

**Woodworking  
Tools**

# Lathes



**Teacher's Guide**

**SHOPWARE**

## Introduction

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This Teacher's Guide provides information to help you get the most out of *Lathes*, part of the *Woodworking Tools* series. The contents in this guide will allow you to prepare your students before they use the program, assist them as they navigate through the content, and present follow-up activities to reinforce the material's key learning points.

*Woodworking Tools* is a 16-part series of programs that address the safe operation of the most popular and useful types of woodworking tools. Each program delves into a different tool, including its purpose and associated parts. It teaches students how to choose the proper blade or bit for the task and perform the various woodworking operations that can be accomplished with a particular tool. The 16 videos in this series enable and encourage students to safely and creatively use power tools to their maximum proficiency.

*Lathes* is a 14-minute video targeted to teenagers and young adults. Its content is appropriate to such curriculum areas as Technology Education, Trade, and Industrial Education. In addition, the information presented in *Woodworking Tools* could also be presented in vocational/technical schools or adult education courses that focus on shop, carpentry, woodworking, or construction education and research.

## Learning Objectives

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After watching each video program in the series, students will be able to:

- Identify which tools are best for which job in the wood shop.
- Understand how to safely operate a variety of woodworking tools.
- Demonstrate how to safely clean, maintain, and sharpen a variety of woodworking tools.
- Explain how to change and adjust bits, blades, and other elements of a variety of woodworking tools.

## Educational Standards

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The *Lathes* video program correlates with the following standards:

- The competency standards for Core Curriculum and Carpentry from the National Center for Construction Education & Research;
  - The State Standards of Essential Knowledge and Skills for Trade and Industrial Education (Construction-Maintenance Systems, High School) for the State of Texas;
  - The Technology Education Standards (Tools, Resources, and Technological Processes) for the State of New York.
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- 2.0 Career Cluster: Architecture and Construction Careers in designing, planning, managing, building and maintaining the built environment. (*Competency Standards for Core Curriculum and Carpentry from the National Center for Construction Education & Research.*)

- The student knows the function and application of the tools, equipment, technologies, and materials used in construction carpentry. The student is expected to safely use hand and power tools and equipment commonly employed in carpentry. The student demonstrates knowledge of new and emerging technologies that may affect construction carpentry. (*Texas State Standards on Building Carpentry: Essential Knowledge and Skills for Trade and Industrial Education—Construction-Maintenance Systems, High School*)
- The student knows the function and application of the tools, equipment, technologies, and materials used in mill and cabinetmaking. The student is expected to safely use hand and power tools and equipment commonly employed in mill and cabinetmaking; properly handle and dispose of humanly and/or environmentally hazardous materials used in mill and cabinetmaking; utilize the proper procedures in sawing, planing, shaping, turning, boring, mortising, and sanding various types of woods; demonstrate knowledge of numerically-controlled and computer-controlled production devices; and demonstrate knowledge of new and emerging technologies that may affect mill and cabinetmaking. (*Texas State Standards on Mill and Cabinetmaking: Essential Knowledge and Skills for Trade and Industrial Education—Construction-Maintenance Systems, High School*)
- The student applies technological knowledge and skills to design, construct, use, and evaluate products and systems to satisfy human and environmental needs. The student uses a variety of materials and energy sources to construct things; understands the importance of safety and ease of use in selecting tools and resources for a specific purpose; and develops basic skills in the use of hand tools. (*New York State Standards on Technology Education—Tools, Resources, and Technological Processes*)

## Program Summary

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Regardless of whether a student wants to gain an overall understanding of the myriad of wood-working tools available in today's wood shops, or just focus on one specific tool's features and capabilities, the *Woodworking Tools* series will be an invaluable visual learning aid. By emphasizing safety issues, the series allows students to understand not only which tools are best for each kind of job in the wood shop, but also how to operate, clean, maintain, and sharpen the wood-working tools for maximum efficiency and safety.

The *Woodworking Tools* video program series consists of sixteen titles:

- Table Saws
- Cutoff Saws
- Radial Arm Saws
- Band Saws and Scroll Saws
- Routers
- Jointers
- Planers
- Lathes
- Power Nailers
- Drill Presses

- Drills and Drivers
- Stationary Sanders
- Circular Saws
- Jigsaws and Reciprocating Saws
- Rotary Tools, Bench Grinders, and Sharpeners
- Building a Workcenter

*Lathes* presents an overview of the major components of the lathe, the steps to follow for preparing and mounting the material, and the procedures for operating the lathe safely.

