and video connection ports.
    b) Use the touch screen on the back of the camera to reset the camera to video mode, 1080p resolution.

Cart Shutdown:

1) Shut down GoPro camera by pressing and hold power button on front of camera until camera shuts down
    a) A red light will flash and the camera will beep
2) Turn off monitors
3) Unplug black HDMI cable from the GoPro camera.
4) If the GoPro camera has been removed from the small tripod to use alternate mountings, replace the GoPro camera on the tripod and return the mountings to the correct storage locations.
5) Return the GoPro camera and small tripod to the box under the cart.
6) Roll the black HDMI cord up, and hang it from the hook under the cart
7) Unplug the orange extension cord from the power outlet.
8) Roll the orange extension cord up, and hang it from the hook under the cart.

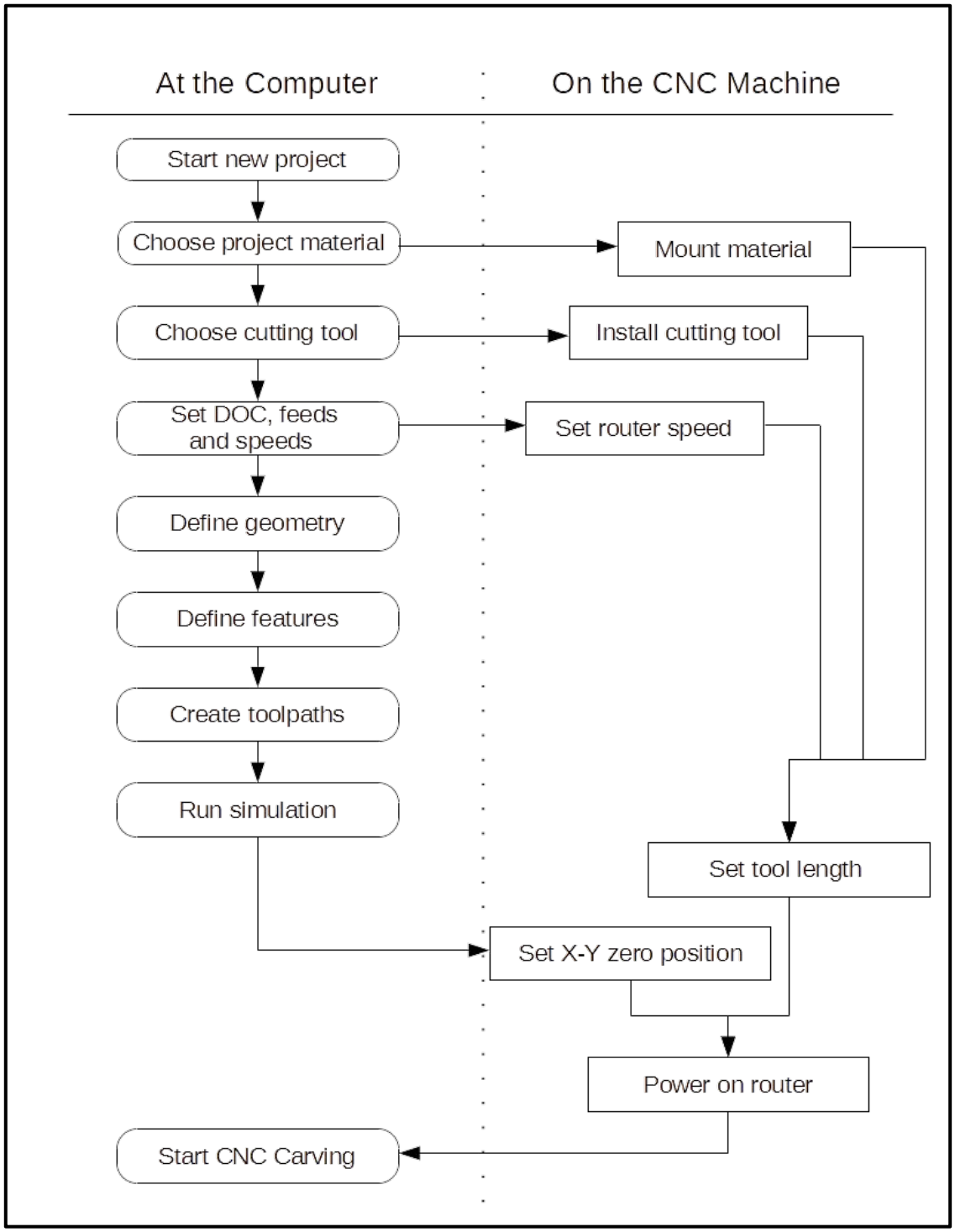
Spark Close-Up Cam Instructions

Woodshop Shooting Angles:

1) Chop saw - mount the camera on the clamp mount, and clamp it to the stock shelf above the saw (not on the saw dust collection hood)
2) Bandsaw - roll the cart to the outfeed side of the bandsaw, and clamp the camera to the vertical board rising above the monitors in a position where both sides of the blade can be seen clearly
3) Table saw - place the camera on clamp or tripod on the outfeed table, where both sides of the blade can be seen.

Spark Makerspace Woodshop Class:
CNC Certification

This handout will is intended as a useful reference during the CNC certification class, as well as subsequent CNC use by members.



Fraction to Decimal Conversion

0	0.000
1/32	0.031
1/16	0.063
3/32	0.094
1/8	0.125
5/32	0.156
3/16	0.188
7/32	0.219
1/4	0.250
9/32	0.281
5/16	0.313
11/32	0.344
3/8	0.375
13/32	0.406
7/16	0.438
15/32	0.469
1/2	0.500
17/32	0.531
9/16	0.563
19/32	0.594
5/8	0.625
21/32	0.656
11/16	0.688
23/32	0.719
3/4	0.750
25/32	0.781
13/16	0.813
27/32	0.844
7/8	0.875
29/32	0.906
15/16	0.938
31/32	0.969
1	1.000

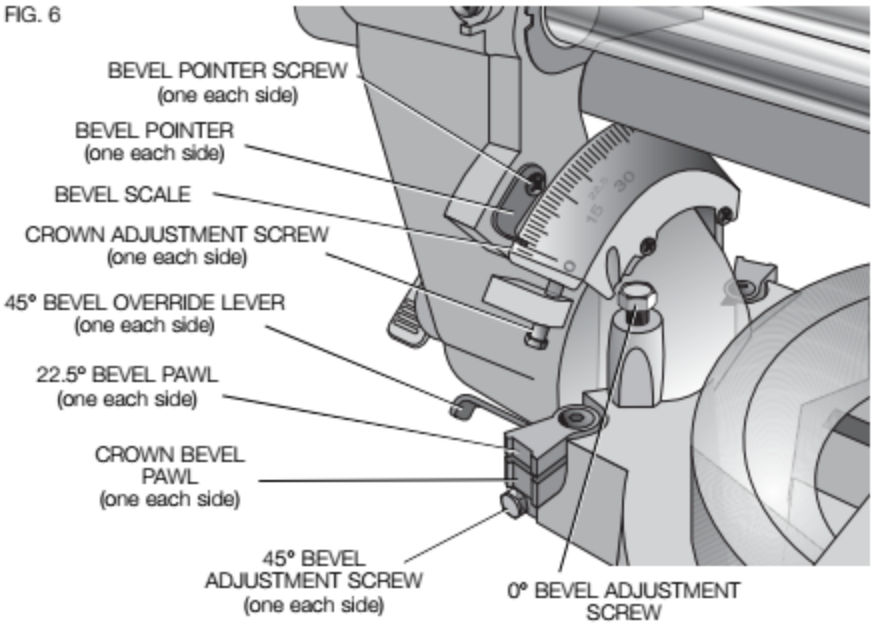
Link to the Spark X-Carve Wiki webpage:
https://wiki.sparkmakerspace.org/index.php?title=X-Carve_Router
(updated 3/15/24)

COMPOUND MITER SAW GUIDE

(updated 12/29/20)

Safety Rules

1. Wear proper personal protection equipment (safety glasses).
2. Keep loose clothing, hair, and jewelry away from the spinning blade
3. Do not bypass any safety devices
4. Keep hands clear of the area near the blade as marked on the tool
5. Bring blade up to speed prior to lowering handle and uncovering the blade
6. If something is broken or breaks, notify one of the woodshop leads at (woodshop@sparkmakerspace.org).



Unless otherwise noted, diagrams in this document are taken from the manual for the DeWalt DWS780 Sliding Compound Miter Saw Manual, and are copyright of DeWalt Industrial Tool Company..

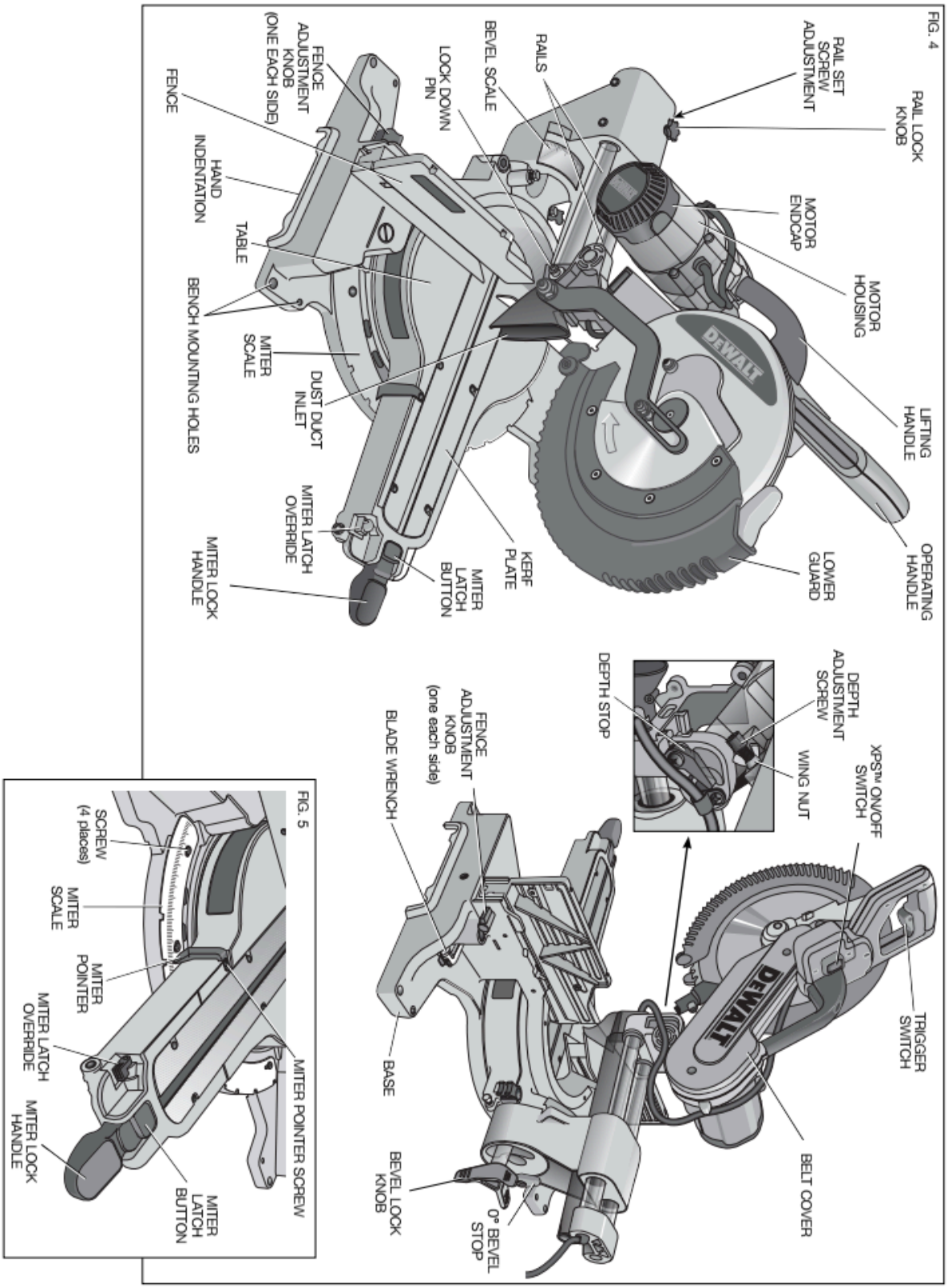


FIG. 4
RAIL LOCK KNOB
RAIL SET SCREW ADJUSTMENT
MOTOR ENDCAP
MOTOR HOUSING
LIFTING HANDLE
OPERATING HANDLE
LOWER GUARD
RAILS
BEVEL SCALE
LOCK DOWN PIN
FENCE ADJUSTMENT KNOB (ONE EACH SIDE)
FENCE
HAND INDENTATION
TABLE
BENCH MOUNTING HOLES
MITER SCALE
DUST DUCT INLET
MITER LATCH OVERRIDE
MITER LOCK HANDLE
KERF PLATE
MITER LATCH BUTTON
DEPTH STOP
DEPTH ADJUSTMENT SCREW
WING NUT
XPS™ ON/OFF SWITCH
TRIGGER SWITCH
FENCE ADJUSTMENT KNOB (one each side)
BLADE WRENCH
BASE
BELT COVER
BEVEL LOCK KNOB
0° BEVEL STOP
FIG. 5
SCREW (4 places)
MITER SCALE
MITER POINTER
MITER LATCH OVERRIDE
MITER LOCK HANDLE
MITER POINTER SCREW
MITER LATCH BUTTON

Compound Miter Saw Summary

1. Tool Location in Shop
2. Uses for Tool:
    a. Good for:
        i. Cross-cutting long boards
        ii. Miter (angle cut) on boards
        iii. Wood materials
    b. OK for:
        i. Plastics
        ii. Tubular materials
    c. Bad for:
        i. Sheet goods (plywood, panels, etc)
        ii. Metals
        iii. Small pieces
        iv. Rip cuts
3. Parts of the saw (refer to diagram)
4. Important Variables
    a. Blade tooth count
    b. Blade tooth type
    c. Miter angle
5. Important Setup Steps
    a. Cut plan
    b. Secure Workpiece
    c. Miter angle
    d. Dust collection
6. Operational Guidance
    a. Line up cut
        i. Dry run
    b. Start saw with blade clear of workpiece
    c. Cut away from operator
    d. Even feed force
7. Cleanup

Instructions for Use

Before Use

1. Wear personal protective equipment.
    a. Safety glasses
    b. No gloves may be worn while operating the compound miter saw.
    c. Hearing protection is recommended.
    d. Tie long hair back
    e. Roll loose sleeves above elbow
2. Inspect the circular saw blade for damage. If damage is observed report to a woodshop lead.
3. Unlock the sliding carriage and the cutter head.
    a. Loosen the sliding carriage knob to allow the blade to travel axially.
    b. Push down on the switch handle, and release the stop latch knob.
4. Prepare a cutting plan.
    a. Determine what miter angle and bevel angle are needed.
    b. Mark the material as necessary.
5. Adjust the miter angle.
    a. Lift the miter lock handle
    b. Depress the miter latch button and rotate the miter table to the desired miter angle.
    c. Release the miter latch button and press down on the miter lock handle to secure the table.
6. Adjust the saw bevel angle.
    a. Loosen the bevel lock handle and tilt the blade.
    b. The miter saw has stops at 45 degrees and 33.9 degrees.
        i. For 45 degrees, tilt the blade to the hard stop.
        ii. For 33.9 degrees, engage the bevel detent pin and tilt the blade until the bevel detent pin is engaged.
    c. Secure the bevel lock handle.
    d. Verify with a measuring tool that the bevel is set to the desired angle.
7. Move the hold-down clamp to the proper side of the saw.
    a. Move the mounting clamp to the right side of the saw for right handed use.
    b. Move the mounting clamp to the left side of the saw for left handed use.
8. Dust Collection
    a. Press fit the shop vacuum hose into the miter saw's dust collection system outfeed, found below and to the right of the saw, under the work table.
    b. Turn on the shop vacuum.
9. Plug in the compound miter saw.

During Use

1. Position and secure the material on the miter table
    a. If possible, use a hold down clamp to secure the material

        i. If using a length stop, ensure clamp is on the same side of the cut as the stop to prevent kickback
    b. Use your non-dominant hand to hold the material outside the exclusion zone (marked on the saw table)
2. Without powering up the saw, lower the blade until it touches the material
    a. Use of the saw light will assist in accurate cuts.
        i. The light switch is labeled “XPS Switch” in the diagram, and found above the operating handle
    b. Verify that the material is positioned properly and that the miter and bevel angles are set correctly.
    c. Be aware of the saw kerf.
        i. “Kerf” is gap left by the thickness of the blade; verify that the cut line is on the correct side of the blade before cutting
3. Return the blade to its upper position.
4. Power up the blade.
    a. Press and hold trigger lock button
    b. Squeeze trigger to operate saw
5. After the blade is spinning at its working RPM, make the cut.
    a. Slide the carriage to its forward most position.
    b. Lower the blade into the material.
    c. Push the blade forward to complete the cut.
        i. Feed slowly enough to let the saw do the work
        ii. For thick cuts in hard or dense materials, multiple partial depth passes may be required. Ask a Woodshop Lead for assistance if you run into trouble.

After Use

1. Power down the shop vacuum.
2. Return the miter angle to 90 degrees.
    a. Lift the miter lock handle
    b. Depress the miter latch button and rotate the miter table to the desired miter angle.
    c. Release the miter latch button and press down on the miter lock handle to secure the table.
3. Return the bevel angle to 90 degrees.
    a. Loosen the bevel lock handle and tilt the blade back to the 90 degree position.
    b. Secure the bevel lock handle.
    c. Verify with a measuring tool that the bevel is set to 90 degrees.
4. Lock sliding carriage and the cutter head.
    a. Without powering the tool, lower the cutting head and secure the stop latch knob.
    b. Push the carriage to the aft end of the tool and lock the sliding carriage knob
5. Unplug the tool.
6. Sweep and dust the areas around the saw.

Baseline Configuration Identification

1. Bevel angle is set to 90 degrees
2. Miter angle is set to 90 degrees
3. Cutting head locked in the down position
4. Sliding carriage locked
5. Tool unplugged

Compound Miter Saw Competencies

Trained User Competencies

Setup
- Blade damage inspection
- Clamping

Operation
- Square cuts
- Miter cuts (single angle via table)

Changes and Adjustments
- Miter angle (table)

Maintenance and Care
- Cleanup of saw and surround space

Advanced User Competencies

Setup
- Blade depth stop adjustment

Operation
- Compound miter cuts (via head and table)
- Partial depth cuts (via depth stop)
- Safe use of length stops

Changes and Adjustments
- Head angle
- Miter stop adjustment (head)

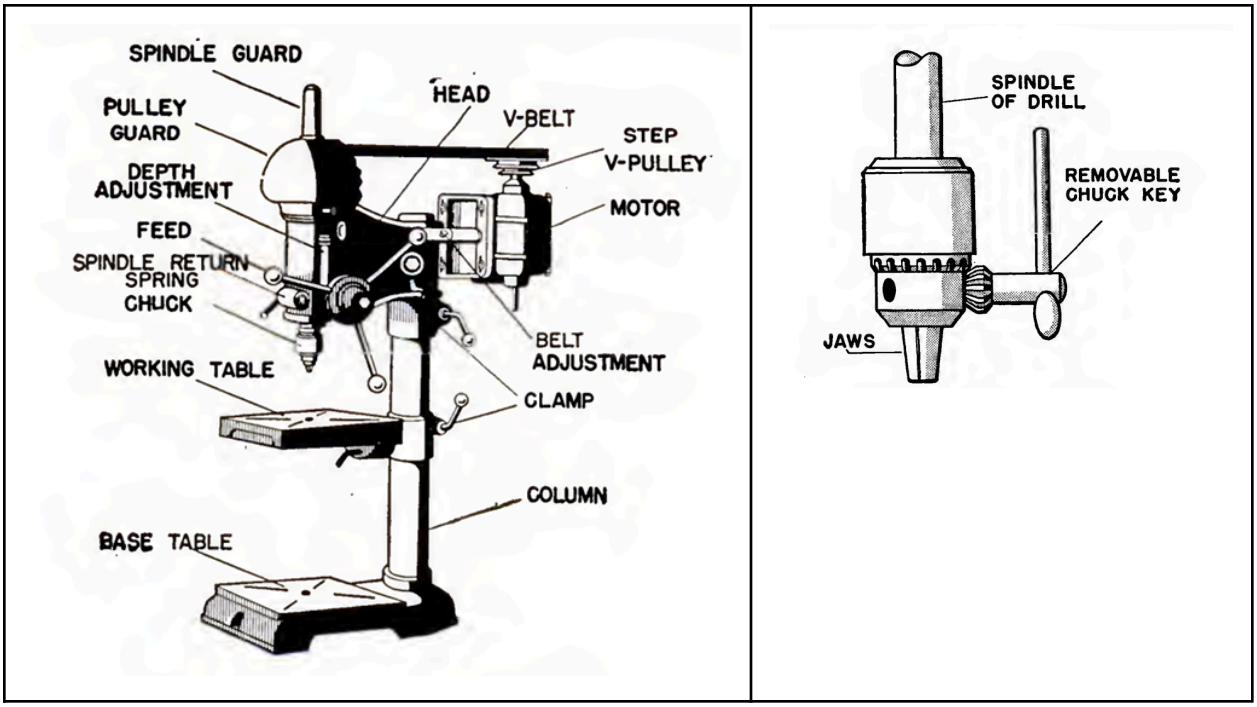
Maintenance and Care
- Blade replacement

DRILL PRESS GUIDE

(updated 12/29/20)

Safety Rules

1. Wear proper personal protection equipment (safety glasses)
2. Keep loose clothing, hair, and jewelry away from the drill bit
3. Do not bypass any safety devises
4. Secure the table prior to using the drill press
5. Secure the piece to the table if a large drill bit is being used or if the size of the piece precludes keeping hands a safe distance from the drill bit.
6. If something is broken or breaks, notify one of the wood shop leads at (woodshop@sparkmakerspace.org).



