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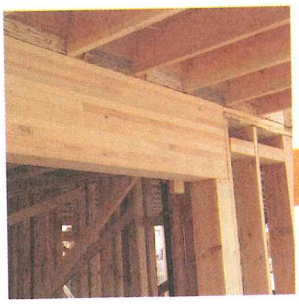
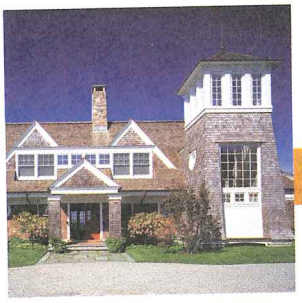
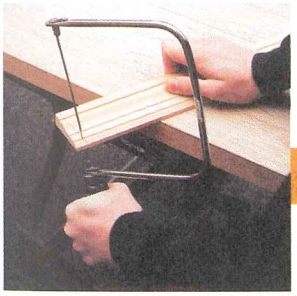
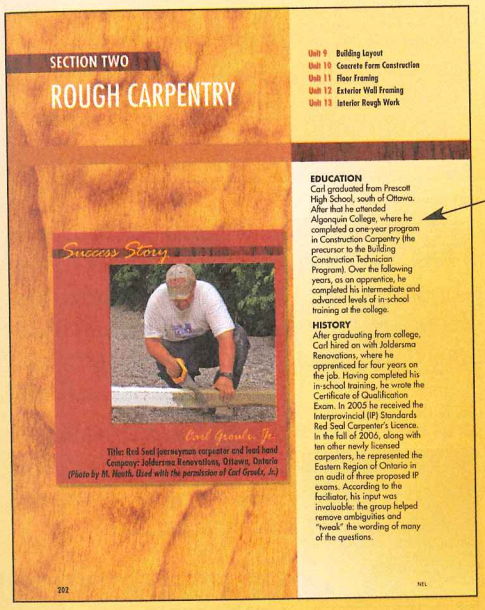






Key Features



SECTION TWO

ROUGH CARPENTRY

Unit 9 Building Layout
Unit 10 Concrete Form Construction
Unit 11 Floor Framing
Unit 12 Exterior Wall Framing
Unit 13 Interior Rough Work

Success Story

Carl Groulx, Jr.

Title: Red Seal journeyman carpenter and lead hand
Company: Joldersma Renovations, Ottawa, Ontario
(Photo by M. Heath. Used with the permission of Carl Groulx, Jr.)

EDUCATION
Carl graduated from Prescott High School, south of Ottawa. After that he attended Algonquin College, where he completed a one-year program in Construction Carpentry (the precursor to the Building Construction Technician Program). Over the following years, as an apprentice, he completed his intermediate and advanced levels of in-school training at the college.

HISTORY
After graduating from college, Carl hired on with Joldersma Renovations, where he apprenticed for four years on the job. Having completed his in-school training, he wrote the Certificate of Qualification Exam. In 2005 he received the Interprovincial (IP) Standards Red Seal Carpenter's Licence. In the fall of 2006, along with ten other newly licensed carpenters, he represented the Eastern Region of Ontario in an audit of three proposed IP exams. According to the facilitator, his input was invaluable: the group helped remove ambiguities and "tweak" the wording of many of the questions.

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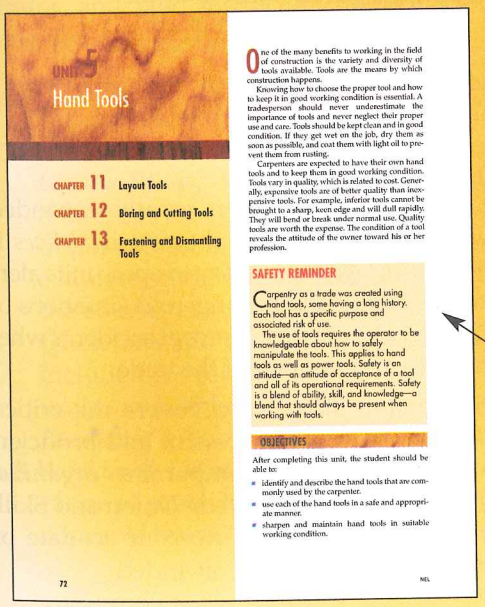
The **Introduction** provides essential information on working in the construction field, including *General Safety Guidelines*, critical *Soft Skills*, and notable *Organizations* to help keep students informed of industry expectations.

Success Stories open each of the four sections, featuring stories of success from individuals across the nation who currently work in the field.



UNIT 5

Hand Tools

CHAPTER 11 Layout Tools
CHAPTER 12 Boring and Cutting Tools
CHAPTER 13 Fastening and Dismantling Tools

One of the many benefits to working in the field of construction is the variety and diversity of tools available. Tools are the means by which construction happens.

Knowing how to choose the proper tool and how to keep it in good working condition is essential. A tradesperson should never underestimate the importance of tools and never neglect their proper use and care. Tools should be kept clean and in good condition. If they get wet on the job, dry them as soon as possible, and coat them with light oil to prevent them from rusting.

Carpenters are expected to have their own hand tools and to keep them in good working condition. Tools vary in quality, which is related to cost. Generally, expensive tools are of better quality than inexpensive tools. For example, inferior tools cannot be brought to a sharp, keen edge and will dull rapidly. They will bend or break under normal use. Quality tools are worth the expense. The condition of a tool reveals the attitude of the owner toward his or her profession.

SAFETY REMINDER

Carpentry as a trade was created using hand tools, some having a long history. Each tool has a specific purpose and associated risk of use.

The use of tools requires the operator to be knowledgeable about how to safely manipulate the tools. This applies to hand tools as well as power tools. Safety is an attitude—an attitude of acceptance of a tool and all of its operational requirements. Safety is a blend of ability, skill, and knowledge—a blend that should always be present when working with tools.

OBJECTIVES

After completing this unit, the student should be able to:

- identify and describe the hand tools that are commonly used by the carpenter.
- use each of the hand tools in a safe and appropriate manner.
- sharpen and maintain hand tools in suitable working condition.

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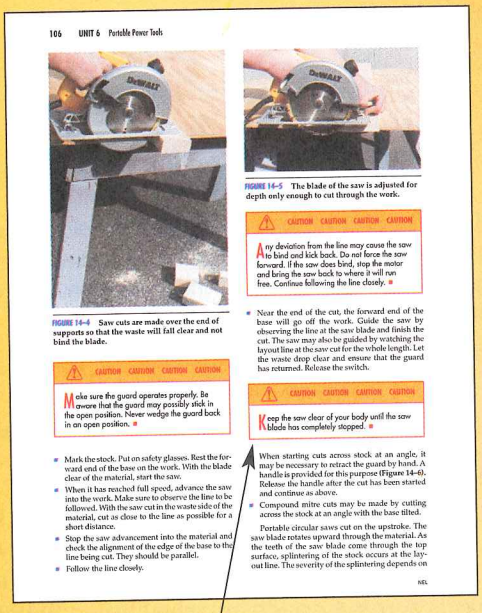


106 UNIT 6 Portable Power Tools

FIGURE 14–5 The blade of the saw is adjusted for depth only enough to cut through the work.

FIGURE 14–4 Saw cuts are made over the end of supports so that the waste will fall clear and not bind the blade.

CAUTION CAUTION CAUTION CAUTION

Make sure the guard operates properly. Be aware that the guard may possibly stick in the open position. Never wedge the guard back in an open position.

- Mark the stock. Put on safety glasses. Rest the forward end of the base on the work. With the blade clear of the material, start the saw.
- When it has reached full speed, advance the saw into the work. Make sure to observe the line to be followed. With the saw cut in the waste side of the material, cut as close to the line as possible for a short distance.
- Stop the saw advancement into the material and check the alignment of the edge of the base to the line being cut. They should be parallel.
- Follow the line closely.