## **Main Topics**

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### **Topic 1: Introduction**

The program's host, Pete Bilotta, introduces the viewer to a unique power tool that doesn't require blades, bits, or abrasives to perform its intended function—the lathe.

### **Topic 2: Overview**

The primary components of both stationary models and benchtop units are discussed, as are the turning tools the operator uses on workpieces.

### **Topic 3: Mounting the Workpiece**

In this section, the viewer is shown how to prepare and mount the material for spindle turning.

### **Topic 4: Safe Operating Techniques**

The host demonstrates the basics in tool control and cutting techniques.

### **Topic 5: Key Points**

The program concludes with an overview of the key points that have been discussed.

## **Fast Facts**

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- OSHA regulations require the following when working with a lathe: The tool rest should be set slightly below the stock's center line and as close as possible to the work to prevent tools from being caught or thrown. The more cylindrical, the easier the stock is to turn and the less likely it is to grab a tool or jump out of the lathe due to imbalance. To prevent the stock from slipping, imbed centers properly and clamp the tailstock securely to keep it tight. The guards on lathes will help contain the workpiece if it separates from its anchorage.
- A lathe is a machine tool which spins a block of material so that when abrasive, cutting, or deformation tools are applied to the block, it can be shaped to produce an object which has symmetry about an axis of rotation. A lathe must not be confused with lath, a thin piece of wood.

- Lathes are used in woodturning, metalworking, metal spinning, and glassworking. Examples of objects that can be produced on a lathe include candlestick holders, cue sticks, table legs, bowls, baseball bats, crankshafts, and camshafts.
- The earliest illustration of a lathe is from a well-known Egyptian wall relief carved in stone in the tomb of Petosiris dated some 300 BC. One man provides the power by pulling backwards and forwards on a cord or leather strap wrapped around the workpiece while the turner sits opposite with his chisel on the tool rest.
- A lathe is designed simply to rotate a piece of stock and does not perform any type of cutting function. Because of this, a lathe is technically known as a woodturning machine, rather than a woodworking machine.
- In addition to turning tools, inside and outside calipers are essential for measuring workpiece diameters.
- When using the parting tool to establish the ends of the baluster, be sure not to cut through the stock completely with the parting tool, to prevent personal injury and/or property damage.
- Power is transferred via a belt drive, with a pair of continuously variable pulleys providing the machine's total speed range, which typically falls between 350 and 3,000 rpm. To provide variable speeds on less expensive lathes, a series of stepped pulleys is used.
- Once the layout lines have been cut, the profile is cut using a detail gouge, and then sculpted with the appropriately shaped scrapers.
- The tailstock supports the opposite end of the workpiece and has a large handwheel to control the fore and aft movement of its spindle. To dislodge the drive center from the headstock, a long rod is normally provided with the machine.

## Vocabulary Terms

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**belt-drive system:** A system in which power is transmitted by a continuous flexible belt.

**calipers:** A tool that is essential for measuring workpiece diameters.

**chisel:** A metal tool with a sharp beveled edge, used to cut and shape stone, wood, or metal.

**compass:** A V-shaped device for describing circles or circular arcs and for taking measurements, consisting of a pair of rigid, end-hinged legs, one of which is equipped with a pen, pencil, or other marker and the other with a sharp point providing a pivot about which the drawing leg is turned.

**full-face shield:** A shield that provides the highest level of eye protection from flying chips and debris.

**headstock:** A nonmoving part of the lathe that contains the lathe's drive mechanism.

**gouge:** A tool with a curved cutting edge used in a variety of forms and sizes for carving hollows, rounds, and sweeping curves.

**jack plane:** A general-purpose bench plane, used for general smoothing of the edges and sizing of wood. Jack planes are about 15 inches long, and the blade usually has a moderately curved edge.

**kerf:** A groove or notch made by a cutting tool.

**lathe:** A workshop power tool designed to rotate a piece of stock—it does not perform any type of cutting function. Lathes come in large stationary models as well as benchtop units, commonly called mini-lathes. All lathes consist of four primary components, including the headstock, tailstock, bed, and tool rest.

**lathe bed:** Connecting the head and tailstocks is the lathe bed. Typically made of cast iron, the bed also serves as a rail for the adjustable tool rest, which as its name implies, supports the blade of a turning tool.