Drill Press Summary

1. Tool location in shop
2. Possible uses for tool
    a. Good for:
        i. Drilling holes (1/16” - 1”)
    b. OK for:
        i. Large diameter holes (>1”)
        ii. Buffing and sanding

    c. Bad for:
        i. Milling
3. Parts of a drill press (refer to diagram)
4. Important variables:
    a. Spindle speed
    b. Bit type
    c. Bit diameter
5. Important setup steps:
    a. Drilling plan
    b. Check spindle travel
        i. Adjust the bed height as needed
    c. Center punch
    d. Securing workpiece
        i. Table top vise
        ii. Clamp
6. Operational guidance
    a. Applying even bit pressure
    b. Removing shavings during cut
7. Cleanup

Instructions for Use

Before Use

1. Wear personal protective equipment
    a. Wear safety glasses
    b. No gloves may be worn while operating the drill press
    c. Long hair must be tied back
    d. Loose sleeves should be rolled above the elbow
2. Determine appropriate drill bit
    a. Twist drills:
        i. Most common drill bits
        ii. Depending on tip, good for wood, plastics, or metal
        iii. Can be used for blind or through holes
        iv. Generally available from 1/16” through 1/2"
            1. Larger sizes available but increasingly expensive
    b. Forstner:
        i. Good for wood, OK in plastics
        ii. Good for clean, precise, large diameter (>3/8”) holes
        iii. Good for flat-bottomed holes
    c. Spade bits:
        i. Good for wood, OK for some plastics
        ii. Good for larger diameter (>1/2”) holes, but leaves rougher finish than Forstner
        iii. Can make blind holes
    d. Hole saws
        i. Good for wood, ok for plastics, some work on metals
        ii. Hole must be through material, and material thickness is limited
        iii. Available from approximately 1” through 4”
    e. See reference charts or talk to a Woodshop Lead for specific applications
3. Check the height of the drill press table. The table should be low enough to allow the work piece to be mounted and to change drill bits but high enough for the spindle travel to make the desired hole depth.
    a. Loosen the table clamp from the column by loosening the table clamp handle behind the column
    b. Raise or lower the table by turning the raising handle to actuate the rack and pinion gear
    c. Rotate the table radially around the column as needed.
    d. Tighten the table clamp handle to secure the table position.
4. Orient the table so that the spindle creates the desired hole angle. The drill press should be oriented with the spindle travel perpendicular to the table in its baseline configuration. The alignment pin can only be inserted when the table is perpendicular, so verifying the presence of the pin is a good visual check.

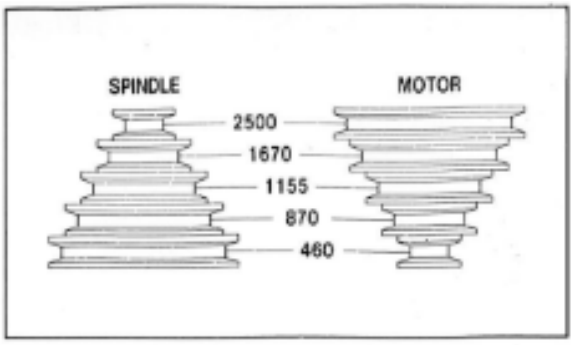
   a. If an angled hole is desired, remove the alignment pin. Removing the alignment nut can assist in removing the pin.
   b. Loosen the table locking bolt and turn the table to the desired angle. Tighten the locking bolt.
5. Check the spindle speed setting. Higher speeds will be desired for drilling small holes while slower speeds will be desired for drilling larger holes (see Table 1).
   a. Unplug the drill press
   b. Open the belt cover on top of the press
   c. Loosen the tension lock knob holding the motor in position (right side, rear)
   d. Pull the tensioning lever forward to loosen the belt.
   e. Shift the belt to the desired set of pulleys that produce the desired speed (see diagram on next page).
   f. The two pulleys selected should be at the same height to prevent the belt from jumping off of the pulleys.
   g. Push the tension lever towards the rear to tension the best.
   h. Set the tension by tightening the knob to secure the motor position
4. Verify that the drill chuck is securely mounted in the spindle
   a. The drill chuck has a Morse taper that is press fit into the spindle.
5. Use a center punch to mark the location of the center of hole to be drilled.
6. Mount the drill bit in the chuck
   a. The drill chuck has a key which is secured to the machine by a tether.
   b. The outer housing of the chuck will rotate to open and close the jaws
   c. Twist the outer housing of the chuck to hold the drill bit in place
   d. Use the key to turn the teeth on the outer housing to fully secure the bit.
7. Secure the workpiece to the press table. This is particularly important for larger drill bits.
   a. If a through hole is being drilled, to protect the press table and the drill bit:
      i. The drill bit should pass through the hole in the middle of the press table, OR
      ii. Scrap wood should be placed between the bottom of the workpiece and the press table
   b. Large pieces can be secured directly to the table with clamps.
   c. Small pieces can be secured with the portable vise.The vise should then be secured to the table with clamps.
8. Drilling the desired hole
   a. If a large twist drill bit is to be used for the final hole diameter, a pilot hole can help maintain an accurate position.
   b. Forstner bits do not need a pilot hole.

Useful Tables

Table 1: Drill Speed Chart

Twist Drill Bit Size (in)	Softwood Speed (rpm)	Hardwood Speed (rpm)
1/16” - 3/16”	3000	3000
1/4” - 3/8”	3000	1500
7/16“ - 5/8“	1500	750
11/16” - 1”	750	500

Source: “Wood Magazine’s Drill Press Speed Chart”



During Use

1. Drill the workpiece
    a. A twist bit can often make a hole in a single pass
    b. Forstner bits need to make gradual cuts. After making a partial cut, the forstner bit is backed out of the piece to remove shavings. The forstner bit is plunged back into the workpiece to continue the cut.
    c. Hole saws and spade bits do not remove shaving from the hole, similar to a forstner bit. Gradual cuts should also be made with these bits where the shavings are removed from the piece after each pass.

After Use

1. Unclamp the workpiece from the table.
2. Remove the vise, if used.
3. Unchuck the drill bit and return it to the correct storage.
4. Return the table to perpendicular
    a. Loosen the table locking bolt, and return the table to the perpendicular orientation.
    b. Replace the alignment bolt and nut
    c. Tighten the table locking bolt.
5. Return the tool to the baseline configuration (see Baseline Configuration Identification).
6. Clean up the sawdust around the tool.

Baseline Configuration Identification

1. Remove bit from chuck
2. Spindle speed set to its lowest setting.
3. Table perpendicular to spindle.

Drill Press Competencies

Trained User Competencies

Setup
- Table Height Adjustments
- Spindle Speed Adjustments
- Bit Identification (Twist, Forstner, Spade, Hole, etc)

Operations
- Securing a Bit in the Chuck
- Securing Workpiece
- Drilling Hole

Maintenance and Care
- Cleanup of Machine and Surrounding Space

Advanced User Competencies

Setup
- Table Angle Change and Reset
- Reseating Morse Taper

Maintenance
- Table Cleaning and Waxing
- Belt Replacement

JOINTER GUIDE

(updated 8/7/25)

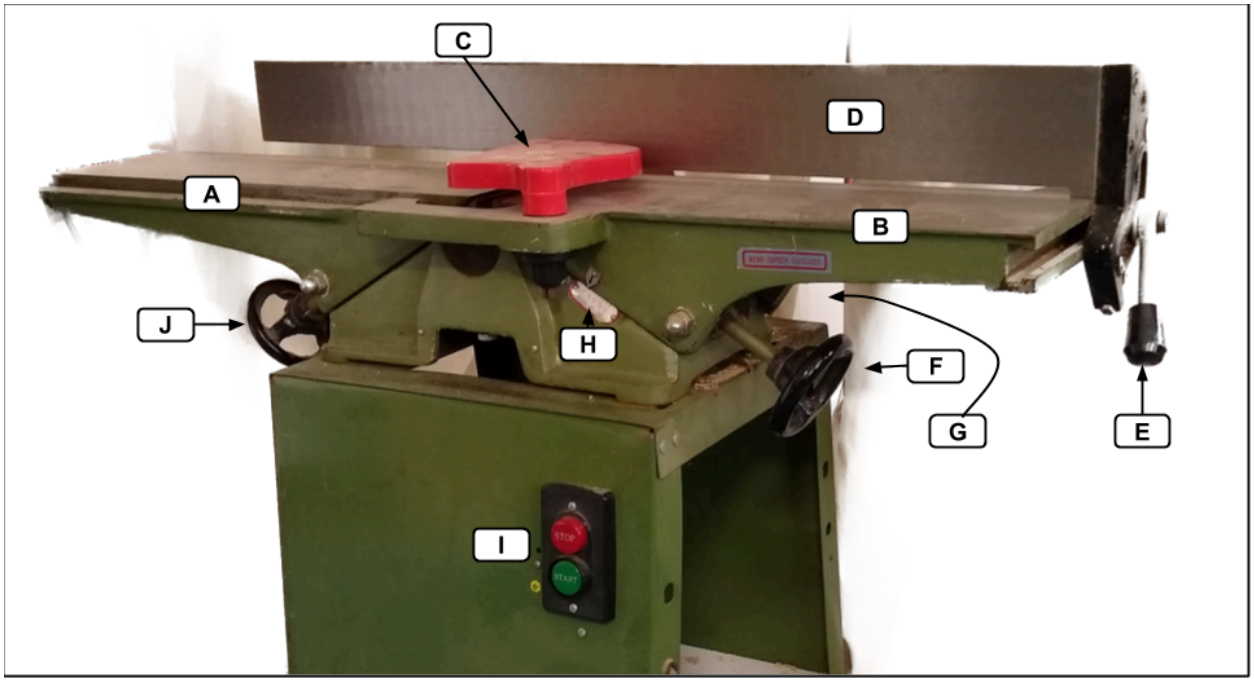
Safety Rules

1. Wear proper personal protection equipment (safety glasses, hearing protection, respiratory protection)
2. Keep loose clothing, hair, and jewelry away from the machine
3. Do not bypass any safety devices
4. Keep hands clear of the feed area
5. Ensure the workpiece is appropriate material and size
6. Inspect workpiece thoroughly before using jointer
7. Plane/joint only one piece at a time
8. Let the jointer come up to speed before starting the cut
9. Let the jointer come to a complete stop before leaving the tool
10. If something is broken or breaks, notify one of the woodshop leads at (woodshop@sparkmakerspace.org).

Jointer Summary

1. Tool Location in Shop
2. Parts of the jointer (refer to diagram)
3. Uses for Tool
4. Kickback Prevention
5. Before Use
    a. Check workpiece for jointer suitability
        i. Natural wood only
        ii. Min thickness: 1/2”
        iii. Min width: 1”
        iv. Min length: 10”
        v. Maximum width: 6”
    b. Set start depth (⅛” max)
6. During Use
    a. Start jointer with workpiece clear of cutting head
    b. Keep hands clear cutting area
    c. Use assistant or feed roller for large stock
    d. Make repeated light cuts
7. Cleanup

Machine Parts



A) Outfeed table - set at same high as cutter. Should not be adjusted without consulting with the Woodshop Leads.
B) Infeed table - starting position for workpiece. Can be adjusted in height to change depth of cut
C) Cutter guard - covers rotary knife cutters when no workpiece is being fed through the machine. Users should keep hands and fingers clear of this area.
D) Fence - guide for workpiece. Adjustable for width and angle
E) Fence clamp level - loosened to allow adjustment of the fence, and should be tightened before using the jointer.
F) Infeed table adjustment handwheel - used to adjust position of infeed table, and resulting depth of cut.
G) Infeed table lock (not shown) - threaded knob on back of jointer; used to prevent table from shifting during operation. This must be loosened before adjusting table height.
H) Infeed table position indicator - questionably accurate on the Spark jointer, this indicator shows intended depth of cut.
I) Power controls - used to turn jointer on or off
J) Outfeed table adjustment handwheel - allows adjustment of outfeed table during jointer calibration. DO NOT ALTER THE POSITION OF THIS HANDWHEEL WITHOUT A WOODSHOP LEAD BEING PRESENT.

Instructions for Use

Uses for Tool:

1. Good for:
    a. Correcting cupping, warping, twisting, or bending in lumber
    b. Squaring rough stock
    c. Solid, natural wood
2. Bad for:
    a. Engineered lumber (Plywood/laminates/particle board/MDF)
    b. Wood with nails, staples, rocks, sand, etc. (NO PALLET LUMBER)
    c. End grain
    d. Significantly warped boards
    e. Green (wet, undried) lumber
    f. Small parts
    g. Metals
    h. Ceramics/Glass/Tiles
    i. Composites (fiberglass or carbon fiber)

Kickback Prevention

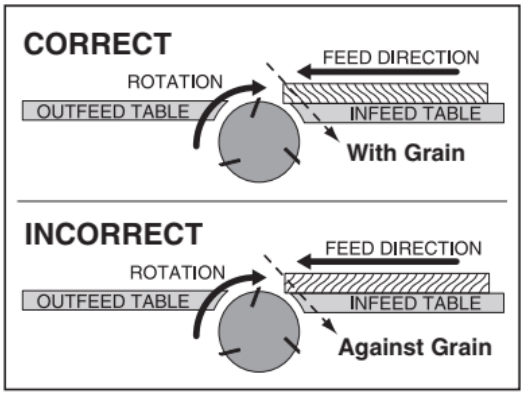
1. “Kickback” occurs during the operation when the workpiece is ejected from the machine at a high rate of speed. Kickback is commonly caused by poor workpiece selection, unsafe feeding techniques, or improper machine setup/maintenance. Kickback injuries typically occur as follows:
    a. Operator/bystanders are struck by the workpiece, resulting in impact injuries (i.e., blindness, broken bones, bruises, death)
    b. Operator’s hands are pulled into the blade, resulting in amputation or severe lacerations.
2. To prevent kickback:
    a. Ensure the workpiece is appropriate before using in jointer
    b. Feed gently but firmly; do not force the tool
    c. Do not attempt to take a deep cut; several shallower passes are preferred
    d. Plane parallel to the grain (or slightly offset) only
    e. Support long workpieces into and out of the jointer
3. Standing offset to the machine will reduce the chances of injury should kickback occur

Before Use

1. Wear personal protective equipment.
    a. Safety glasses
        i. Face shields may be worn for greater comfort, but safety glasses must be worn underneath
        ii. Do not attempt to view inside the jointer during operation, even with safety glasses
    b. Dust masks or respirators are strongly encouraged; use of dust collector required
    c. Gloves shall not be worn while operating the jointer
    d. Hearing protection is recommended
    e. Tie long hair back
    f. Roll loose sleeves above the elbow
    g. Remove all jewelry
2. Inspect the workpiece for suitability
    a. Workpiece should be greater than 1/2” thick, wider than 1”, and at least 10” long
    b. Materials should be limited to natural wood
        i. No laminates, plywood, MDF, particle board, OSB, etc.
    c. Workpiece should be clear of foreign objects such as nails, screws, fasteners, dirt, rocks, sand, debris, or any other non-wood material.
        i. If planing a glued assembly, scrape all surface glue off the workpiece before feeding to reduce wear on jointer knives/cutters
        ii. Loose knots should be removed before being fed through the jointer. If loose knots can not be removed, an alternate cut method should be found.
    d. Green, pressure treated, or any other “wet” workpiece should be avoided.
    e. Care should be taken with cut orientation and feeding. Cut must be made in the most stable orientation (concave side down).

At the Jointer

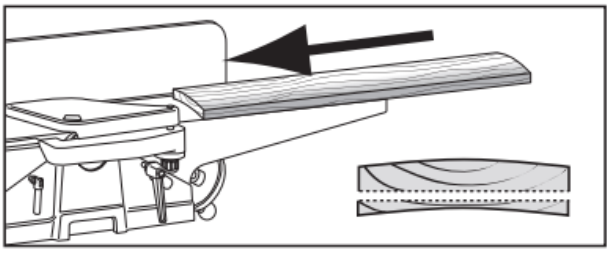
1. Material Handling
    a. Joint only one piece at a time. Do not attempt to run multiple workpieces through the jointer simultaneously.
    b. Support long workpieces on both infeed and outfeed sides, either by hand or with roller stands.
        i. Uneven loading will result in uneven cutting and increased wear on the machine
2. The maximum material removal on a single pass is approximately 1/8”
    a. Wide materials will require a reduced cutting depth
    b. Hard woods will require a reduced cutting depth
    c. Depth can be adjusted by:
        i. Loosening the infeed table lock
        ii. Turning the infeed table adjustment handwheel until the indicator shows the correct depth of cut
        iii. Gently tightening the infeed table lock
3. The fence angle can be set between 45 and 135 degrees.
    a. Most jointing operations will have the fence set to 90 degrees.
    b. Fence angle can be adjusted by:
        i. loosening the fence lock handle,
        ii. rolling the fence into location,
        iii. and tightening the fence lock handle again.
4. For best surface finish, joint with the grain direction of the wood. The diagram to the right has been taken from the Grizzly Model 725 Manual, and demonstrates the correct grain orientation.
    a. Do not joint cross- or end-grain; the workpiece can be destroyed and cause injury to the user.



General Operation

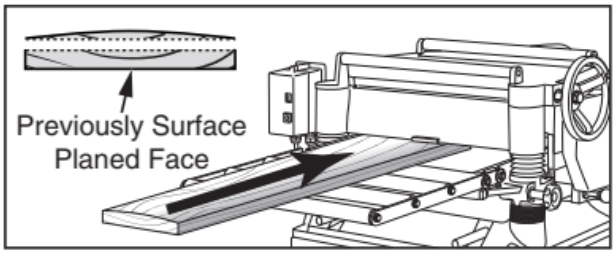
1. Ensure workpiece is acceptable for planing
2. Adjust the depth of cut, up to ⅛”, as required to clean the chosen edge
    a. Harder woods will require a reduced depth of cut.
    b. It is often preferable to make several light passes instead of fewer heavy passes.
3. Set the fence at the angle required.
    a. Most operations will use a 90 deg fence position.
4. Turn on dust collection with appropriate manifold gate open.
5. Allow the jointer to reach full operating speed before feeding the workpiece into the cutting area.
6. If a piece is bent or cupped, cuts should be made to the concave face.

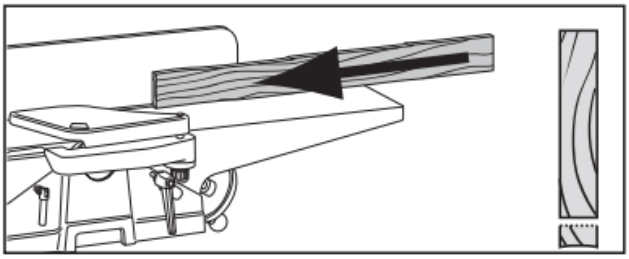
   a. Attempts to cut the convex face will result in uneven cuts as the workpiece will shift during cutting operations.
7. Feed the workpiece into the cutting area, holding it firmly against the fence and maintaining control of the workpiece to prevent kickback.
   a. Excess speed will overwork the jointer motor. If the motor pitch changes significantly while feeding, reduce feed rate
   b. Excess feed rate may result in a rippled surface on the workpiece
8. As the front of the workpiece passes out of the cutting zone, maintain pressure to hold it against the fence and the outfeed table.
   a. Small or thin pieces will require the use of push blocks.
9. Feed the workpiece completely; do not move a workpiece backwards while cutting.
10. Shut down the jointer when done.
11. Turn off dust collection and return manifold to baseline.

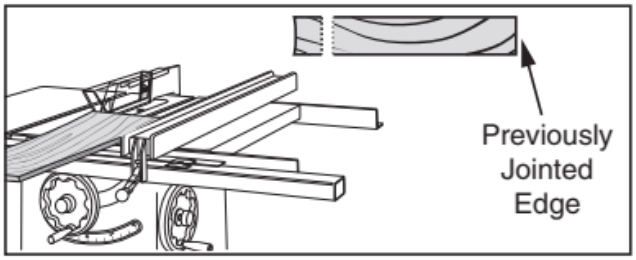


Specific Jointer Operations

1. The jointer is usually used for the following three operations:
   a. Surface planing
   b. Edge jointing
   c. Bevel cutting
2. To square stock (starting from rough, cupped, bent, or warped stock), four steps are usually required. The illustrations are taken from the Grizzly G0725 Jointer manual.
   a. First, one face is planed on the jointer until flat(concave face down)
   b. The opposing face is now planed with a surface planer, with the previously cleaned face against the work table.
   c. The concave edge of the workpiece is then edge jointed.
   d. The final edge is cut on the table saw, using the previously finished edge against the fence.
   e. Use of the planer and table saw is required to ensure that all faces are parallel.

