Protohaven

# Wood Lathe

Powermatic Lathe 4224B

## Tool Guide

# Usage Highlights

Wood Lathe Clearance or Class Equivalent Required Before Use

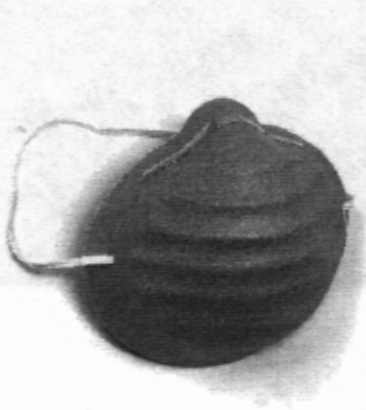
| SAFETY | CARE | CLEANUP |
|---|---|---|
| 1. Ensure that your piece is secure and mounted appropriately | 1. Stop use if you hear scraping or grinding sounds from the machine | 1. Reduce the speed to zero before powering off the machine |
| 2. Wear a face shield and a well-fitted dust mask, especially while sanding | 2. Beware of impacts on the tool rest | 2. Sweep and vacuum both the lathe and floor |
| 3. Immediately stop turning if there is excessive vibration or a piece becomes loose | 3. Submit a maintenance request when needed | 3. Return accessories to the checkout kit |

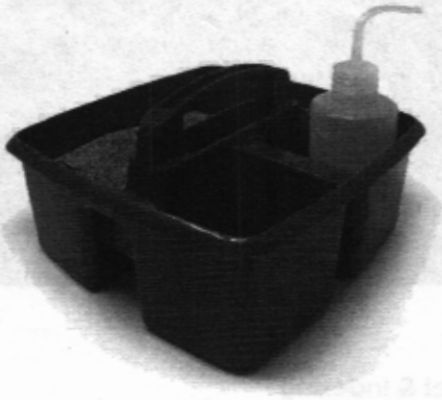
# Equipment

Face Masks & Cleaning Kits are required at all times during the Pandemic.\

At the Lathe, **Hearing Protection**, **Closed-toed Shoes**, and an industrial quality **Face Shield** is also required. A well-fitting **dust mask** is also required for sanding.

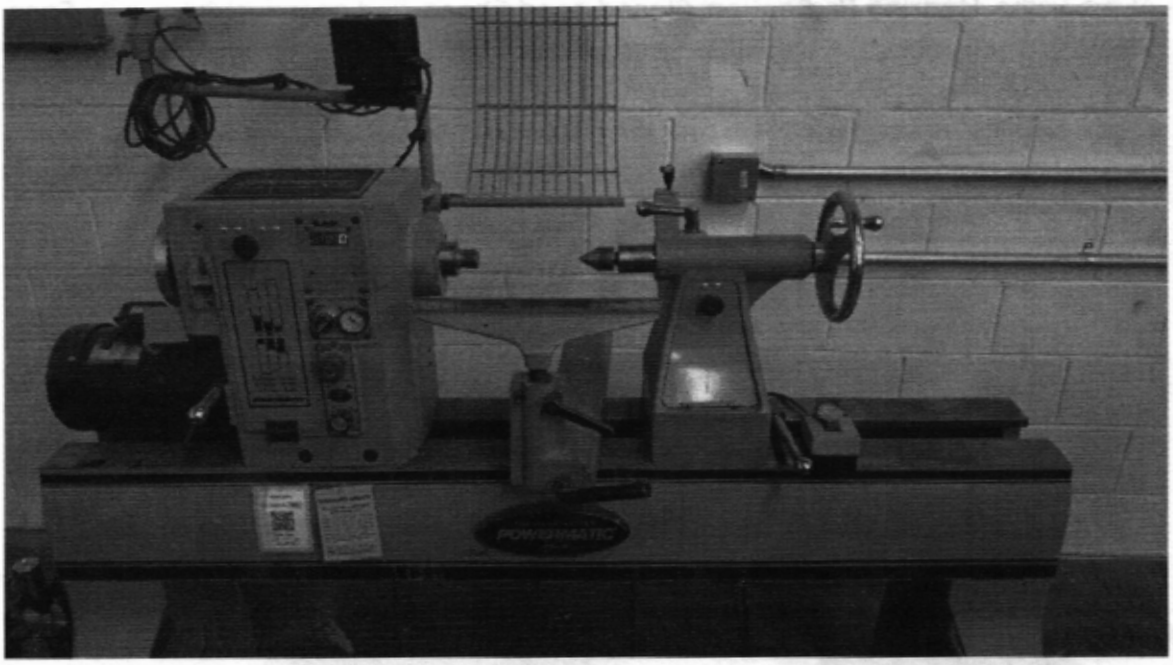
Loose sleeves must be rolled up and long hair and scarves must be tied back. Avoid any dangling drawstrings or other articles of clothing that may come in contact with the lathe.