**live center:** Live centers are used to hold or support a workpiece in a lathe or other machine tools—often between the headstock and tailstock. Live centers revolve with the work, while dead centers are stationary.

**lockpin:** A spring-loaded pin that can be engaged to lock the spindle into place.

**parting tool:** A tool designed primarily for marking out the layout lines from a template.

**roughing gouge:** One of the most common turning tools, it is used to remove large amounts of material quickly. As the name indicates, the roughing gouge leaves behind a rugged surface.

**rpm:** Revolutions per minute.

**safety glasses:** Safety glasses are usually made with shatter-resistant plastic lenses to protect the eyes from flying debris. Although safety lenses may be constructed from a variety of materials that vary in impact resistance, standards suggest that they maintain a minimum 1 mm thickness at the thinnest point, regardless of material.

**scraper:** Any of various hand tools for scraping.

**skew:** A type of chisel designed to smooth the stock by acting like a hand plane.

**spindle:** A part of the lathe to which various plates are attached. These plates change depending on what is being turned. The spindle is threaded on the outside to accept various accessories. Locking the spindle makes it easier to remove attached accessories.

**spindle turning:** A common woodturning method which employs a lathe. Also known as “turning between centers,” it involves a piece of wood on a lathe being turned on its center axis between the lathe’s headstock and tailstock. Spindle turning is used to create long, thin objects such as chair and table legs and candlesticks.

**square end chisel:** A tool that is moved across the stock laterally in small increments, and then moved across the tool rest gradually to remove the ridges.

**tailstock:** Supporting the opposite end of the workpiece is the tailstock, which has a large hand-wheel to control the fore and aft movement of its spindle.

**tapered staircase baluster:** One of the supporting posts of a handrail.

**tool rest:** A small metal bar on which the material is rested while using the lathe.

**turning tools:** Essentially a woodturner’s chisels, but unlike a chisel, a turning tool has a longer blade fitted with an even longer handle.

**woodworking:** The forming or shaping of wood to create, restore, or repair useful or decorative objects. Carpentry, joinery, and cabinetmaking are specialized woodworking crafts, providing a range of products from wooden structures and furniture to wooden toys.

## **Pre-Program Discussion Questions**

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1. How does a lathe differ from all other woodworking machines?
2. Does anyone know what the most common woodturning task is?
3. Can you explain the difference between a turning tool and a chisel?

## **Post-Program Discussion Questions**

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1. What are the two types of lathes available, and what are their main components?
2. How are power and variable speeds provided on a lathe?
3. Name some important safety guidelines to keep in mind when using a lathe.
4. Explain the proper grips you should use when working with a lathe. Also, where should the index finger be placed in order to guide the tool along the workpiece?
5. If you notice any excessive vibration with the lathe running under no-load, for what three conditions should you check?

## Individual Student Projects

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- Have your students create a paper, presentation, or video that describes the various turning tools available, how they are used properly, and for what tasks they are best suited.

## Group Activities

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- As a class, ask your students to identify and demonstrate six or more ways to properly position their body, feet, hands, and fingers when using a lathe.
- Divide your class in half. Group A should discuss the steps necessary to prepare material for a lathe, while Group B should discuss the steps necessary to mount the material on a lathe. Then, have each group write down and practice the steps necessary to complete the task, concluding by demonstrating the safe and proper techniques for the other group.
- In small groups, ask your students to practice using the following turning tools to gain an understanding of how the workpiece is affected:
  - Roughing gouge
  - Detail gouge
  - Skew
  - Square end chisel
  - Parting tool
  - Inside calipers
  - Outside calipers
  - Flat scraper

## Internet Activities

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- Have your students research possible projects on the Web sites listed later in this guide, locating steps in the project that call for the use of lathes. This will provide practical applications for the procedures that are shown in the video.



## Assessment Questions

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Q1: Which two turning tools allow you to create a smooth finish surface?

Q2: What is another name for spindle turning?

Q3: Matching exercise:

1. Serves as a rail for the adjustable tool rest.
2. Contains the lathe's drive mechanism.
3. Has a large handwheel to control the fore and aft movement of its spindle.
4. Is threaded on the outside to accept various accessories.
  - a. headstock
  - b. lathe bed
  - c. spindle
  - d. tailstock

Q4: If you notice any excessive vibration with the lathe running under no-load, for what three conditions should you check?

Q5: Why is it important not to stand too far from the machine?

