

**Woodworking
Tools**

Band Saws and Scroll Saws



Teacher's Guide

SHOPWARE

Introduction

This Teacher's Guide provides information to help you get the most out of *Band Saws and Scroll Saws*, 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.

Band Saws and Scroll Saws is a 22-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, wood-working, 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 *Band Saws and Scroll Saws* 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.
-
- 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

Band Saws and Scroll Saws presents a comprehensive review of the design and operation, controls, and techniques for safe operation and adjustment for both band and scroll saws.

Main Topics

Topic 1: Introduction

The program's host, Pete Bilotta, introduces the saws to use for cutting curves, namely, band saws and scroll saws.

Topic 2: Design and Operation

Although both saw types are designed for cutting curves, the machines themselves operate quite differently. Their similarities and differences are explored in this section, particularly in their drive wheel and motor, and overall size and motion.

Topic 3: Controls

In this section, the student learns about various controls for power, cutting speed, tilting, cross-cutting, shielding the blade and setting blade tension, and collecting dust.

Topic 4: Safe Operating Techniques

Even though band saws and scroll saws are arguably much safer than their rotary-cutting counterparts due to their thin vertical blades, there are many techniques that should be employed to operate the tools safely. The host reviews and demonstrates these techniques and offers a few tips to keep in mind.

Topic 5: Band Saw Blades

The host explains the four basic considerations for choosing the right band saw blade for the job, then shows how to change a band saw blade.

Topic 6: Band Saw Adjustments

To ensure that a band saw delivers consistently accurate cuts, there are several other adjustments that should be performed. In this section, students learn how to adjust the upper and lower blade guides, as well as how check table-to-blade squareness, blade guard height, and rip fence alignment.

Topic 7: Scroll Blades

This section focuses on the two basic designs of scroll blades, and the available widths, thicknesses, and tooth patterns. It continues by explaining how to change a pin-type blade.

Topic 8: Scroll Saw Adjustments

The host reviews the procedures for squaring the table to the blade and for setting blade tension.

Topic 9: Key Points

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

Fast Facts

- When cutting tight radius curves with a band saw or scroll saw, several relief cuts should be made in the material first to reduce the stress on the blade.
- Woodworkers who prefer less down time and greater productivity might prefer table saws to band saws, due to the fact that a band saw requires special blades for special cuts, while a table saw can cut just about anything when fitted with a high-quality combination blade.
- Fewer teeth on a band saw blade, such as 6 teeth per inch (TPI), will produce faster, rougher cuts, while more teeth, such as 12 TPI, will yield slower, smoother cuts.
- During a rip cut on a band saw, it's not uncommon for the blade to "drift" (veer slightly off course), a condition that can be corrected by attaching a resaw bar to the rip fence.
- The evolution of the scroll saw is linked to the rise in popularity of fretwork. Although there are examples of fretwork-like decorations on early Egyptian, Greek, and Roman furniture, these were probably carved or cut with a knife. It wasn't possible to saw delicate wooden shapes until the late 1500's, when a German craftsman devised a method for making fine, narrow blades.
- Some scroll saws provide multiple cutting speeds. Low speed should be used when cutting plastics and metals, while high speed is the best for cutting wood.
- Although the band saw and scroll saw both cut on the downstroke, the reciprocating action of a scroll saw means that the blade only cuts half of the time. Therefore, a workpiece should be fed into the blade slowly to compensate for the blade's non-cutting upstrokes. Feeding the material too quickly increases the risk of blade breakage, which could lead to personal injury.
- Blade width affects the minimum cutting radius. This means that an eighth-inch wide blade can cut a radius as tight as five-sixteenths of an inch, while a three-quarter inch blade is only able to cut a curve with a five-and-a-half inch radius. To be sure the correct blade is used, a blade width-cutting chart that matches blade width to minimum radius should be consulted prior to cutting curves.
- While higher number scroll blades are more resistant to breakage, lower number blades are better for cutting tight curves.
- When adjusting tension in scroll saw blades, it should be remembered that fine-toothed blades require more tension than coarse blades due to their narrow width and thin body.

Vocabulary Terms

band saw: Band saws come in both stationary and benchtop models. The band saw blade is coiled around two or more wheels and shaped like a ribbon. Band saws are used for such heavy work as ripping logs into boards and cutting very thick wood.

bellows: In order to keep the cut line clear of sawdust, a bellows is used; it pumps air through a tube that discharges close to the blade.