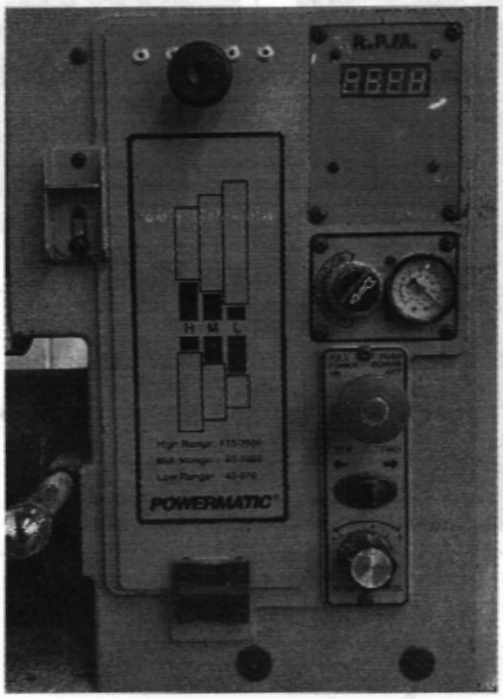
# Tool Anatomy

LATHE ANATOMY



1. **Headstock**
2. **Hand Wheel & Indexing**
3. **Speed control and display**
4. **Spindle Lock**
5. **E-stops**
6. **Motor access and belts**
7. **Tool rest**
8. **Banjo**
9. **Bed**
10. **Tailstock**
11. **Live Center**
12. **Lights**
13. **Chip Guard**
14. **Maintenance Tag** - Manually tracks the usability status with Green/Yellow/Red cards

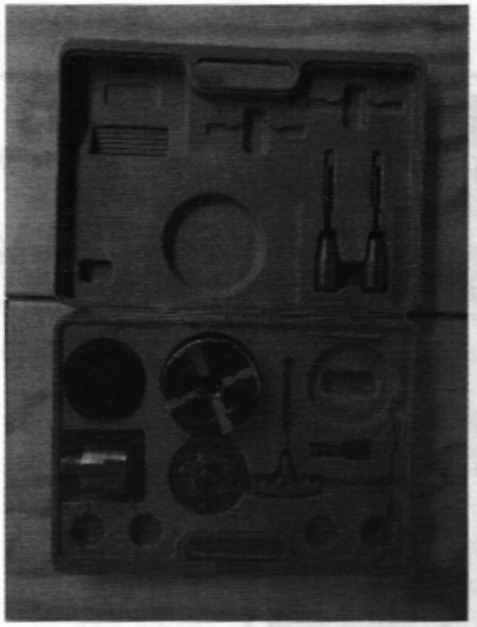
LATHE CONTROLS




1. Emergency Stop —Push in to stop lathe; pull out to start
2. Forward/reverse
3. Speed control—always start lathe with dial rotated all the way counterclockwise

ADDITIONAL EQUIPMENT

| | | |
|---|---|---|
| Drive Center | Chuck and Jaws | Face Plate |



TURNING TOOLS

1. **Carbide: Square, round, or diamond carbide scrapers**

# Tool Safety

Even though there are no cutting blades, the rotational power of the lathe is dangerous. Proper setup is essential to preventing injury.

## COMMON HAZARDS

The most significant safety hazard is **getting a body part caught** in the lathe and being drawn into the machine while it is rotating. This is a potentially deadly hazard and should be carefully avoided by:

- wearing the proper clothes
- positioning the tool rest properly
- using break-away materials when sanding and finishing (e.g. applying finish with a paper towel instead of a cloth rag).

The most common hazard is **material breaking off** of the lathe and impacting the user. **Stop turning immediately** if there is excessive vibration or a piece becomes loose. This hazard can be minimized by:

- wearing appropriate PPE
- properly securing materials
- turning at the proper speed
- carefully turning glue-ups/potentially weakened materials

**Pinching** between the tool rest and the turning tool is also a common hazard, caused when the tool makes contact with the piece before being properly placed on the tool rest. Avoid this by always placing the tool against the tool rest, then feeding it into the turning piece.