CAUTION CAUTION CAUTION CAUTION

Any deviation from the line may cause the saw to bind and kick back. Do not force the saw forward. If the saw does bind, stop the motor and bring the saw back to where it will run free. Continue following the line closely.

- Near the end of the cut, the forward end of the base will go off the work. Guide the saw by observing the line at the saw blade and finish the cut. The saw may also be guided by watching the layout line at the saw cut for the whole length. Let the waste drop clear and ensure that the guard has returned. Release the switch.

CAUTION CAUTION CAUTION CAUTION

Keep the saw clear of your body until the saw blade has completely stopped.

When starting cuts across stock at an angle, it may be necessary to retract the guard by hand. A handle is provided for this purpose (Figure 14–6). Release the handle after the cut has been started and continue as above.

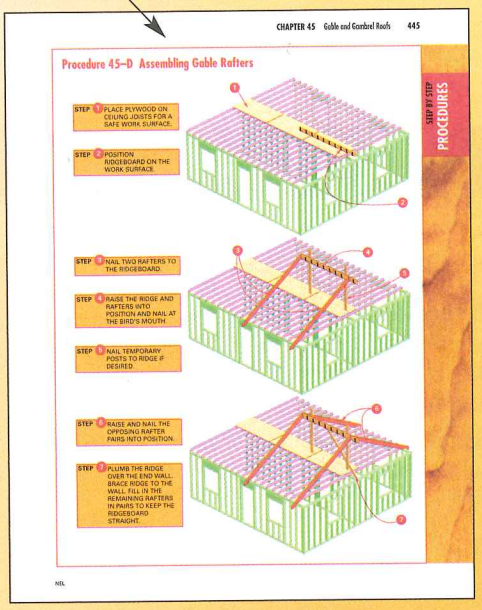
- Compound mitre cuts may be made by cutting across the stock at an angle with the base tilted.

Portable circular saws cut on the upstroke. The saw blade rotates upward through the material. As the teeth of the saw blade come through the top surface, splintering of the stock occurs at the layout line. The severity of the splintering depends on

NEL

Safety Reminders and **Cautions** integrated throughout the units continuously reinforce the importance of proactively practising safety in order to prevent injury or fatalities on the job.

Step-by-Step Procedures walk readers through the key tasks associated with specific residential building tasks, including **On the Job** tips of the trade.


CHAPTER 45 Gable and Gambrel Roofs 445

Procedure 45–D Assembling Gable Rafters

STEP 1 PLACE PLYWOOD ON CEILING JOISTS FOR A SAFE WORK SURFACE.

STEP 2 POSITION RIDGEBOARD ON THE WORK SURFACE.

STEP 3 NAIL TWO RAFTERS TO THE RIDGEBOARD.

STEP 4 RAISE THE RIDGE AND RAFTERS INTO POSITION AND NAIL AT THE BIRD'S MOUTH.

STEP 5 NAIL TEMPORARY POSTS TO RIDGE IF DESIRED.

STEP 6 RAISE AND NAIL THE OPPOSING RAFTER PAIRS INTO POSITION.

STEP 7 PLUMB THE RIDGE OVER THE END WALL. BRACE RIDGE TO THE WALL. FILL IN THE REMAINING RAFTERS IN PAIRS TO KEEP THE RIDGEBOARD STRAIGHT.

STEP BY STEP PROCEDURES

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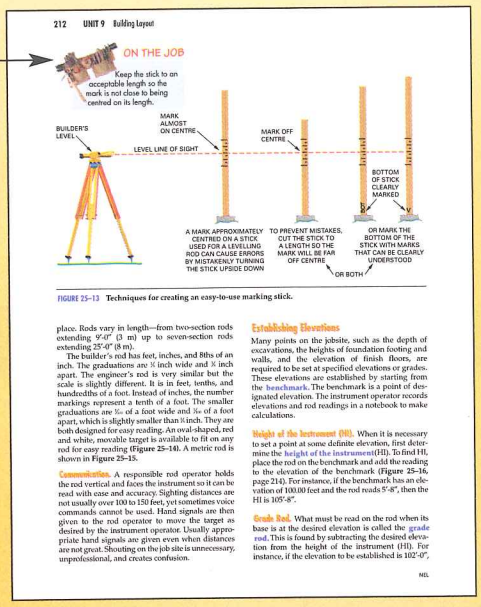
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ON THE JOB

Keep the stick to an acceptable length so the mark is not close to being centred on its length.

BUILDER'S LEVEL

LEVEL LINE OF SIGHT

MARK ALMOST ON CENTRE

MARK OFF CENTRE

BOTTOM OF STICK CLEARLY MARKED

A MARK APPROXIMATELY CENTRED ON A STICK USED FOR A LEVELLING ROD CAN CAUSE ERRORS BY MISTAKENLY TURNING THE STICK UPSIDE DOWN

TO PREVENT MISTAKES, CUT THE STICK TO A LENGTH SO THE MARK WILL BE FAR OFF CENTRE

OR MARK THE BOTTOM OF THE STICK WITH MARKS THAT CAN BE CLEARLY UNDERSTOOD

OR BOTH

FIGURE 25–13 Techniques for creating an easy-to-use marking stick.

place. Rods vary in length—from two-section rods extending 9'-0" (3 m) up to seven-section rods extending 25'-0" (8 m).

The builder's rod has feet, inches, and fifths of an inch. The graduations are ¼ inch wide and ⅛ inch apart. The engineer's rod is very similar but the scale is slightly different. It is in feet, tenths, and hundredths of a foot. Instead of inches, the number markings represent a tenth of a foot. The smaller graduations are ⅒ of a foot wide and ⅓₀ of a foot apart, which is slightly smaller than ⅛ inch. They are both designed for easy reading. An oval-shaped, red and white, movable target is available to fit on any rod for easy reading (**Figure 25–14**). A metric rod is shown in **Figure 25–15**.

Communication. A responsible rod operator holds the rod vertical and faces the instrument so it can be read with ease and accuracy. Sighting distances are not usually over 100 to 150 feet, yet sometimes voice commands cannot be used. Hand signals are then given to the rod operator to move the target as desired by the instrument operator. Usually appropriate hand signals are given even when distances are not great. Shouting on the job site is unnecessary, unprofessional, and creates confusion.

Establishing Elevations

Many points on the jobsite, such as the depth of excavations, the heights of foundation footing and walls, and the elevation of finish floors, are required to be set at specified elevations or grades. These elevations are established by starting from the **benchmark**. The benchmark is a point of designated elevation. The instrument operator records elevations and rod readings in a notebook to make calculations.

Height of the Instrument (HI). When it is necessary to set a point at some definite elevation, first determine the **height of the instrument** (HI). To find HI, place the rod on the benchmark and add the reading to the elevation of the benchmark (**Figure 25–16**, page 214). For instance, if the benchmark has an elevation of 100.00 feet and the rod reads 5'-8", then the HI is 105'-8".

Grade Rod. What must be read on the rod when its base is at the desired elevation is called the **grade rod**. This is found by subtracting the desired elevation from the height of the instrument (HI). For instance, if the elevation to be established is 102'-0",

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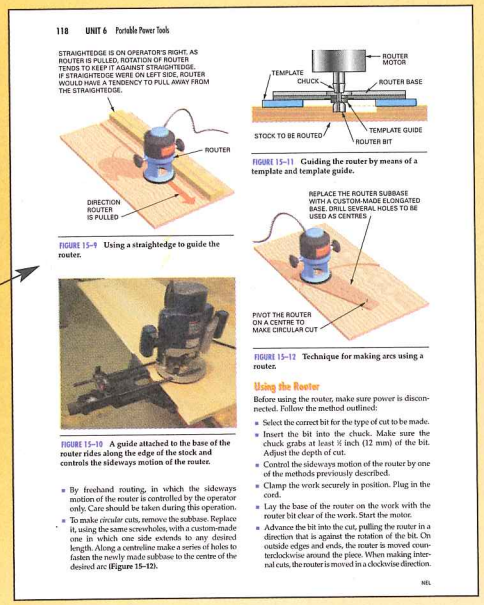
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STRAIGHTEDGE IS ON OPERATOR'S RIGHT. AS ROUTER IS PULLED, ROTATION OF ROUTER TENDS TO KEEP IT AGAINST STRAIGHTEDGE. IF STRAIGHTEDGE WERE ON LEFT SIDE, ROUTER WOULD HAVE A TENDENCY TO PULL AWAY FROM THE STRAIGHTEDGE.

