

Woodworking: The Art and the Craft

CREATING MORTISE AND TENON JOINTS



**TEACHER'S
GUIDE**



INTRODUCTION

This Teacher's Guide provides information to help you get the most out of *Creating Mortise and Tenon Joints*. The contents of this guide will allow you to prepare your students before using the program and to present follow-up activities to reinforce the program's key learning points.

Part of *Woodworking: The Art and the Craft* video series, *Creating Mortise and Tenon Joints* provides step-by-step procedures for making mortise and tenon joints using hand tools and using power tools. It also demonstrates how to secure the mortise and tenon joint using dowels or wedges, and discusses the types of mortise and tenon joints and pertinent safety practices.

LEARNING OBJECTIVES

After viewing the program, students will be able to:

- Make an open mortise and tenon joint using hand tools and a drill press.
- Make an open mortise and tenon joint using a hollow-chisel mortiser and a table saw.
- Secure the mortise and tenon joint using dowels and/or using wedges.

EDUCATIONAL STANDARDS

National Standards

This program correlates with the following competency standards from the National Center for Construction Education & Research. The content has been aligned with the following educational standards and benchmarks from this organization.

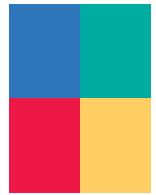
- Explain the role that safety plays in the construction crafts.
- Demonstrate the use and care of appropriate personal protective equipment.
- Use hand tools in a safe and appropriate manner.
- State the general safety rules for operating all power tools, regardless of type.
- Identify the portable power tools commonly used by carpenters and describe their uses.
- Use portable power tools in a safe and appropriate manner.
- Identify and cut the various types of joints used in cabinetmaking.

The competencies and objectives from the National Center for Construction Education & Research have been reprinted with permission.

English Language Arts Standards

The activities in this Teacher's Guide were created in compliance with the following National Standards for the English Language Arts from the National Council of Teachers of English.

- Uses the general skills and strategies of the writing process.
- Gathers and uses information for research purposes.
- Uses strategies to adapt writing for different purposes (e.g., to explain, inform, analyze, entertain, reflect, persuade).
- Uses reading skills and strategies to understand and interpret a variety of informational texts.
- Uses discussions with peers as a way of understanding information.
- Uses listening and speaking strategies for different purposes.



- Makes formal presentations to the class (e.g., includes definitions for clarity; supports main ideas using anecdotes, examples, statistics, analogies, and other evidence; uses visual aids or technology, such as transparencies, slides, electronic media; cites information sources).
- Uses viewing skills and strategies to understand and interpret visual media.
- Uses a variety of criteria (e.g., clarity, accuracy, effectiveness, bias, relevance of facts) to evaluate informational media (e.g., web sites, documentaries, news programs).

Standards for the English Language Arts, by the International Reading Association and the National Council of Teachers of English, Copyright 1996 by the International Reading Association and the National Council of Teachers of English. Reprinted with permission.

Technology Standards

The activities in this Teacher's Guide were created in compliance with the following National Education Technology Standards from the National Education Technology Standards Project.

- Students demonstrate a sound understanding of the nature and operation of technology systems.
- Students are proficient in the use of technology.
- Students use a variety of media and formats to communicate information and ideas effectively to multiple audiences.
- Students use technology to locate, evaluate, and collect information from a variety of sources.
- Students use technology tools to process data and report results.
- Students evaluate and select new information resources and technological innovations based on the appropriateness for specific tasks.

The National Education Technology Standards reprinted with permission from the International Society for Technology Education.

PROGRAM OVERVIEW

One of the most widely used and strongest types of wood joints, the mortise and tenon joint has been used by woodworkers for centuries to make doors, build furniture, and construct timber frame homes. This video provides step-by-step procedures for making open joints using both hand tools and power tools. It also shows how to secure joints using dowels or wedges. Good safety practices are demonstrated where appropriate.