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

bevel scale: A bevel scale indicates the degree of tilt.

blade guard: This metal or plastic safety feature helps shield the user from the rotating blade and flying debris. On a band saw, the blade is shielded by the machine itself and a vertical blade guard that extends down from the top half of the housing. On a scroll saw, the lower part of the blade is isolated from the operator by a plastic or metal enclosure.

blade guides: Since a band saw uses a coiled blade, upper and lower blade guides are used to minimize flex when cutting curves.

climbing: A condition in which the workpiece loses contact with the table.

drift: A condition in which the blade veers slightly off course during a rip cut. This condition can be corrected by substituting the rip fence with a rounded guide block.

drive wheel: In large stationary models, the drive wheel is belt-driven by an induction motor, while most benchtop units, with their smaller cutting capacity, rely on a universal motor to power the drive wheel.

dust collection ports: For efficient sawdust removal, all machines have dust collection ports that can be connected to a shop vacuum or central dust collection system.

feet per minute (FPM): The cutting speed of a band saw is measured in feet per minute (FPM). This value indicates the distance in feet any given point on the blade travels in 60 seconds.

fence: A piece of lath or scrap fixed to the bench surface to prevent movement of the work.

fretwork: Ornamental work consisting of three-dimensional frets; geometric openwork.

gullet: The cut-out area in front of a saw blade tooth which allows wood chips and dust to escape from the kerf. It also helps keep the wood and the blade from overheating by allowing air to circulate freely.

induction motor: Designed for heavy-duty use, and relatively quiet due to its brushless design.

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

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.

miter gauge: A gauge that moves parallel to the blade along a slot machined into the saw table. Used for crosscutting material from 90° to 45°.

miter joint: A joint made by beveling each of two surfaces to be joined, usually at a 45° angle, to form a corner, usually a 90° angle.

paddle switch: Benchtop saws of both types typically use a dual-colored paddle switch for the ON/OFF function.

parallel arm design: A pair of equal length arms are mounted to pivots in the machine's frame. A rod and spring connect the arms at the rear, while the blade is held between the arms at the front. The assembly is driven by an induction motor, which is linked to the lower arm via an eccentric and bearing assembly.

push-button switches: Stationary band saws usually have large push-button switches labeled START and STOP.

push stick: An essential safety tool that allows the operator to keep fingers away from a table-saw or router's blades, especially when ripping narrow stock.

rake angle: The position of the teeth relative to the blade body.

relief cuts: A cut or series of cuts, usually parallel, made to reduce stress on the blade. When cutting tight radius curves on a band saw or scroll saw, several relief cuts should be made in the material first.

resaw: Ripping boards on edge.

resaw bar: A rounded guide that can be attached vertically to a rip fence to combat the problem of drift when ripping a board.

reverse-tooth blade: Scroll saw blade in which the bottom five to nine teeth face upwards to produce smoother cuts.

saw blade gullet: The open area between the teeth.

scroll saw: A scroll saw is essentially a motorized coping saw that is fitted with finer blades for making intricate cuts in thinner material.

scroll saw blades: Scroll saw blades come in two basic designs: pin-type and plain-end. Pin-type blades can be identified by the perpendicular pin at each end. Plain-end blades have flat ends, which are designed for machines that clamp the blade at each end.

skip tooth blade: A scroll saw blade that has large gullets for fast, coarse cuts.

speed square: An abbreviated or simplified steel square that is a 12- or 7-inch isosceles triangle in shape, made of steel aluminum or plastic. At the intersection of the two sides of the triangle there is a squared pivot point, which is placed on the edge of the board.

strokes per minute (SPM): On a scroll saw, cutting speed is measured in SPM, which indicates the speed of the blade's reciprocating movement.

square grind: On a square ground blade, all of the teeth have a flat top. This grind is designed primarily for ripping.

teeth per inch (TPI): When it comes to TPI, fewer teeth will produce faster, rougher cuts, while more teeth, such as 12 TPI, will yield slower, smoother cuts.

tooth profile: A factor that affects the quality of the cut. There are three common types: regular, skip, and hook.

tooth sets: There are two kinds of tooth sets: standard and raker. On a standard set blade, the teeth are bent alternately for straight-cutting, while a raker set has pairs of alternate teeth separated by a single straight tooth, which is best for cutting curves.

throat depth: Determined by the diameter of the wheels, it is the distance between the blade and the midsection of the frame.

tires: Both the drive wheel and upper wheel are fitted with thin layers of rubber called tires, which keep the blade running quietly and tracking smoothly.

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

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

1. If band and scroll saws are both used to cut curves, what distinguishes them from each other?
2. Do these saws cut on the downstroke, the upstroke, or both?
3. Which type of band saw—stationary or benchtop—runs more quietly? Why?

Post-Program Discussion Questions

1. Which has finer blades: band saws or scroll saws?
2. What safety techniques are important when using a band saw? What about for a scroll saw?
3. How is cutting speed measured on a scroll saw? How about on a band saw?
4. What kinds of maintenance and adjustments should be made on band saws? What about on scroll saws?
5. When considering the blade number for a scroll saw, are higher or lower numbers more resistant to breakage? Which are better for cutting tight curves?