ROUTER

DIRECTION ROUTER IS PULLED

FIGURE 15–9 Using a straightedge to guide the router.

ROUTER MOTOR

TEMPLATE

CHUCK

ROUTER BASE

STOCK TO BE ROUTED

TEMPLATE GUIDE

ROUTER BIT

FIGURE 15–11 Guiding the router by means of a template and template guide.

REPLACE THE ROUTER SUBBASE WITH A CUSTOM-MADE ELONGATED BASE. DRILL SEVERAL HOLES TO BE USED AS CENTRES.

PIVOT THE ROUTER ON A CENTRE TO MAKE CIRCULAR CUT

FIGURE 15–12 Technique for making arcs using a router.

FIGURE 15–10 A guide attached to the base of the router rides along the edge of the stock and controls the sideways motion of the router.

- By freehand routing, in which the sideways motion of the router is controlled by the operator only. Care should be taken during this operation.
- To make *circular* cuts, remove the subbase. Replace it, using the same screwholes, with a custom-made one in which one side extends to any desired length. Along a centreline make a series of holes to fasten the newly made subbase to the centre of the desired arc (**Figure 15–12**).

Using the Router

Before using the router, make sure power is disconnected. Follow the method outlined:

- Select the correct bit for the type of cut to be made.
- Insert the bit into the chuck. Make sure the chuck grabs at least ½ inch (12 mm) of the bit. Adjust the depth of cut.
- Control the sideways motion of the router by one of the methods previously described.
- Clamp the work securely in position. Plug in the cord.
- Lay the base of the router on the work with the router bit clear of the work. Start the motor.
- Advance the bit into the cut, pulling the router in a direction that is against the rotation of the bit. On outside edges and ends, the router is moved counterclockwise around the piece. When making internal cuts, the router is moved in a clockwise direction.

NEL

Visually intensive content featuring *photo-realistic drawings* and *full-colour jobsite photos*, drawn from live construction sites in geographically diverse locations in North America, bridges the gap between the classroom and the jobsite.

THE FIRST CANADIAN EDITION

- A ***full-colour design*** brings the jobsite to life—integrating photo-realistic drawings, drawn to scale, and on-the-job photos from construction projects across Canada and the United States.
- Measurements in the text are recorded in both imperial and metric—some conversions are approximate, such as 16" (400 mm), whereas others are exact, especially in building code references, such as 7⅞" (200 mm) for maximum rise for a set of stairs to a dwelling unit.
- ***Safety*** information has been greatly expanded, including a section on *General Safety Guidelines* in the *Introduction*, *Safety Reminders* to open units alerting students to potentially dangerous situations on the job, and *Cautions* to help prevent accidents when working with various tools of the trade.
- A section in the *Introduction* covers the critical ***Soft Skills*** required of successful and proficient carpenters. Coverage of important ***organizations***, including the Carpenters' Union and Skills Canada, that help students keep up to date on industry expectations is also included.

UNIT 5
Hand Tools

One of the many benefits to working in the field of construction is the variety and diversity of tools available. Tools are the means by which construction happens.

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- identify and describe the hand tools that are commonly used by the carpenter.
- use each of the hand tools in a safe and appropriate manner.
- sharpen and maintain hand tools in suitable working condition.

11 Layout Tools

LAYOUT TOOLS

Much of the work a carpenter does must first be laid out, measured, and marked. Layout tools are used to measure distances, mark lines and angles, test for depths, and align various materials into the proper positions.

The layout tools highlighted in this chapter will be calibrated in the imperial system of measure.

Measuring Tools

The ability to take measurements quickly and accurately must be mastered early in the carpenter's training. Practise reading the rule or tape to gain skill in fast and precise measuring.

Most industrialized countries use the metric system of measure (Système Internationale, SI). Linear metric measure centres on the metre, which is slightly longer than a yard. Smaller parts of a metre are denoted by the prefix *deci-* (1/10), which is used instead of *feet*. *Centi-* (1/100) and *milli-* (1/1000) are used instead of inches and fractions. The prefix *kilo-* represents 1,000 times larger and *kilometres* is used instead of *miles*. For example, in metric measure a 2 × 4 is 38 mm (millimetres) × 89 mm. The metric system is easier to use than the imperial system because all measurements are in decimal form and there are no fractions.

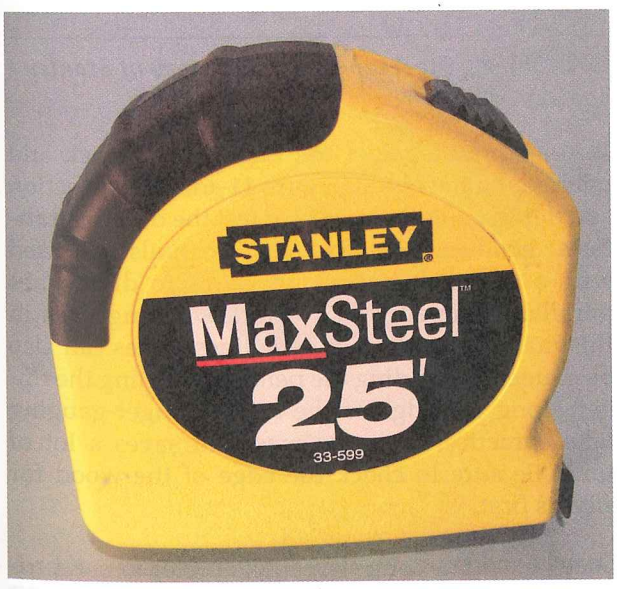


FIGURE 11–1 Pocket tape. *(Courtesy of Stanley Tools)*

Pocket Tapes. Most measuring done by tradespeople is done with **pocket tapes** **(Figure 11–1).** These are painted steel ribbons wound around a spool with a spring inside. The spring returns the tape after it is extended. They are made as small as 3 feet but typical professional models are 16, 25, and 33 feet long.

They are divided into feet, inches, and sixteenths of an inch. They have clearly marked increments of 12 and 16 inches, the spacing for standard framing members, to speed up the layout. Markings are usually black for each 12 inches and red for every 16 inches. Some tapes also have small black dots at increments of 19.2 inches **(Figure 11–2).** This spacing

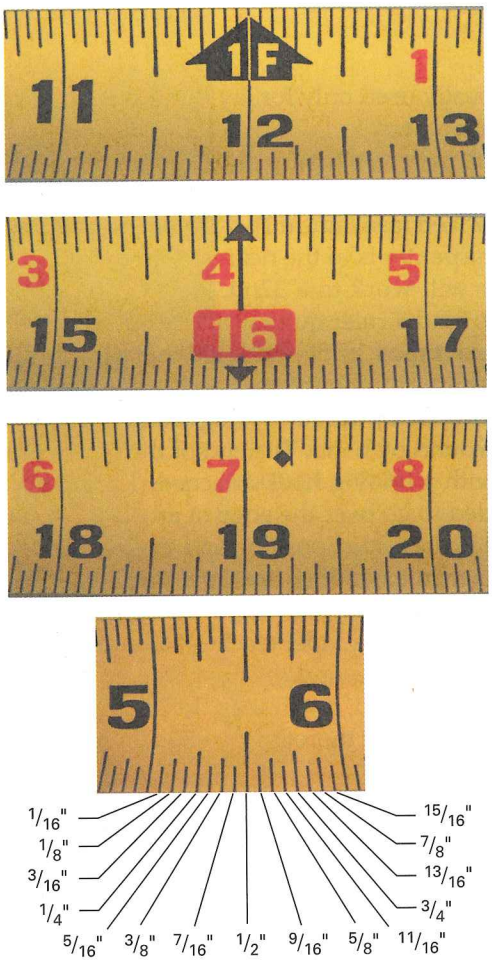


FIGURE 11–2 Tapes have colour-coded markings at 12-, 16- and 19.2-inch intervals. Each inch is typically broken into sixteenth of an inch increments.