While not a primary safety concern, **woodturning catches** can be frightening and result in damage to your workpiece, or in extreme circumstances, can cause a piece to break from the lathe. Catches are a part of woodturning and require time and practice to minimize.

PROHIBITED MATERIALS

| MATERIAL | DANGER |
|---|---|
| Rotted or split wood | Potential to break apart on the lathe |
| Off-center turnings at high speed | Can cause excessive vibration |
| Improper glue-ups | Potential to break apart on the lathe |
| Metal | Inappropriate for the wood lathe; use the metal lathe instead |

# Initial Setup

SETUP CHECKLIST

1. **Check** that both e-stops are engaged
2. **Check** that speed control is set to zero
3. **Slide** the tailstock and banjo away from the headstock
4. **Install** a drive center, faceplate, or chuck
5. **Secure** your turning piece on center, using the tailstock for spindle turning
6. **For spindle turning**, set the brakes on the tailstock arm and lathe bed to lock the tailstock in place. **Otherwise**, move the tailstock to the far end of the lathe bed.
7. **Adjust** the tool rest to the appropriate height, leaving an 1/8" gap between the tool rest and the workpiece
8. **Rotate** the workpiece one full rotation by hand to check for impact on the tool rest
9. **Set** the brakes on the banjo and tool rest.
10. **Place** turning tools within easy reach.
11. **Secure** loose clothing, tie back long hair and scarves, and put on PPE

## COMMON SETTINGS

Turning pieces at the proper speed will help ensure better results with greater safety. In general, use lower speeds for roughing and for long or large diameter work. Turn smaller pieces at higher RPMs and larger pieces at lower RPMs.

This is not an exact science, so always begin turning a piece at close to the recommended RPMs below, increasing speed only if necessary.

**Turning Speed Guidelines**

| Diameter of Workpiece | Roughing RPM | General Cutting RPM | Finishing RPM |
|---|---|---|---|
| Under 2" | 1500 | 3000 | 3000 |
| 2"-4" | 600 | 1500 | 2300 |
| 4"-6" | 450 | 1100 | 1500 |
| 6"-8" | 450 | 600 | 1100 |
| 8"-10" | 450 | 600 | 850 |
| 10"-12" | 450 | 600 | 850 |
| 12"-14" | 450 | 450 | 600 |

# Basic Operation

SPINDLE TURNING CHECKLIST

1. **Center** your workpiece between the drive center or chuck in the headstock, and the live center on the tailstock.
2. **Set** the tool rest such that the cutting edge of your tool is even with the centerline of the workpiece and roughly 1/8th inch from the workpiece.
3. **Lock** the tailstock and tool rest in place and put on PPE
4. **Release** the e-stops and **slowly ramp up** RPMs to the proper speed, standing out of the direct line of rotation for the piece. Watch for vibration, loosening of the piece, or other hazards before beginning turning.
5. Use roughing tools to round the piece, then shape with cutting tools.
6. If sanding, remove the tool rest and run the lathe at a slow speed.
7. If finishing, use a paper towel to apply finish.
8. Use a parting tool to remove the piece, and cut away excess tenons with a hand saw.
9. Clean the lathe station and return all checkout items.

BOWL TURNING CHECKLIST

What is the step-by-step walkthrough of basic operation? How does one mitigate dust/mess during use?

1. Center the faceplate on the bowl blank and secure with sheet metal screws of appropriate size for your bowl.
2. Set the tool rest such that the cutting edge of your tool is even with the centerline of the workpiece and roughly 1/8th inch from the edge of the workpiece.
3. Slide the tailstock to the end of the lathe bed and lock the tool rest in place. Put on PPE.
4. Release the e-stops and slowly ramp up RPMs to the proper speed, standing out of the direct line of rotation for the piece. Watch for vibration, loosening of

the piece, or other hazards before beginning turning.

5. Use roughing tools to round the piece, then shape the outside of the bowl with cutting tools.
6. Cut a tenon or recess in the bottom of the bowl to accept the chuck jaws.
7. Remove the piece and unscrew the faceplate. Flip the bowl and secure in the chuck. Repeat steps 4 and 5 to shape the inside of the bowl.
8. If sanding, remove the tool rest and run the lathe at a slow speed. Exercise extra caution when sanding the inside of the bowl.
9. If finishing, use a paper towel to apply finish. Exercise extra caution when finishing the inside of the bowl.
10. Remove the bowl from the chuck and finish by hand .
11. Clean the lathe station and return all checkout items.