Group Activities

- After reviewing the correct use of bevel scales and miter gauges, divide the class into small groups. Have each group practice tilting the saws and making beveled cuts and crosscuts of various angles.
- Demonstrate what drift is during a resaw. Then, as a class, follow the steps detailed in the program, and practice correcting for drift by using the resaw bar instead of the rip fence.
- Divide the class into two groups and assign each group either the band saw or the scroll saw. Then, have each group discuss, write down, and perform for the other group the step-by-step procedure for replacing the blade on its particular type of saw.

Individual/Internet Student Projects

- Have your students write a paper or create a presentation explaining the four basic blade considerations to keep in mind when selecting a band saw. Ensure that the students select and label pictures to demonstrate blades of various TPIs, tooth profiles, and tooth sets.
- 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 band or scroll saws. This will provide practical applications for the procedures that are shown in the video.

Assessment Questions

- Q1: Which type of band saw (stationary or benchtop) runs more quietly? Why?
- Q2: True or False: To compensate for the scroll saw blade's non-cutting upstrokes, it is important to feed the material quickly.
- Q3: What should be done to reduce stress on the blade when cutting tight radius curves on a band saw or scroll saw?
- Q4: True or False: The cutting speed of a band saw is measured in feet per minute (FPM).
- Q5: To what height should you set the blade guard on a band saw?
- Q6: What is the purpose of having blade guides on a band saw?
- Q7: Describe the three common types of tooth profiles for band saws, and what they should be used for.
- Q8: Choose either "clockwise" or "counterclockwise": On a scroll saw, rotating the appropriate knob or lever _____ increases tension, and rotating it _____ reduces tension.
- Q9: What are the advantages and disadvantage of both types of scroll saw blades?
- Q10: Choose either "fewer" or "more": When it comes to teeth per inch, a blade with _____ TPI is better for cutting thin stock, while blades with _____ TPI are better suited for cutting thicker material.

Assessment Questions Answer Key

Q1: Which type of band saw (stationary or benchtop) runs more quietly? Why?

A1: In large stationary models, the drive wheel is belt-driven by an induction motor, while most benchtop units, with their smaller cutting capacity, rely on a universal motor to power the drive wheel. Induction motors are more efficient and less noisy than universal motors due to their brushless design.

Q2: True or False: To compensate for the scroll saw blade's non-cutting upstrokes, it is important to feed the material quickly.

A2: False. It is important to feed the workpiece into the blade slowly to compensate for the blade's non-cutting upstrokes. Feeding it too quickly increases the risk of blade breakage, which could lead to personal injury.

Q3: What should be done to reduce stress on the blade when cutting tight radius curves on a band saw or scroll saw?

A3: Several relief cuts should be made in the material first to reduce the stress on the blade.

Q4: True or False: The cutting speed of a band saw is measured in feet per minute (FPM).

A4: This statement is true.

Q5: To what height should you set the blade guard on a band saw?

A5: The blade guard should be set so the upper blade guide is within a quarter inch of the workpiece.

Q6: What is the purpose of having blade guides on a band saw?

A6: Since a band saw uses a coiled blade, upper and lower blade guides are used to minimize flex when cutting curves.

Q7: Describe the three common types of tooth profiles for band saws, and what they should be used for.

A7: A regular profile blade has teeth set at a 0° rake angle and is good for cutting smooth curves in material one inch thick or less. A skip profile blade is basically the same as a regular profile but has every other tooth missing in order to provide wide gullets for efficient chip removal. A hook profile blade has wide gullets and a positive rake angle to aggressively cut through thick material quickly.

Q8: Choose either "clockwise" or "counterclockwise": On a scroll saw, rotating the appropriate knob or lever _____ increases tension, and rotating it _____ reduces tension.

A8: On a scroll saw, rotating the appropriate knob or lever **clockwise** increases tension, and rotating it **counterclockwise** reduces tension.

Q9: What are the advantages and disadvantage of both types of scroll saw blades?

A9: A pin-type blade can be changed quickly. However, the pin may not fit through the starter hole required for intricate inside cuts, so the blade is limited in the level of detail work it can perform. Plain-end blades, while more time-consuming to change, are ultimately more versatile.

Q10: *Choose either "fewer" or "more":* **When it comes to teeth per inch, a blade with _____ TPI is better for cutting thin stock, while blades with _____ TPI are better suited for cutting thicker material.**

A10: When it comes to teeth per inch, a blade with **more** TPI is better for cutting thin stock, while blades with **fewer** TPI are better suited for cutting thicker material.

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 equip-

ment 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/Surfacers & 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)



2572 Brunswick Pike, Lawrenceville, NJ 08648

www.shopware-usa.com

Call Toll Free: 800/487-3392