FIGURE 11–3 **Imperial/metric tape measure.** *(Courtesy of Stanley Tools)*

is typically used only for layout of some engineered floor members.

Each inch on a tape is divided into fractions of an inch. Each fraction line has a name that must be memorized (see Figure 11–2). Most measuring done by a carpenter is to the nearest 16th, while a cabinet maker will work to a 32nd. A carpenter should be able to read a ruler quickly and accurately.

Steel tapes in 50- and 100-foot (15- and 30-m) lengths are commonly used to lay out longer measurements. They are not spring loaded, so they must be rewound by hand. The end of the tape has a steel ring with a folding hook attached. The hook can be unfolded to go over the edge of an object. It can also be left in the folded position and the ring placed over a nail when extending the tape. Remember to place the nail so that the *outside* of the ring, which is the actual end of the tape, reaches to the desired mark **(Figure 11–4).** Rewind the tape when not using it. If the tape is kinked, it will snap. Keep it out of water. If it gets wet, dry it thoroughly while rewinding.

Squares

The carpenter has the use of a number of different kinds of squares to measure and lay out for square and other angle cuts.

Combination Squares. The **combination square (Figure 11–5)** consists of a movable blade, 1 inch (25 mm) wide and 12 inches (305 mm) long, that slides along the body of the square. It is used to lay out or test 90- and 45-degree angles. Hold the body

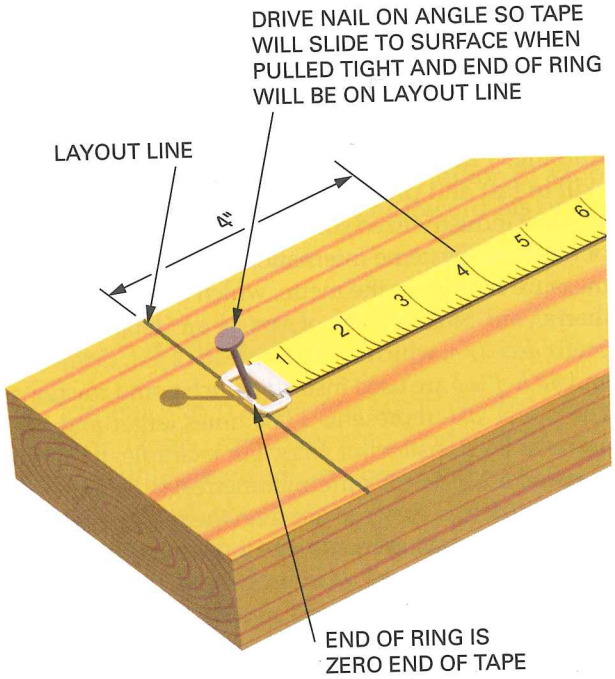


FIGURE 11–4 **Steel tape.** *(Top: Courtesy of Stanley Tools)*

of the square against the edge of the stock and mark along the blade **(Figure 11–6).** It can function as a depth gauge to lay out or test the depth of **rabbets, grooves,** and **dadoes.** It can also be used with a pencil as a marking gauge to draw lines parallel to the edge of a board. Drawing lines in this manner is called *gauging* lines. Lines can also be gauged by holding the pencil and riding the finger along the edge of the board. Finger-gauging takes practice, but once mastered saves a lot of time. Be sure to check the edge of the wood for slivers first.

Speed Squares. Some carpenters prefer to use a triangular-shaped square known by the brand name **Speed Square (Figure 11–8).** Speed Squares are made of one-piece plastic or aluminum alloy and are

FIGURE 11–5 The body and blade of a combination square are adjustable.

available in two sizes. They can be used to lay out 90- and 45-degree angles and as guides for portable power saws. A degree scale allows angles to be laid out; other scales can be used to lay out rafters.

Try squares. The **try square** consists of a steel blade, graduated in inches or millimetres, that is fitted into a centre slot at the end of a handle, which is fastened rigidly at 90 degrees to the blade. It is used to measure, lay out, and verify the squareness of members and joints.

Framing Squares. The **framing square,** often called the *steel, or rafter square* **(Figure 11–9),** is an L-shaped tool made of thin steel or aluminum. The longer of the two legs is called the *blade* or *body* and is 2 inches

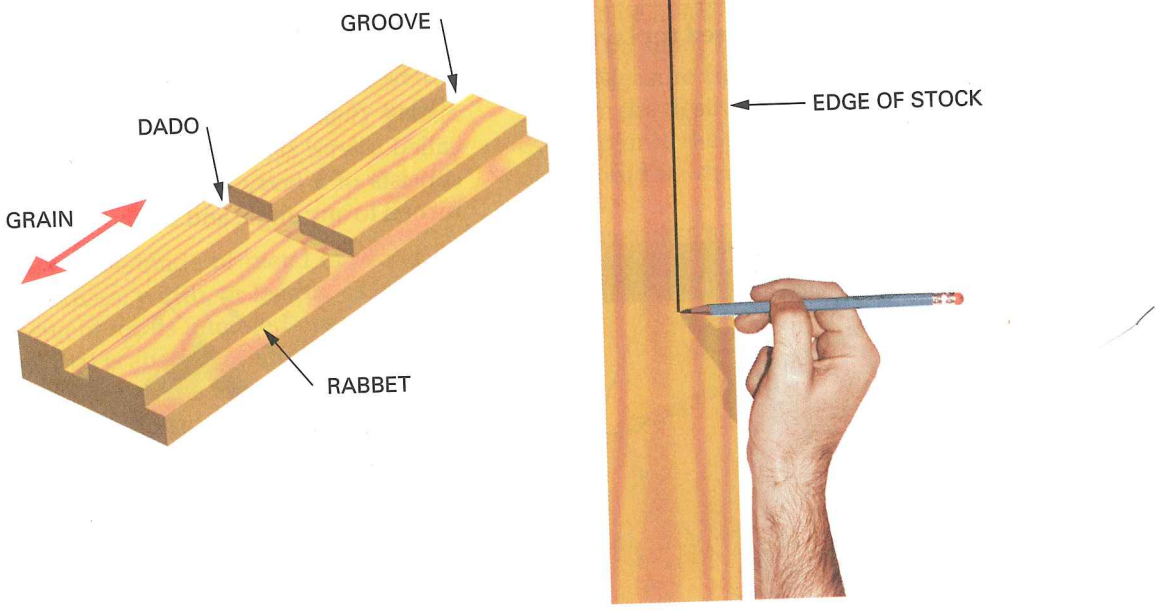


FIGURE 11–6 The combination square is useful for squaring and as a marking gauge. A pencil held in one hand is a quick way to draw a parallel line. Check the wood first to reduce the potential for splinters.

