Chapter 4 - Framing Materials and Tools

Contents

Building Materials

This section defines the materials typically used to frame a Habitat for Humanity home.

Dimensional Lumber

The basic frame of the house is constructed of dimensional lumber. This lumber is called out by its nominal name such as 2x4, but is actually smaller. Most houses will be built with the following:

- 2x4s – 1 ½" x 3 ½"
- 2x6s – 1 ½" x 5 3/8". The widths may vary by 1/8"
- 2x8s – 1 ½" x 7 ¼". The widths may vary by 1/8"
- 2x10s- 1/1/2" x 9 ¼". The widths may vary by 1/8"
- 2x12s - 1/1/2" x 11 ¼". The widths may vary by 1/8"
- 4x4s – 3 ½" x 3 ½"
- 6x6s – 5 ½" x 5 ½"

Spruce/Pine/Fir Lumber (SPF)

Most dimensional lumber will be stamped with SPF which means it is cut from one of the soft wood trees: Spruce, pine or fir. This type of lumber can be used everywhere except where it will contact concrete or exposed to the weather.

Pressure-Treated Lumber (PT)

Most dimensional lumber is available as pressure-treated lumber. Pressure-Treated Lumber is used as sill plates and anywhere framing lumber contacts concrete, such as foundations, basement floors and porches.

Pressure-Treating is a process of impregnating lumber with various chemicals, such as preservatives and fire-retardants, by forcing the chemicals into the structure of the wood using high pressure. Pressure-treated lumber is required anywhere the lumber will contact concrete. The most typical chemical today is ACQ (Alkaline Copper Quaternary) which is a water-based wood preservative method where copper and quaternary ammonium compound are introduced to the wood to increase the resistance to bacteria and fungi. **Note:** common nails will be dissolved when used in pressure-treated lumber by the ACQ unless they have a galvanized coating.

Precut Stud

Dimensional lumber cut to a precise length at the mill and designed to be used in framing building walls with little or no trimming before it is set in place. Precut studs are most often 2x4s, but 2x6s are also available.

A typical 8' wall will use 92 5/8" pre-cut studs.

Laminated Veneer Lumber (LVL)

Laminated Veneer Lumber is stronger than dimensional lumber which is the same size. It is used where long spans are required or extra support is required.

Oriented Strand Board (OSB)

A structural panel made of narrow strands of fiber oriented lengthwise and crosswise in layers, with a resin binder. Depending on the resin used, OSB can be suitable for interior or exterior applications.

Laminated Strand Lumber (LSL)

Laminated Strand Lumber uses the same processes as OSB to create dimensional size lumber.

Plywood

A flat panel made up of a number of thin sheets, or veneers, of wood in which the grain direction of each ply, or layer, is at right angles to the one adjacent to it. The veneer sheets are united, under pressure, by a bonding agent.

Floor Joists

Floor Joists are the materials used horizontally to support the floor of the structure and the framing above. They lie on edge atop the sill plate and bearing walls below. These can be made with dimensional lumber, Flak Jacketed I-joists, or open-web joist or trusses. The choice and size of the material will vary depending on the application and the span required.

Figure 4.1 – Triforce Open Web Joists

Dimensional lumber – 2x10 or larger are normally used.

Pros- Cheaper, easier access to the materials. Currently does not require fire-proofing.

Cons – The crown of each piece will be different causing the floor to be less level. The material is narrower leaving less room for glue, limited span without a bearing wall.

Flak Jacketed I-Joist - A beam whose cross section resembles the letter "I"; one in which the top and bottom flanges are made from SPF lumber and are connected by a thinner material installed vertically made of either plywood or OSB. The sides and bottom are covered with an intumescent coating.

Pros – Easy to cut to fit, does not require additional fire-proofing, extremely level.
Cons – Expensive, limited span without a bearing wall

Open Web Trusses

Pros – very level, longer spans, more green

Cons – Requires fire-proofing, sharp metal plates and cannot be cut to fit.

TriForce Floor Joist

Pros – very level, longer spans, more green

Does NOT require fire-proofing, no metal plates and CAN be cut to fit.