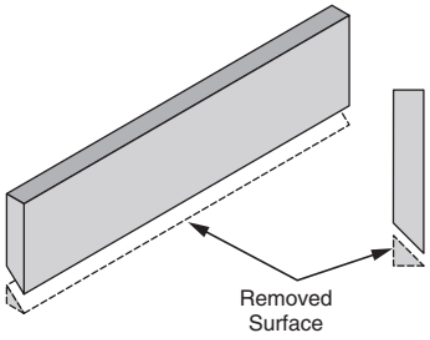






3. Surface Planing:
   a. Inspect stock for suitability

   b. Set infeed table height for correct depth of cut
      i. For surface planning, shallow passes are required.
      ii. Passes less than 1/16” will minimize chances of kickback
   c. Set fence to 90 degrees
   d. Start jointer
   e. Place workpiece firmly against the fence and infeed table, concave side down
   f. Feed workpiece across the cutting head, keeping it firmly against the fence and tables
      i. Feed workpiece to completion
      ii. Use pushblocks to keep hands free of cutting area
   g. Repeat passes until face is flat
4. Edge Jointing
   a. Inspect stock for suitability
   b. Set infeed table height for correct depth of cut
      i. For surface planning, shallow passes are required.
      ii. Passes less than 1/8” will minimize chances of kickback
   c. Set fence to 90 degrees
   d. Start jointer
   e. Place workpiece firmly against the fence and infeed table, concave side down
   f. Feed workpiece across the cutting head, keeping it firmly against the fence and tables
      i. Feed workpiece to completion
      ii. Use pushblocks to keep hands free of cutting area
   g. Repeat passes until edge is flat
5. Bevel Cutting
   a. Inspect stock for suitability
   b. Set infeed table height for correct depth of cut
      i. For surface planning, shallow passes are required.
      ii. Passes should be between 1/16” and 1/8”, depending on the hardness of the lumber



   c. Set fence to desired bevel angle
   d. Start jointer
   e. Place workpiece firmly against the fence and infeed table, concave side down
   f. Feed the workpiece across the cutting head, using the leading hand to press the workpiece against the table and fence. Feed the workpiece with the trailing hand.
      i. Push blocks may be required for one or both hands
      ii. Feed workpiece to completion
   g. Repeat passes until edge is flat

After Use

1. Return the jointer to baseline configuration.
2. Clean up shavings and sawdust from around the tool.

Baseline Configuration Identification

1. Depth set to zero
2. Fence set to 90 degrees
3. Area cleaned

Jointer Competencies

Trained User Competencies

Setup
- Set fence angle
- Set fence position
- Set cut depth

Operation
- Material feed
- Depth adjustment

Changes and Adjustments
- None

Maintenance and Care
- Cleanup of jointer and surrounding space

Advanced User Competencies

Setup
- None

Operation
- None

Changes and Adjustments
- None

Maintenance and Care
- Table clean and wax

Lathe and High Speed Grinder Training Guide

(updated 12/15/22)

Table of Contents:

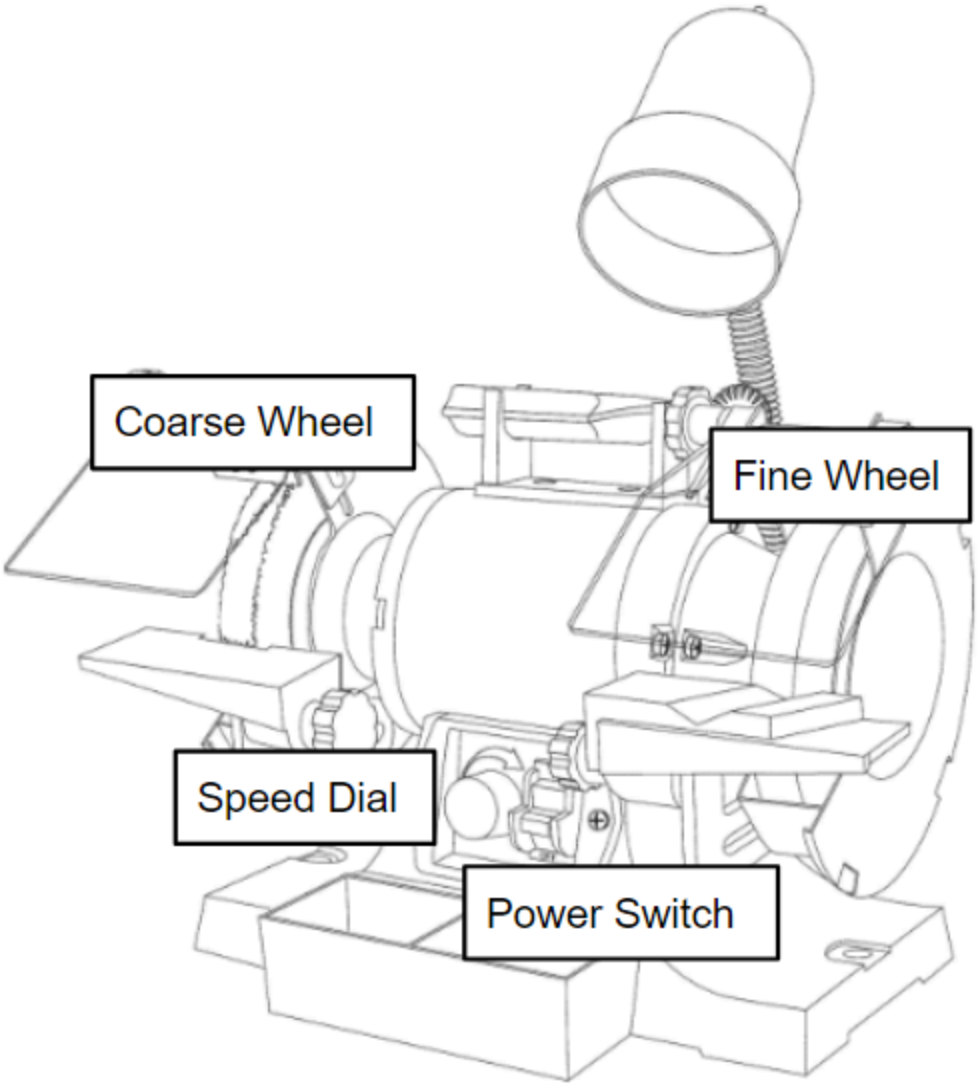
Bench Grinder Safety Rules

1. Wear proper personal protection equipment:
    a. Safety glasses are required.
    b. Face shield is required.
    c. Ear protection is encouraged.
    d. Dust protection (mask or respirator) is recommended
2. Do not bypass any safety devices.
3. Keep hands, clothing, and hair, and jewelry clear of the spinning wheels.
4. **Never use non-ferrous (brass, copper, aluminum, wood, etc) materials on any of the sharpening devices.**
5. Inspect the wheels for clogged grit, coves, or beads in the surface prior to use. If defects are found, do not use the grinder, and notify one of the shop leads.
6. Always use the lowest speed setting
7. NEVER use the sides of the wheels to grind or sharpen tools
8. Do not use if excessive vibration occurs when the high speed grinder is running.
9. Do not leave the grinder until it comes to a complete stop.
10. If something is broken or breaks, notify one of the wood shop leads at (woodshop@sparkmakerspace.org).

Lathe Safety Rules

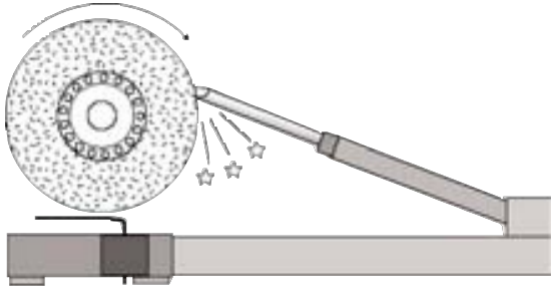
1. Wear proper personal protection equipment:
    a. Safety glasses are required.
    b. Face shield is required.
    c. Dust protection (mask or respirator) is recommended especially during sanding
2. Do not bypass any safety devices.
3. Keep hands, clothing, and hair, and jewelry clear of the spinning material.
4. Always use sharp tools. Dull tools are prone to catch the material and could injure the user.
5. **NEVER USE A SPINDLE ROUGHING GOUGE FOR FACEPLATE TURNING.**
6. Provide as much support to the workpiece as possible (tailstock, spindle steady, etc.).
7. Let the lathe come up to full speed prior to engaging a tool with the piece.
8. Do not use your hands to slow down the lathe.
9. Let the lathe come to a stop prior to leaving the tool.
10. If something is broken or breaks, notify one of the wood shop leads at (woodshop@sparkmakerspace.org).

Grinder Diagram



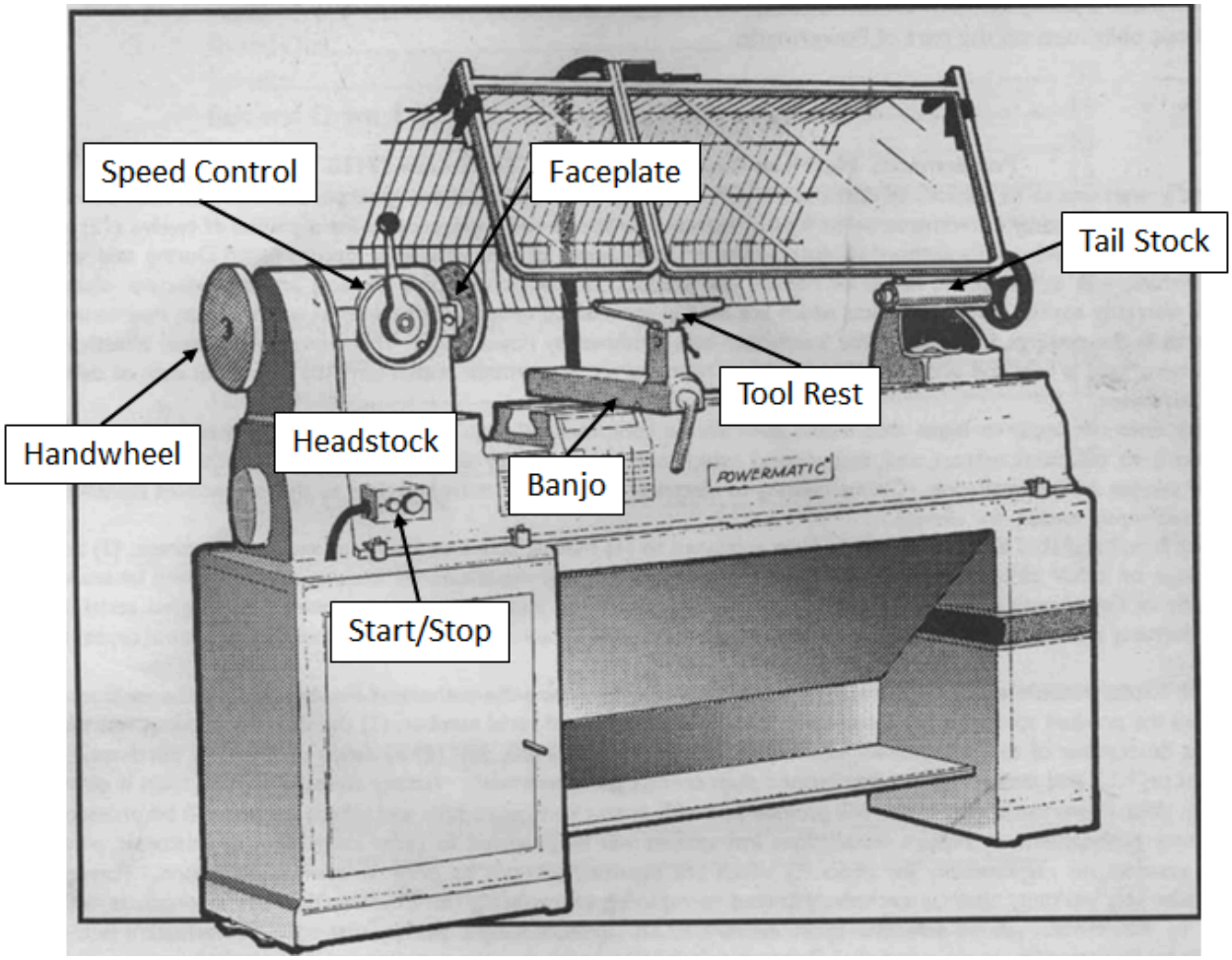
Grinder Instructions for Use

1. The bench grinder is reserved for lathe tools only
    a. Sharpening tool steel on a power grinder can cause burning of the metal which causes the tool to lose its temper and its edge retention ability
        i. Quenching is always required for non-alloyed carbon steel
        ii. High speed tool steels such as M2 and M4 are more resistant to high temperatures but can still be burned. Quenching is recommended.
        iii. Primary lathe tools available at Spark Makerspace are high speed steel (M2)
        iv. If in doubt about tool steel alloy, use water to quench the tool
        v. When quenching, keep a cup of water nearby while sharpening. Periodically (every few seconds of sharpening), dip the tool in the cup of water to cool the metal to prevent damaging the temper.
    b. Carbide cutters shall NOT be sharpened on the bench grinder.
    c. Other hand tools (chisels, plane irons) shall NOT be sharpened on the bench grinder and only sharpened by hand (Note 9/8/2022: Hand sharpening system still in work).
    d. Only the leads are to use the grinder in the corner by the chop saw
2. **NEVER USE NON-FERROUS MATERIALS ON THE BENCH GRINDER**
    a. Non-ferrous materials can clog the wheels and can lead to explosive results
3. Inspect the wheel before use
    a. Surface should not have any hills or valleys in the surface
    b. Surface should be clear of any clogged grit
    c. Wheels should spin true
    d. Notify the shop leads if the wheels exhibit any issues
4. Aluminum oxide wheels may have to be dressed periodically
    a. Dressing is required when the surface of the wheels has bumps or undulations
    b. Diamond dresser may be used to surface the wheels
    c. Always wear dust protection when dressing aluminum oxide wheels
5. Always use the lowest speed setting on the bench grinder
    a. Lower speeds cut slower and prevent the buildup of heat
    b. Turn the speed dial all the way to the left prior to starting the bench grinder
6. Only apply light pressure on the tool when sharpening
    a. Weight of the tool is enough pressure to sharpen the tool
    b. Heavy pressure can cause the tool to dig into the wheels and damage them as well as causing burning of the steel
7. Only sharpen tools on the face of the wheels
    a. Sides of the wheels **shall never** be used for sharpening
8. Variety of jigs are available for use to sharpen lathe tools
    a. Spark woodshop has the Oneway Wolverine Grinding System which include: vee-arm base, the vari-grind attachment, and platform base

Sharpening Jig	Using the Jig
<u>Vee-Arm Base</u> 	Sharpens constant bevel gouges: spindle roughing gouge, some bowl gouges 1. Mark the bevel of the tool to be sharpened with a sharpie 2. Loosen handle in base to shift vee-arm out away from bench grinder 3. With the bench grinder off, plant the end of the handle in the vee-arm 4. Spin the wheel by hand to verify that the distance set by the vee-arm is correct ○ Correctly adjusted vee-arm should remove a constant width band of sharpie from the heel to the toe of the bevel 5. Remove tool from vee-arm and start up bench grinder at the slowest setting 6. Drop handle in the vee-arm and slowly lower bevel onto the grinding wheel 7. Only use the weight of the tool to perform sharpening 8. Once the bevel makes contact with the wheel, rotate the tool back and forth while moving the bevel side-to-side across the face of the wheel to sharpen a consistent bevel along the edge of the gouge
<u>Platform Base</u> 	Sharpens chisels: skew chisels 1. Mark the bevel of the tool to be sharpened with a sharpie 2. Loosen the adjustment lever to angle the platform to the desired bevel angle 3. Loosen the base lever to move the platform to be one-quarter to one-eighth of an inch from the wheel 4. Spin the wheel by hand to verify that the angle and distance are correct a. Correctly adjusted platform and base should remove a constant width band of sharpie from the heel to the toe of the bevel 5. Remove tool from platform base and start up bench grinder at the

	slowest setting 6. Firmly rest the tool on the platform without engaging the wheel 7. Slowly move the tool forward until the wheel engages with the bevel 8. Move the tool from side to side on the face of the wheel to sharpen a consistent bevel along the width of the tool
Vari-Grind Attachment 	Sharpens fingernail grind gouges: bowl gouges and spindle gouges 1. Always used in conjunction with the vee-arm base 2. Mark the bevel of the tool to be sharpened with a sharpie 3. Loosen the thumb screw on the vari-grind attachment and insert gouge into the vari-grind attachment as shown to the left 4. Use the wooden block attached to the grinding bench to adjust the protrusion of the gouge past the end of the jig and tighten the thumb screw 5. Using a combination of the in-out adjustment on the vee arm base and the wing nut adjustment of the angle of the vari-grind attachment, adjust the compound angles such that the bevel at the nose and bevel at the wing both make full contact with the grinding wheel. 6. With the grinder off, verify that both the vee-arm base and vari-grind attachment setting are correct by spinning the wheel by hand a. Correct adjustment should remove a constant width band of sharpie at both the toe of the gouge and on the wings 7. Remove the vari-grind attachment from vee-arm and start up bench grinder at the slowest setting 8. Place the arm of the vari-grind attachment in the vee-arm base and slowly lower either the left or right wing ono the grinding wheel a. Only use the weight of the tool to perform sharpening 9. Start on one wing of the fingernail grind gouge and swing the tool arm while maintaining contact with the grinding wheel to sharpen the nose and other wing in one sweep

Lathe Diagram



Lathe Instructions for Use

Types of Woodturning

1. Faceplate turning
    a. This form of woodturning positions the piece of wood so the wood fibers are perpendicular to the axis of rotation.
    b. This method of woodturning is used to produce bowls, platters, and cross-grain hollow forms.
    c. Common tools include: bowl gouge, parting tool, and scrapers.
    d. **NEVER USE A SPINDLE ROUGHING GOUGE FOR FACEPLATE TURNING.**
2. Spindle turning
    a. This form of woodturning positions the piece of wood so the wood fibers are parallel to the axis of rotation.
    b. Things that are commonly made by this form of woodturning include: goblets, honey dippers, pens, boxes, bats, banister spindles, chair legs, and end grain hollow forms.
    c. Common tools include: spindle roughing gouge, spindle gouge, parting tool, and skew chisel.

Before Use

1. Wear personal protective equipment.
    a. Safety glasses are required.
    b. A face shield is required while operating the lathe.
    c. Gloves may not be worn while operating the lathe.
2. No items may be worn that extend below the elbow.
3. Tie up loose hair.
4. Inspect the material for checking and cracks.
    a. Checking and cracking can lead to wood flying from the lathe.
    b. Severely cracked pieces should non be turned on the lathe.
    c. Slight checking should be secured with CA glue prior to woodturning.
5. Balance the wood prior to mounting it in the lathe.
    a. Out of balance wood induces machinery vibration.
    b. Use the bandsaw to trim off corners and other protrusions to balance the piece.
    c. Slightly unbalanced wood can be turned on the lathe, but speeds should be minimized to prevent vibration.
    d. If the lathe vibrates at the lowest speed setting, the piece shall be rebalanced before proceeding.
6. Verify that the tools being used are razor sharp.
7. Ensure that the lathe speed control dial is at the stop setting.
    a. Do not attempt to adjust the speed setting while the lathe is not spinning.
    b. If the lathe speed control dial is not at the stop setting, turn the lathe on, and turn the handle to the stop setting prior to mounting any piece of material on the lathe.

8. Oil the lathe with a few drops of oil in the oil port prior to running the lathe or changing the speed setting
    a. Oil can will be located on the shelf below one of the lathes

Mounting the Workpiece

1. Always use as much support for the workpiece as practically possible
    a. Workpieces mounted on a faceplate or in a chuck should use the tailstock to support the workpiece as long as possible
    b. Long spindles turned between centers should use the spindle steady rest
2. All-thread rod can be used for knocking morse taper centers out of the headstock
3. Faceplate mounting
    a. Use the center finder to determine the center of the workpiece on the side to be mounted on the faceplate
    b. Mark the locations for the screws and drill pilot holes to the desired depth
    c. Secure the workpiece to the faceplate with screws
    d. Remove the spur drive from the headstock prior to mounting the face plate with knocker rod through headstock
    e. Screw the faceplate on the headstock spindle
    f. Faceplate can be tightened down by depressing the spindle lock and tightening the faceplate with a wrench
    g. Bring the tailstock forward to support the piece with the live center. The tailstock should be used until the piece is brought to round.
4. Between center mounting
    a. Use the center finder to determine the center on both sides of the workpiece
    b. Use a center punch to mark the center on each end of the piece.
    c. Mount the drive center in the headstock. This equipment is identified by its multiple prongs to grip and spin the wood.
    d. A cup or cone style live center should be used in the tailstock. A live center has bearings which allows the support to spin freely.
    e. Loosen the tailstock and move to a position where the tailstock quill can be brought forward to support the piece. Extension of the tailstock quill should be minimized to provide maximum support of the workpiece.
    f. Tighten the nut to secure the tailstock.
    g. Turn the handwheel on the tailstock to advance the live center into the piece.
5. Worm screw and chuck
    a. Use the center finder to determine the center of the workpiece on the side to be mounted in the chuck
    b. Drill a hole corresponding to the worm screw diameter into the piece.
    c. **Remove the spur drive from the headstock prior to mounting the face plate with knocker rod through headstock**
    d. Screw the chuck onto the headstock spindle.
    e. Secure the worm screw in the chuck jaws.
    f. While restraining the headstock spindle with either the handwheel or the spindle lock, screw the piece onto the worm screw.

6. Using the mortise or tenon with the chuck
    a. Mortise and tenons are cut on the lathe and uses after the piece has been brought into round
    b. When faceplate turning, a mortise or tenon is used to reverse the piece of wood.
    c. The chuck jaws shall not be extended past the maximum reach as specified by the manufacturer. If unsure about the maximum reach, please consult the manufacturer's guide.

Turning at the Lathe

1. Once the piece is mounted in the lathe, position the banjo close to the workpiece where the tool outreach will be minimized. Also verify that the piece can spin an entire 360 degrees without banging into the banjo or tool rest.
2. The tool rest height should be positioned to minimize the outreach of the tool and to keep the cutting edge at the axis of rotation.
    a. Gouges and chisels performing shear cuts or planning cuts can be positioned above the axis of rotation.
    b. Scrapers being used on the outside of a piece should be placed a hair below the axis of rotation while scrapers being used on the inside of a piece should be placed a hair above the axis of rotation
3. To start up the lathe, turn the speed dial from the stop position to the start position.
4. Adjust the speed of the lathe using the speed dial. If the lathe starts to vibrate, reduce the lathe speed. Do not exceed the speed at which the lathe vibrates.
5. Roughing the piece should be done at the lowest possible setting. Once the piece is brought to round, the speed may be gradually increased as long as vibration does not occur.
6. Larger diameter pieces should be turned at lower speeds than small diameter pieces.

