Introduction

This Teacher’s Guide provides information to help you get the most out of Circular 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.

Circular Saws 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 Circular 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 woodworking 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 woodworking tools for maximum efficiency and safety.

The *Woodworking Tools* video program series consists of sixteen titles:
• Table Saws
• Cutoff Saws
• Radial Arm Saws
• Band and Scroll Saws
• Routers
• Jointers
• Planers
• Lathes
• Power Nailers
• Drill Press
Circular Saws presents a comprehensive review of the basic operation, controls, blades, and safe operating techniques for the two kinds of circular saws.

Main Topics

Topic 1: Introduction
The program’s host, Pete Bilotta, introduces the tool that he considers an indispensable part of any woodworker’s toolbox – the circular saw.

Topic 2: Overview
From ripping and crosscutting, to cutting bevels, miters, and chamfers, to making plunge cuts, the circular saw’s design allows for both speed and efficiency. The host provides an overview of the two basic types of circular saws – the worm drive saw and the sidewinder – and reviews their basic controls.

Topic 3: Blades
This section highlights the number of recommended teeth for various circular saw tasks and reviews the blade classifications and cutting capabilities of various blades. It concludes by explaining how to change a blade.

Topic 4: Safe Operating Techniques
The host shows the viewer how to capitalize on the circular saw’s assets and minimize its liabilities. He teaches how to make crosscuts and bevel cuts, chamfer a workpiece, trim a door, crosscut a wide piece, make a right-angle fence, ripcut flexible and rigid materials, make a ripping jig, and perform a plunge cut.

Topic 5: Key Points
The program concludes with an overview of the key points that have been discussed.
Fast Facts

- Many Occupational Health and Safety Regulations require that a hand-fed circular saw with rip-type teeth must have kickback fingers and a splitter or spreader designed to prevent kickback. It must also have a guard that automatically adjusts to the thickness of the material being cut and that completely covers the cutting area of the blade when the saw is withdrawn from the material. Lastly, circular saws that have a blade diameter greater than 2 inches must be equipped with guards above and below the base plate or shoe.

- Circular saws are extremely versatile and can cut either with or against the grain.

- The worm drive portable circular saw was invented in 1924 by the Michel Electric Handsaw Company, which renamed itself Skilsaw Inc., and is today a subsidiary of Robert Bosch GmbH. To get around the Skil patents, Art Emmons of Porter-Cable invented the direct-drive sidewinder saw in 1928.

- In a worm drive saw, the gearing is designed for high torque output, which makes these saws virtually impervious to stalling, even when cutting wet lumber.

- Since most people are right handed, the blade on most 7 1/4" sidewinders is positioned to the right of the motor. This design offers the safety of keeping your left hand a safe distance from the blade. However, it can make it difficult to see the cut line. This is why some manufacturers offer blade-to-the-left models, which is typical on most cordless circular saws.

- Carbide blades cut cleaner and last far longer than steel blades. They are essentially steel blades with carbide teeth attached, and although they are more costly, their durability and performance more than justify the expense.

- The silicon carbide masonry blade is designed to cut block, brick, stone, and slate, as well as soft metals like aluminum.

- Since blade teeth travel upward as they are cutting, any splintering or tearout that occurs will appear on the upper surface of the workpiece. Consequently, when trimming a door or cutting other material where appearance is important, the workpiece's good side (meaning the side that is exposed when the piece is installed) should be placed down.

- Whenever a circular saw is to be used for ripcutting flexible materials like 1/2-inch plywood, the workpiece should first be supported on both sides of the cut line with several 2x4s laid across the sawhorses.

- Whenever the operator begins to cut off the line, the saw should never be forced back in line. Instead, the saw should be stopped and repositioned back on the line.
**Vocabulary Terms**

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

**blade:** Circular saw blades are generally classified according to the material used for the blade teeth, which is either steel or carbide.

**blade brake:** A feature found on some high-end circular saws that brings the blade to a stop almost immediately after releasing the trigger.

**blade guard:** The blade guard consists of a fixed upper portion, and a spring-loaded lower section that automatically retracts as the circular saw is moved forward.

**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.

**circular saw:** Invented in England in 1780 and less commonly known as a buzz saw in the U.S., it is a tool for cutting wood or other materials and may be hand-held or table-mounted.