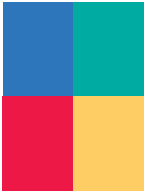
MAIN TOPICS

Topic 1: Introduction to Mortise and Tenon Joints

Explains the parts of a mortise and tenon joint and illustrates several types: open joint, stub joint, haunched joint, double tenon, and twin tenon.

Topic 2: Making an Open Mortise and Tenon Joint Using Hand Tools

Demonstrates the step-by-step procedure for making an open-tenon joint for a bed frame using hand tools and a drill press. Included is laying out the mortise and tenons, scribing the cut lines with a mortise gauge, making the cuts, and assembling the joint.



Topic 3: Making an Open Mortise and Tenon Joint Using a Hollow-Chisel Mortiser and a Table Saw

Starting with an already laid out mortise and tenon, demonstrates cutting the mortise using a hollow-chisel mortiser, and then cutting the tenon using a table saw.

Topic 4: Securing the Mortise and Tenon Joint

Demonstrates the step-by-step procedure for adding dowels to an assembled mortise and tenon joint. Also demonstrates using wedges to secure an open joint.

FAST FACTS

- A mortise and tenon joint consists of two parts: the tenon, which extends from the end of one board, and the mortise, which is a slot cut into the mating piece.
- The open mortise and tenon joint is commonly found in tables, chairs, and bed frames.
- Achieving a high-quality appearance with an open mortise and tenon joint depends on precise measuring and accurate cutting.
- When measuring the tenon stock, add 1/8 inch to the finished width for each end having a tenon. The excess material will allow the tenon to be planed flush with the stiles for best appearance.
- The position of the shoulder line should account for the depth of the mortise plus an additional 1/8 inch.
- In an open joint, the mortise is typically one-third the width of the stile.
- When making cuts, always start with the mortise, since it is easier to adjust the tenon if required.
- Make sure the chisel is sharp—more force is required to drive a dull chisel, which increases the risk of the tool slipping and causing injury.

VOCABULARY TERMS

brad point bit: A twist drill bit with spurs on the end for accurate centering and cleaner cutting.

double tenon: A mortise and tenon joint in which two tenons are cut in one board and two mortises are cut in the other board. They are used for wide joints where cutting one large mortise would weaken that board.

haunched joint: Similar to an open mortise and tenon, with the exception of the shoulder or haunch on top of the tenon, and the matching recess in the top of the mortise.

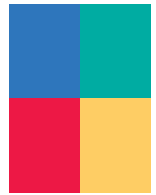
hollow-chisel mortiser: A tool that combines an auger-type drill bit and a square-shaped open chisel that is used to remove the wood for a mortise.

mortise and tenon joint: A two-part joint with a tenon extending from the end of one board and a mortise slot cut into the mating piece.

mortise gauge: A gauge with two pins for scribing both sides of the mortise or tenon simultaneously. One pin is fixed, and the other is adjustable. Most gauges also have a fixed pin on the opposite side of the beam that allows the tool to be used as a standard marking gauge.

open joint: A mortise and tenon joint in which the mortise is cut completely through the material so that the tenon is visible when the pieces are joined together.

shoulder: The part of the wood not cut away; when looked at from the side it resembles a neck and shoulder in which the tenon is the neck.



blind joint: A mortise and tenon joint in which the tenon is cut shorter, and the mortise only penetrates a portion of the material to keep the tenon hidden once the pieces are assembled.

PRE-PROGRAM DISCUSSION QUESTIONS

1. Pass around a sample mortise and tenon joint and ask, "Do you think that this is a strong wood joint?"
2. While the sample is still going around, ask "Where have you seen this kind of joint?"
3. What do you think are the most difficult steps in making this kind of joint?

POST-PROGRAM DISCUSSION QUESTIONS

1. What are the most difficult steps in making the mortise and tenon joint using hand tools? How can you be successful at these steps?
2. Do you prefer the hand tools procedure or the power tools procedure? Why?
3. What projects can you think of that could use the mortise and tenon joint? Where in the project would it be used?
4. In what careers might the techniques demonstrated in this video be useful?