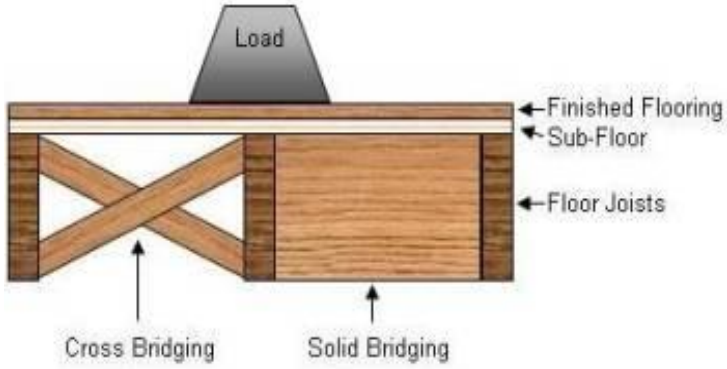
Cons –

Beam

A large steel strut or a series of dimensional lumber pieces glued and nailed together that support the joist when the span of the foundation is greater than the technical limits of the joists.

Cross Bridging / Blocking

Figure 4.2 – Floor Joist Bridging



Wooden 1x3 X bracing

Metal X bracing

For floors built with linear lumber or with I-Joists, cross bridging is required to prevent squeaks. Cross bridging can be installed with:

- pieces of 1x nailed diagonally in between the joists
- Solid pieces of 2x nailed between the joists.
- Manufactured metal bracing.

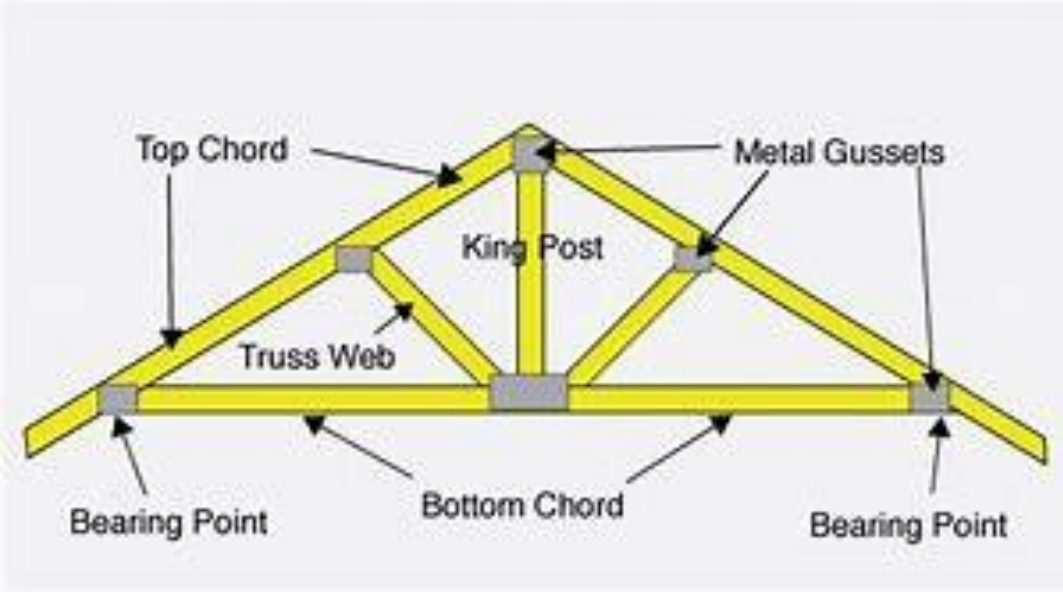
Two (2) braces should be installed between each pair of joists. There should be approximately 1" between the braces.

The tops of the braces are nailed in place before the decking is installed. Then, the bottom of each brace is nailed in place after the decking and walls above are installed.

TRUSSES

Roof Trusses are used to frame the roof.

Figure 4.3 – Roof Trusses



Sill Seal

Sill Seal is a thin foam layer installed between the foundation and the sill plates to fill in the gap and help insulate the house.