**crosscutting:** The process of cutting a board at approximately a right angle to the grain direction.

**dust collection port:** A port that allows the machine to be connected to a bag, shop vac, or central collection system in order to reduce flying sawdust, keep the air cleaner, and provide the operator with a better view of the work for improved safety.

**frame:** The saw’s frame serves as a sled that supports the motor and blade assembly and allows the tool to glide along the surface of the workpiece. The frame also contains the cutting depth and bevel adjustment controls.

**framing square:** A flat piece of metal shaped like an L, with measurements along both legs of the L, used to check for perpendicularity.

**gullets:** The spaces between saw blade teeth, which allow for the efficient removal of waste and help reduce the chance of kickback.

**helical gears:** A type of gear found on a sidewinder saw. The teeth are arranged in a spiral resembling a screw; this overdrive arrangement produces higher RPM with less motor wear.

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

**kickback:** A potentially dangerous condition that occurs when the material pinches the back half of the blade. As a result, the saw will climb out of the kerf and be thrown back towards the operator with considerable force.

**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.
plunge cut: A cut made in the interior of the work piece that receives another piece to form a joint.

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.

rip cut: To split or saw (wood) along the grain.

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.

sidewinder: A type of circular saw in which the blade is mounted directly to the motor’s driveshaft.

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.

switch lock: To prevent starting the saw accidentally, many circular saws include a switch lock, which must be depressed first before the trigger switch will operate.

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

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.

worm drive saw: A circular saw in which motor power is transmitted to a gear on the blade arbor through a worm gear on the end of the motor shaft.

Pre-Program Discussion Questions

1. Can you name some tasks for which a circular saw should be used?

2. For which tasks do you think smaller, portable models of circular saws are designed?

3. What feature is common on cordless circular saws but not usually found on most 7½” sidewinders? Why do you think the difference is significant?

4. Which type of blade do you think is better – steel or carbide? Why?

5. Why do you think workpieces are placed “good-side down” when using a circular saw?
Post-Program Discussion Questions

1. On what is the advertised size of a circular saw based, and what is the most popular size?

2. Discuss and point out the basic controls of the circular saw.

3. What safety features are built into the design of a circular saw?

4. Describe the various blade types and tooth sizes. For what purposes are they best suited?

5. What is important to remember when ripping flexible materials such as 1/2-inch plywood?

Individual Student Projects

- Ask your students to write a paper, create a multimedia presentation, or draw descriptive pictures regarding the differences between the two basic types of circular saws, specifically in the areas of their motor and gears, and how the saws are powered. What are the advantages of each design?

Group Activities

- Divide the class into small groups and have each group practice one or more of the following using a circular saw:
  - Ripping flexible or rigid material
  - Crosscutting a board
  - Making a bevel cut
  - Making a miter cut
  - Making a chamfer
  - Making a plunge cut

- Discuss and demonstrate the use of a right-angle fence and a ripping jig. Then, divide the class in half, and have each group practice crosscutting a wide board using a right-angle fence and making a ripping jig.

- As a class, review the important safety considerations to remember when handling blades. Then, divide the class into groups and assign each group one of the following tasks:
  - Ripping dimensional lumber (18-tooth blade)
  - Crosscutting dimensional lumber (18-tooth blade)
  - Crosscutting material for a piece of furniture (40-tooth blade)
  - Ripping paneling (plywood blade with 150 teeth)
  - Cutting brick (silicon carbide masonry blade)

Ask each group which kind of blade and what minimum number of teeth would be good to use for the task (see italics). Then, have each group practice changing the blade and using it to perform the assigned task.
Internet Activities

• 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 table saws. This will provide practical applications for the procedures that are shown in the video.
Assessment Questions

Q1: What are the two basic types of circular saws, and how can you differentiate between them?

Q2: How is power transmitted in a worm drive saw, as compared to how it is transmitted in a sidewinder saw?

Q3: What is the maximum cutting depth of most 7¼” saws?

Q4: What is a blade brake?

Q5: Which type of blade cuts cleaner and lasts longer?

Q6: True or False: When a smooth edge is not important, you should use a blade with fewer teeth.