GROUP ACTIVITIES

Mortise and Tenon Joint Display

Have the class build a sample of each type of mortise and tenon joint and make them into a display. This activity will develop skill at making mortise and tenon joints and distinguishing between the types.

Build a Timber Frame Doll House

Have the class build a timber frame doll house using mortise and tenon joints wherever possible. This activity will develop students' skills at making mortise and tenon joints (as well as other carpentry skills).

INDIVIDUAL STUDENT PROJECTS

Make a Bed Frame

Have individuals make a bed frame that uses mortise and tenon joints. The bed frame can be full sized or doll sized. This activity will develop students' skills at making mortise and tenon joints (as well as other carpentry skills).

Make a Panel Door

Have individuals make a panel door using mortise and tenon joints. The door can be full sized or a cabinet door. The panels should be inset using rabbets. This activity will develop student's skills at making mortise and tenon joints and inseting panels with rabbets.

INTERNET ACTIVITIES

Research the History of the Mortise and Tenon Joint

Have individuals or groups of students research the history of the mortise and tenon joint, including where the name came from, when and where it was first used, and how it developed through the years.



ASSESSMENT QUESTIONS

Q: What is a mortise and tenon joint?

Answer/Feedback: A two-part joint with a tenon extending from the end of one board and a mortise slot cut into the mating piece.

Q: Mortise and tenon joints always show the tenon on the other side of the receiving wood. (*True or False*)

A: False

Feedback: In a blind joint, the tenon is cut shorter, and the mortise penetrates only a portion of the material. This keeps the tenon hidden once the pieces are assembled.

Q: What is a mortise gauge?

Answer/Feedback: A gauge with two pins for scribing both sides of the mortise or tenon simultaneously; one pin is fixed, and the other is adjustable. Most gauges also have a fixed pin on the opposite side of the beam that allows the tool to be used as a standard marking gauge.

Q: Place the steps for making a mortise and tenon joint in the correct order.

- (a) Mark the shoulder lines on all four sides of the board.
- (b) Scribe the mortise cut lines using a mortise gauge.
- (c) Draw the tenon outline on the board to be mortised.
- (d) Saw both faces of the tenon to the shoulder line.
- (e) Calculate the width of the mortise to be $\frac{1}{3}$ of the width of the tenon board.
- (f) Saw at the shoulder line to the depth of the tenon on both faces.
- (g) Measure the piece that will receive the tenon or tenons to the proper length.
- (h) Drill out the mortise hole; then square it with a chisel.
- (i) Glue and assemble the joint.

A: (g) Measure the piece that will receive the tenon or tenons to the proper length.

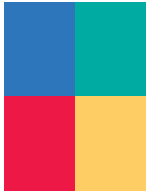
- (a) Mark the shoulder lines on all four sides of the board.
- (c) Draw the tenon outline on the board to be mortised.
- (e) Calculate the width of the mortise to be $\frac{1}{3}$ of the width of the tenon board.
- (b) Scribe the mortise cut lines using a mortise gauge.
- (h) Drill out the mortise hole; then square it with a chisel.
- (d) Saw both faces of the tenon to the shoulder line.
- (f) Saw at the shoulder line to the depth of the tenon on both faces.
- (i) Glue and assemble the joint.

Feedback: Basically, cut the tenon to the proper length, mark its location on the mortise wood, mark and cut out $\frac{1}{3}$ the width of the marked location as the mortise, mark and cut out the tenon to be $\frac{1}{3}$ of the width, glue and assemble the joint.

Q: What is the shoulder of the tenon?

- (a) The extreme end that is later sanded off flush to the mortise wood.
- (b) The thickness of the tenon.
- (c) The place where the tenon board returns to full width.
- (d) The part of the tenon board that is sawn off.
- (e) None of the above.

A: (c) The place where the tenon board returns to full width.



Feedback: The part of the wood not cut away; when looked at from the side it resembles a neck and shoulder in which the tenon is the neck.

Q: What is a hollow-chisel mortiser?

Answer/Feedback: A tool that combines an auger-type drill bit and a square-shaped open chisel that is used to remove the wood for a mortise.