Outside of the basic step-by-step checklist, this is the area to further break down any of the basic steps. For the lasers, that means

# Cleanup

Woodturning generates a lot of wood chips and sawdust. Give yourself extra time, especially before the shop closes, to ensure you have enough time to fully clean your area.

CLEANUP CHECKLIST

1. **Reduce** speed to zero
2. **Power off** both e-stops
3. **Wipe** any finish or other waste from the bed, tool rest, live center, and banjo
4. **Sweep/vacuum** the machine from top to bottom and the surrounding area
5. **Retract** live center into tailstock housing
6. **Remove** the drive center with a rod hammer, or use the spindle lock and wrench to remove a chuck, faceplate, or adapter
7. **Return** all accessories to the check-out box
8. **Clean off** the carbide tools of any chips or sawdust and return them to their case
9. **Push** the tool rest close to the lathe to avoid it catching on anyone as they pass by.
10. **Note** any maintenance needs or concerns on the tag and at protohaven.org/maintenance
11. **Recycle waste** in the single-stream scrap bins

SCRAP BREAKDOWN

There is **one black scrap bin** reserved for wood waste and **several trash bins**. Maintaining these is a shared, communal responsibility.

When you notice a bin is full, it's time to **take it to the dumpster** out back. Feel free to enlist a helping hand.

If you notice valuable material while emptying the bins, use your judgement to **selectively save** a few pieces or **take it home** for your personal use.

MAINTENANCE REQUESTS

1. **Update** the physical Maintenance Tag at the machine
   - **Green** can be used without issue
   - **Yellow** can be used with caution
   - **Red** cannot be used without hazard to either the user or the equipment
2. **Record** issues at protohaven.org/maintenance. This notifies our staff and volunteer maintenance crew of any issues

# Troubleshooting

| Common Issues | Possible Causes | Resolutions |
|---|---|---|
| Lathe will not power on. | One or more estops are activated. | Set the lathe speed to zero, then check that the power cord is fully plugged in and that all estops are released. |
| | The inverter is overheated | Clear chips away from the inverter and allow the inverter to cool. Power cycle the lathe and inverter if necessary. |
| Lathe powers on but spindle does not rotate | Spindle lock or indexing pin is engaged. | Set the lathe speed to zero, then check that the spindle lock and the indexing pin are both disengaged. |
| | Belt is worn or untensioned | Check the belt for wear, breakage, and proper tensioning. |
| Sticky movement of the banjo or tailstock. | Debris buildup on the lathe bed. | Clean the bed of any debris or built-up residue, then apply paste wax to the lathe bed to improve movement. |
| Chatter or vibration in the workpiece piece | Loose, cracked, or off-center piece | Stop turning and check the piece for breakage. Small cracks can be repaired with CA glue; larger cracks or breaks require fully-cured wood |

| | | |
|---|---|---|
| | | glue, or may require restarting with a new piece.<br><br>If the turning is off-center, slow the speed down to reduce vibration. |

# Special Setups

A wide variety of setups are available for use with the lathe, including, but not limited to;

- Using the indexing pin to route flutes along a spindle
- Setting a reference behind the turning to make copies
- Using a vacuum setup for platters
- Using a cole jaw or jam chuck for bowls and vases
- Using a screw chuck to secure a small bowl
- A coring system for cutting bowls
- Off-center turning
- Router lathe duplication

All of these processes will rely on the same basic principles outlined above: secure workholding, proper PPE, sharp and appropriate tools, and correct turning speeds.

2. **HSS: Bowl and Spindle Gouges, Skew Chisels, Scrapers, Parting Tool**

# Additional Resources

Tool Manual: http://content.powermatic.com/assets/manuals/1794224B_man_EN.pdf

Turners Anonymous - Local wood turning organization
www.turnersanonymous.org

https://www.finewoodworking.com/2009/04/01/safety-manual-woodworking-lathe

Powermatic Lathe Website:
http://www.powermatic.com/us/en/p/4224b-lathe-with-lamp-kit/1794224K

Powermatic 4224B Manual:
http://content.powermatic.com/assets/manuals/1794224B_man_EN.pdf

Turners Anonymous, local resource for turning demos, classes, and materials:
www.turnersanonymous.org

Worth The Effort Woodworking, a great YouTube resource for woodturning
Four Cuts video: https://www.youtube.com/watch?v=KXzEjCorWO0