

**Woodworking
Tools**

Jointers



Teacher's Guide

SHOPWARE

Introduction

This Teacher's Guide provides information to help you get the most out of *Jointers*, 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.

Jointers is an 18-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

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

The *Jointers* 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

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

Jointers presents a comprehensive review of the features, controls, and capabilities of jointers and biscuit (plate) jointers, and shows students the techniques for safely operating, maintaining, and adjusting the tool.

Main Topics

Topic 1: Introduction

The program's host, Pete Bilotta, introduces the jointer, which is used to make perfectly squared edges, and the biscuit jointer, which is used to provide strong joints.

Topic 2: Overview: Jointers

The second section provides an in-depth overview of the jointer's features and controls.

Topic 3: Overview: Biscuit (Plate) Jointers

The host continues by exploring the features, controls, and capabilities of biscuit jointers, also known as plate jointers.

Topic 4: Safe Operating Techniques: Jointers

In this section, the student learns how to safely perform three basic operations using the jointer: edge jointing, jointing end grain, and surfacing.

Topic 5: Safe Operating Techniques: Biscuit (Plate) Jointers

One of the most common uses for biscuit jointers—making edge-to-edge joints for a tabletop—is highlighted and demonstrated.

Topic 6: Maintenance and Adjustments

The host looks at several maintenance and adjustment procedures that help insure jointers deliver clean and accurate cuts, including checking the alignment of the outfeed table and knives, checking the accuracy of the infeed table depth gauge, and changing the blade on a biscuit jointer.

Topic 7: Key Points

The program concludes with a high-level overview of the key points that have been discussed.

Fast Facts

- Many Occupational Health and Safety Regulations require that a hand-fed wood jointer must have a self-adjusting guard over the cutting head on the working side and a guard over the portion of the cutting head behind the fence.
- Most biscuits are made from compressed beech shavings stamped out into an oval pattern. Glue in the joint soaks into the biscuit causing it to swell and tighten up in the joint.
- The most common joints are edge-to-edge (e.g., table tops), miter joints (e.g., picture frames), butt joinery (end to end), corner joints (e.g., drawers), and T joints (e.g., a book shelf).
- Biscuits should be stored in a clean, dry container as they can absorb humidity from the air and swell.
- When a jointer starts to burn or smoke the wood in the slots, it indicates that it is time to sharpen or replace the blade.
- Finish quality improves as cuts per minute increases. For example, a jointer with three knives operating at 4000 rpm produces 12,000 cuts per minute and a finer finish than a machine with only two knives operating at 4500 rpm, with which only 9,000 cuts per minute are possible.
- The three most common sizes of biscuits are: #0 ($\frac{5}{8}$ " wide X $1\frac{3}{4}$ " long); #10 ($\frac{3}{4}$ " wide X $2\frac{1}{8}$ " long); and #20 (1" wide X $2\frac{3}{8}$ " long). All of these biscuits are .148" thick. Some manufacturers are now offering biscuit jointers that use mini biscuits or max biscuits.
- When jointing end grain, it is essential to make two passes in order to prevent tearout.
- When flattening a warped board, always lay the board with the concave side down. This position provides the best stability and insures that the final cut will result in a perfectly flat surface.
- As the cutter head spins, it forms a cutting circle that must be in the same plane as the outfeed table. If the outfeed table is too low, the material will not be supported during the pass. When the table is too high, the material must be forced through the cutter head. Both conditions are potentially unsafe and may result in a damaged workpiece.

Vocabulary Terms

belt and pulley system: A system in which power transmission is achieved by specially designed belts and pulleys.

bevel: Two surfaces meeting at an angle other than 90°.

biscuits: Flat, football-shaped slices of compressed birch or beechwood. Once glued and inserted between the slots, the biscuit forms an exceptionally strong joint that is easy to align. Examples of biscuit types include max biscuits and mini biscuits.

biscuit jointer: Also known as a plate jointer, it is basically a small plunge saw designed to join two pieces of wood by cutting adjoining slots, which accept biscuits, into the two pieces of wood.

chamfer: A flat surface made by cutting off the edge or corner of a block of wood or other material. A furrow or groove, as in a column.