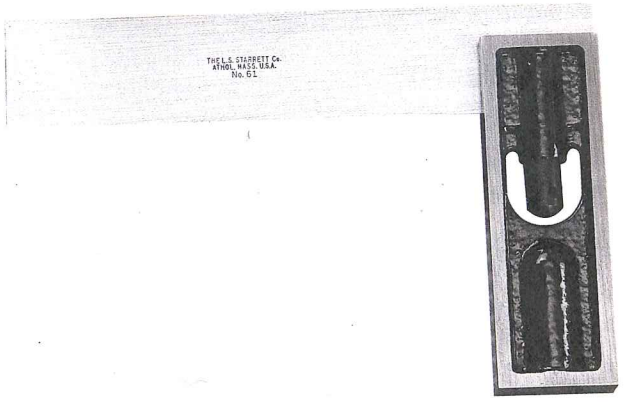


FIGURE 11–7 A try square. *(Courtesy of The Starrett Company)*

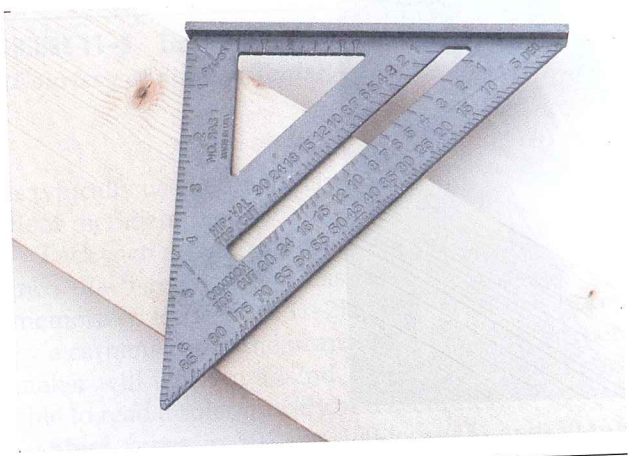


FIGURE 11–8 Speed Squares are used for layout of rafters and other angles.

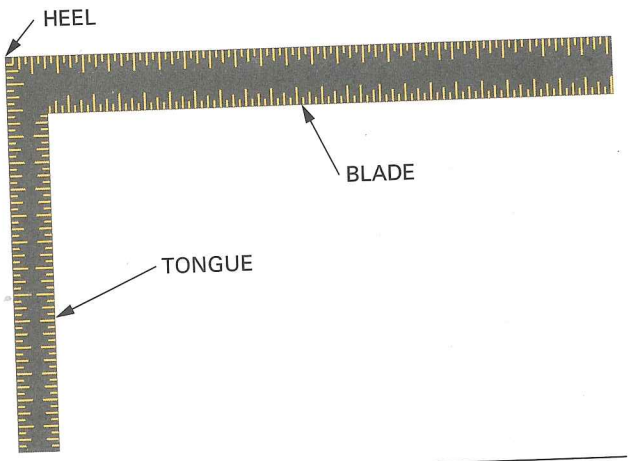


FIGURE 11–9 Framing or rafter square. *(Courtesy of Stanley Tools)*

(50 mm) wide and 24 inches (600 mm) long. The shorter leg is called the *tongue* and is 1½ inches (38 mm) wide and 16 inches (400 mm) long. The outside corner is called the *heel.*

The framing square is a centuries-old tool. Entire books have been written about it. Based on the use of the right triangle, many layout techniques have been devised and used. These techniques and the necessary scales, tables, and graduations stamped on the square were designed to assist the carpenter in the many calculations needed. Today a pocket calculator has virtually replaced these aids. The only exception is the rafter table, which is still useful today and will be discussed in more detail in Unit 15.

The framing square is useful in laying out roof rafters, bridging, and stairs. It is also used to lay out 90- and 45-degree angles **(Figure 11–10).**

The side that has the manufacturer's name stamped on it is referred to as the *face side.* The rafter table is printed on the body. On the same side of the square, on the tongue, can be found the *octagon scale,* which is used to lay out eight-sided timbers from square ones **(Figure 11–11).**

On the back side of the square, the *Essex board foot table* is used to calculate the number of board feet in lumber. The *brace table* is used to figure the length of diagonal braces. The *hundredths scale,* consisting of an inch divided into one hundred parts, is used to find 1/100ths of an inch. This scale may be used to convert fractions to decimals and vice versa.

On the face side, the edges are divided into inches, which are graduated into 1/8ths on the inside and 1/16ths on the outside. The edges on the back are divided into inches and 1/12ths on the outside, while one inside edge is graduated into 1/16ths and the other into 1/10ths.

Sliding T-Bevels. The *sliding T-bevel,* sometimes called a *bevel square* or just a **bevel (Figure 11–12),** consists of a body and a sliding blade that can be turned to any angle and locked in position. It is used

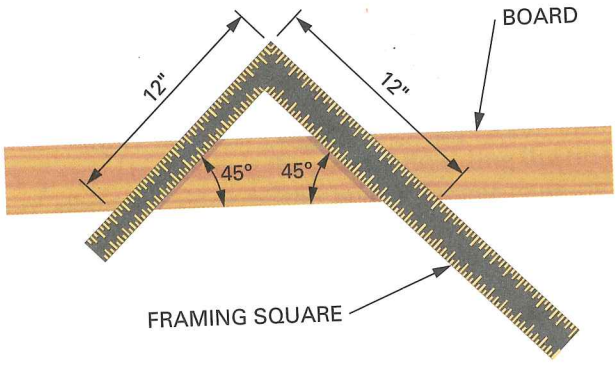


FIGURE 11–10 Laying out 45-degree angles with a framing square.

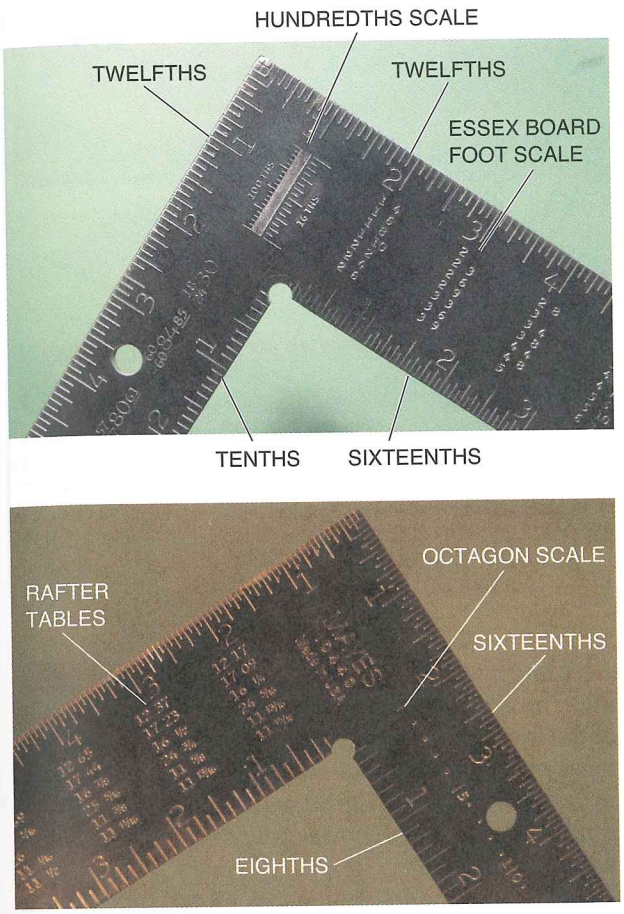


FIGURE 11–11 **Both sides of a rafter square have tables and scales to assist the carpenter.**

to lay out or test angles other than those laid out with squares. The body of the tool is held against the edge of the stock, and the angle is laid out by marking along the blade.

Straightedges

A **straightedge** can be made of metal or wood. It can have any thickness, width, or length, as long as the size is convenient for its intended use and it has at least one edge that is absolutely straight from one end to the other. To determine whether it is straight, sight along the edge. Another way is to lay the piece on its side and mark along its edge from one end to the other. Turn the piece over. Hold each end on the line just marked, and mark another line. If the two lines coincide, the edge is straight **(Procedure 11–A).**

Straightedges are useful for many purposes. The framing square, the blade of the combination square, or the back of a saw could be used as a straightedge for drawing short, straight lines.