Bowl Gouge

Primarily used for bowl turning to form the outside and inside of the bowl

1. Tool is placed on the tool rest with the handle low and the work is rubbing the back side of the tool
2. Handle is raised until the edge of the tool begins cutting
3. Cut is performed by “riding the bevel” such that both the toe and heel of the bevel is in constant contact with the piece being cut
4. Handle is rotated such that the flute is pointed in the direction of the cut
5. Slide the tool along the tool rest to continue the cut
6. As the cut progresses along the workpiece, handle is swung as continue riding the bevel

Parting Tool

Used to “part” wood into separate pieces or cut a step in the wood

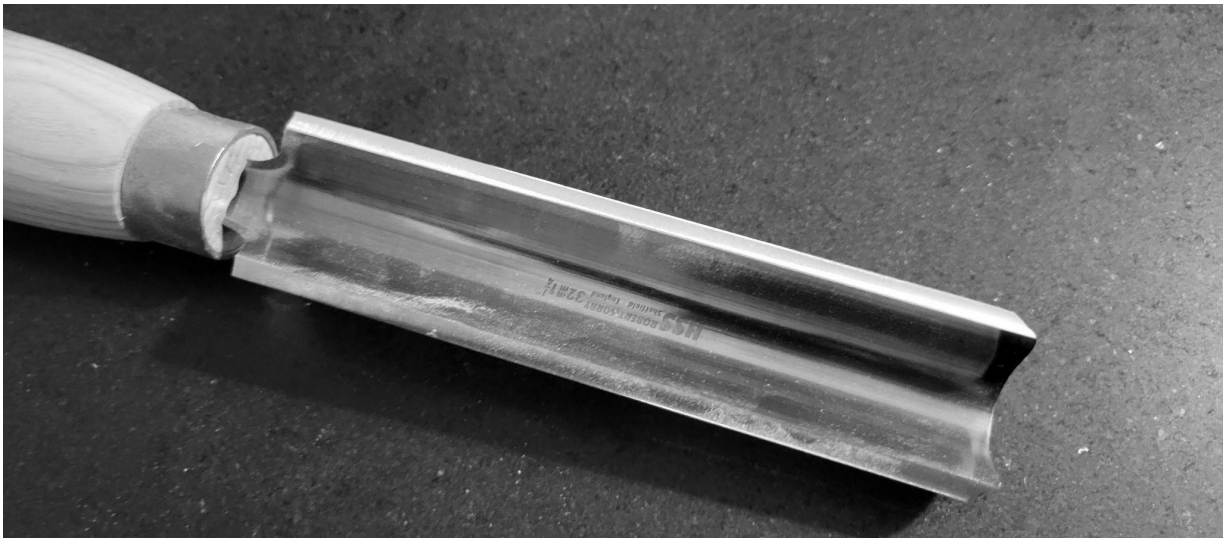
1. Tool is used differently whether faceplate turning or spindle turning
2. Faceplate turning
    a. The parting tool is oriented horizontal to the floor with the thin face of the tool supported on the tool rest
    b. Tool rest is positioned such that the point of the tool is aligned with the center of rotation
    c. Parting tool is plunged into the workpiece
3. Spindle turning
    a. Handle of the parting tool is dropped such that the parting tool is pointed to the sky
    b. Bevel of the parting tool is rubbed against the workpiece
    c. Handle is raised until the tool begins making a peeling cut
    d. As the tool makes the cut, the handle is raised and plunged into the work to continue riding the bevel

Scraper

Burr is raised on the edge of the tool to perform a shearing cut on the inside of forms (bowls, goblets, boxes, etc.) and can also be used for outside turning as well (though other cutting tools will make a cleaner cut)

1. Inside turning
    a. Tool rest is positioned such that the edge of the tool is just a hair above the axis of rotation
        i. Minimizes the severity of catches
    b. Tool is oriented horizontally with the bevel relief on the underside of the tool
    c. Tool is lightly pressed into the wood to start the cut
    d. Handle is swung to progress the cut
2. Outside turning
    a. Tool rest is positioned such that the edge of the tool is just a hair below the axis of rotation
        i. Minimizes the severity of catches
    b. Performing a cut progresses identical to inside turning (see above)

Spindle Roughing Gouge



Tool is used when spindle turning to bring a square blank into round
NEVER USE A SPINDLE ROUGHING GOUGE FOR FACEPLATE TURNING

1. Tool rest is oriented close to the workpiece while still allowing the workpiece to swing past the tool rest
2. Back of the spindle roughing gouge is placed on the tool rest with the handle low and the cutting edge pointed toward the sky
3. Handle is raised as the back of the tool rubs against the spinning workpiece
4. Continue raising the handle until the cutting edge begins making a cut - do not raise the handle any further
5. Rotate the handle to turn the flute in the direction of the cut
6. Slide the tool along the tool rest to make the cut
7. Once the end of the workpiece is reached, rotate the flute to point in the opposite direction and make a pass in the opposite direction
8. Continue making passes back and forth along the workpiece until the work is brought into round
9. Tool rest will have to be periodically adjusted to minimize the overhand distance of the tool
    a. **Always keep the tool rest near the work to minimize the stress on the tang of the tool**

Spindle Gouge

Spindle gouge is used to cut beads, and coves on the outside of spindles. This tool is also used to hollow end grain when spindle turning for cutting the cups of goblets and boxes

1. Spindle gouges require three simultaneous motions to cut beads and coves: lifting the handle, rotating the handle, and traversing the tool rest
2. Cutting beads
    a. Begin with the tool riding the bevel with the flute pointed upwards
    b. As the cut begins, move the tool along the tool rest, close the flute in the direction being cut and lift the handle to cut one side of the bead
    c. Cut the second side of the bead using the same technique but moving the opposite direction along the tool rest
    d. Always cut beads downhill
3. Cutting coves
    a. Begin with the tool riding the bevel with the flute closed pointed towards the the center of the cove
    b. As the cut begins, move the tool along the tool rest, open the flute and raise the tool handle
    c. Stop once the bottom of the cove has been reached
    d. Cut the second side of the cove using the same technique but moving the other direction
    e. Always cut coves downhill
4. End grain hollowing
    a. Advanced technique with the spindle gouge - will not be discussed here

Skew Chisel

Note: Various forms of the skew exist - oval skew is shown above
Used for shear cutting spindles, peel cutting spindle, creating vee cuts, cutting beads

1. **<<Add discussion of making vee-cuts here>>**
2. Skew chisel is an advanced user tool and will not be discussed here - if interested in using the skew chisel, talk with the woodshop leads

Powermatic Lathe Baseline Configuration

1. Headstock drive center mounted
2. Tailstock secured to ways
3. Banjo secured to ways

Lathe Competencies

Basic User Competencies

Knowledge
- Identification of various turning tools and their general uses
- Understanding of temper and not burning carbon steel tools
- Materials to use and not use on the bench grinder
- What tool to never use on faceplate turning

Sharpening
- Sharpening the various tools for spindle and faceplate turning
- Using the various jigs for sharpening including: vee-arm, platform base, and vari-grind jig

Turning
- Proper methods for mounting a workpiece
- Maintaining good speeds for woodturning
- Positioning the banjo and tool rest
- Riding the bevel
- Understanding of general motions, “the dance”, needed to maintain bevel support

Advanced User Competencies

Additional tools that require advanced user sign-off
- Skew chisel (other than vee-cut)
- Hollowing tools, coring tools

Operations that require advanced user sign-off
- End grain hollowing with a spindle gouge
- Segmented turning
- Multi-axis (off-centered) turning
- Inside-out turning
- Hollow forms
- Coring

PLANER GUIDE

(updated 3/29/24)

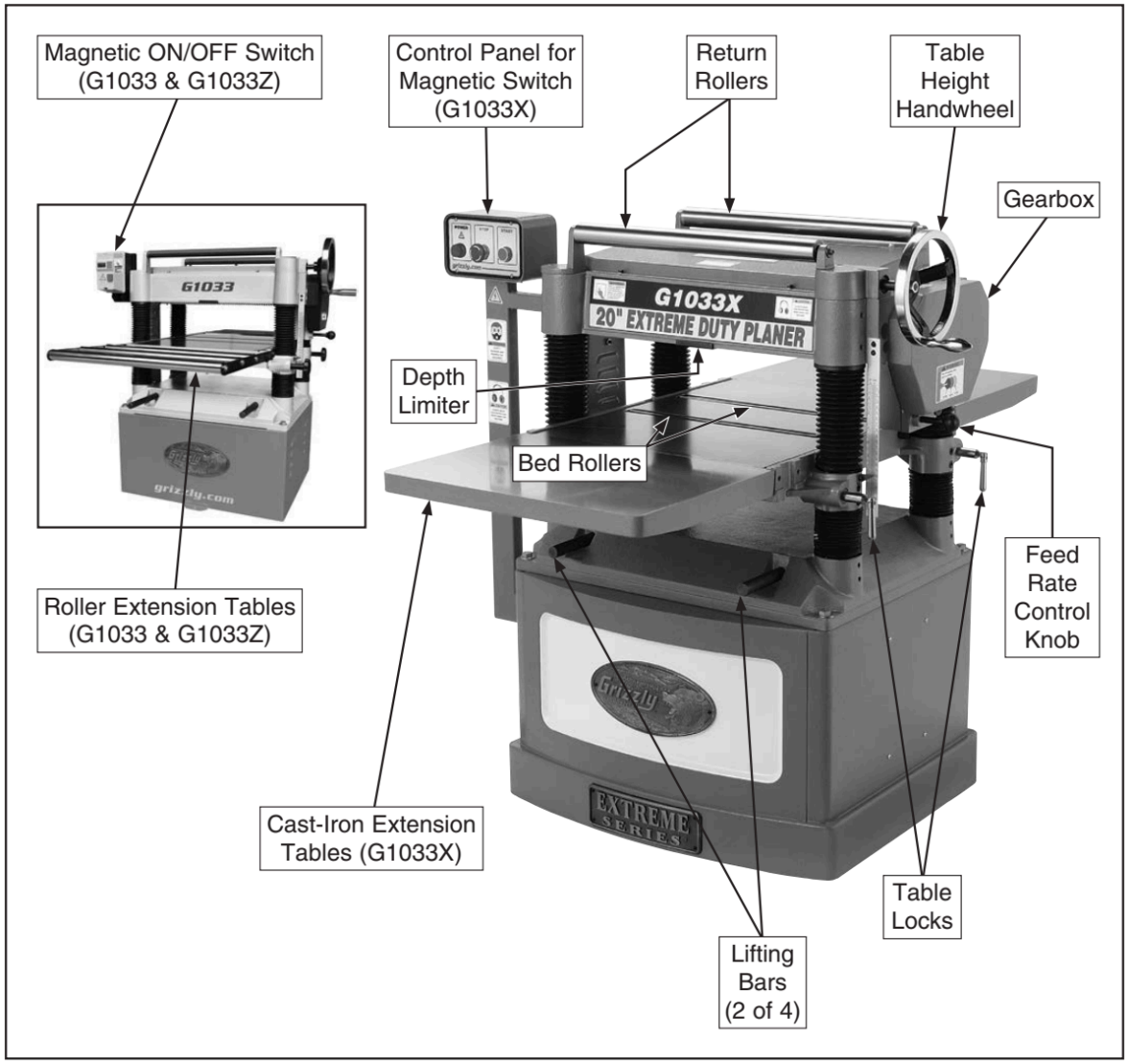
Safety Rules

1. Wear proper personal protection equipment (safety glasses, hearing protection, respiratory protection)
2. Keep loose clothing, hair, and jewelry away from the machine
3. Do not bypass any safety devices
4. Keep hands clear of the feed area
5. Ensure the workpiece is appropriate material and size
6. Inspect workpiece thoroughly before using planer
7. Plane only one piece at a time
8. Let the planer come up to speed before starting the cut
9. Let the planer come to a complete stop before leaving the tool
10. If something is broken or breaks, notify one of the woodshop leads at (woodshop@sparkmakerspace.org).

Planer Summary

1. Tool Location in Shop
2. Parts of the saw (refer to diagram)
3. Uses for Tool
4. Kickback Prevention
5. Before Use
    a. Oil Planer
        i. One drop each, four hex sockets
    b. Check workpiece for planer suitability
        i. NO REUSED, RECLAIMED, OR RECYCLED LUMBER
        ii. Natural wood only
        iii. Min thickness: ¼”
        iv. Min width: ¾”
        v. Min length: 12”
        vi. Maximum width: 20”
    c. Set start depth
6. During Use
    a. Start planer without workpiece
    b. Keep hands clear of machine internals
    c. Let automatic feed controls workpiece motion
    d. Adjust depth as needed (¼ - ½ turn of handle)
    e. Use assistant or outfeed roller for large stock
7. Cleanup
8. Defects & Corrections

Machine Parts



1) Table height handwheel: raises and lowers table to adjust cutting height. One complete handwheel turn is approximately 1/16".
2) Feed rate control knob: adjusts feed rate of planer. The feed rate must only be adjusted when the machine is running, but not during a cutting operation, or the gearbox may be damaged.
    a) Generally, low feed rates are used for material removal passes, while high feed rates are used for finishing passes.

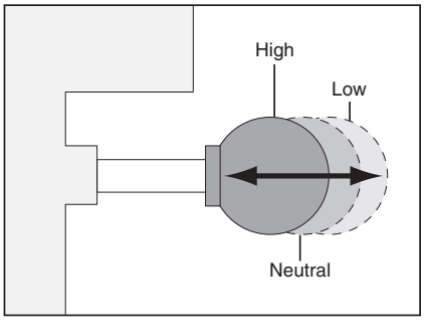


Figure 24. Feed rate control knob positions.

3) Return rollers: used to pass material back over the machine from the outfeed to the infeed side.

Internal Parts

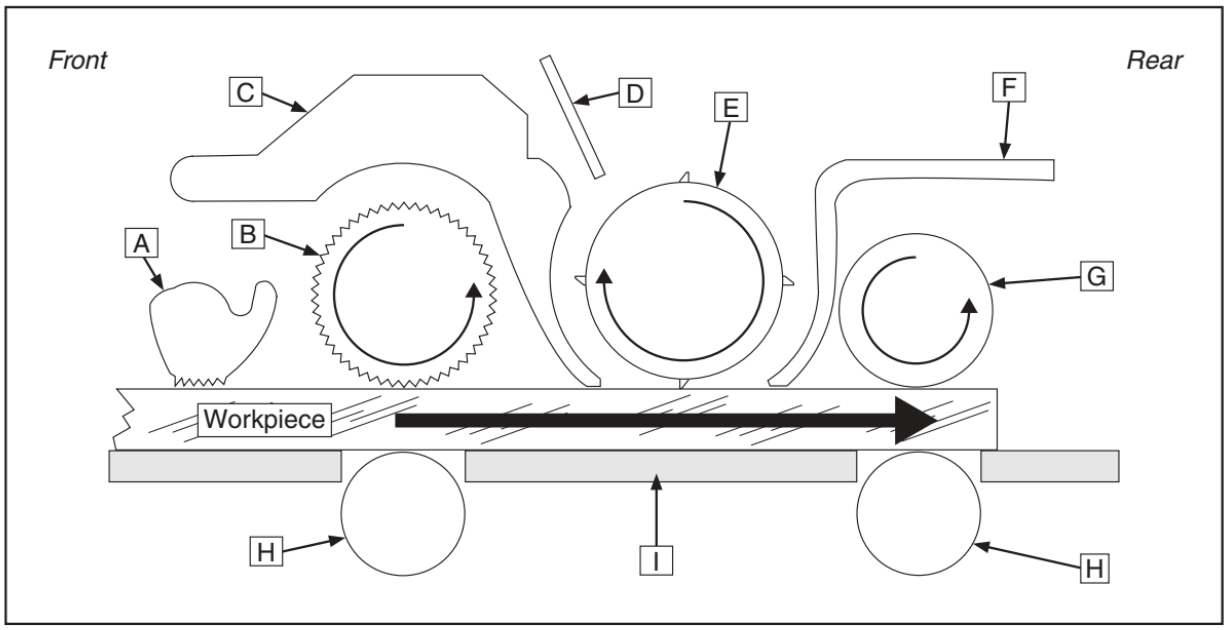


Figure 3. Workpiece path and major planing components (side cutaway view).

A. Anti-Kickback Fingers: Provide additional safety for the operator by minimizing sudden movements of the workpiece.
B. Serrated Infeed Roller: Pulls the workpiece toward the cutterhead.
C. Chip Breaker: Breaks off chips created by the cutterhead to prevent tear-out and diverts the chips to the dust hood.
D. Chip Deflector: Directs chips into the dust hood.
E. Cutterhead: Holds the knives/indexable carbide inserts that remove material from the workpiece.
F. Pressure Bar: Stabilizes the workpiece as it leaves the cutterhead and assists in deflecting wood particles toward the dust hood.
G. Outfeed Roller: Pulls the workpiece through the planer.
H. Bed Rollers: Provide upward pressure on the workpiece, enabling the feed rollers to pull the workpiece along.
I. Planer Table: Provides a smooth and level path for the workpiece as it moves through the planer.

Instructions for Use

Uses for Tool:

1. Good for:
    a. Reducing board thickness
    b. Solid, natural wood
2. Prohibited:
    a. Reused, reclaimed, or recycled lumber
    b. Engineered lumber (Plywood/laminates/particle board/MDF)
    c. Wood with nails, staples, rocks, sand, etc. (NO PALLET LUMBER)
    d. End grain
    e. Significantly warped boards
    f. Green (wet, undried) lumber
    g. Small parts
    h. Metals
    i. Ceramics/Glass/Tiles
    j. Composites (fiberglass or carbon fiber)
    k. Finished or painted material

Kickback Prevention

1. “Kickback” occurs during the operation when the workpiece is ejected from the machine at a high rate of speed. Kickback is commonly caused by poor workpiece selection, unsafe feeding techniques, or improper machine setup/maintenance. Kickback injuries typically occur as follows:
    a. Operator/bystanders are struck by the workpiece, resulting in impact injuries (i.e., blindness, broken bones, bruises, death)
    b. Operator’s hands are pulled into the blade, resulting in amputation or severe lacerations.
2. To prevent kickback:
    a. Ensure the workpiece is appropriate before using in planer
    b. Feed gently but firmly; do not force the tool
    c. Choose correct feed rate for the workpiece
    d. Do not attempt to take a deep cut; several shallower passes are preferred
    e. Plane parallel to the grain (or slightly offset) only
    f. Support long workpieces into and out of the planer
3. Standing offset to the machine will reduce the chances of injury should kickback occur

Before Use

1. Wear personal protective equipment.
    a. Safety glasses
        i. Face shields may be worn for greater comfort, but safety glasses must be worn underneath.
        ii. Do not attempt to view inside the planer during operation, even with safety glasses
    b. Dust masks or respirators are strongly encouraged.
    c. Gloves shall not be worn while operating the planer.
    d. Hearing protection is recommended.
    e. Tie long hair back.
    f. Roll loose sleeves above elbow.
    g. Remove all jewelry.
2. Inspect the workpiece for suitability
    a. Workpiece must be greater than ¼” thick, wider than ¾”, and at least 12” long
        i. If uniform thickness is critical, the workpiece should be longer than required to compensate for snipe (see section on Defects & Corrections)
        ii. Planer has a maximum width capacity of 20”
    b. Materials must be limited to natural wood
        i. No laminates, plywood, MDF, particle board, OSB, etc.
    c. Workpiece must be clear of foreign objects such as nails, screws, fasteners, dirt, rocks, sand, debris, or any other non-wood material.
        i. If planing a glued assembly, scrape all surface glue off the workpiece before feeding to reduce wear on planer knives/cutters
        ii. Do not use the planer on painted or finished surfaces. If further information is needed, contact a Woodshop Lead.
    d. Loose knots should be removed before being fed through the planer. If loose knots can not be removed, an alternate cut method should be found.
    e. Green, pressure treated, or any other “wet” workpiece should be avoided.
    f. Minor warping is acceptable, but care should be taken with cut orientation and feeding. Cut must be made in the most stable orientation (concave side down).
    g. Significantly warped lumber (cupped, bowed, or twisted) should not be planed.
    h. The Grizzly planer is on loan to SPARK, and should be treated with utmost respect.

At The Planer

1. Material Handling
    a. Plane only one piece at a time. Do not attempt to run multiple workpieces through the planer simultaneously.
    b. Varying the location of the workpiece left and right on the infeed table will increase the life of the cutting edges.
    c. Support the workpiece on both infeed and outfeed sides, either by hand or with roller stands.
        i. Uneven loading will result in uneven cutting and increased wear on the machine
    d. Where possible, plane equally on both sides of the board to reduce the chances of twisting, cupping, or warping.
2. The maximum material removal on a single pass is approximately 1/32” (or about half a turn of the table height handwheel). A number of passes will be required to significantly reduce the thickness of a workpiece.
    a. Wide materials will require a reduced cutting depth
    b. Hard woods will require a reduced cutting depth
3. For best surface finish, plane with the grain direction of the wood.
    a. Do not plane cross- or end-grain; the workpiece can be destroyed and cause injury to the user.
4. Machine lubrication
    a. There are four hexagon sockets in bolts on top of the planer. A drop of oil should be placed in each socket before starting the planer.
    b. Oiling is only required the first time the planer is started each day.
    c. The oiler requires very little pressure to dispense one oil drop; beware of over-dispensing.

Operation

1. Ensure workpiece is acceptable for planing
2. Place a drop of oil in each of the four hex sockets on the top of the machine
3. Check that both infeed and outfeed space is sufficient for the length of the workpiece
    a. Set up feed rollers or assistants as needed
4. Set table height to be slightly greater than the thickness of the workpiece
    a. Loosen table locks before adjusting table height
    b. The table height handwheel should be turned clockwise to raise the table, and decrease the material thickness. Turning counterclockwise will lower table.
    c. Gap between table and cutter should be larger than workpiece
    d. Table locks should be snugged after each adjustment
5. Connect dust collection system to the planer
6. Turn on dust collection system
7. Turn on planer
8. Allow planer to reach operating speeds
    a. Set speed, if required, by pulling or pushing speed selection knob

    b. Speed should only be set while planer is running
9. Stand to one side of planer path, and feed workpiece into planer
    a. Ensure the piece is fed squarely into planer, particularly on long pieces
    b. The infeed and outfeed rollers will grab and feed the workpiece. Users should not push or pull on the workpiece once the workpiece is engaged with the automatic feed system.
10. If the pitch of the planer motor decreases significantly, or the planer “bogs,” immediately shut off the plane. The planer table should be lowered, the workpiece removed, and the table reset for a lighter cut before continuing.
    a. If the planer does not automatically feed the workpiece, turn the table height handwheel clockwise by ½ turn and try again. Several iterations may be required.
11. As the workpiece leaves the outfeed side of the machine, it should be supported. Once clear of the machine, it can be laid on the return rollers on top of the machine to return it to the infeed side.
12. If further thickness reduction is required, the table should be raised by turning the table height handwheel clockwise by ¼ - ½ turn.
    a. Loosen table locks before adjusting; retighten after adjusting.
    b. A larger number of light passes will achieve better results than heavy cuts
    c. If possible, passes should be made on alternating sides of the workpiece to reduce cutting or twisting of the wood.
13. Once the desired thickness of workpiece has been achieved, turn off the planer and the dust collection system.

After Use

1. Shut down the dust collection system.
2. Return the planer to baseline configuration.
3. Clean up shavings and sawdust from around the tool.

Defects & Corrections

1. Chipped Grain
    a. Problem:
        i. Small chips or lifted portions of the workpiece. Usually a result of cutting against the grain, planing lumber with knots or excessive amount of cross grain, or using dull knives/inserts.
        ii. Some amount of chipping is normal with highly figured wood.
    b. Solution:
        i. Decrease the depth of cut.
        ii. Reduce the feed rate.
        iii. Inspect your lumber and determine if its grain pattern or feed directions is causing the problem.
        iv. If the lumber does not show substantial crossgrain, and reducing feed rate and depth of cut does not resolve the problem, contact a Woodshop Lead for assistance.
2. Fuzzy Grain
    a. Problem:
        i. “Fur” or fuzz on the workpiece after planing
        ii. Usually caused by surfacing lumber with too high of a moisture content.
        iii. Sometimes fuzzy grain is an unavoidable characteristic of some woods, such as basswood.
        iv. Fuzzy grain can also be caused by dull knives/inserts.
    b. Solution:
        i. Check the lumber with a moisture meter. If moisture is greater than 20%, set the lumber aside and allow it to dry.
        ii. Otherwise, contact a Woodshop Lead to check the condition of the cutting blades.
3. Snipe
    a. Problem:
        i. A thinned or tapered end to the lumber after planing. Occurs when board ends have more material removed than the rest of the board.
        ii. Usually caused when the workpiece is not properly supported as it goes through the machine.
        iii. In many cases, a small amount of snipe is inevitable.
    b. Solution:
        i. Hold workpiece up slightly as it leaves the outfeed end of the planer.
        ii. The best way to deal with snipe is by planing lumber longer than your intended work length and then cutting off the excess after planing is completed.
4. Pitch and Glue Build-up
    a. Problem:

i. Glue and resin buildup on the rollers and cutterhead will cause overheating by decreasing cutting sharpness while increasing drag in the feed mechanism.
ii. The result can include scorched lumber, uneven knife/insert marks, and chatter.

b. Solution:
i. Ensure all glue-ups are thoroughly dry before being planed
1. Ensure as much dry glue as possible is removed before planing to reduce wear on the cutters
ii. Contact a Woodshop Lead to determine if the rollers and cutterhead require cleaning.