cuts per minute (cpm) rating: When comparing jointer performance, the machine's cuts per minute rating is more important than the motor's rpm. This is because finish quality improves as cuts per minute increases.

cutter head: A heavy steel cylinder with slots that hold a jointer's knives, usually two slots for benchtop models and three slots for stationary machines.

dust collection port: Since jointers create lots of dust, a dust collection port is located on the base of the machine to help improve breathing and visibility.

feeler gauge: A simple tool used to measure thicknesses and the clearance between two parts.

fence: A jointer uses a fence to keep the work perpendicular to the cutter head and to adjust the width of the cut. The fence can also be tilted for making angular cuts, such as bevels and chamfers. This is done by loosening a lever and rotating the fence to the desired angle.

guards: To protect the operator from the rotating cutter head, a spring-loaded guard is mounted to a platform alongside the tables. To conceal the knives when the fence is positioned for narrow width cuts, a rear guard is used.

induction motor: Designed for heavy-duty use, induction motors are relatively quiet due to their brushless design.

infeed table: The table that supports the material as it is fed through the cutter head. To vary the depth of cut, the infeed table adjusts downward.

jointer: A tool or machine used to make perfectly squared edges, to make joints, or for surfacing. An inverted plane, it consists of a cutter head mounted between two tables.

kickback: Kickback occurs when the wood contacts the back half of the blade. Under this condition, the material can be thrown backwards towards the operator with considerable force.

mortise: A recessed cavity in a piece of wood used to receive hardware or another piece of wood.

outfeed table: The table that receives the finished piece. A scale below the infeed table indicates the desired cutting depth.

power switch: Jointers are equipped with large, clearly marked power switches. Benchtop models typically use a paddle or rocker switch for the ON/OFF function, while stationary machines usually have large push-button switches marked START and STOP.

push blocks: Push blocks help keep the material flat on the table and hands a safe distance from the jointer's cutter head.

rabbet joint: Also known as rebate, it is a recess or groove cut into the edge of a piece of machineable material, usually wood. When viewed in cross-section, a rabbet is two-sided and open to the edge or end of the surface into which it is cut.

revolutions per minute (rpm): A unit of frequency, commonly used to measure rotational speed, in particular in the case of rotation around a fixed axis. It represents the number of full rotations something makes in one minute.

surfacing: A process used to smooth a piece of stock, reduce its thickness, or remove warping.

tearout: The jagged finish that can result when planing against the grain.

tenon joint: A projection on the end of a piece of wood shaped for insertion into a mortise to make a joint.

universal motor: A motor that can run on either AC or DC voltage, which saves space and reduces bulk for portability.

Pre-Program Discussion Questions

1. What is the difference between a jointer and a biscuit jointer?
2. Try to identify the differences between benchtop and stationary jointers.
3. Why do you think it is important to remove shavings and debris when using a jointer?
4. What are biscuits and why are they important?
5. Can you think of four reasons why an operator would set the depth of cut to the minimum required for obtaining a square edge or a flat surface?

Post-Program Discussion Questions

1. What kind of motor drives each type of jointer and biscuit jointer?
2. What is the name of the component that holds the knives, and how many knives does it hold for each type of jointer?
3. On what is the advertised size of a jointer based?
4. When comparing jointer performance, which is more important—cpm or rpm? Why?
5. What is the maximum cutting depth for typical benchtop jointers? Why is the depth significant?

Individual Student Projects

- Have each student practice how to use biscuits and the biscuit jointer to create a strong joint.

Group Activities

- Divide the class into small groups, then assign each a cutting width or an angular cut such as a bevel or chamfer. Have groups practice setting the width and angle using the fence and/or tilt scale. After the jointer has accumulated shavings and debris, reinforce why it is important to remove this, then have groups do so.
- Divide your class into small groups and assign them one of the following three basic operations to perform using a jointer: Joint an edge; Joint end grain; Surface a board. Have each group create a poster of the step-by-step procedure, practice the steps and safety considerations, then present the procedure, start to finish, to the rest of the class.
- Divide your class into small groups and assign them one of the following maintenance/replacement/adjustment activities:
 - Check the alignment of the outfeed table and knives on a jointer
 - Check the accuracy of the infeed table depth gauge on a jointer
 - Make an edge-to-edge joint using a biscuit jointer
 - Replace the blade on a biscuit jointer

Have each group create a poster of the step-by-step procedure, practice the steps and safety considerations, then present the procedure, start to finish, to the rest of the class.

