

Lathe Training Guide

Table of Contents:

1. Lathe Safety Rules
2. High Speed Grinder Safety Rules
3. Lathe Diagram
4. Instructions for Use
 - a. Types of Woodturning
 - b. Before Use
 - c. Sharpening Tools
 - d. Mounting the Workpiece
 - e. Turning at the Lathe
5. Baseline Configuration Identification
6. Competency Sheet

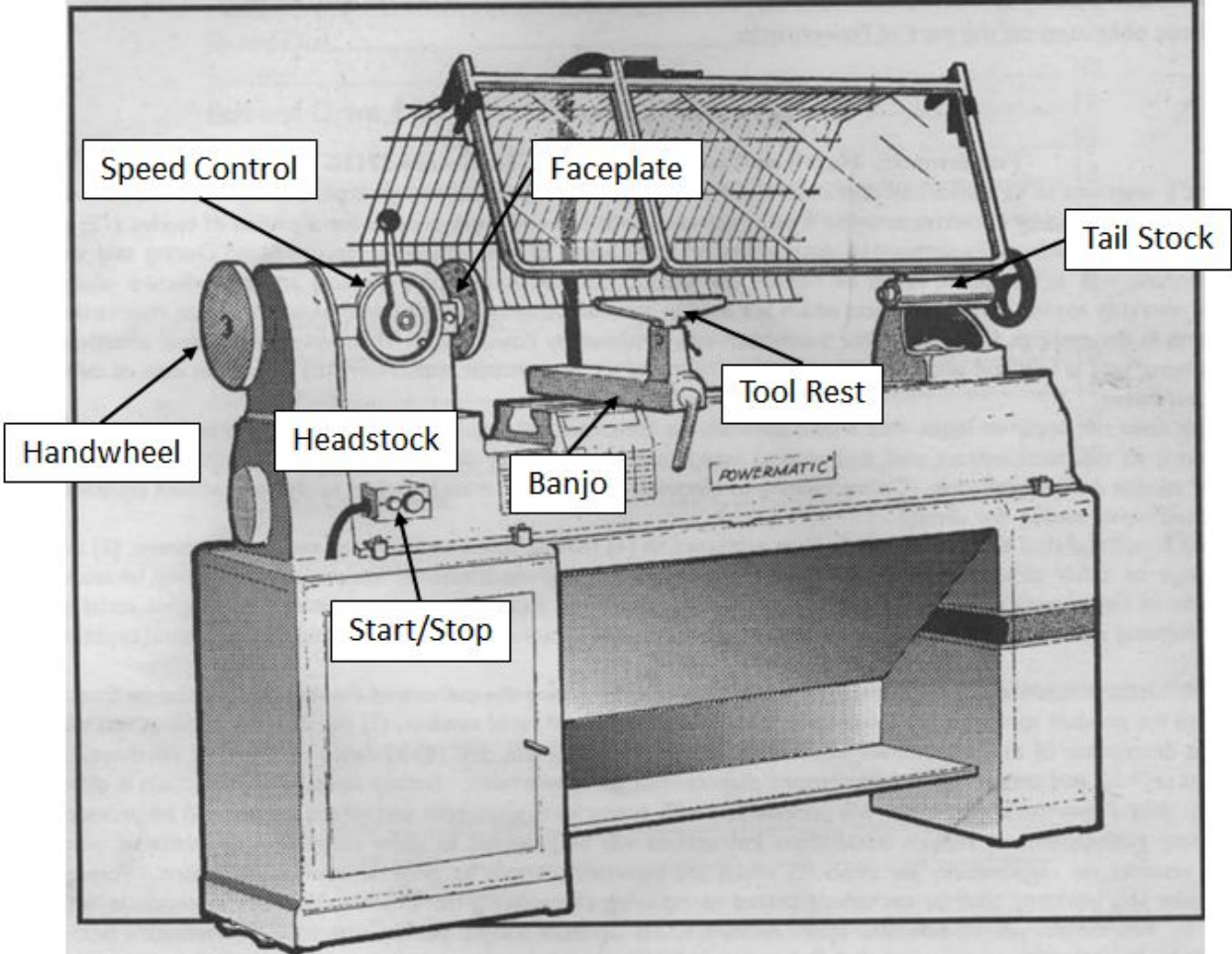
Lathe Safety Rules

1. Wear proper personal protection equipment:
 - a. Safety glasses are required.
 - b. Face shield is required.
2. Do not bypass any safety devices.
3. Keep hands, clothing, and hair, and jewelry clear of the spinning material.
4. Always use sharp blades. Dull blades are prone to catch the material and could hurt 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 power 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).

High Speed Grinder Safety Rules

1. Wear proper personal protection equipment:
 - a. Safety glasses are required.
 - b. Face shield is required.
 - c. Ear protection is **strongly** encouraged.
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. Do not use if excessive vibration occurs when the high speed grinder is running.
7. Do not leave either the low speed grinder or the high speed grinder until it comes to a complete stop.
8. If something is broken or breaks, notify one of the wood shop leads at (woodshop@sparkmakerspace.org).