Framing Connectors

Framing Nails

There are two (2) types of nails used to attach the framing members: sinkers and common nails. The size of the nails are denoted with a “d” suffix which is an archaic English abbreviation for “penny”. The following is a table of the most common sizes:

Nail Sizes:

Common Nails

Size	Length	Gauge	#/LB
6D	2”	13	290
8D	2 1/2"	11 ½	150
10D	3"	11	110
12D	3 1/4"	10	81
16D	3 1/2"	9	64
20D	4"	7	40

Sinker Nails:

Size	Length	Gauge	#/LB
6D	2”	11 ½	160
8D	2 ½”	10 ¼	100
10D	3”	9	65
12D	3 ¼”	9	60
16D	3 ½”	8	45
20D	4”	6	30

Sinker

Sinkers are the most common nails used in framing today. They are more sleek and better for framing. Sinkers usually have a coating of vinyl or epoxy that helps them slide into wood more easily. The bottom of the head is tapered like a wedge or funnel and the top of the head is grid embossed to keep the hammer strike from sliding off.

Common Nails

Common nails are a common construction wire nail with a smooth disk-shaped head that is typically 3 to 4 times the diameter of the shank. Common nails have larger shanks and are a heavier gauge nail than sinkers.

Box Nails

Box nails are a wire nail and have a smaller shank than *common* nails of the same size.

Bright Nails

Bright nails have no surface coating; not recommended for weather exposure or acidic or treated lumber.

Galvanized Nails

Galvanized nail is a type of fastener that has been coated in Zinc to prevent corrosion and/or weather exposure.

Double Dipped Galvanized
Double dipped galvanized nails have an extra layer of protective zinc applied to fastener, making it even more resistant to rusting.

Hot-Dip Galvanized
Hot-dip galvanized nails have a rough finish that collects more zinc than other methods, resulting in very high corrosion resistance that is suitable for some acidic and treated lumber.

Casing Nails
Casing nails are a wire nail with a slightly larger head than *finish* nails; often used for wood trim and flooring.

Duplex Nails
Duplex nails are a common nail with a second head, allowing for easy extraction; often used for temporary work, such as concrete forms or wood scaffolding; sometimes called a "scaffold nail".

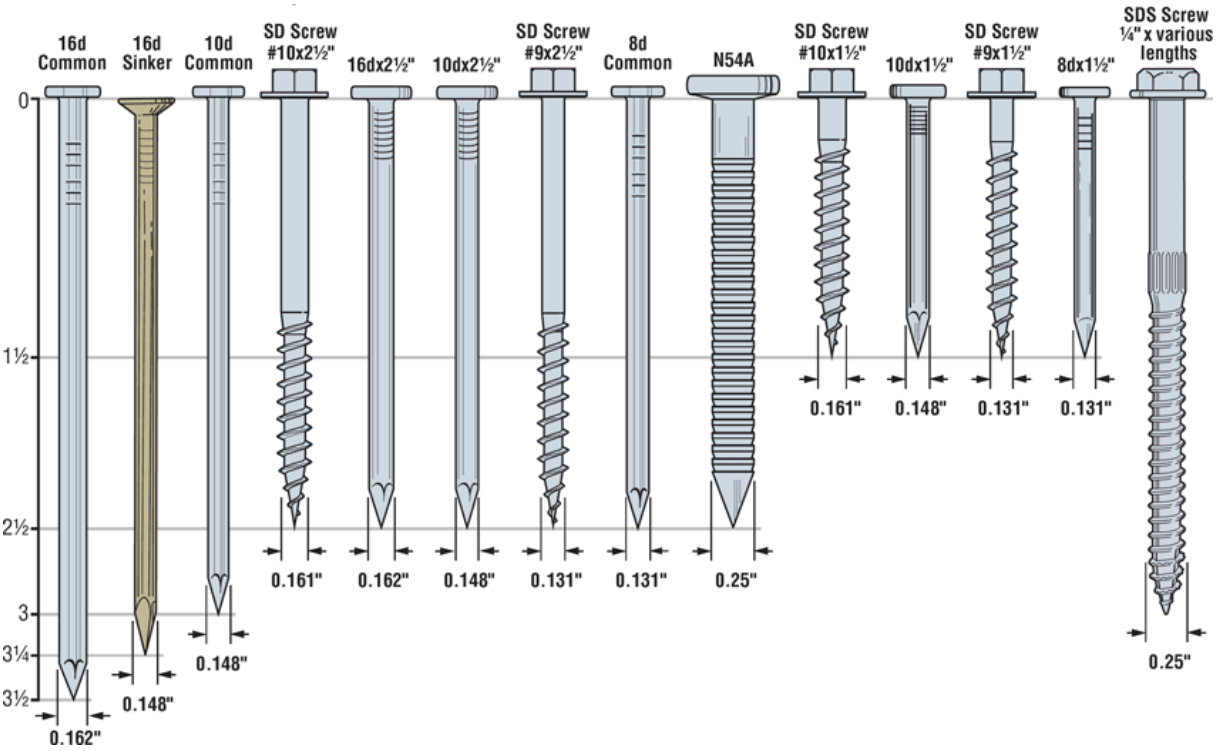
Drywall Nails
Drywall nails are a specialty blued-steel nail with a thin broad head used to fasten gypsum wallboard to wooden framing members.