5. Chip Marks or Indentations
a. Problem:
i. Woodchip patterns embedded or embossed on the surface of the workpiece after planing.
ii. Chip indentation or chip bruising is the result of wood chips not being thrown away from the cutterhead and out of the machine. Instead they are carried around the cutterhead, deposited on the planed surface and crushed by the outfeed roller. Some of the causes of chip indentation are:
1. Wood chips/sawdust not being properly expelled from the cutterhead.
2. The type of lumber being planed. Certain species have a tendency to chip bruise.
3. A high moisture content (over 20%) or surface moisture
4. Excessive depth of cut.

b. Solution:
i. Use a proper dust-collection system
ii. Lumber must be completely dry, preferably kiln-dried (KD). Air-dried (AD) lumber must be seasoned properly and have no surface moisture.
iii. Reduce depth of cut.
iv. Contact a Woodshop Lead to make sure planer knives/inserts are sharp.

6. Rippled Cut
a. Problem:
i. Regularly spaced indentations across face of workpiece are caused by excessive outfeed roller pressure or excessive feed rate.

b. Solution:
i. Reduce feed rate.
ii. Contact a Woodshop Lead to check outfeed roller pressure

Baseline Configuration Identification

1. Depth set <2”
2. Feed speed set to low (knob furthest out)
    a. Feed speed adjustment must be made with planer running
3. Dust collection system attached

Planer Competencies

Trained User Competencies

Setup
- Set feed rate
- Set cut offset
- Connect dust collection system

Operation
- Material feed
- Depth adjustment

Changes and Adjustments
- None

Maintenance and Care
- Cleanup of planer and surrounding space

Advanced User Competencies

Setup
- None

Operation
- None

Changes and Adjustments
- None

Maintenance and Care
- Table clean and wax

PORTABLE POWER TOOLS GUIDE

(updated 12/29/20)

Safety Rules

1. Wear proper personal protection equipment (safety glasses, hearing protection, respiratory protection)
2. Remove loose clothing and jewelry before use. Tie long hair back before use.
3. Do not bypass any safety devices
4. Keep fingers clear of switches when moving or changing position with the tool
5. Ensure the tool has stopped moving before putting it down
6. Ensure the tool is off before plugging it in
7. Unplug the tool whenever changes to the tool are required
8. Do not carry the tools by the cord
9. Do not use the cord to unplug the tool
10. Be aware of the cord location while using the tools
11. Clamp workpiece firmly
12. If something is broken or breaks, notify one of the wood shop leads at (woodshop@sparkmakerspace.org).

Portable Power Tool Summary

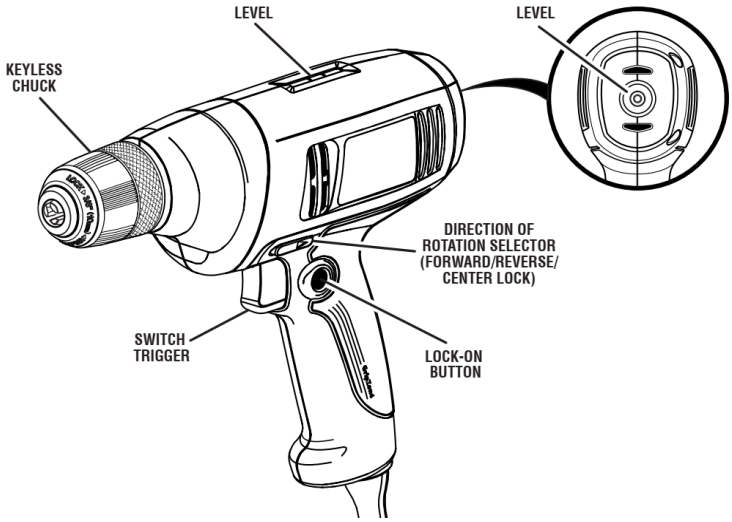
1. Tool Location in Shop
2. Uses for Tools
3. Drills
4. Jigsaw
5. Sanders
    a. Belt
    b. Oscillating
6. Grinder
7. Circular Saw
8. Routers
9. Biscuit Joiner
10. Power Planer
11. Oscillating Tool

Uses For Tools

Tool	Good for:	OK for:	Bad for:
Drills	- Making holes in wood or plastic	- Making holes in metal - Driving screws	
Belt Sander	- Aggressive sanding (wood, metal, plastic) - Large areas	- Removal of old finishes	- Finish sanding - Sanding lead-based paints
Oscillating Sander	- Finish sanding wood or metal	- Removal of old finishes	- Sanding lead-based paints - Aggressive sanding
Grinder	- Aggressive material removal in wood or metal, depending on wheel		- Sanding lead-based paints
Jigsaw	- Curved cuts in wood, metal, or plastic	- Straight cuts in wood, metal, or plastic	
Circular Saw	- Straight cuts in wood or plastics		- Metal, ceramics, composites, etc
Biscuit Joiner	- Joining two wooden parts together		- Anything other than lumber
Compact Router	- Light duty rounding of edges - Small slots - Inletting	- Freehand pockets - Large diameter holes (with appropriate fixture)	- Anything other than lumber
Full Size Router	- Rounding or chamfering of edges - Slotting - Pocketing	- Freehand carving - Large diameter holes (with appropriate fixture)	- Anything other than lumber

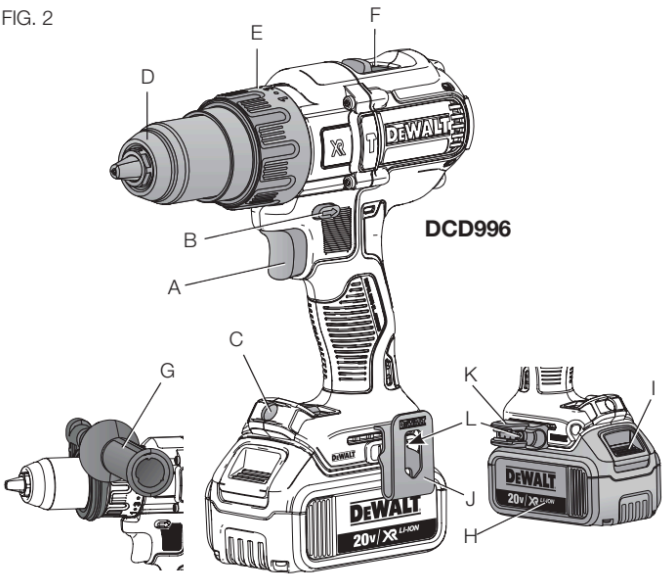
Power Drills

1. Safety:
    a. Wear personal protective equipment.
        i. Safety glasses
        ii. Hearing protection is recommended.
        iii. Tie long hair back.
    b. Keep finger clear of trigger until lined up for drilling
    c. Let the drill come to a complete stop before putting the tool down.
2. Drill Bits
    a. Portable tools have limited capacity. Only smaller bits (½" and below) should be used in portable power drills. Larger holes should be drilled on the drill press. If a hole saw or other large bit must be used with a portable drill, contact a Woodshop Lead for assistance.
3. Drill Parts:
    a. Diagram below shows basic parts of corded and cordless drills. Look and operation of parts may vary between manufacturers and models.



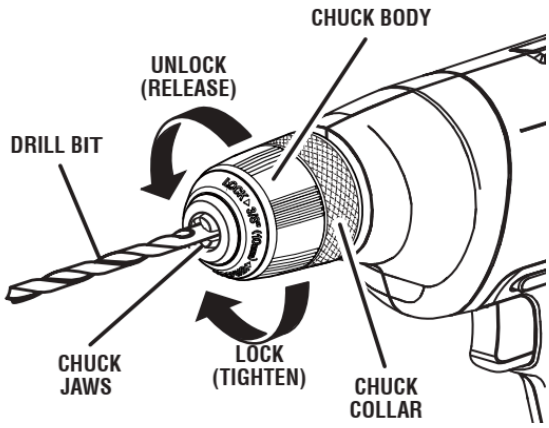
A. Trigger switch
B. Forward/reverse control button
C. Worklight
D. Chuck
E. Torque adjustment collar
F. Gear shifter
G. Side handle
H. Battery pack
I. Battery release button
J. Belt hook
K. Bit clip (Optional accessory)
L. Screw

FIG. 2



4. Operation:
    a. Mounting drill bits:
        i. Loosen chuck until the internal chuck fingers allow insertion of the drill bit.
        ii. Pointing the drill slightly upwards to allow the chuck to be tightened.

iii. Tighten chuck, keeping drill bit straight out of center of chuck.
iv. Removal is the reverse of installation.

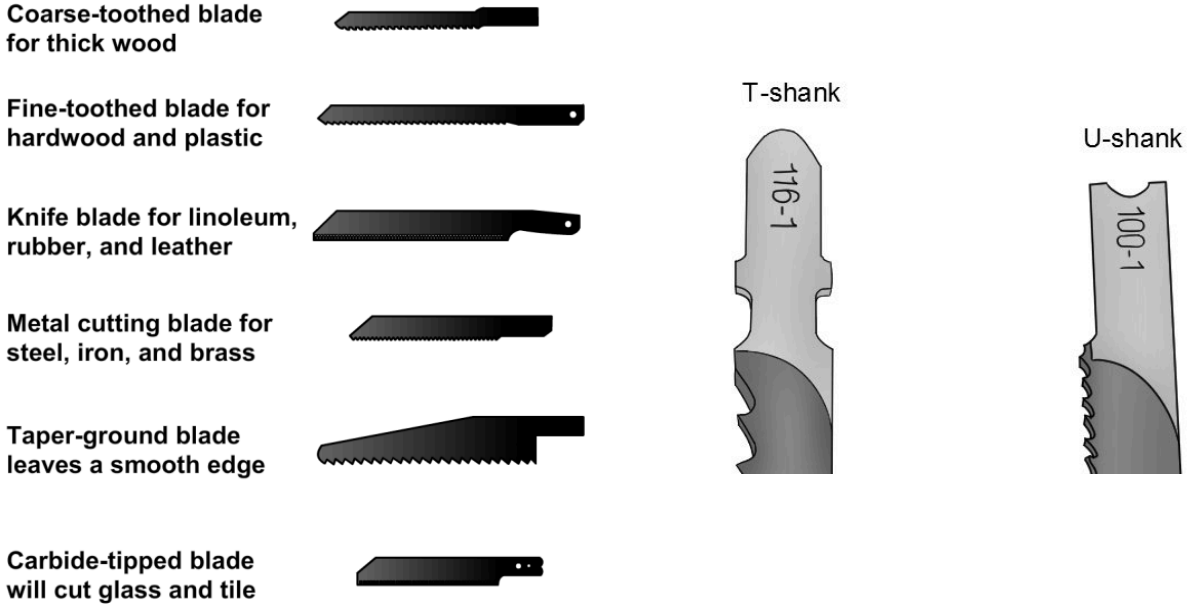


b. Alignment:
   i. Many modern drills have bubble levels built into them. By orienting the drill so that the bubble is centered between the lines of the level, it is possible to ensure the drill is plumb or level, depending on the orientation.
   ii. A center punch may be required to start in order to keep the drill bit from "walking" as the hole is started.
c. Trigger:
   i. Almost all drills will have a switch, toggle, or slide to change the direction of the drilling. This switch should only be moved when the drill is not moving and the trigger is not being pulled.
      1. Many drills will have a "locked" position midway between the forward and reverse position of the directional switch. This position may be used to help prevent accidental activation of the drill.
   ii. Most drills have variable speed trigger switches, which means that the further back the trigger switch is pulled, the faster the drill will go.
      1. Larger bits should be spun slower than larger bits.
      2. Drilling holes in metal should be done much slower than drilling holes in wood.
         a. Oil or other lubrication should be used when drilling metals.
   iii. Many drills have a button or latch to hold the trigger switch in the "on" position. This may be useful for extended drilling. However, care must be taken when using these latches, and the drill bit should be brought to a complete stop between holes.
   iv. When the hole is completed, keep the drill bit spinning as it is removed from the hole. This will reduce the chances of binding or breaking the bit.

5. After Use:
   a. Remove drill bit
      i. Return drill bit to correct storage location
   b. Wrap cord loosely
      i. Do not create tight bends or angles in the cord, to prevent damage to the conductor
   c. Return drill to correct location for next user

Jigsaw (or saber saw):

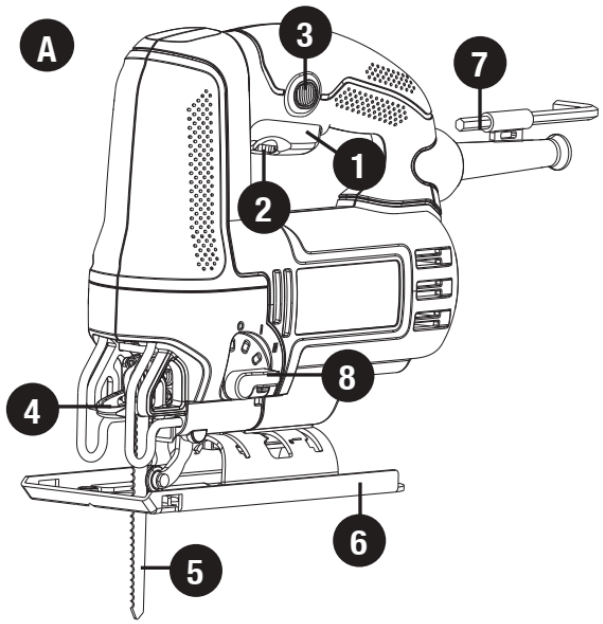
1. Safety:
    a. Wear personal protective equipment.
        i. Safety glasses
        ii. Hearing protection is recommended.
        iii. Tie long hair back.
        iv. Respiratory protection is recommended for extended use
    b. Clamp or anchor workpiece firmly
    c. Let the jigsaw come to a complete stop before putting the jigsaw down.
    d. Keep the electrical cord clear of the cutting area to prevent cord damage
2. Jigsaw Blades
    a. Jigsaw blades come in a variety of styles, depth, and tooth counts.



    b. Shank:
        i. Jigsaw blades may come with either a U or T shank. The current Spark saw uses T shank blades. The image above, from www.wonkeedonkeetools.co.uk, shows the difference.
    c. Teeth Per Inch (TPI):
        i. A large TPI value indicates a larger number of finer teeth. A lower TPI indicates a smaller number of larger teeth.
        ii. Coarser teeth will cut faster, but leave a coarser finish. Cutting wood will usually occur with a tooth count between 6 and 18 TPI.
    d. Blade depth
        i. Blade depth is the distance from the teeth to the spine of the blade. Shallower blades will turn corners more easily.
3. Jigsaw Parts:
    a. The figure below is from the manual for the Spark jigsaw, and contains the following parts.

FUNCTIONAL DESCRIPTION

1. Variable speed switch
2. Speed control dial
3. Lock-on button
4. Saw blade locking lever
5. Saw blade
6. Shoe
7. Wrench
8. Cutting action lever



i. Variable speed trigger switch - controls the speed of the saw. Pulling the trigger switch further results in higher saw speeds.
ii. Speed control dial - sets the maximum speed for the saw
iii. Lock-on button - latches the trigger switch in the “On” position. Potentially very dangerous, as releasing the trigger will not stop the saw.
iv. Saw blade locking lever - holds the saw blade into the saw holder.
v. Saw blade - the working portion of the saw. Do not lick this part, particularly when it is in motion.
vi. Shoe - the baseplate of the saw. The shoe is adjustable to cut beveled parts. The shoe should always be locked in place before using the saw. If bevel cuts are made, the shoe should be returned to the perpendicular at the end of use.
vii. Wrench (5mm) - used to loosen shoe for adjustment
viii. Cutting action lever - used to adjust the action of the saw on a scale from 0 to III. 0 is the smoothest cut, while III us the fastest. This lever should be returned to 0 at the end of use.

4. Jigsaw Shoe Adjustment and Blade Installation
    a. Shoe Adjustment:
        i. Ensure the saw is unplugged
        ii. Turn the saw upside down
        iii. Loosen the bolt holding the shoe in position using the hex wrench in the holder on the power cord
            1. If using the Dewalt jigsaws, no wrench is required - instead, loosen the clamping bar found between the body of the saw and the shoe

iv. Move the shoe towards the front of the saw to clear the angle stop teeth on the shoe
v. Adjust the shoe to the desired angle
vi. Move the shoe toward the back of the saw to lock the angle stop teeth.
vii. Tighten the bold holding the shoe in position
viii. Return the hex wrench to its holder
ix. When the cutting operation is completed, return the shoe to the position perpendicular to the blade

b. Blade Installation:
i. Ensure the saw is unplugged
ii. Push the saw blade locking lever upward.
iii. With teeth facing forward, insert the shank of the saw blade into the blade holder as far as it will go.
iv. Release the lever.
v. Check the blade is secure before cutting

5. Jigsaw Operation:
a. Hold the workpiece firmly with clamps or other retainment methods.
b. Clearly mark the intended cut path
c. Holding the jigsaw blade clear of the workpiece, line up the blade with one end of the cut mark
i. If the cut is entirely contained within the workpiece, a hole may be drilled to allow access for the blade
d. Pull the trigger switch to start the blade. The further the trigger is pulled, the faster the blade will move, up to the limit set by the speed control dial.
e. Once the blade is moving at the desired speed, follow the cut lines to completion.
f. The cutting radius of the saw is dependent on the blade installed. If the saw starts to slow down or bog during a turn, the turn is too tight for the saw. Back up in the cut, and try again using a larger radius.
g. Let the blade come to a complete stop before putting the saw down.
6. After Use:
a. Clean all dust from the jigsaw using brush or vacuum.
b. Remove the blade from the saw, and return the blade to the correct storage location.
c. Set the shoe back to zero degrees
d. Set the cutting action lever back to zero
e. Loosely wrap the cord around the jigsaw
i. Do not create tight bends or angles in the cord, to prevent damage to the internal cable conductors
f. Return the jigsaw to the correct location for the next user

Belt Sander

1. Safety:
    a. Wear personal protective equipment.
        i. Safety glasses
        ii. Hearing protection is recommended.
        iii. Tie long hair back.
        iv. Respiratory protection is recommended for extended use
    b. Moving belts can cause significant lacerations. Care should be taken to avoid contact with the belt while operating the sander.
        i. Tracking should be checked before each use.
    c. Keep a firm grip on the sander during operation
    d. Clamp or anchor workpiece firmly
    e. Let the sander come to a complete stop before putting the sander down.
    f. Keep the electrical cord clear of the area being sanded to prevent accidental contact
2. Abrasive Belts:
    a. The belt sander uses a flexible abrasive belt. The belts are available in a wide range of sanding grits, where a high number indicates a finer (smoother) belt.
    b. The following table may be used for guidance on choosing belt abrasive grits for various applications:

Abrasive (grit)	***Application***
36 to 60	Rough, fast stock removal; removal of old finishes
60 to 100	Stock removal, surface preparation for painting
120 to 180	Wood finishing
200 or greater	Fine finishing, especially on hard woods

3. Belt Sander parts (not all machines will have all parts; locations vary by model)
    a. Belt tension lever - used to release pressure from the abrasive belt to allow replacement of the belt.
    b. Belt alignment (tracking) adjustment - a knob used to adjust the alignment of the belt rollers to ensure the belt remains centered on the rollers during use
    c. Platten - the hard, smooth, flat surface against which the belt runs on the working surface of the machine
    d. Trigger switch - switch use to control power to the sander
    e. Trigger lock button - latch used to lock the sander in the powered position
        i. The trigger lock button should be used with extreme care. The sander will remain running without any further interaction with the user, which can be dangerous without proper attention.

ii. To use: pull the trigger to power on the sander, then press the trigger lock button. The sander will remain running until the trigger is squeezed again and released.

f. Speed selection dial - Used to adjust running speed of the sander. Adjustment should not be made while the sander is running.
g. Forward handle - used to increase user control over the sander
h. Dust extraction outlet - exit for the dust extraction system within the sander. Ideally, this should be connected to a vacuum or dust bag
i. Dust bag - Collection point for sanding dust. Should be emptied after each use of the sander.

4. Belt Replacement and Tracking Adjustment:
    a. Belt Replacement:
        i. Ensure power is disconnected from the sander
        ii. Toggle the belt tension lever to move the idle roller closer to the drive roller
        iii. Remove the old belt (if installed)
        iv. Identify the direction of rotation on the new belt. This is usually indicated by an arrow printed on the interior of the belt. If no arrow is present, the belt is bidirectional and may be installed in either orientation.
            1. When the sander is upright on a flat surface, the bottom working surface of the belt will move towards the user, pulling the sander away from the user. If the belt is directional, it should be installed so the arrow points in the direction of rotation.
        v. Install the belt so that it is centered on both rollers
        vi. Return the belt tension lever to the original closed position.
        vii. Adjust the belt tracking (below).
    b. Belt Tracking Adjustment:
        i. Turn sander upside down and plug it into the power source
        ii. Hold the sander firmly with one hand, engage trigger switch to turn the sander “ON”, and note the tracking of the sanding belt
            1. The ideal belt tracking will keep the belt centered on the both rollers, and the platten.
            2. Do not allow the belt to contact the frame of the sander.
            3. Belts extending off the roller are a laceration hazard; the belt should be tuned to run centered for safety
        iii. Adjust belt tracking by turning the belt adjustment knob until the belt runs smooth in the center of the rollers.
        iv. Belt tracking should be checked after several minutes of operation, and regularly during use.
5. Operation:
    a. Ensure the workpiece is held firmly in place, through clamps or other retention methods.

   b. The sander will be used in a forward and backward motion, usually parallel to the grain of the surface being sanded. The user should be in a position to comfortably work with the sander.
   c. Keep a firm grip on both handles of the sander.
   d. With the sander belt off the work, start the sander by depressing the trigger switch.
   e. Place the “heel” of the sander on the workpiece, and start moving the sander forward while lowering the sander onto the workpiece.
   f. Keep the sander moving in back and forth strokes to keep sanding even, and prevent gouging.
      i. No downward pressure is required. The weight of the sander should be doing the work.
   g. When sanding is complete, lift the sander from the workpiece before releasing the trigger switch to stop the sander.
6. After Use:
   a. Clean all dust from the sander using brush or vacuum.
   b. Empty the dust collection bag, if present.
   c. Loosely wrap the cord around the sander handles
      i. Do not create tight bends or angles in the cord, to prevent damage to the internal cable conductors
   d. Return the sander to the correct location for the next user

Oscillating Sanders

1. Safety:
    a. Wear personal protective equipment.
        i. Safety glasses
        ii. Hearing protection is recommended.
        iii. Tie long hair back.
        iv. Respiratory protection is recommended for extended use
    b. Keep a firm grip on the sander during operation
    c. Clamp or anchor workpiece firmly
    d. Let the sander come to a complete stop before putting the sander down.
    e. Keep the electrical cord clear of the area being sanded to prevent accidental contact
2. Types of Sanders
    a. Several types of oscillation sanders are available, categorized by type of oscillation, pad size, and pad shape.
    b. Oscillation may be linear, orbital, or random-orbital.
        i. Linear sanders move the sanding surface in a back-and-forth linear motion. This is commonly found in older sanders.
            1. Linear sanders should be used parallel to the wood grain direction, to prevent gouging or marking of the work surface
        ii. Orbital sanders move the sanding surface in a series of small circles,
            1. Orbital sanders are less sensitive to grain direction, but may leave small swirls in the work surface
        iii. Random orbital sanders move the sanding surface in an erratic series of ellipses.
            1. Random orbital sanders are least sensitive to grain direction
    c. Pad size and Shape
        i. Square:
            1. Usually referred to as a “quarter sheet sander” because it uses one-quarter of a standard sheet of sandpaper.
            2. Usually orbital
        ii. Rectangular:
            1. Either a half or third sheet sander, as it uses a half or a third of a standard sheet of sandpaper
            2. Usually orbital or linear
        iii. Round:
            1. Often 5-inch, but sizes may vary
            2. Usually random orbital
            3. Require sandpaper specific to the diameter, attachment method, and hold pattern for use
        iv. Others:
            1. Other sizes and shapes are available for specific applications. Triangular pads are common for corner applications.

d. Sanding Grits
    i. The chart below is taken from the manual of a Bosch quarter-sheet sander.