Lathe Image



Lathe Instructions for Use

Type of Woodturning

1. 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, 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.
2. Faceplate turning
 - a. This form of woodturning position the piece of wood so the wood fibers are perpendicular to the axis of rotation.
 - b. This method of woodturning iis 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.

Before Use

1. Wear personal protective equipment.
 - a. Safety glasses are required.
 - b. A face shield is required while operating the lathe.
 - c. No gloves may 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 portions of the wood flying from the lathe.
 - b. Severely cracked pieces should non be turned on the lathe.
 - c. Slight checking should be secured with CA or wood glue.
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 should be rebalanced before proceeding.
6. Verify that the tools being used are razor sharp.
 - a. Dull tools lead to catches and unsafe operation.
 - b. Carbide cutters can be rotated to a fresh edge or sharpened with a diamond hone.
 - c. Non-HSS steel (carbon steel) can be sharpened on either the low speed or high speed grinders.

- d. High speed steel (HSS) should be sharpened on the high speed grinder with the Aluminium Oxide wheels.
- 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.

Sharpening Tools

1. The various sharpening tools at Spark Makerspace are to be used only for the lathe tools.
2. Hand carving tools may only be sharpened by the leads. The sharpening devices are for lathe tools only.
3. Never use the high speed grinder, low speed grinder, or diamond hone to sharpen non-ferrous materials (aluminum, copper, brass, etc.).
4. Using a diamond hone
 - a. Diamond hones are good for sharpening carbide cutters and touching up the edge on HSS or non-HSS tools.
 - b. Maintain even contact between the heel and toe of the cutting edge on the hone.
 - c. Apply light pressure and slide the hone in a circular motion.
5. Low speed low speed grinder
 - a. It is preferred to sharpen non-HSS tools on the low speed low speed grinder.
 - b. Do NOT use to sharpen carbide cutters.
 - c. Keep the water bath filled at all times while sharpening.
 - d. Have a separate water supply (solo cup, dixie cup, etc.) available to periodically cool the tool.
 - e. Using the low speed low speed grinder
 - i. Use the tool rest to support the shank.
 - ii. Start grinding on the heel of the edge, and lift the tool handle until the toe just begins to make contact with the wheel.
 - iii. Rotate the tool as needed while maintaining even contact between the heel and the toe of the cutting edge.
6. High speed grinder
 - a. HSS tools should be sharpened on the high speed grinder.
 - b. Non-HSS (carbon steel) tools may be sharpened on the high speed grinder.
 - i. The preferred method for the carbon steel tools is to use the low speed grinder.
 - ii. A water bath should be available (solo cup, dixie cup, etc.) to periodically cool the carbon steel tool
 - iii. Letting the tool get hot will damage the temper on the tool.
 - c. DEFINITELY DO NOT use the high speed grinder to sharpen carbide cutters.
 - d. Inspect the aluminum oxide wheels for defects (clogged grit, coves or beads in the surface).
 - i. If defects are noticed, notify one of the shop leads.

- ii. NEVER USE NON-FERROUS MATERIALS ON THE HIGH SPEED GRINDER.
- e. Always sharpen Spark Makerspace tools with a jig (no freehand sharpening) when using the high speed grinder.
 - i. The “Wolverine Vari-Grind” in conjunction with the v-arm base is used for making fingernail grinds.
 - ii. The v-arm base is for sharpening constant bevel gouges.
 - iii. Skew chisels and scrapers are sharpened on the tilting platform.
- f. Using the high speed grinder
 - i. Mark the cutting edge of the tool with sharpie so the bevel angle can be checked prior to sharpening
 - ii. Use the appropriate jig for the tool (see 6.e).
 - iii. Once the jig is set up for sharpening, test the bevel by lightly touching the edge to the wheels. The sharpie mark should be evenly wearing off of the edge. If this is not the case, remark the tool and adjust the jig accordingly.
 - iv. Always make light passes over the stones as the wheels are spinning at ~3600 rpm.
 - v. Move the tool back and forth across the stone while sharpening. Using only one spot on the stone will create beads and coves in the stone decrease the life of the stone.
 - vi. Keep a cup of water available to cool the tool and protect the temper.

Mounting the Workpiece

1. Always use adequate support on the workpiece while woodturning.
2. Before mounting any piece of wood, determine where the axis of rotation should be located on the piece.
3. Mark the locations to will be supported by the headstock and tailstock.
4. Spindle turning between centers
 - a. Use a center punch to mark the center on each end of the piece.
 - b. The drive center should be mounted in the headstock. This equipment is identified by its multiple prongs to grip and spin the wood.
 - c. 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.
 - d. Loosen the tailstock and move to a position where the tailstock quill can be brought forward to support the piece.
 - e. Tighten the nut to secure the tailstock.
 - f. Turn the handwheel on the tailstock to advance the live center into the the piece.
5. Faceplate
 - a. Mark the locations for the screw pattern.
 - b. Drill pilot holes to the desired depth.
 - c. Use screws that are sized to just fit the holes in the faceplate. Do not use undersized screws.