Q: What is the table saw used for when making a mortise and tenon joint?

- (a) Sawing out the mortise.
- (b) Sawing off the tenon sides.
- (c) Sawing the finished joint to size.
- (d) Sawing off the excess tenon sticking through the mortise.
- (e) None of the above.

A: (b) Sawing off the tenon sides.

Feedback: The table saw is used to saw the tenon at the shoulder, then additionally to remove the waste by cutting the material away a little at a time until it has been removed.

Q: What do you do if the joint is too tight?

Answer/Feedback: Carefully remove material on each side of the tenon, using a chisel or sandpaper.

Q: Dowels can be inserted through a mortise joint to make it more secure. (*True or False*)

A: True

Feedback: The dowels prevent the tenon from being pulled out of the mortise.

Q: When must safety glasses be worn?

- (a) At all times when near power equipment.
- (b) When power equipment is running.
- (c) When others are using power equipment.
- (d) None of the above.
- (e) All of the above.

A: (e) All of the above.

Feedback: All these times present a possible danger to your eyes—even when equipment is not running or you are not the one using it.

ADDITIONAL RESOURCES

WEBSITES

Woodworking.com

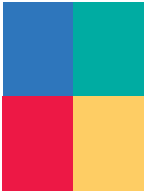
www.woodworking.com

New Woodworker.com

www.newwoodworker.com

Fine Woodworking

www.taunton.com/finewoodworking/index.asp



Women in Woodworking

www.womeninwoodworking.com

National Center for Construction Education and Research

www.nccer.org

BOOKS

The Basics of Craftsmanship: Key Advice on Every Aspect of Woodworking (Essentials of Woodworking), by Purdy Strother. Rodney Crosby Publishers' Group West, 1999. ISBN: 1561582972

Tage Frid Teaches Woodworking 1&2: A Step-By-Step Guidebook to Essential Woodworking Technique, by Tage Frid, Peter Chapman (Editor). Taunton Press, 1994. ISBN: 1561580686

Setting Up Shop: The Practical Guide to Designing and Building Your Dream Shop, by Sandor Nagyszalanczy. Taunton Press, 2001. ISBN: 1561585556

Wood: Technology and Processes, by John L. Feirer and Mark D. Feirer. McGraw Hill, 2002. ISBN: 007822411X

MAGAZINES

American Woodworker, F&W Publications Inc., ASIN: B00005NION

Fine Woodworking, Taunton Direct, Inc., ASIN: B000063XJH

Popular Woodworking, F&W Publications Inc., ASIN: B00005NION

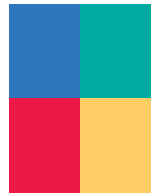
Woodworkers Journal, Rockler Press, ASIN: B00005N7TN

OTHER PRODUCTS

Woodworking: The Art and the Craft, VHS/DVD, Meridian Education

Woodworking: The Art and the Craft is a 15-part video series that explains and illustrates a variety of common techniques and cuts used in woodworking. While each program includes information on the tools and safety requirements of each task, the focus of the program is to provide specific information on "how to" accomplish each task. The series includes the following titles: *Ripping and Crosscutting; Finishing Techniques; Basic Methods of Measuring and Cutting; Working with Nails and Screws; Planning; Sanding; Methods of Cutting Circles and Curves; Sawing & Shaping; Gluing & Clamping; Creating Biscuit and Dowel Joints; Creating Rabbet Joints; Creating Dado Joints; Creating Miter Joints; Creating Mortise-and-Tenon Joints; Creating Dovetail Joints and Casework.*

Item no: 31970, www.meridianeducation.com, 1-800-727-5507



Careers in Construction Trades, CD-ROM, Shopware

The need for qualified construction workers continues to grow. This interactive CD-ROM guides users through several occupations in the construction industry, including cement masons, bricklayers, plumbers, pipe fitters, carpenters, and electricians. Video interview segments include information on the background of each job, what is expected of the employee, qualifications, subjects in which to enroll, what the job is like, expected wages, and outlook for each job. Interactions and quiz segments appear throughout the program to help reinforce concepts and information. This is the perfect program for those interested in a construction career! Windows only.