Q6: Choose the correct answer: When making rough cuts, use an [underhand/overhand] grip to control the blade. For precision cutting, use an [underhand/overhand] grip with your thumb on top of the blade.

Q7: How can you control the depth of cut?

Q8: What is important to remember in order to avoid damaging a lathe equipped with continuously variable pulleys?

Q9: What turning tool is designed to mark out the layout lines from a template?  
a) Roughing gouge      b) Skew      c) Parting tool      d) Calipers

Q10: How do you prevent sandpaper from tearing when sanding a piece on the lathe?

## Assessment Questions Answer Key

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**Q1: Which two turning tools allow you to create a smooth finish surface?**

**A1:** A skew, and a square end chisel. The skew is designed to smooth the stock by acting like a hand plane. The same finish surface can be achieved by using a square end chisel.

**Q2: What is another name for spindle turning?**

**A2:** It is also referred to as “turning between centers.”

**Q3: Matching exercise:**

1. Serves as a rail for the adjustable tool rest.
2. Contains the lathe’s drive mechanism.
3. Has a large handwheel to control the fore and aft movement of its spindle.
4. Is threaded on the outside to accept various accessories.

a. headstock      b. lathe bed      c. spindle      d. tailstock

**A3:**

1. b. The lathe bed serves as a rail for the adjustable tool rest.
2. a. The headstock contains the lathe’s drive mechanism.
3. d. The tailstock has a large handwheel to control the fore and aft movement of its spindle.
4. c. The spindle is threaded on the outside to accept various accessories.

**Q4: If you notice any excessive vibration with the lathe running under no-load, for what three conditions should you check?**

**A4:** You should check for these conditions: that the lathe speed is too high, that the workpiece is incorrectly aligned, and/or the workpiece is unbalanced.

**Q5: Why is it important not to stand too far from the machine?**

**A5:** When standing too far from the machine, the operator is forced to lean into the work, which can cause fatigue and lead to a loss of tool control and potential injury.

**Q6: When making rough cuts, use an [underhand/overhand] grip to control the blade. For precision cutting, use an [underhand/overhand] grip with your thumb on top of the blade.**

**A6:** When making rough cuts, use an **overhand** grip to control the blade. For precision cutting, use an **underhand** grip with your thumb on top of the blade.

**Q7: How can you control the depth of cut?**

**A7:** Your hand allows you to control the depth of cut by positioning the tool correctly and then pinching the tool between your thumb and index finger.

**Q8: What is important to remember in order to avoid damaging a lathe equipped with continuously variable pulleys?**

**A8:** Never change speeds unless the machine is running.

**Q9: What turning tool is designed to mark out the layout lines from a template?**

a) Roughing gouge      b) Skew      c) Parting tool      d) Calipers

**A9:** (c)

**Q10: How do you prevent sandpaper from tearing when sanding a piece on the lathe?**

**A10:** To prevent the paper from tearing, the piece should be folded in half.

## Additional Resources

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### About.com: Woodworking

<http://woodworking.about.com>

### Encarta Encyclopedia: Woodworking

[http://encarta.msn.com/encyclopedia\\_761570306/Woodworking.html](http://encarta.msn.com/encyclopedia_761570306/Woodworking.html)

### Inside Woodworking: Free Online Woodworking Magazine

<http://www.inside-woodworking.com/tools/PowerTools.html>

### WoodNet.net: The Woodworker's Online Resource

<http://www.woodnet.net/tips/index>

### Woodworker's Information and Plans for Woodworkers: WOOD Magazine

<http://www.woodmagazine.com>

### Woodworking Shop Safety Tips

[http://www.wood-worker.com/articles/shop\\_safety.htm](http://www.wood-worker.com/articles/shop_safety.htm)

### Woodzone.com

<http://www.woodzone.com/tips.htm>

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### Multimedia Woodshop Safety

- Windows/Macintosh CD-ROM #20466

*Multimedia Woodshop Safety* uses video and animation sequences, along with still photos, to provide an overview of shop practices including stationary woodworking equipment, portable power and hand tools, as well as material storage and handling. In addition to the usual shop safety practices, the user is also reminded of the hazards of horseplay, loose clothing, and lack of concentration on the job. As the viewer moves into the arenas of stationary woodworking equipment and power tools, he is guided through an inspection for evidence of loose fittings, bad wiring and/or grounding, and poor tool use of lathe, drill press, and band and bench saws. The program segment dealing with materials storage offers ideas which facilitate safety and accessibility. Issues of wood stacking, container labeling, chemical mixing, hazardous materials handling, and lighting are addressed. Part of the Series *Shop Safety*. A Shopware Production. ©1996.