To determine a straight distance over large distances, a line (or string) and gauge blocks can be

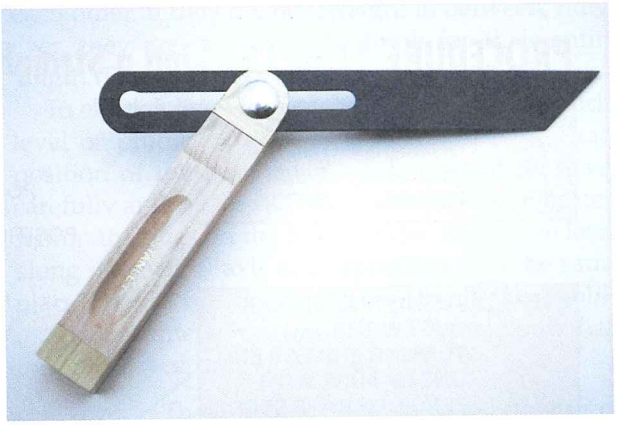


FIGURE 11–12 **Sliding T-bevel.** *(Courtesy of Stanley Tools)*

used. This method uses a taut string held away by offset blocks from the surface of the material being straightened. Another block of the same thickness as the offset blocks is then used intermittently to test the material's distance from the line **(Figure 11–13).** This method is easy and can be very accurate.

Trammel Points. A pair of tools called **trammel points** can be used to draw circles or parts of circles, called arcs **(Figure 11–14),** that may be too large for a compass. They can be clamped to a strip of wood any distance apart according to the desired radius of the circle to be laid out. One trammel point can be set on the centre while the other, which may have a pencil attached, is swung to lay out the circle or arc.

In place of trammel points, the same kinds of layouts can be made by using a thin strip of wood with a brad or small finish nail through it for a centre point. Measure from the end of the strip a distance equal to the desired radius. Drive the brad through the strip until the point comes through. Set the point of the brad on the centre, and hold a pencil against

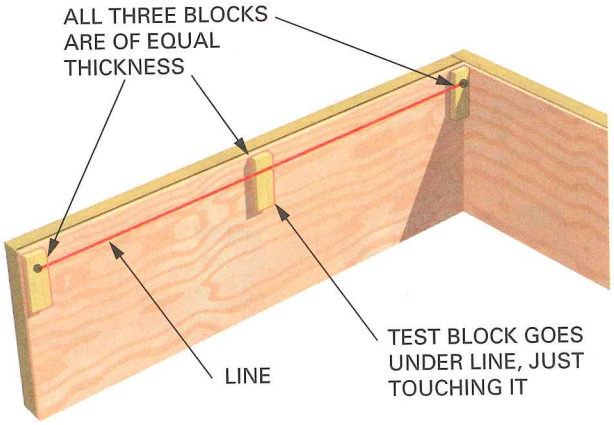


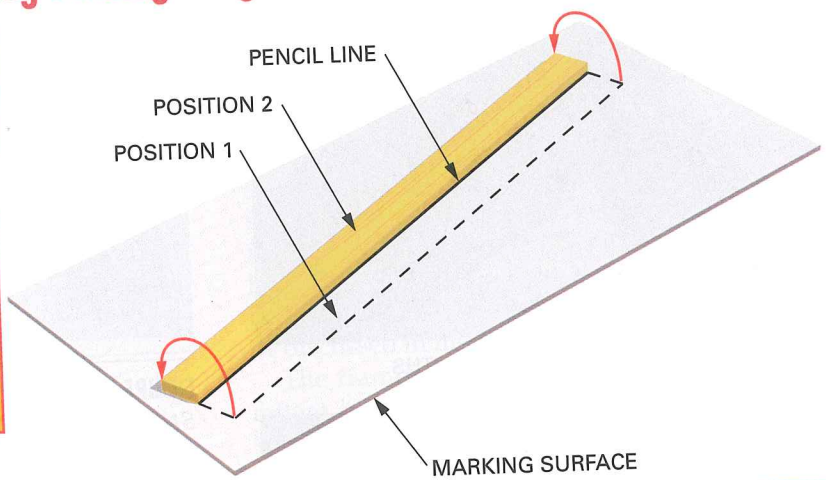
FIGURE 11–13 **Use of a line and gauge blocks is an effective method to determine a straight line.**

STEP BY STEP PROCEDURES

PROCEDURE 11–A Checking a Straightedge

STEP 1 LAY STRAIGHTEDGE ON MARKING SURFACE AND DRAW LINE ALONG ITS EDGE (POSITION 1).

STEP 2 TURN STRAIGHTEDGE OVER WITHOUT TURNING END FOR END. LINE UP EDGE WITH PENCIL MARK. IF EDGE COINCIDES WITH LINE FOR TOTAL LENGTH, EDGE IS STRAIGHT.



the end while swinging the strip to form the circle or arc **(Figure 11–15).** To keep the pencil from slipping, a small V can be cut on the end of the strip or a hole may be drilled near the end to insert the pencil. Make sure measurements are taken from the bottom of the V or the centre of the hole.

Levels

In construction, the term **level** is used to indicate that which is *horizontal,* and the term **plumb** is used to mean the same as *vertical.* The term *level* also refers to a tool that is used to achieve both level and plumb.

Carpenter's Levels. The **carpenter's level (Figure 11–16)** is used to test both level and plumb surfaces. Accurate use of the level depends on accurate reading. The air bubble in the slightly crowned glass tube of the level must be exactly centred between the lines marked on the tube. The tubes of a level are oriented in two directions for testing level and plumb. The number of tubes in a level depends on the level length and manufacturer.

Levels are made of wood or metal, usually aluminum. They come in various lengths from 12 to 78 inches (305 to 1981 mm). It is wise to use the longest level practical to improve accuracy.

An important point to remember is that level and plumb lines, or objects, must also be straight throughout their length or height. Parts of a structure may have their end points level or plumb with

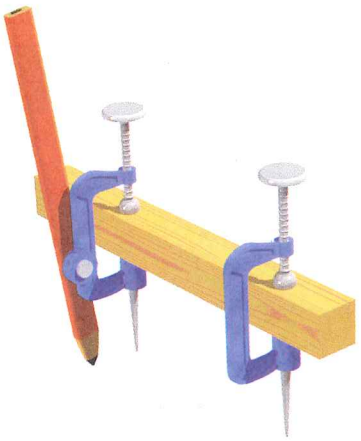


FIGURE 11–14 Trammel points are used to lay out arcs of large diameter.

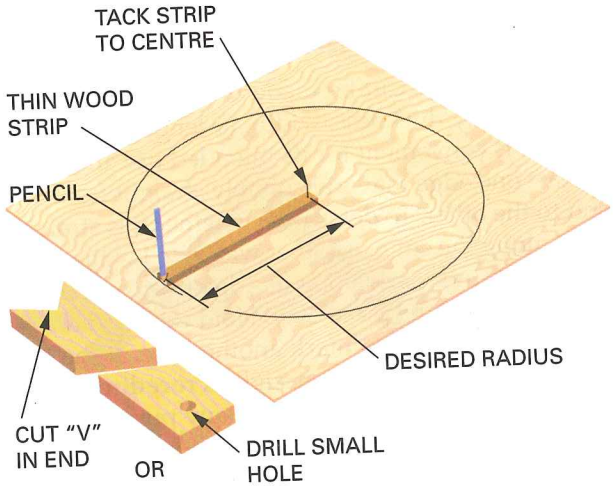


FIGURE 11–15 A thin strip of wood can be used to lay out circles or arcs.