Q7: A silicon carbide masonry blade is designed to cut what materials?

Q8: True or False: For crosscuts, the material should be supported as far away from the cut line as possible.

A9: How do you make a right-angle fence?

Q10: Place the following steps in order for performing a plunge cut using a circular saw:
   a. Once the blade begins cutting, release the blade guard, and then continue lowering the saw until the base is flush with the material.
   b. Tilt the back of the saw up so that the blade is slightly above the surface of the work, and then align the front of the base with the cut line.
   c. Set the blade to the proper cutting depth.
   d. Use a handsaw to cut the corners and then use a screwdriver to pry out the cutout.
   e. While holding the saw firmly, squeeze the trigger and let the motor come up to speed.
   f. Using the front of the base as a pivot, slowly lower the rear of the saw into the work.
   g. Rotate the blade guard fully forward to expose the blade.
Assessment Questions Answer Key

Q1: What are the two basic types of circular saws, and how can you differentiate between them?
A1: There are two basic types of circular saws: the worm drive saw, which can be identified by its rear-mounted motor, and the sidewinder, so named because its motor is positioned alongside the blade.

Q2: How is power transmitted in a worm drive saw, as compared to how it is transmitted in a sidewinder saw?
A2: In a worm drive saw, power is transmitted to a gear on the blade arbor through a worm gear on the end of the motor shaft. In a sidewinder design, the motor transfers power to the blade using a pair of helical gears.

Q3: What is the maximum cutting depth of most 7'/4" saws?
A3: Most 7'/4" saws provide a maximum cutting depth just shy of 2'/2" at 90°, and slightly greater than 1'/½" at 45°.

Q4: What is a blade brake?
A4: A blade brake is a feature found on some high-end circular saws that brings the blade to a stop almost immediately after releasing the trigger.

Q5: Which type of blade cuts cleaner and lasts longer?
A5: Carbide blades cut cleaner and last far longer than steel blades.

Q6: True or False: When a smooth edge is not important, you should use a blade with fewer teeth.
A6: True. Generally, blades with fewer teeth, such as an 18- or 24-tooth blade, work well for tasks in which a smooth edge is not important.

Q7: A silicon carbide masonry blade is designed to cut what materials?
A7: It is designed to cut block, brick, stone, and slate, as well as soft metals like aluminum.

Q8: True or False: For crosscuts, the material should be supported as far away from the cut line as possible.
A8: False. For crosscuts, the material should be supported as close to the cut line as possible, leaving just enough room for the blade to pass by the supports without interference.

Q9: How do you make a right-angle fence?
A9: Fasten a pair of square one-by-one stock together in the form of a T. Before adding more fasteners, adjust the pieces against a framing square to insure accuracy. With the two pieces secured, clamp the jig to a piece of scrap, and run your saw along the fence to trim off the crosspiece. This customizes the fence to the particular saw.
Q10: Place the following steps in order for performing a plunge cut using a circular saw:
   a. Once the blade begins cutting, release the blade guard, and then continue lowering
      the saw until the base is flush with the material.
   b. Tilt the back of the saw up so that the blade is slightly above the surface of the
      work, and then align the front of the base with the cut line.
   c. Set the blade to the proper cutting depth.
   d. Use a handsaw to cut the corners and then use a screwdriver to pry out the cutout.
   e. While holding the saw firmly, squeeze the trigger and let the motor come up to
      speed.
   f. Using the front of the base as a pivot, slowly lower the rear of the saw into the work.
   g. Rotate the blade guard fully forward to expose the blade.

A10:

1. c. Set the blade to the proper cutting depth.
2. g. Rotate the blade guard fully forward to expose the blade.
3. b. Tilt the back of the saw up so that the blade is slightly above the surface of
      the work, and then align the front of the base with the cut line.
4. e. While holding the saw firmly, squeeze the trigger and let the motor come up to
      speed.
5. f. Using the front of the base as a pivot, slowly lower the rear of the saw into
      the work.
6. a. Once the blade begins cutting, release the blade guard, and then continue
      lowering the saw until the base is flush with the material.
7. d. Use a handsaw to cut the corners and then use a screwdriver to pry out the
      cutout.
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

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 | 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
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)