Internet Activities

- Ask your students to research possible projects on the Web sites listed later in this guide, locating steps in the project that call for the use of jointers and/or biscuit jointers. This will provide practical applications for the procedures that are shown in the video.

Assessment Questions

- Q1: *Fill in the blanks with either "universal" or "induction":* A biscuit jointer is powered by a(n) _____ motor. In a benchtop jointer, the cutter head is driven by a(n) _____ motor. On a stationary jointer, the cutter head is driven by a(n) _____ motor along with a belt and pulley system.
- Q2: What is the most material that should be removed in a single pass when using a benchtop jointer?
- Q3: On a jointer, how do you measure the width of cut?
- Q4: True or False: Finish quality is reduced as cuts per minute increases.
- Q5: What are three common presets for biscuit jointers, and for what thickness of material are they used?
- Q6: Name four important safety tips to remember when using a jointer.
- Q7: When flattening a warped board, which way should you lay the board?
- Q8: How are biscuits usually spaced?
- Q9: What is considered the most important adjustment you can make on a jointer?
- Q10: When checking a table for flatness, you find a gap exceeding $^{10}/_{1,000}$ of an inch. What does this indicate?

Assessment Questions Answer Key

Q1: Fill in the blanks with either "universal" or "induction": A biscuit jointer is powered by a(n) _____ motor. In a benchtop jointer, the cutter head is driven by a(n) _____ motor. On a stationary jointer, the cutter head is driven by a(n) _____ motor along with a belt and pulley system.

A1: A biscuit jointer is powered by a **universal** motor. In a benchtop jointer, the cutter head is driven by a **universal** motor. On a stationary jointer, the cutter head is driven by an **induction** motor along with a belt and pulley system.

Q2: What is the most material that should be removed in a single pass when using a benchtop jointer?

A2: Benchtop jointers typically have a maximum cutting depth of $\frac{1}{8}$ " inch since $\frac{1}{8}$ " inch is the most that should be removed in a single pass.

Q3: On a jointer, how do you measure the width of cut?

A3: The width of cut is measured between the outside edge of a knife and the inside of the fence.

Q4: True or False: Finish quality is reduced as cuts per minute increases.

A4: This statement is false. Finish quality is improved as cuts per minute increases.

Q5: What are three common presets for biscuit jointers, and for what thickness of material are they used?

A5: 0 is used for materials up to a $\frac{1}{2}$ " thick; 10 is used for $\frac{1}{2}$ " to $\frac{3}{4}$ " thick stock; and 20 is used for materials more than $\frac{3}{4}$ " thick.

Q6: Name four important safety tips to remember when using a jointer.

A6: Never force the material or advance it too quickly; never let your hands pass through the cutting area; never operate the machine without the cutter guard in place and working properly; and never use a jointer for surfacing without using push blocks.

Q7: When flattening a warped board, which way should you lay the board?

A7: Always lay the board with the concave side down to provide the best stability and insure that the final cut will result in a perfectly flat surface.

Q8: How are biscuits usually spaced?

A8: Typically, biscuits are spaced every 6 to 10 inches, with the centerline of the outside biscuits set 2 to 3 inches from the edge of the workpiece.

Q9: What is considered the most important adjustment you can make on a jointer?

A9: The most important adjustment on a jointer is the alignment of the outfeed table and knives.

Q10: When checking a table for flatness, you find a gap exceeding $\frac{10}{1,000}$ of an inch. What does this indicate?

A10: The gap indicates that the table needs to be reground, which can be accomplished by a reliable machine shop.

Additional Resources

About.com: Woodworking

<http://woodworking.about.com>

Encarta Encyclopedia: Woodworking

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

Woodzone.com

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

Available from Films Media Group • www.filmsmediagroup.com • 1-800-257-5126

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 | Rippling | 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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