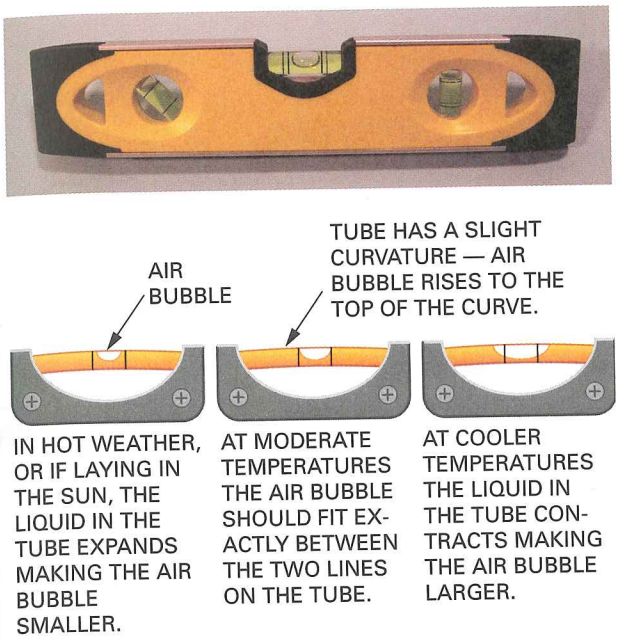


FIGURE 11–16 **The bubble size of a carpenter's level can be affected by temperature.**

each other. If they are not straight in between, however, they are not level or plumb for their entire length **(Figure 11–17).**

To check a level for accuracy, place it on a nearly level or plumb object that is firm. Note the exact position of the level on the object. Read the level carefully and remember where the bubble is located within the lines on the bubble tube. Rotate the level along its vertical axis and reposition it in the same place on the object **(Figure 11–18).** If the bubble reads the same as the previous measurement, then the level is accurate.

Line Levels. The **line level** **(Figure 11–19)** consists of one glass tube encased in a metal sleeve with hooks on each end. The hooks are attached to a stretched line, which is then moved up or down until the bubble is centred. However, this is not an accurate method and gives only approximate levelness. Care must be taken that the level be attached close to the centre of the suspended line because the weight of the level causes the line to sag. If the line level is off centre to any great degree, the results are faulty.

Plumb Bobs. The **plumb bob** **(Figure 11–20)** is accurate and is used frequently for testing and establishing plumb lines. Suspended from a line, the plumb bob hangs absolutely vertical. However, it is difficult to use outside when the wind is blowing because it will

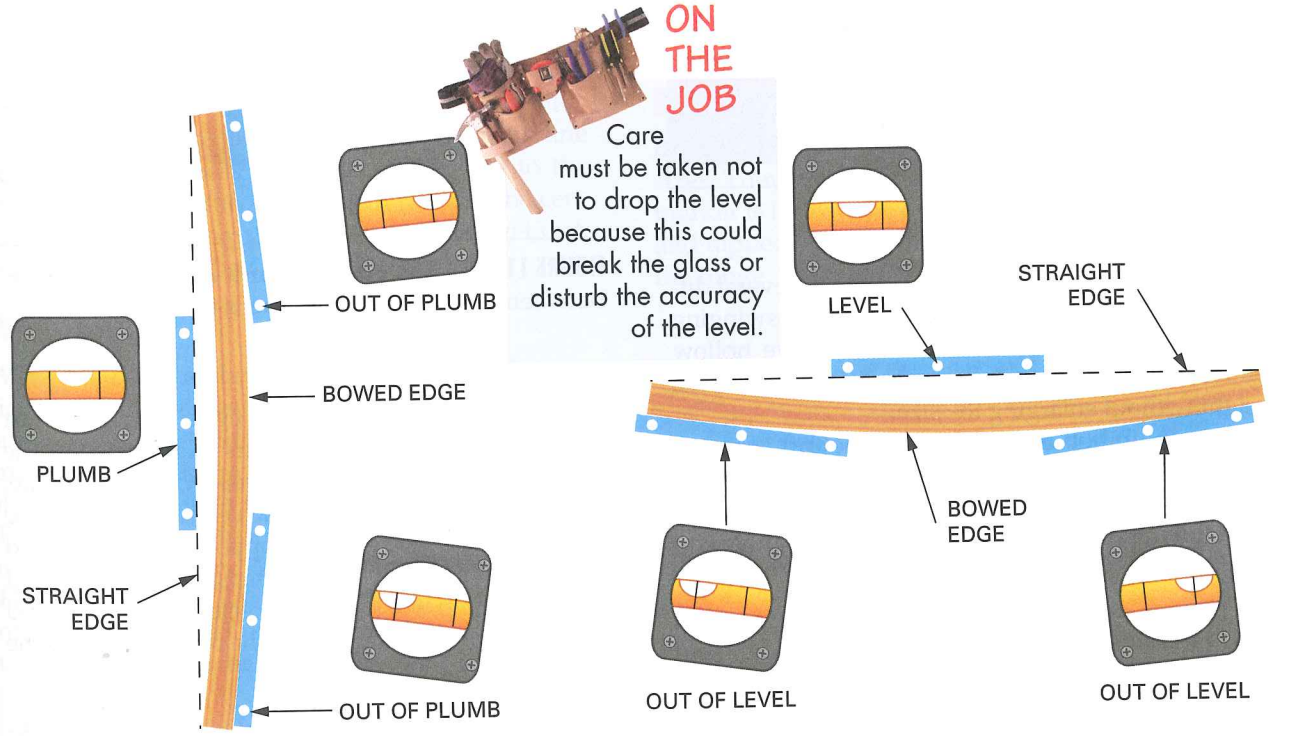


FIGURE 11–17 **To be level or plumb for their entire length, pieces must be straight from end to end.**

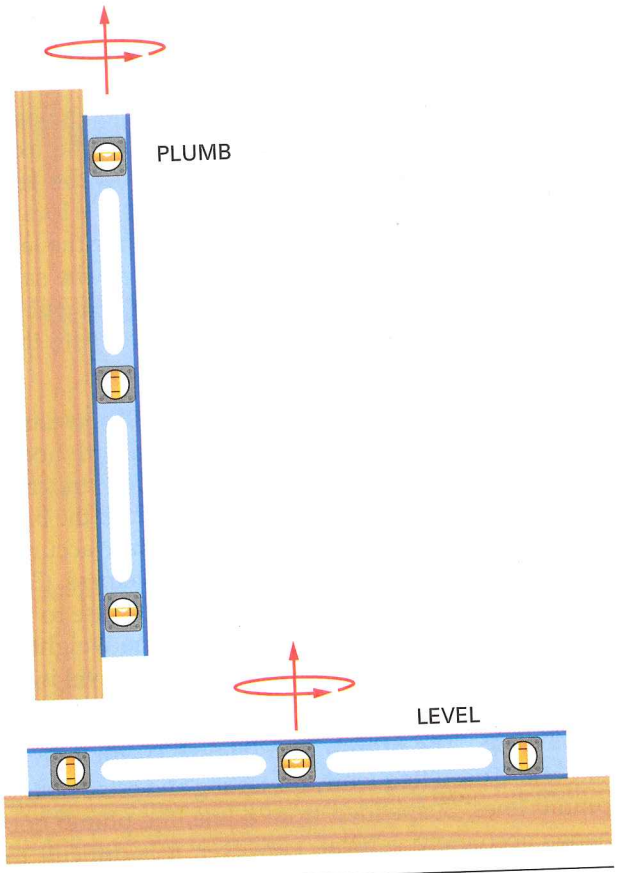


FIGURE 11–18 To check a level for accuracy the bubble should read exactly the same before and after rotating it.

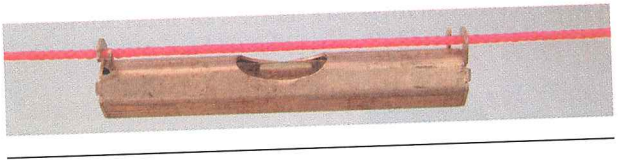


FIGURE 11–19 Line level.

move with the wind. Plumb bobs come in several different weights. Heavy plumb bobs stop swinging more quickly than lighter ones. Some have hollow centres that are filled with heavy metal to increase the weight without enlarging the size.