### Portable Power Woodworking Tools

- VHS/DVD-R #26093
- 9-part series

This series features the most popular and useful types of woodworking tools. Students learn the safe operation of each tool, the different models and their purpose, the parts, choosing the proper blade or bit for the task, and the various woodworking operations that can be accomplished

with each tool. A Meridian Production. The series includes: Biscuit Joiner | Circular Saws | Drills | Jigsaws | Power Plane | Reciprocating Saw | Router Bit Magic | Routers | Sanders. (14-20 minutes each)

### **Safety First: Woodworking Safety**

- VHS/DVD-R #14464
- Closed captioned

Covers the most common hand tools and their proper applications. The importance of a clean working environment, preventive maintenance on machinery, and using the correct tool for each job is covered in detail. Also covered are how to check power cords for defects, sharpening and replacing saw blades, and correct body position when using equipment. Part of the series *Safety First: Shop Safety*. A Cambridge Educational Production. (30 minutes) ©1995.

### **Woodworking**

- VHS/DVD-R #26839
- 19-part series

This comprehensive library of low-cost woodworking videos provides all of the information your students need in the world of woodworking, from types of wood, to cutting techniques, to workshop safety. Each video covers a specific topic clearly and comprehensively, giving enormous flexibility in the classroom. Use videos to complement your lesson plans, to introduce new material, to review safety procedures, or as a handy reference for students who need additional help. A Meridian Production. The series includes: Cabinet Doors and Hinges | Cabinet Drawers | Chamfers and Bevels | Crosscutting | Cutting Curves and Circles | Dados and Rabbets | Gluing and Clamping | How to Safely Build with Pressure Treated Wood | Joinery | Measuring Hardwoods | Miter Joints | Outdoor Uses of Pressure Treated Wood | Preparing Hardwood to Use | Ripping | Safety in the Workshop | Smoothing Wood | Uses of Hardwood | Using Veneers | What Is Hardwood. (8-14 minutes each)

### **Woodworking Equipment Safety**

- VHS/DVD-R #20422
- 15-part series
- Closed captioned

This series of fifteen live-action videotapes shows students the proper safety procedures for the set-up and use of stationary and portable woodworking equipment. Viewers are guided through the step-by-step procedures for using safety guards, clamping devices, protective equipment, and more. An excellent series for introducing new students to the joys of safe woodworking and also as a refresher course for experienced craftsmen. A Shopware Production. The series includes: Router Safety | Portable Drill Safety | Saber Saw Safety | Portable Circular Saw Safety | Portable Sander Safety | Drill Press Safety | Scroll Saw Safety | Shaper Safety | Wood Lathe Safety | Jointer Safety | Thickness Planer Safety | Band Saw Safety | Radial Arm Saw Safety | Table Saw Safety | Disk/Belt Sander Safety. (13-33 minutes each)

## **Woodworking Power Tools**

- VHS/DVD-R #26837
- 5-part series
- Closed captioned

This series of live-action videotapes details both basic and advanced operational techniques for each of the five most important and useful woodworking power tools. Clear, sharp, color video graphically portrays the proper operation of each machine, and the correct use of its associated accessories. Close-ups detail how each machine performs cutting, forming, or shaping operations. Shaping procedures and considerations are stressed throughout, emphasizing the proper use of each machine's safety guards. Personal safety procedures and equipment are also thoroughly covered, along with proper housekeeping methods which can help assure that accidents do not occur. This series is recommended for all woodworking students as well as the home craftsman. A Meridian Production. The series includes: Band Saw: Operation & Safety | Jointer/Surfacer & Accessories: Operation & Safety | Radial Arm Saw: Operation & Safety | Table Saw & Accessories: Operation & Safety | Wood Lathe & Accessories: Operation & Safety. (14 minutes each)

## **Woodworking Tools**

- VHS/DVD-R #26836
- 7-part series

This series explains the basic operation of each woodworking tool, how each is adjusted, how blades are changed, and how each is used for specialty operations. Safety is stressed throughout. A Meridian Production. The series includes: Band Saw | Drill Press | Jointer | Planer | Shaper | Table Saw: Safety and Basic Operation | Table Saw: Specialty Operations. (7-26 minutes each)



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