	Applications	Grit
Wood	For preliminary sanding of rough wood, unplaned boards.	Coarse 40, 60
	For mid-stage sanding and smoothing of small irregularities.	Medium 80, 100, 120
	For finish and fine sanding speed and sanding sheet (sandpaper).	Fine 180, 240, 320, 400
Paint/enamels and primers, and fillers	For removing paint.	Coarse 40, 60
	For sanding primer.	Medium 80, 100, 120
	For final sanding of primers between coats.	Fine 180, 240, 320

    ii. If the surface is rough, start sanding with a coarse grit, then medium, and then finish with a fine or extra-fine grit. The required process will vary with different workpieces.
        1. Continue sanding with each grit stage until all scratches from previous grits are no longer visible

3. Sander Parts: (varies by sander age, manufacturer, and model)
    a. Sanding Pad - foam pad mounted on the bottom of the sander
    b. Sandpaper clamps - mounted on each end of partial sheet sanders (¼, ⅓, or ½ sheet) to hold sandpaper; may be of several styles.
    c. Switch - power switch to turn sander on and off.
    d. Oscillation switch - found on older sanders capable of linear or oscillating operation; used to switch between operating modes
    e. Dust extraction port - exit of sander dust collection system. Should be fed into a dust bag or vacuum system. May not be present on all models
    f. Dust collection bag - collector for dust extraction port
4. Sandpaper Installation:
    a. Ensure power to the sander is disconnected
    b. For round sanders:
        i. Attach the sandpaper using either pressure sensitive adhesive (PSA) self-stick sheets, or hook-and-loop sheets, as appropriate.
            1. PSA sanders will have a mostly smooth sanding pad bottom.
                a. PSA sandpaper should be removed immediately after use. The sanding process warms the adhesive, and when it

cools it will solidify and cannot be removed without damage to the sanding pad. If the sander has PSA sanding sheets attached which must be removed, run the sander against a scrap piece of lumber for several minutes to soften the adhesive before removal.

2. Hook and loop sanders will have a fuzzy sanding pad bottom
3. Holes in the sandpaper should be lined up, as much as possible, with the holes in the sander pad. This allows the dust extraction system to function properly.

c. For partial sheet sanders:
   i. Divide a standard sheet of sandpaper into the correct size, using a sharp table or scrap edge as a guide.
      1. Do not use scissors, as the abrasive sheet will damage the cutting edges.
   ii. Remove the old sandpaper by releasing the clamp on each end.
      1. Wire clamps:
         a. The loop of each wire clamp arm should be lifted up past the clamp retaining post, then pulled horizontally out and away from the sander body.
         b. Move the loop down past the sanding pad until all pressure is off the clamp
      2. Spring clamps:
         a. Lift and hold the tab to release the clamp. In some sanders, it may be necessary to first slide the dust evacuation shroud out of the way.
   iii. Clamp the new sandpaper in one end of the sander.
      1. Wire clamps:
         a. Set the end of the sandpaper under the clamp
         b. Holding the sandpaper in place, lift the loop on the arm of the appropriate clamp until it is above the clamp retaining post.
         c. Swivel the clamp arm loop until it is in its original position alongside the sander body.
         d. Gently tug the sandpaper to ensure it is held firmly.
   iv. Pull the paper taut, fold it over the sanding pad with the abrasive out, and clamp the other end.

5. Sander Operation
   a. Secure the workpiece firmly, using clamps or other retainment methods
   b. Before turning the sander on, place the sander on the workpiece
   c. Turn sander on
   d. Allow the weight of the sander to do the work; excessive force on the sander is counterproductive

e. Continually move the sander, sweeping the sander in overlapping strokes along the grain of the workpiece
f. When the work is completed, remove the sander from the workpiece before shutting it off.
g. Ensure the sander has stopped moving before putting it down.

6. After Use:
    a. Clean all dust from the sander using brush or vacuum.
    b. Empty the dust collection bag, if present.
    c. Loosely wrap the cord around the sander handles
        i. Do not create tight bends or angles in the cord, to prevent damage to the internal cable conductors
    d. Return the sander to the correct location for the next user

Grinder/Disc Sander:

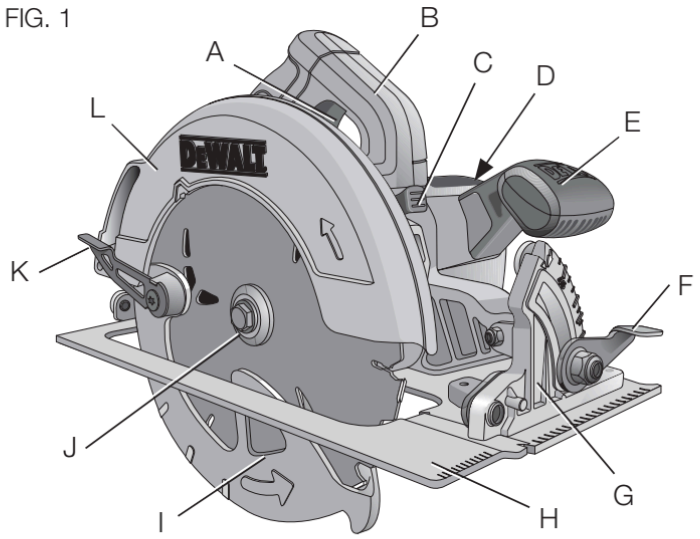
The SPARK grinder is currently missing important parts, including a safety guard. These instructions will be updated when the grinder is back in service.

Portable Circular Saw:

A. Safety
    a. Wear personal protective equipment.
        i. Safety glasses
        ii. Hearing protection is recommended.
        iii. Tie long hair back.
        iv. Respiratory protection is recommended for extended use
    b. Do not bypass safety guards on the circular saw
    c. Clamp or anchor workpiece firmly
    d. Be aware of what is under the workpiece
    e. Let the circular saw come to complete stop before putting the saw down
    f. Only cut wood or engineered lumber (plywood, MDF, particle board, etc) with the circular saw. Do not cut plastics, metals, ceramics, or any other materials.
    g. Keep the electrical cord clear of the cutting area to prevent cord damage
    h. Do not attempt plunge cuts with the portable circular saw. If you must make a plunge cut, contact a Woodshop Lead for permission and assistance before proceeding
B. Kickback Prevention:
    a. Kickback occurs when the saw blade hits a sudden increase in resistance while cutting.
        i. Increased resistance may be due to knots, inclusions, or foreign material in the wood.
        ii. Increased resistance may also be due to a pinched, bound, or misaligned blade.
    b. The sudden increase in resistance results in the blade forcing the saw back towards the user, often in a sudden and startling fashion. This can also throw the workpiece if it is not properly restrained.
    c. Kickback may be prevented by:
        i. Starting the saw with the teeth clear of the workpiece
        ii. Inspecting the workpiece for knots, inclusions, or foreign material before starting the cut
        iii. Ensuring the workpiece is properly restrained before cutting operations start
        iv. Keeping blade depth to the minimum required for the cut
        v. Using a sharp saw blade
    d. Should kickback occur, release the saw trigger switch and let the blade come to a complete halt before correcting the situation which caused the kickback
    e. If the correction is not obvious, or there are any questions regarding safe operation, get help from a Woodshop Lead.
C. Circular Saw blades
    a. Saw blades come in a number of sizes and tooth counts, depending on saw and application

b. Blades should be mounted on the saw so that the bottom of the blades rotates forward (see arrow on diagram below for direction of rotation).
c. Saw blade sizes range from 3-½ inches to 10 inches. The most common size for corded portable saws is 7-½ inch or 8-¼ inch. The lighter Spark saw (size drive) uses 7-½ inch blades; the heavier saw (worm drive) uses 8-¼ inch blades.
d. Blades for coarser cuts have fewer teeth; blades for finer finishing have more teeth.

FIG. 1



COMPONENTS (Fig. 1)

⚠ ***WARNING:*** *Never modify the power tool or any part of it. Damage or personal injury could result.*

A. Trigger switch
B. Main handle
C. Blade lock
D. End cap
E. Auxiliary handle
F. Bevel adjustment lever
G. Bevel angle adjustment mechanism
H. Foot plate
I. Lower blade guard
J. Blade clamping screw
K. Lower guard lever
L. Upper blade guard

D. Circular Saw Parts (figure taken from the Canadian Centre for Occupational Health and Safety; parts will vary in location and style on different makes and models)
   a. Trigger switch - turns saw on. Releasing trigger switch will cut power to the saw motor; however, blade will not stop immediately
   b. Main handle - not to be confused with a Maine handle; this one's in Connecticut.
   c. Blade arbor lock - used to prevent rotation of the blade arbor when changing saw blades
   d. Motor housing end cap - contains the electric motor to drive the saw
   e. Front/Auxiliary handle - used to help guide the saw during cutting

f. Bevel adjustment lock lever - this lever may be loosened to allow the bevel angle to be adjusted, by changing the angle between the shoe and the saw blade. The lever must be tightened completely after adjustment and before cutting
g. Bevel adjustment gauge and assembly - adjusted by loosening the bevel adjustment lever (f).
h. Foot (also base or shoe) plate: flat plate which the saw rides on during operation. It is usually adjustable for depth and angle (bevel). The plate usually has a notch in the front to indicate the path of blade travel; one side is for the for the blade at 0”, and the other one for the blade at 45”
i. Lower blade guard - a retracting guard that covers the lower half of the saw blade. This blade uncovers the lower half of the blade as the cut progresses. This part must return to the starting position before the saw is laid down.
j. Blade clamp screw - holds the blade to the saw spindle. Loosened with blade wrench
k. Lower blade guard lever - used to move lower blade guard, if required.
l. Upper blade guard (not labeled on diagram) - a fixed safety cover for the top half of the saw blade
m. Depth adjustment lock lever (not shown on diagram) - this knob may be loosened to allow the depth of cut to be adjusted, by exposing more or less of the blade. The knob must be tightened completely after adjustment and before cutting
n. Blade wrench (not shown on diagram) - wrench used to change saw blades

E. Operation:
   a. Angle adjustment:
      i. The angle of the blade may be adjusted by loosening the bevel adjustment knob or lever, and moving the shoe until the correct blade angle is reached.
      ii. The angle adjustment knob or lever should then be tightened completely to prevent movement during the cut
   b. Depth Adjustment:
      i. The depth of the blade may be adjusted by loosening the depth adjustment knob or lever, and moving the shoe until the correct blade depth is reached.
      ii. The saw blade should extend approximately one tooth length through the workpiece.
      iii. The depth adjustment knob or lever should then be tightened completely to prevent movement during the cut
   c. Line Guide:
      i. The notch in the front of the shoe is normally labeled; one side for the blade at 0 degrees, and the other side for the blade at 45 degrees.
      ii. The line guide may or may not be accurate, depending on the saw, blade, and shoe combination.
   d. Cuts:
      i. The blade should be started with all blade teeth clear of the workpiece

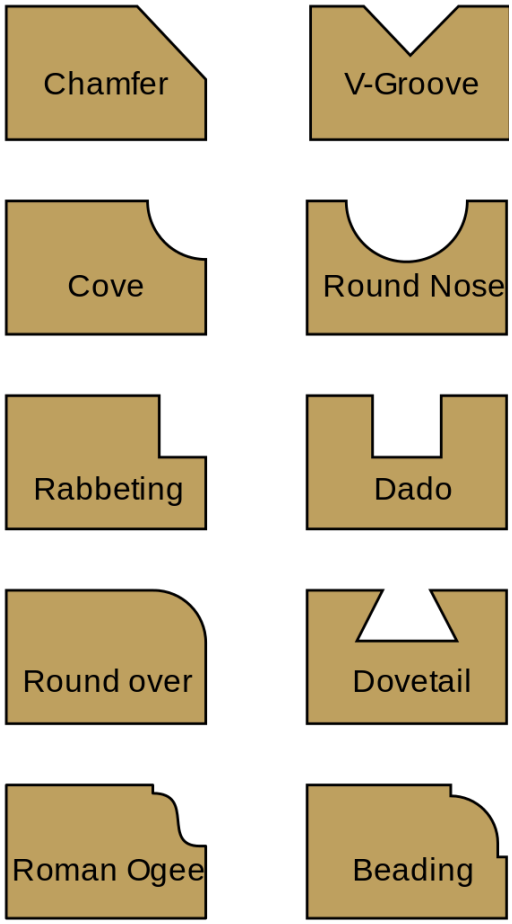
ii. The saw should be firmly grasped on both main and forward handles when the blade is started. The torque of spinning blade up may cause the saw to twist
    1. Ensure the hand position does not restrict the movement of the lower blade guard
iii. Squeeze the trigger switch to start the saw. The trigger switch has only two positions -- on and off. Do not stop and start the blade in the middle of a cut
iv. Make the cut using light and continuous pressure. Do not force the saw.
v. After the cut, release the trigger switch. Be aware that the saw will continue to rotate, and be dangerous, for some time after the trigger switch is released. Maintain control of the saw until the blade comes to a complete stop.
vi. Ensure the lower blade guard returns to the fully-covered position before putting the saw down

F. After use:
    a. Clean all dust from the circular saw using brush or vacuum.
    b. Set the bevel angle back to zero degrees
    c. Set the cutting depth back to zero
    d. Loosely wrap the cord around the saw
        i. Do not create tight bends or angles in the cord, to prevent damage to the internal cable conductors
    e. Return the saw to the correct location for the next user

Routers:

1. Safety:
    a. Wear personal protective equipment.
        i. Safety glasses
        ii. Hearing protection is recommended.
        iii. Tie long hair back.
        iv. Respiratory protection is recommended for extended use
    b. Keep a firm grip on the router during operation
    c. Clamp or anchor workpiece firmly
    d. Let the router come to a complete stop before putting the sander down.
    e. Keep the electrical cord clear of the area being sanded to prevent accidental contact
2. Router Types:
    a. Routers come in four base styles, and two size classes
    b. Bases:
        i. Fixed base - simplest portable type. The base is set at the desired cut depth, and remains fixed in place during cutting operations. The workpiece is fixed, and the router is controlled by the user
        ii. Plunge base - allows vertical movement of a portable router, to allow plunge cuts (in the center of parts). Maximum cut depth is set on the base before use. Similar to the fixed base, the workpiece is fixed, and the router is controlled by the user.
        iii. Table - The router is fixed on the underside of the router table, so the cutting bit protrudes upwards from the table surface. Unlike the fixed or plunge bases, the router is fixed and the workpiece controlled by the user. The router table allows the use of fences and other jigs for consistent work
        iv. CNC - A computer controlled gantry controls the motion of the router over a fixed workpiece. The SPARK CNC router is covered under separate instructions.
    c. Router Sizes
        i. Routers fall into two size categories: full size and compact
        ii. Full size routers are often rated to 1.5 HP or greater. They will accept router bits with a shank size up to 1/2-inch. They are commonly used in fixed or plunge bases, and router tables.
        iii. Compact (trim, palm, etc) routers are generally rated up to 1 hp. They will accept router bits with a shank size up to 1/4-inch. They are commonly used in fixed or plunge bases, and small CNC machines (like the one at SPARK).
3. Router Bits
    a. Router bits are available in a truly mind-boggling number of sizes and profiles. The most commonly used varieties are shown in the diagram below, borrowed from Wikipedia.

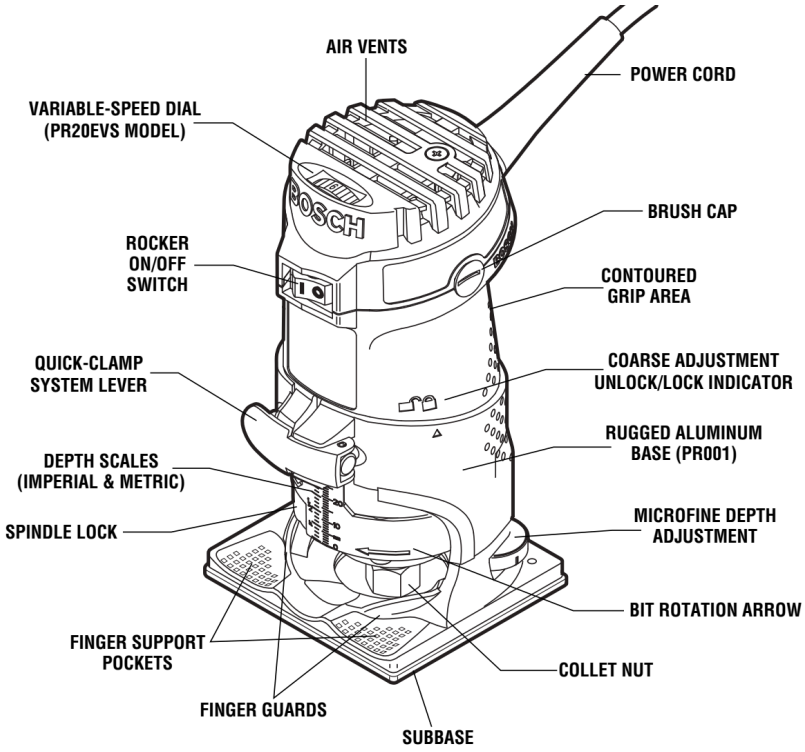
b. Bit shanks in the US will be either 1/4 or 1/2 inch.
c. Some bits will include a guide bearing, either at the top or bottom of the bit. This will allow them to follow an existing contour in the wood. This also allows the use of templates for repeated patterns.
d. Router bits may be either solid high speed steel (HSS), or a steel body with carbide cutting edges. Generally, the carbide bits will remain sharper longer, but will cost more to purchase.
e. Multi-piece bits are used for more complex geometries. These bits have an arbor shaft, which mounts several smaller cutters, spacers, and bearings stacked together to get the required profile.
f. Bits for portable (fixed base and plunge) routers should be at least 1/4-inch smaller than the opening in the router base, to prevent contact between the bit and the base during operation.

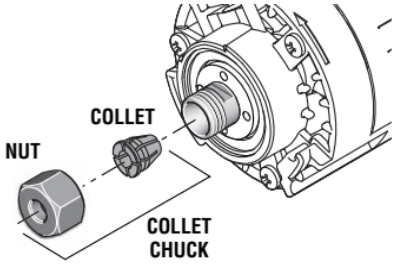


g. Larger bits, generally above 1-inch outside diameter, should only be used on the router table, as they are too large to safely be controlled by hand.
h. The SPARK woodshop has a small selection of commonly used router bits. If a member has a particular project which requires a specific bit, they will likely have to supply it themselves. However, talk to your friendly Woodshop Lead to discuss options.

4. Router Parts: (SPARK palm router shown; parts and locations will vary by make and model)
   a. Power switch - turns router on and off
   b. Variable speed dial (not present on all tools) - allows adjustment of router rotation speed. Larger diameter bits should be spuns at lower speeds than smaller bits
   c. Depth lock (“quick-clamp system lever”) - when released, allows adjustment of the depth of cut for the router. Must be locked before cutting
   d. Fine adjustment wheel (not present on all tools) - allows fine adjustment of the cut depth of the router. Depth lock must be unlocked prior to adjustment, and should be locked before cutting
   e. Base - fixed base, usually metal. Allows depth adjustment of the router

f. Sub-base - plastic cover for base to protect the workpiece. May be removed to mount base to fixtures
g. Spindle lock - locks spindle to prevent rotation. Only used when changing bits
h. Collet chuck - made of two parts, collet and collet nut. The collet is a segmented ring, used to evenly and firmly grip the shaft of a router bit. It should remain mounted in the collet nut at all times. Loosening the collet nut relieves pressure on the collet, allowing installation or removal of the cutting bit.



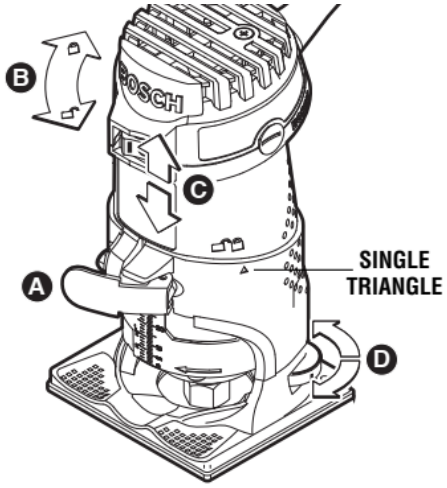


5. Router Bit Installation and Removal
    a. Unplug router
    b. If the router has recently been used, ensure the cutter, collet nut, and collet have cooled enough to touch
    c. Place the router on its side or back
    d. Press in the spindle lock gently, and turn the spindle until the lock engages. The spindle will no longer rotate
    e. Holding the spindle lock engaged, use the appropriate sized wrench to loosen the collet nut
    f. One the nut is loosened, back the nut off until the collet relaxes enough to allow removal or insertion of the router bit.
        i. If the collet chuck it loosened enough to come off the router, ensure the collet nut is firmly mounted before remounting the collet chuck.
        ii. For some older routers, it may be necessary to tap the router bit with a plastic mallet or piece of scrap wood to break the collet loose once the nut

is loosened. Use of a metal hammer will damage the bit, and should be avoided.

g. Insert the shank of the router bit into the collet chuck as far as it will go, then back out until the cutters are 1/8 to 1/4 inch from the collet nut face
    i. For safety, at least 5/8-inch of shank must remain in the collet at all times
    ii. The cutter diameter must be at least 1/4-inch smaller than the opening in the router base, to prevent accidental contact between the bit and the shoe.
h. With the spindle lock engaged, tighten the collet nut firmly
    i. To prevent damage to the collet chuck, do not tighten the collet nut without a bit installed.