The plumb bob is useful for quick and accurate plumbing of vertical members of a structure **(Figure 11–21).** It can be suspended from a great height to establish a point that is plumb with another. Its only limitation is the length of the line.

Chalk Lines

Long straight lines are laid out by using a **chalk line.** A line coated with chalk dust is stretched tightly between two points and snapped against the surface **(Figure 11–22).** The chalk dust is dislodged from the line and remains on the surface.

FIGURE 11–20 Plumb bob.

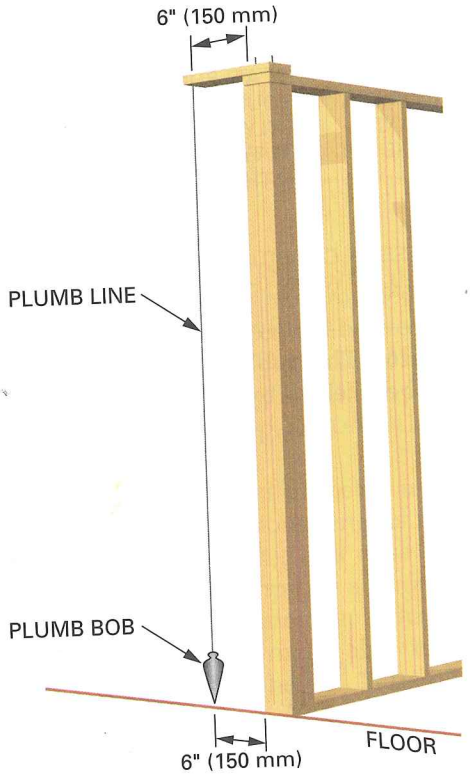


FIGURE 11–21 The post is plumb when the distance between it and the plumb line is the same.

A *chalk box* or *chalk line reel* is filled with chalk dust that comes in a number of colours **(Figure 11–23).** The most popular colours are blue, yellow, red, and white. The dust saturates the line, which is on a reel inside the box. The line is ready to be snapped when it is pulled out of the box. After several snaps, the line will need more chalk and will have to be reeled in to be recoated with chalk. Shaking or tapping the box helps recoat the line.

Chalk Line Techniques. When unwinding and chalking the line, keep it off the surface until snapped. Otherwise many lines will be made on the surface, and this could be confusing. Make sure lines are

FIGURE 11–22 Snapping a chalk line.

FIGURE 11–23 Chalk line reel.

stretched tight before snapping in order to snap a straight and true line. Sight long lines by eye for straightness to make sure there is no sag in the line. If there is a sag, take it out by supporting the line near the centre. Press the centre of the line to the material and snap the line on both sides of the centre. Keep the line from getting wet. If it does get wet, leave it outside the box until it dries.

Wing Dividers

Wing dividers can be used as a compass to lay out circles and arcs and as dividers to space off equal distances. However, this tool is used mainly for **scribing** and is often called a *scriber*. Scribing is the technique of laying out stock to fit against an irregular surface **(Figure 11–24).** For easier and more accurate scribing, heat and bend the end of the solid metal leg outward **(Figure 11–25).** Pencils are usually used in place of the interchangeable steel marking leg. Use pencils with hard lead that keep their points longer.

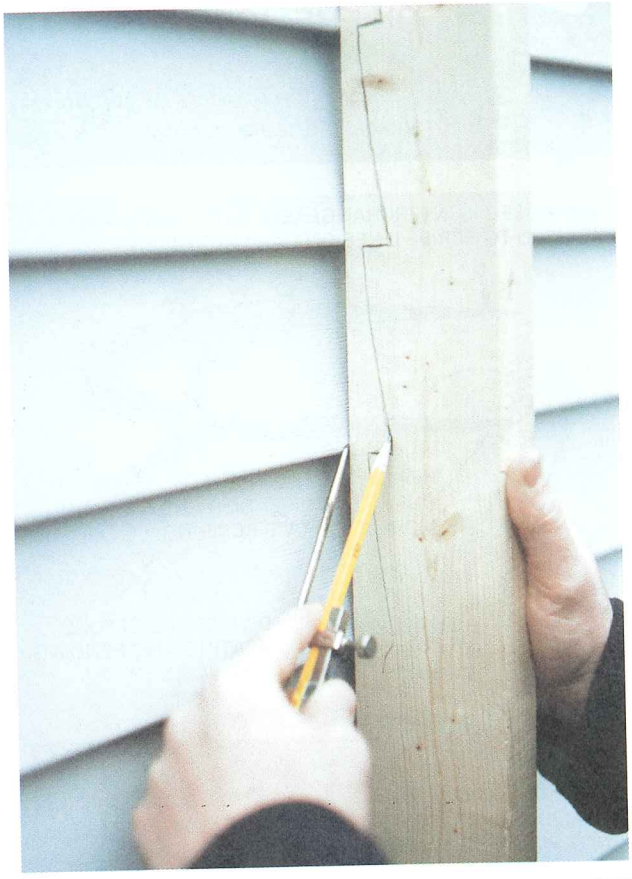
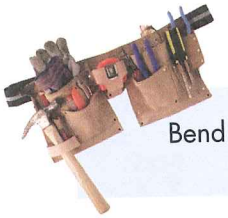


FIGURE 11–24 Scribing is laying out a piece to fit against an irregular surface.

Butt Markers

Butt markers **(Figure 11–26)** are available in three sizes. They are often used to mark hinge gains. The marker is laid on the door edge at the hinge location and tapped with a hammer to outline the cutout for the hinge.



ON THE JOB

Bend the leg of the dividers as shown for easier and more accurate scribing.

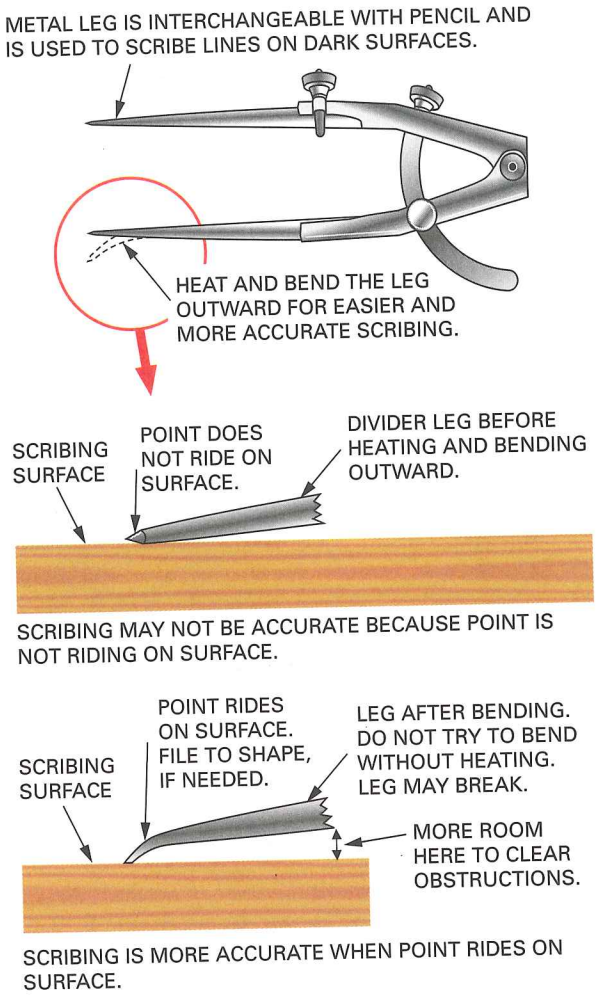


FIGURE 11–25 Adjusting one of the metal legs of a scriber makes it a more accurate tool.

FIGURE 11–26 Butt hinge markers make mortising the hinge into a door easier.