- d. Remove the drive center from the headstock using the knocking rod.
 - e. Screw the faceplate onto the headstock spindle.
 - f. Bring the tailstock forward to support the piece with the live center. The tailstock should be used until the piece is brought to round.
6. Worm screw and chuck
- a. Drill a hole corresponding to the worm screw diameter into the piece.
 - b. Remove the drive center from the headstock using the knocking rod.
 - c. Screw the chuck onto the headstock spindle.
 - d. Secure the worm screw in the chuck jaws.
 - e. While restraining the headstock spindle with either the handwheel or the spindle lock, screw the piece onto the worm screw.
7. Using the mortise or tenon with the chuck
- a. When faceplate turning, a mortise or tenon is used to reverse the piece of wood.
 - b. The chuck jaws shall not be extended past the maximum reach as specified by the manufacture. 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 above the axis of rotation.
 - a. Scrapers should be positioned at the axis of rotation.
 - b. Gouges and chisels performing shear cuts or planning cuts can be positioned above the axis of rotation.
3. To start up the lathe, turn the speed dial from the stop position to the start position.
4. Press the start button, and wait for the Variable Frequency Drive (VFD) to bring the lathe up to full speed at the lowest setting.
5. Adjust the speed of the lathe using the speed dial. If the lathe starts to vibrate, bring the lathe speed back down below the natural frequency which is evidenced by severe vibration. Do not turn a piece on the lathe above the natural frequency. Recommended lathe speeds as specified by Powermatic are shown below.
6. 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.
7. Larger diameter pieces should be turned at lower speeds than small diameter pieces.
8. Proper methods for cutting with a tool (not a comprehensive list):
 - a. Gouges should be used by rubbing the bevel on the piece of wood. Positioning the tool in this manner prevents "skating" of the blade and reduces the chance for catches.
 - b. Fingernail grind gouges with swept back wings can also be used to make a scraping cut. This cut is performed by using the wings in scaping motion. A finer

cut may be made by lowering the tool handle and presenting the edge at an angle along the piece.

- c. Carbide tools and scrapers should be positioned so the cutting axis is level with the axis of rotation.
 - d. Parting tools can be used to make peeling cuts when spindle turning. The bevel of the parting tool is rubbed, and the handle is raised until the tools starts slicing the wood fibers. The tool is then pushed into the wood to make the cut.
 - e. Parting tools can also be used to make shearing cuts for both spindle and faceplate turning. The parting tool is positioned level with the axis of rotation and plunged into the wood.
9. Advanced tool uses and techniques are not discussed here. Various resources talk in great detail to some of these techniques. If interested in learning about these, please discuss with one of the shop leads or a Spark Makerspace certified lathe instructor.

WOOD TURNING LATHE SPEEDS

DIA. OF WORK	ROUGHING R. P. M.	GEN. CUTTING R. P. M.	FINISHING R. P. M.
Under 2"	1520	3000	3000
2 to 4"	760	1600	2480
4 to 6"	510	1080	1650
6 to 8"	380	810	1240
8 to 10"	300	650	1000
10 to 12"	255	540	830
12 to 14"	220	460	710
14 to 16"	190	400	620

Powermatic Lathe Baseline Configuration

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

Lathe Competencies

Basic User Competencies

Setup

- Sharpening tools on a diamond hone, low speed grinder, or high speed grinder
- Mounting the workpiece between centers

Approved Tool Usage

- Spindle gouges, continental gouges, and parting tools

Operation

- Outside spindle turning

Intermediate User Competencies

Setup

- Sharpening tools on a diamond hone, low speed grinder, or high speed grinder
- Mounting the workpiece between centers, on a faceplate, or in a chuck

Approved Tool Usage

- Spindle gouges, parting tool, spindle roughing gouge
- Bowl gouge, shear scrapers

Operation

- Faceplate turning bowls
- Outside spindle turning

Advanced User Competencies

Setup

- Sharpening tools on a diamond hone, low speed grinder, or high speed grinder
- Changing the bevel or shape of some tooling
- Mounting the workpiece between centers, on a faceplate, or in a chuck
- Setting up a spindle steady for end grain hollowing
- Off-center chuck use

Approved Tool Usage

- Spindle gouges, parting tool, spindle roughing gouge
- Bowl gouge, shear scrapers
- Hollowing tools, coring tools

Operations

- Faceplate turning bowls
- Outside spindle turning
- End grain hollowing
- Segmented turning
- Multi-axis (off-centered) turning
- Hollow forms

Maintenance and Care

- Resurfacing and rebalancing grinding wheels
- Bed way maintenance and waxing