6. Setting Router Depth
    a. Deep cuts with a router should be done in several stages. Depth of cut will depend on router bit and router power, but single pass depths should not exceed 1/8-inch maximum.
    b. Open the clamping lever, or equivalent, to loosen the base from the router.
        i. In the case of the small Bosch router, turn the motor sideways (B) until the small arrow points to the “Unlock” symbol after loosening the clamp lever (A).

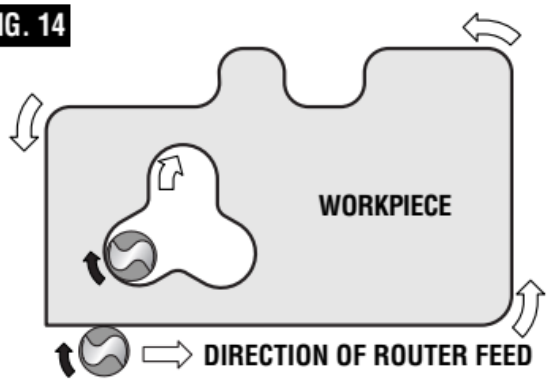


    c. Slide the router up and down in the base.
        i. In the case of the table router, the large midbody ring should be turned to adjust the depth of cut.
    d. Some routers will have a knob or wheel for fine adjustment of the depth of cut.
        i. In the case of the small Bosch router, the body should be turned sideways until the arrow points to the “Lock” symbol, then the fine adjustment wheel (D) should be used for final adjustment.
    e. Close the clamping lever, or equivalent, to lock the router and base into position.
7. Router Operation
    a. Ensure the workpiece is firmly mounted, using clamps or other retention method.
    b. The router should be held firmly, away from the workpiece, when being started. A significant twisting will occur as the motor spins up.
    c. The router should be firmly held with both hands during all cutting operations.
    d. The router should be given time to reach full speed before cutting is started.
    e. Router feed rates:
        i. Feed rates will take practice to perfect. The ideal feed rate should result in the continuous production of uniform wood chips - not intermittent production of very large chips, or the continuous production of sawdust.

ii. The router should be moved steadily and smoothly. Pay attention to the sound of the machine as it works.
iii. Softer woods will require a faster feed rate than harder woods.
iv. Larger bits or deeper cuts will require a slower feed rate than smaller bits and shallow cuts.
v. Cutting parallel to the grain usually requires a faster feed that cutting perpendicular to it
vi. Feeding the router too fast will result in the spindle slowing down as the router attempts to take a larger than normal chunk out of the wood with each revolution. This can result in “tearout” - roughly removed splintery chunks at the edge of the cut
vii. Feeding the router too slowly will result in the router scraping the workpiece rather than cutting it, resulting in sawdust-like waste. Scraping produces significant heat which can mar or burn the workpiece, and in extreme cases damage the cutter.
    1. Slow feeding also increases the tendency of the router to bounce off the sides of the cut, resulting in scalloped edges

f. Feed direction:
    i. The cutting edge on the router should “scoop” the material out of the workpiece ahead of the router. The diagram, Fig 14 from the Bosch router manual, shows the correct feed direction for both internal and external work.

FIG. 14



g. Router guiding:
    i. The router can be used freehand, mounted in a jig (such as the router table), or can use external fixturing for guidance.
        1. External fixtures can include pre-cut templates, finger-joint or dovetail jigs, or something as simple as a scrap lumber clamped to a workpiece as a guide.
    ii. Some bits have either a pilot, or a pilot bearing. These bits can be used to make the router follow an existing edge of the workpiece, commonly used to round over or chamfer work.
        1. If pilot bearings on a bit do not spin freely, the bearing must be replaced. Contact a Woodshop Lead for assistance.
h. Ensure the router has come to a complete stop before putting it down.

8. After use:
    a. Clean all dust from the router using brush or vacuum.
    b. Portable tools:

i. Remove the cutting bit
    1. DO NOT TIGHTEN THE EMPTY COLLET CHUCK
ii. Set the router depth as deep as possible to make the overall size as small as possible
iii. Replace the router in its case, if available
iv. If no case is available, loosely wrap the cord around the router
    1. Do not create tight bends or angles in the cord, to prevent damage to the internal cable conductors
v. Return the router to the correct location for the next user

c. Table router:
    i. Place a piloted round-over bit in the router
    ii. Set the depth as close as possible to the correct depth for the round over bit

There are several other tools available for special uses at SPARK. As they are in special use, SPARK Safety and Instruction Manuals have not yet been made. If you think you have a need for one of these tools in a project, please contact the Woodshop Leads for one-on-one instruction on the tool. The specialty tools are:

Biscuit Joiner - used to attach boards along their narrow edges to make wider stock

Power Plane - a motorized version of a traditional woodworkers plane, used to level or thin boards

Oscillating Tool - used to make flush cuts or do light sanding in corners.

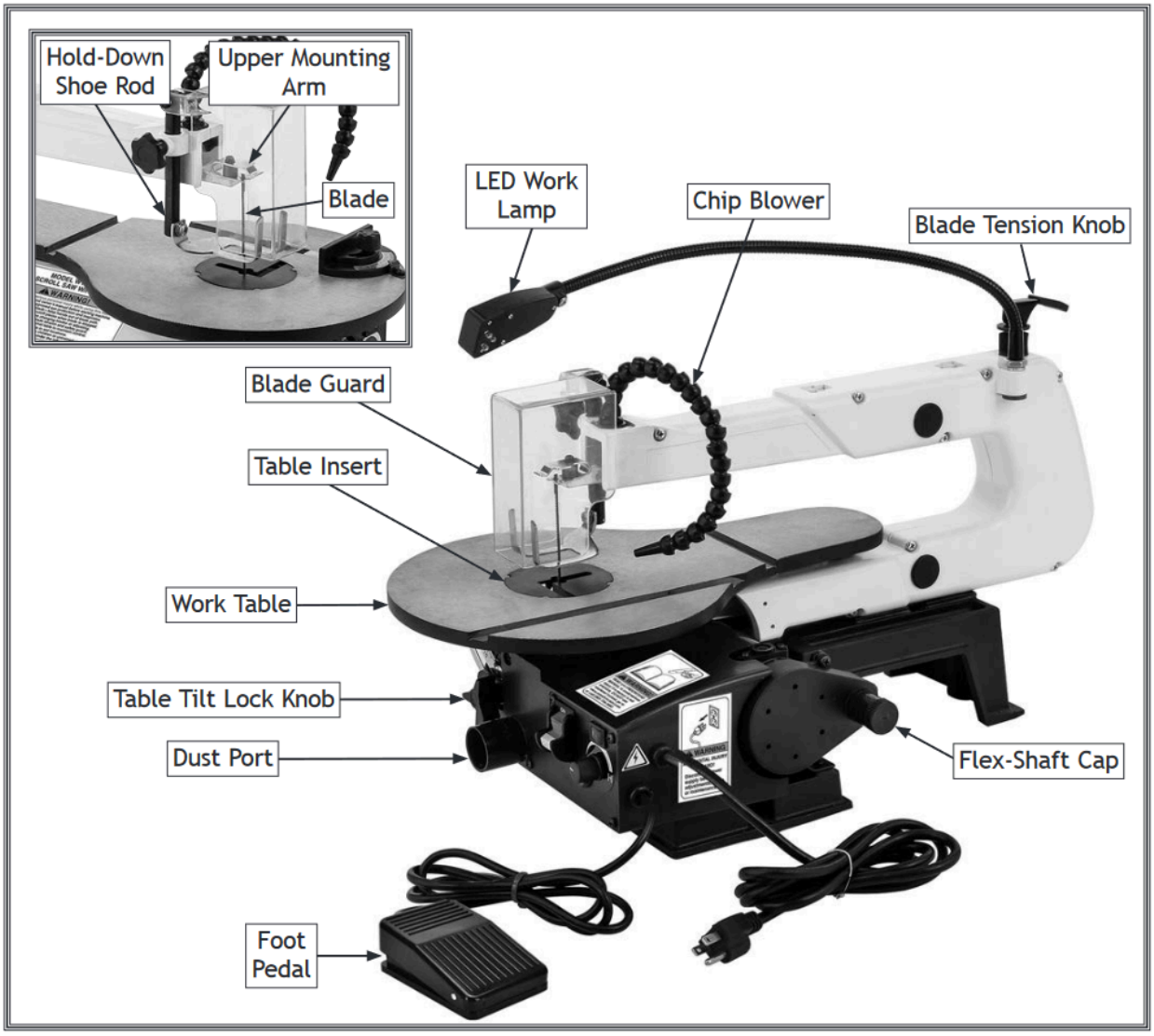
SCROLL SAW GUIDE

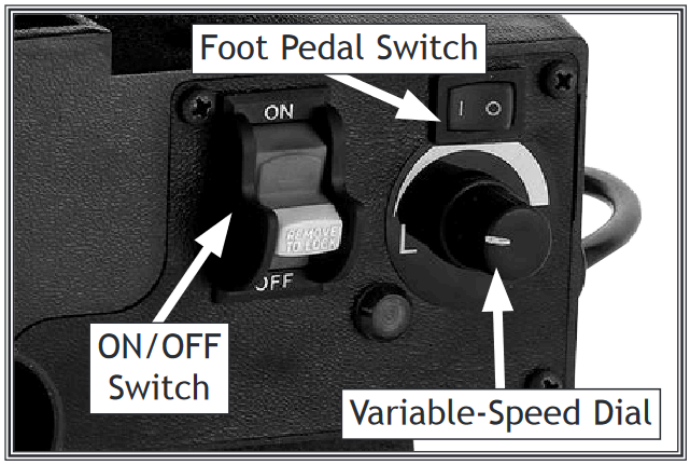
(updated 10/22/24)

Scroll Saw Safety Rules

1. Wear proper personal protection equipment (safety glasses).
2. Do not bypass any safety devices.
3. Keep hands clear of the moving saw blade and the cut path.
    a. If using the saw mounted on the flip-top cart, beware of pinch points when flipping top
4. Keep loose clothing, hair, and jewelry away from the saw blade.
5. Check blade tension before operating the saw.
6. Let the saw blade do the cutting. Do not force the wood into the blade.
7. Back out of straight cuts only
8. Use jig, push sticks, or scrap materials to control small workpieces.
9. Do not clear small pieces in close proximity to the blade until the blade has stopped moving.
10. Let the blade stop prior to leaving the tool.
11. If something is broken or breaks, notify one of the woodshop leads at (woodshop@sparkmakerspace.org).

Scroll Saw Parts (Shopfox W1872)





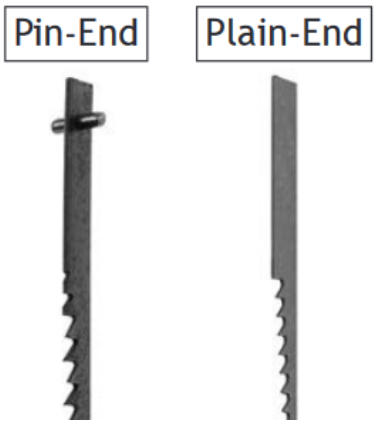
Scroll Saw Summary

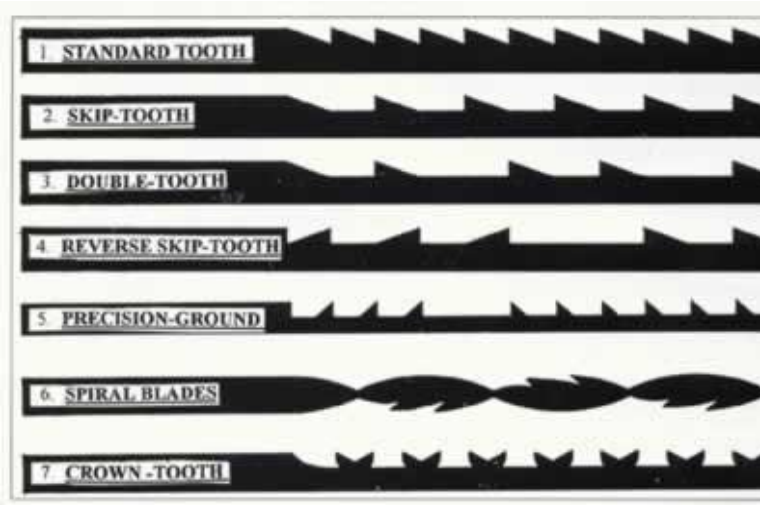
1. Tool location in shop
    a. Flip-top cart setup and safety
    b. Clamp to table or cart
2. Possible uses for tool
    a. Good for:
        i. Curved cuts
        ii. Smaller workpieces
        iii. Wood and engineered wood
        iv. Workpieces less than 1-inch thick
    b. OK for:
        i. Straight cuts (blade wobble)
        ii. Some plastics (check with Woodshop Leads)
    c. Bad for:
        i. Large workpieces (limited table size)
        ii. Materials other than wood or plastic
3. Parts of a scroll saw (refer to diagram)
4. Important variables:
    a. Blade tooth count
        i. Higher tooth count for thinner materials
    b. Blade width (gullet to spine)
        i. Wider blades require larger radius of curvature for cut
    c. Blade type
        i. Pin vs pinless
    d. Blade tension
        i. Listen for “ping”
5. Important setup steps:
    a. Blade installation/inspection
        i. Saw speed should be set according to blade type and workpiece
    b. Cutting plan
    c. Hold down height
        i. Hold down should maintain gentle downward pressure on workpiece
    d. Workpiece control
6. Operation guidance
    a. Lining up a cut (drift angle)
    b. Cutting a curve
    c. Relief cuts
    d. Backing out of a cut
7. Cleanup

Scroll Saw Blades

Choosing a Blade

There are a large variety of blades available for the scroll saw. An exhaustive explanation is not feasible within the limits of these instructions, so feel free to do additional research.





1. Blade Length
    a. The standard length of scroll saw blades is five inches, but other lengths are occasionally encountered.
    b. The Spark scroll saws use 5 inch blades
2. End Connection: Pin or Plain
    a. Pin-End Blades
        i. Pin end blades have a small pin installed in each end of the blade
        ii. Pin ends blades are generally quicker to install, but come in fewer blade sizes and styles
        iii. The Spark scroll saws use pin-end blades
    b. Plain-End Blades
        i. Plain end blades, as the name suggests, have a smooth steel end.
        ii. Plain end blades come in a larger variety of sizes and tooth styles than the pin end blades.
        iii. Pin end blades are commonly used for the thinnest blades for very tight curves and complex work
        iv. Plain end blades may be installed on the Spark scroll saws using adapter mounts.
        v. Installation of plain end blades requires an Advanced scroll saw certification. Contact the Woodshop Leads to get the Advanced certification.

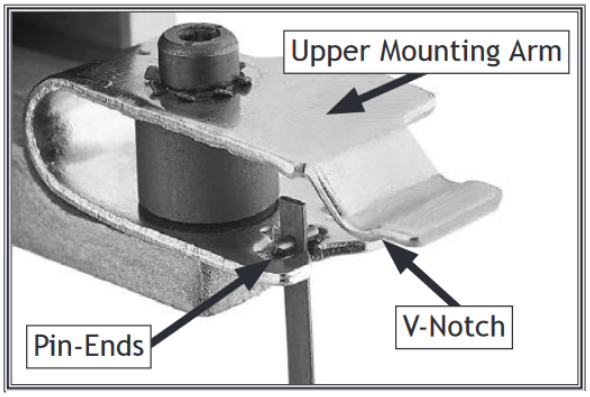
3. Tooth Style
    a. Standard Tooth
        i. Similar to any other saw blade.
        ii. May create heat or clog compared to other blade styles
    b. Skip Tooth
        i. Compared to a standard tooth, every other tooth is missing
        ii. The missing teeth help clear sawdust and reduce heat
        iii. The most common blade type for the Spark saws, and recommended for most purposed
    c. Double Tooth
        i. Similar to skip-tooth but with pairs of teeth followed by a gap
        ii. Slower but cleaner than skip cut
    d. Reverse Tooth
        i. Have a few teeth at the bottom of the blade facing the opposite direction to minimize splintering on the underside of the material
        ii. Used for plywood or veneered workpieces
    e. Spiral Tooth
        i. The teeth wrap around the blade in all directions, allowing cuts in any direction without rotating the workpiece
        ii. Used for intricate cuts
        iii. Requires practice to control
    f. Crown Tooth
        i. Double sided teeth cut on both the up and down stroke
        ii. Better cut finish
4. Tooth Count and Width
    a. Tooth Count
        i. Tooth count is measured in Teeth Per Inch (TPI)
        ii. Higher TPI correlates to slower cuts with smoother finish
        iii. Thicker or harder workpieces required larger teeth = lower TPI
        iv. Most of the Spark blades are between 10 TPI and 18 TPI
    b. Width (from front to back of blade)
        i. Narrower blades turn tighter, but flex more and are more easily broken
        ii. Thicker or harder workpieces required wider blades
        iii. Most of the Spark blades are approximately 0.100-inch
5. Spark Recommendations
    a. These recommendations are a starting point for novice scroll saw operators.
    b. Harder pieces may require wider, stronger blades with fewer teeth
    c. Intricate work may require narrower, finer blades and must be used with care to prevent blade breaks

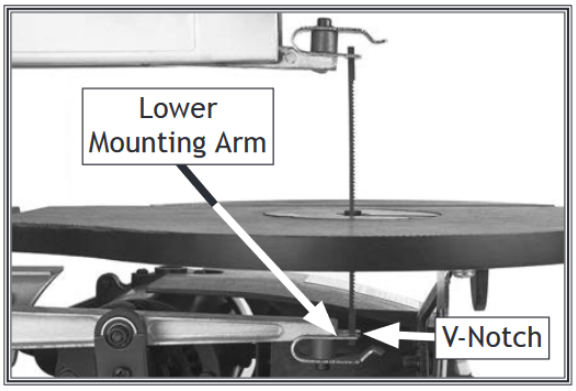
Spark Blade Recommendations				
Wood Thickness (inches)	End Type	TPI	Tooth Type	Notes
1/4 - 1	Pin	10	Regular or Skip	Regular tooth for general cutting. Skip tooth for tighter curves.
3/16 - 1/2	Pin	15	Regular or Skip	
1/8 - 1/8	Pin	18	Skip	For delicate or intricate work

Installing a Blade

The Spark saws are set up for use of pin-end blades. The instructions below assume the member is a Trained User and certified accordingly. Installation of plain-end blades requires an Advanced User certification - contact the Woodshop Leads for more information.

1. **UNPLUG THE SAW**.
2. Double check the saw is unplugged.
3. Remove tension from the blade
    a. On the W1872 (with foot pedal), lift the handle of the blade tension knob on the back of the machine into the vertical position.
    b. On the W1713 (mounted on the flip top), turn the blade tension knob on the back of the saw counterclockwise.
4. Remove the table insert
5. Flip the clear plastic blade guard up and out of the way
6. To remove an existing blade:
    a. Push the upper blade arm down
    b. Pull the top of the blade out of the upper mounting arm V-notch
    c. Lower the blade slightly and remove the bottom of the blade from the lower mounting arm V-notch
    d. Pull the blade clear of the saw table





7. Install a new blade starting with the lower arm V-notch. Insert the lower pin of the blade under the mounting arm, into the V-notch of the mounting bracket
    a. The blade teeth should point down, so cutting forces push the workpiece against the saw table.
    b. To make sure the pins are seated in the indents of the blade holder, wiggle the blade end in the V-notch while pulling the blade up slightly,
8. Press down on the upper arm
9. Insert the upper blade pin into the upper mounting arm V-notch
10. Tension the saw blade (see below).

Tensionsing a Blade

Blade tension is important for efficient, accurate cutting. A certain amount of trial-and-error will be required for different blades and materials. If the tension is too high, the blade may break during installation or use. If the tension is too low, the blade will flex or wander during cutting and may, if significantly under-tensioned, come off the saw.

1. Ensure the saw is unplugged.
2. Ensure the blade pins are firmly mounted in the upper and lower mounting arms.
3. Increase the blade tension until gentle sideways force on the blade results in a less than 1/8-inch movement
    a. On the W1872 (with foot pedal), push the handle of the blade tension knob on the back of the machine into the horizontal position.
    b. On the W1713 (mounted on the flip top), turn the blade tension knob on the back of the saw clockwise.
4. Pluck the back of the saw blade
    a. If the saw blade breaks, the tension was too high. Reduce the blade tension and reinstall a new blade.
        i. On both W1872 and W1713 saws, turn the tension knob counterclockwise to reduce blade tension.
    b. If the saw blade makes a high-pitch sound like a guitar string, the tension is correct.
    c. If the saw blade makes no sound, or a low dull sound, increase the blade tension
        i. On both W1872 and W1713 saws, turn the tension knob clockwise to increase blade tension.
5. Plug the saw in.
6. Perform a test cut on your intended workpiece. Adjust the tension if required.

Scroll Saw Instructions for Use

Before Use

1. Wear personal protective equipment
    a. Safety glasses
    b. No gloves may be worn while operating the scroll saw

    c. Hearing and respiratory protection is recommended for longer duration operations
2. Ensure the saw is firmly mounted to the table, stand, or cart.
    a. If using a saw mounted on a rolling cart, ensure the cart casters are locked.
3. Inspect the scroll saw blade for damage (bend blade, missing teeth, etc.)
4. If a different blade is required, install the blade in accordance with the Scroll Saw Blade installation guide.
5. Check the scroll saw table, and make sure the lock knob is secured. The table should be level in its baseline configuration. If an angled cut is desired, tilt the table to the appropriate angle.
6. Adjust height of the hold down guide to put gentle downward pressure on the workpiece.
7. Determine the location and angle(s) of cuts required. Mark lines clearly on the workpiece.
8. Prepare a cutting plan
    a. Determine if relief cuts are necessary.
    b. Determine if push blocks are needed.
    c. If making an inside cut (creating a hole in the workpiece), drill holes approximately 3/8-inch in the workpiece to allow installation of the scroll saw blade.