Item no: 20434, www.shopware-usa.com, 1-800-257-5126

Carpenters, VHS/DVD, Cambridge Educational

This fast-paced program provides a concise profile of carpenters, looking at educational background, apprenticeships, salary, and the work itself.

Item no: 32261, www.cambridgeeducational.com, 1-800-468-4227

Building Basics: An Interactive Guide to the Fundamentals of Construction, CD-ROM, Shopware

Learn the basics of construction in this exciting and informative CD-ROM. The program covers all aspects of construction, from the initial planning to the steps involved in building both light and heavy constructions. All construction should begin with a good plan—Section One outlines factors to consider during the planning phase, including identifying the purpose of the structure, its form, cost, and types of materials to use. It also introduces various tools used in the construction process and discusses the functions of each. Light construction methods are discussed in Section Two, using homes, small apartment buildings, and offices as examples. Windows only.

Item no: 24232, www.shopware-usa.com, 1-800-257-5126

Building Trades Series, VHS/DVD, Meridian Education

A very comprehensive overview of the many elements needed to build a structure. Each of the ten videos provides a look at a specific construction area and shows the work being performed, while explaining what's involved in the job. Individual titles offer flexibility to cover topics as needed...fits any curriculum requiring general information. The series includes *Blueprints: Planning a Building*; *Climate Control*; *Drywalling and Interior Trimming*; *Electricity*; *Exterior Walls and Roof Construction*; *Floor and Wall Construction*; *Interior Finish Work*; *Plumbing*; *Site Preparation*; and *The Foundation*.

Item no: 24841, www.meridianeducation.com, 1-800-727-5507

Construction Technology, VHS/DVD, Meridian Education

This five-part video series explores the world of construction technology. It provides an overview for elements of project design, site preparation, erecting sub- and superstructures, installing utilities, and enclosing, finishing, and landscaping. Using an entertaining format, the series follows a student in the future who uses his home computer to answer questions on a school project. The series includes *Enclosing, Finishing, and Landscaping Structures*; *Erecting Substructures and Superstructures*; *Installing Utilities*; *Introduction to Construction Technology*; and *Project Design and Site Preparation*.

Item no: 17674, www.meridianeducation.com, 1-800-727-5507



Introduction to Construction Technology, VHS/DVD, Meridian Education

Covers basic information on construction technology, including a definition of construction, the project design, types of construction, the involvement of architects in the construction process, zoning laws, building codes, local covenants, site preparation, substructure and superstructure, building materials, installation of utilities, enclosing, and finishing.

Item no: 25678, www.meridianeducation.com, 1-800-727-5507

Millwrights, VHS/DVD, Meridian Education

This fast-paced program provides a concise profile of millwrights, looking at educational background, apprenticeships, salary, and the work itself.

Item no: 32270, www.meridianeducation.com, 1-800-727-5507

Residential Carpentry Framing Series, VHS/DVD, Meridian Education

A step-by-step "how-to" series of videos that will show your students how to build. Whether working with floor, wall, ceiling, or roof framing, viewers get a first-hand look at construction procedures, safety issues, and proper tools. A clear explanation of each step provides in-depth information, while viewers watch actual carpenters do the work.

"Notes" are given throughout, offering tips and safety warnings. The series includes *Residential Ceiling Framing*; *Residential Floor Framing*; *Residential Roof Framing*; and *Residential Wall Framing*.

Item no: 26204, www.meridianeducation.com, 1-800-727-5507

Tour of the Trades, VHS/DVD, Meridian Education

The construction industry is big business, involving hundreds of professions and specialty areas. This program offers a fast-paced survey of the skilled construction trades, providing a sense of the diversity of jobs available, as well as comparing the wages of construction trades to other industries. Along with dozens of scenes from construction projects on a variety of scales, apprentices and journeyman workers discuss what they enjoy about their trade and how they got started.

Item no: 32258, www.meridianeducation.com, 1-800-727-5507



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