During Use

1. If the scroll saw has a dust collection port, attach the appropriate dust collection system, and turn on the dust collector
2. Prior to starting the saw, ensure that no material or parts are in contact with the blade
    a. Take particular care during inside cuts to ensure the workpiece is clear of the blade before starting the saw.
3. Turn on the scroll saw and let the blade come up to maximum speed prior to starting the cut.
    a. Adjust the speed according to the workpiece, blade, and cut plan
    b. Smaller, higher TPI blades should be run at reduced speed to prevent overheating
4. Listen for unusual or unsteady sounds. If these sounds are heard, stop the blade and notify a Woodshop Lead.
5. If a complex curve is being cut, start by making relief cuts in the workpiece.
    a. Users should not attempt to back out of a curved cut. Relief cuts prevent potential jams.
6. Feed the material into the saw blade while maintaining even pressure. Let the saw blade perform the cutting, and do not force the piece of wood into the blade.
    a. Users should listen to the machine during operation. Changes in machine pitch often indicated overloading.
    b. Use push blocks, miter guide or appropriate scraps of material in order to maintain a safe distance from the blade.
7. If the wood is not cutting, there are several possible causes:

    a. The wood may be very hard.
        i. There is no resolution for this issue. Slow down and be patient. Give the saw and blade occasional breaks to prevent overheating.
    b. The currently installed scroll saw blade may be inappropriate for the material and thickness.
        i. Replace the blade with a more appropriate tooth style and count
    c. The scroll saw blade may be dull
        i. Replace the blade with a sharp one
8. The scroll saw blade is liable to twist slightly under load while cutting, leading to a certain amount of drift angle during the cut. The angle will vary with saw, blade, tension, and workpiece. The user will have to compensate by presenting the piece at a slight angle to the cut line.
10. As the piece is being cut, avoid applying excessive lateral or twisting pressure on the blade.
    a. When cutting tight curves, ensure the blade continues moving forward while turning
11. Be aware of material pinching the blade. This can overload the saw, damage the blade, and burn the material.
12. As the cut progresses, maintain safe hand positions.
13. Once the cut is almost complete, ensure that hands are clear of the region where the saw blade will exit the piece.
    a. Use a push stick or guide as required
14. Once the work is done, turn off the saw and wait until the blade comes to a complete stop before leaving the tool unattended.

After Use

1. Return the saw to the baseline configuration (see Baseline Configuration Identification).
2. Clean up the sawdust around the saw
3. Replace the saw in its storage position

Scroll saw Baseline Configuration

1. Table level at 90 degrees to the blade
2. 1/4" blade with 6 tpi
    a. Tension set properly for blade
    b.
3. All offcuts and cutting debris removed
4. Mounted on cart, cart under miter saw bench

Scroll saw Competencies

Trained User Competencies

Setup
- Setup on Table
- Blade Type Check
- Blade Tension Check

Operation
- Straight Cuts
- Curved Cuts

Changes and Adjustments
- Remove and Install Blade (Pin End Blades)
- Tension Blade
- Adjust Blade Guide Height

Maintenance and Care
- Blade Inspection
- Dust Removal

Advanced User Competencies

Changes and Adjustments
- Remove and Install Blade (Plain End Blades)

TABLE SAW GUIDE *(updated 10/20/24)*

Safety Rules

1. The buddy system is required for the table saw
2. Wear proper personal protection equipment (safety glasses, hearing protection, respiratory protection)
3. Keep loose clothing, hair, and jewelry away from the spinning blade
4. Do not bypass any safety devices
5. Keep hands clear of the area near the blade
6. Maintain positive control of the stock
7. Use one, and only one, of the following at all times: fence, miter gauge, or sled
8. Let the blade come up to speed before starting the cut
9. Let the blade come to a complete stop before leaving the saw
10. If something is broken or breaks, notify one of the wood shop leads at (woodshop@sparkmakerspace.org).

Table Saw Summary

1. Tool Location in Shop
2. Parts of the saw (refer to diagram)
3. Definitions
4. Uses for Tool
5. Kickback Prevention
6. Before Use
    a. Check workpiece for saw suitability
    b. Cut plan
    c. Set cut guide (one, and only one)
    d. Safety devices (blade guards and riving knife)
7. At the Saw
    a. Buddy system
    b. Blade depth
    c. Blade angle
    d. Dust collection
    e. Line up cut
8. Making the Cut
    a. Start saw with blade clear of workpiece
    b. Keep hands clear of blade
    c. Maintain control of workpiece
        i. Use push sticks as required
    d. Use even feed force
    e. Use assistant or outfeed roller for large stock
    f. Shut off saw after every cut
9. Cleanup

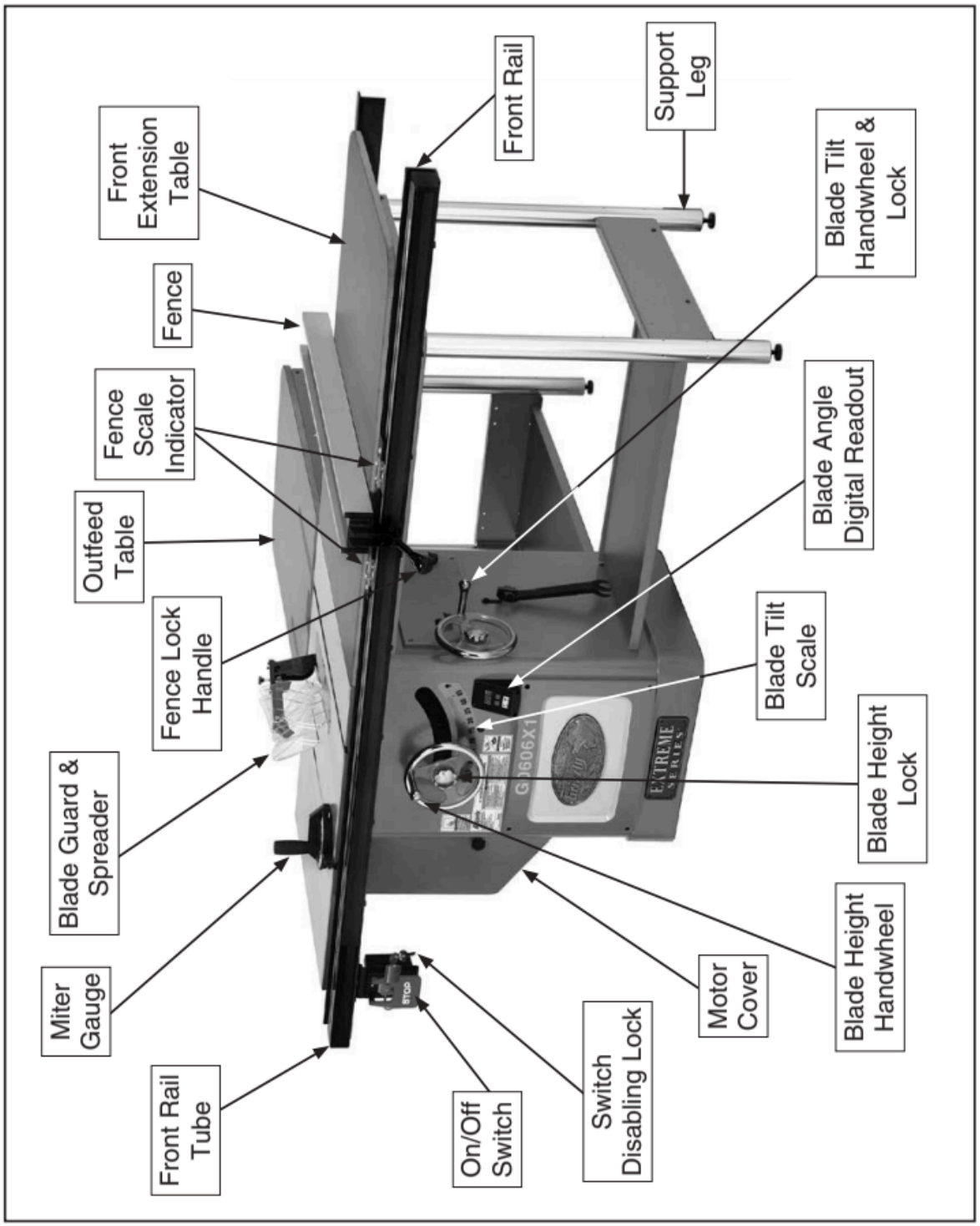


Figure 1. G0606X1 identification.

Definitions

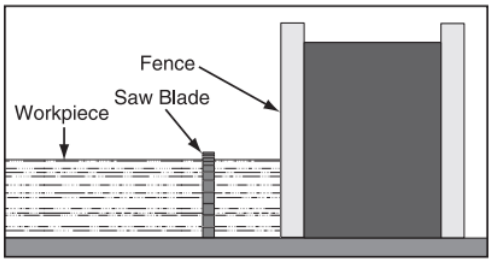


Figure 54. Example of a through cut (blade guard not shown for illustrative clarity).

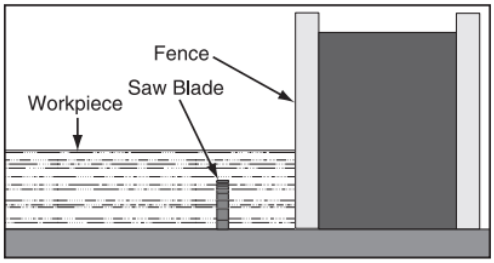


Figure 53. Example of a non-through cut.

Rip cut: Cuts made in the same direction as the wood grain (usually in the long direction of the lumber)
Cross cut: Cuts made perpendicular to the direction of the wood grain (usually in the short direction of the lumber)
Kerf: The cut or gap in the workpiece after the saw blade passes through during a cutting operation
Through Cut: A cut in which the blade cuts completely through the workpiece (requires blade guard)
Non-through cut (or partial depth cut): A cut in which the blade does not cut through the top of the workpiece (requires riving knife)
Dado: A groove cut in the workpiece; uses either a specialty blade set or multiple parallel cuts
Rabbet: An L-shaped channel along the edge of the workpiece
Kickback: An event in which the workpiece is propelled back towards the operator at a high rate of speed
Blade guard: Metal or plastic safety device that mounts over the saw blade which prevents the operator from coming into contact with the saw blade
Riving knife: Metal plate located behind the blade; it prevents the kerf gap from closing and pinching the blade while performing a cutting operation.

Buddy System

1. Use of the table saw requires a second person to be present in the Woodshop to act as a buddy.
    a. The second person must verbally agree to be the “buddy”, to act in case of emergencies. This person must be capable of hearing the tool operator. If the “buddy” leaves the area, use of table saw must cease.
    b. If the second person is not a Spark member, a signed non-member safety waiver must be on file with Spark staff. The non-member must know the location of the phone in the woodshop and the off switch for the saw. During use of the saw, the non-member agrees to watch the operation and not to use tools or work on other projects.

Instructions for Use

Uses for Tool:

1. Good for:
    a. Reducing width of long boards
    b. Cutting sheet goods
    c. Rabbets, grooves, and dados
    d. Woods
2. OK for:
    a. Cross cutting stock
    b. Plastics
3. Prohibited:
    a. Significantly warped or twisted boards
    b. Green (wet, undried) lumber
    c. Small parts
    d. Metals
    e. Ceramics/Glass/Tiles
    f. Composites (fiberglass or carbon fiber)

Kickback Prevention

1. Kickback occurs when the workpiece is in contact with the saw blade but not restrained or controlled properly. The saw blade can propel the workpiece back towards the operator at dangerous speeds and can force the operators hands into the blade.
2. Kickback is usually caused by:
    a. Operator failure to maintain positive control of workpiece
    b. Material being caught between the blade and the fence
    c. Material pinching the blade during cutting
    d. Misaligned feeding of the workpiece
    e. Blade contact with knots or foreign materials in the workpiece
3. Chances of kickback can be greatly reduced by:
    a. Ensuring at least one smooth, straight edge to the workpiece. This will minimize the chances of twisting the material during the cut and pinching the blade.
    b. Using the fence, miter gauge, or sled. Do not make freehand cuts on the table saw. This will minimize the chances of misaligned feed pinching the blade.
        i. Use only one of the guides. Use of the fence in combination with the miter gauge will wedge the workpiece between the fence and the spinning blade which is a dangerous condition.
        ii. Ensure the fence is parallel to the blade, and clamped properly. Misaligned cuts will increase chances of kickback.
    c. Use the blade guard or riving knife.

i. The blade guard has both a spreader, which will prevent the cut pawls, from closing up, and a set of which will dig into the workpiece to mitigate kickback.

ii. The riving knife works identically to the spreader, preventing blade pinch on non-through cuts.

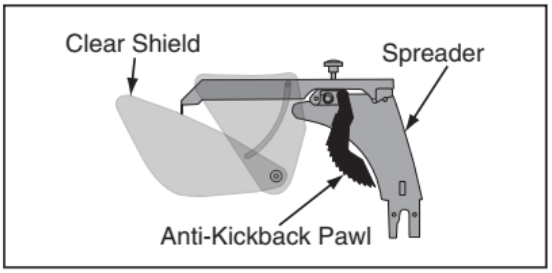


Figure 62. Blade guard assembly components.

d. Feed all cuts to completion. If a cut must be stopped before completion, shut down the saw while maintaining positive control over the material. Let the blade come to a complete stop before backing out of the cut.
e. For deep cuts, make multiple shallower passes rather than a single deep cut.

4. User control of the workpiece is an important aspect of preventing kickback. Users should maintain positive control of the workpiece at all times.
    a. Operate the saw only from the front side. Do not attempt to pull a piece through the saw from the back, or feed from the sides.
    b. Hands should never be in a position with the blade between the hand and the body.
    c. Push sticks should be used to keep hands clear of the blade while maintaining control of the cut.
    d. Users should stand to one side of the blade while cutting. This prevents the user from being in the path of a workpiece if kickback should occur

Before Use

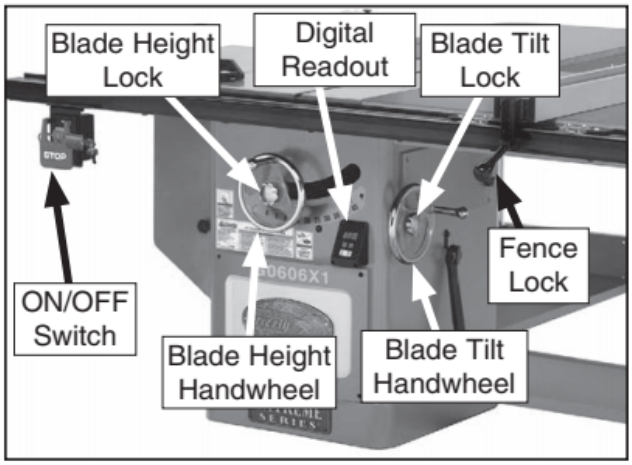
1. Wear personal protective equipment.
    a. Safety glasses
        i. Face shields may be worn for greater comfort, but safety glasses must be worn underneath.
    b. Dust masks or respirators are strongly encouraged.
    c. Gloves shall not be worn while operating the saw.
    d. Hearing protection is recommended.
    e. Tie long hair back.
    f. Roll loose sleeves above the elbow.
    g. Remove all jewelry.
2. Inspect the workpiece for suitability
    a. Materials should be limited to natural wood, engineered wood products, and some forms of plastics.
    b. Workpiece should be clear of foreign objects such as nails, screws, fasteners, dirt, rocks, sand, debris, or any other non-wood material.
    c. Loose knots should be removed before being fed through the saw. If loose knots can not be removed, an alternate cut method should be found.
    d. Green, pressure treated, or any other “wet” workpiece should be avoided.

e. Minor warping is acceptable, but care should be taken with cut orientation and feeding. Cut must be made in the most stable orientation.
f. Significantly warped lumber (cupped, bowed, or twisted) should not be cut with the table saw.
g. If required, pass one side of raw lumber through the jointer to create a smooth, straight reference edge. This edge will slide against the fence during cutting.

3. Prepare a cutting plan.
    a. Determine order of cuts, and ensure there is sufficient space around the table saw.
    b. Safety guards should be used for all through cuts. Non-through cuts require the use of the riving knife and are limited to advanced users.
    c. When cutting multiple parts out of a single workpiece, be aware of kerf thickness, and its effect on cuts.
4. Choose the saw guide appropriate to your cutting situation. Only one guide should be used at a time to minimize kickback.
    a. Rip cuts: Use the fence.
        i. Adjust the fence to the appropriate workpiece thickness by lifting the black handle knob at the front of the fence. Slide the fence left and right to adjust, and press down on the handle knob to lock it in position.
        ii. Precision adjustment of the fence may require measurements to be taken between the fence and the saw blade. Power to the saw should be disconnected before making these measurements.
    b. Rough cross cuts (including miter cuts): Use the miter gauge (or the compound miter saw)
        i. The miter gauge is stored under the right side of the saw against the stand.
        ii. Move the saw fence clear of the work space.
        iii. Set the required angle on the miter gauge .
        iv. Slide the gauge into the T-track in the table surface.
    c. Precise crosscuts, large numbers of repeated cuts, or smaller workpieces: Use the crosscut sled (requires removal of the blade guard and installation of the riving knife; advanced users only).
        i. The cross cut sled is stored under the right side of the saw.
        ii. It has two runners which fit in the T-slots of the table.
        iii. The sled allows stops, blocks, or other fixturing to be mounted to the sled to hold the workpiece.
        iv. Use of the crosscut sled decreases kickback risk, but increases blade exposure.

At The Saw

1. Inspect the circular saw blade for damage. If this is done while power is being provided to the saw, a piece of scrap material should be used to rotate the blade to keep the user clear of the blade.
    a. If damage is observed, report the condition to a woodshop lead.
    b. The blade on the saw should be a general-purpose/combination blade of low to medium tooth count. If your application requires a different blade, please contact a Woodshop Lead for help.
2. Adjust the blade tilt, if required, to the correct angle.
    a. If the saw is unplugged while angle adjustments are made, the digital miter gauge on the saw will have to be reset.
    b. Blade tilt is adjusted using the handwheel on the right side of the saw.
        i. Loosen the blade tilt lock (central knob) to unlock the blade tilt handwheel.
        ii. Turn blade tilt handwheel until the blade is at desired angle, as shown on the blade angle indicator in front of the saw.
        iii. Tighten the blade tilt lock.



3. Adjust blade height
    a. Blade height should be not more than ¼-inch higher than maximum thickness of the workpiece
    b. Blade height is adjusted using the handwheel on the front of the saw.
        i. Loosen the blade height lock (central knob) to unlock the blade height handwheel.
        ii. Turn blade height handwheel until blade is at desired height
        iii. Tighten the blade height lock.
4. Ensure that the saw workspace is clear.
    a. Chips and sawdust should be swept from the operators work space
    b. Outfeed table should be cleared of obstructions
        i. For large pieces, particularly full sheets of plywood, assistance may be required to support parts of the workpiece during the cut.
        ii. If using a second person, the assistant should NOT attempt to feed the material, only hold it up.
        iii. There are several roller supports available
5. If needed, place the “Saw In Use” notification on the back door.

Making The Cut(s)

1. Establish the buddy system is active.
2. Confirm the workpiece is suitable for cutting.
3. Confirm blade angle is correct.
4. Confirm blade height is correct.
5. Confirm guide (fence, miter gauge, or sled) is in the correct position.
6. Confirm that the appropriate guard is in place:
    a. Through cuts: blade guard, kickback paws, and spreader
    b. Non-through cuts: riving knife
7. Confirm that the saw is plugged in.
8. Start dust collection system.
9. With the workpiece clear of the blade, turn on the saw.
    a. Let blade reach operating speed before feeding workpiece
10. Holding the workpiece firmly against the guide, feed the workpiece through the saw.
    a. Hands and other body parts should be kept well clear of the saw blade.
    b. Feed rate should not exceed saw capacity. If the saw looks, sounds, smells like it is slowing down or bogging, feed rate or cut depth should be reduced.
    c. When using the fence, push sticks should be used for the final portion of the cut.

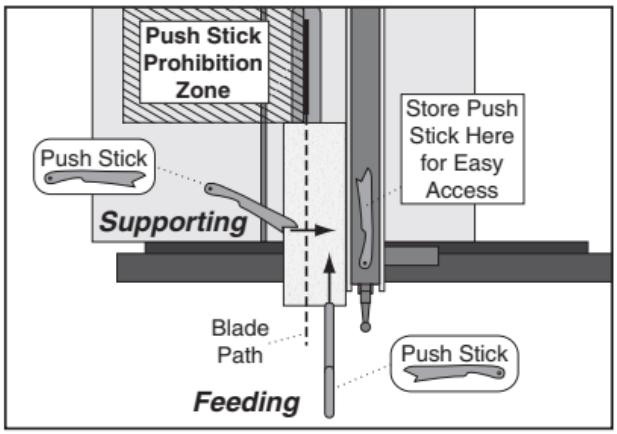


Figure 96. Using push sticks to rip narrow stock.

        i. Feed: The notched end of the push stick should be used against the end of the workpiece and used to move the workpiece past the blade with a steady downward and forward pressure.
        ii. Guide support: A second push stick can be used to keep the workpiece against the fence. When doing so, only apply pressure before the blade. Pressure applied to the parts of the workpiece which have already been cut will pinch the blade and could induce kickback.
11. Do not attempt to remove small offcuts while the blade is spinning
    a. If small pieces fall into the space between the table insert and the blade, shut down the saw, and let the blade stop moving before attempting to remove them.
12. Once the cut is complete, turn off the saw immediately.
13. Remove all pieces from the table before proceeding with further cuts.

After Use

1. Shut down the dust collection system.
2. Remove all offcuts from the table.
3. Return the saw to baseline configuration.
4. Clean up sawdust from around the tool.

Baseline Configuration Identification

1. Blade guard, anti-kickback pawls, and spreader installed
2. Combination blade installed
3. Blade tilt at 0° angle
4. Blade set below surface of table
5. Miter gauge and cross cut sled stored under table wing
6. Saw unplugged

Table Saw Competencies

Trained User Competencies

Setup
- Blade type check
- Blade depth set
- Fence position set
- Miter guide set

Operation
- Dust Collection System
- Rip cuts
- Cross cuts

Changes and Adjustments
- None

Maintenance and Care
- Cleanup of saw and surround space

Advanced User Competencies

Setup
- Miter angle

Operation
- Beveled rips
- Rabbet cuts
- Dado cuts
- Partial depth cuts

Changes and Adjustments
- Blade replacement
- Riving knife installation
- Miter zeroing

Maintenance and Care
- Table clean and wax