Finish Nails
A wire nail that has a head only slightly larger than the shank; can be easily concealed by countersinking the nail slightly below the finished surface with a nail-set and filling the resulting void with a filler (putty, spackle, caulk, etc.).

Hanger Nails / Simpson Nails
A galvanized nail used for hanger applications where sheer force strength is needed.

Figure 4.4 Simpson Nail Chart

Nail	Simpson Model No.	Shank Type	Dimensions	Wire Gauge	Finish
8dx1½"	N8	Smooth	0.131" x 1½" (3.3mm x 38.1mm)	10¼	HDG
	SSN8				SS
	SSNA8	Ring			
8d Common	SS8D	Smooth	0.131" x 2½" (3.3mm x 63.5mm)	10¼	SS
	SSA8D	Ring			
10dx1½"	N10	Smooth	0.148" x 1½" (3.8mm x 38.1mm)	9	HDG
	SSN10				SS
	SSNA10	Ring			
10d Common	10DHDG	Smooth	0.148" x 3" (3.8mm x 76.2mm)	9	HDG
	SS10D				SS
	SSA10D	Ring			
16dx2½"	N16	Smooth	0.162" x 2½" (4.1mm x 63.5mm)	8	Bright
16d Common	16DHDG	Smooth	0.162" x 3½" (4.1mm x 88.9mm)	8	HDG
	SS16D				SS
	SSA16D	Ring			
N54A	N54A	Ring	0.250" x 2½" (6.4mm x 63.5mm)	3	Bright
	N54AHDG				HDG



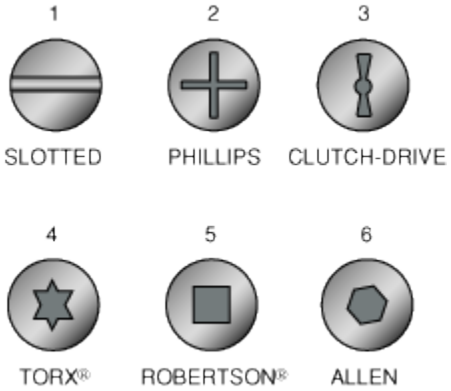
Screws

A screw is a type of fastener characterized by thread wrapped around a cylinder. The threads are designed to cut a helical groove in a softer material as the screw is inserted. The most common uses of screws are to hold objects together and to position objects.

A screw will almost always have a head on one end which contains a specially formed shape that allows it to be turned, or driven, with a manual screwdriver or power screwdriver. The head is usually larger than the body of the screw, which keeps the screw from being driven deeper than the length of the screw and to provide a bearing edge. The cylindrical portion of the screw from the underside of the head to the tip is known as the shank; it may be fully threaded or partially threaded. The distance between each thread is called the "pitch".

The majority of screws are tightened by clockwise rotation, which is termed a right-hand thread.

The type and size of screwdriver or driver bit needed to install the screws depends on the size and shape of the driving hole in the screw head. Today, the most common shape is the Phillips. The slotted shape is less popular as it tends to strip out. All shapes have various sizes.



Slotted blades sizes – 3/32” – ½”

Phillips driver sizes - #0 - #4

Torx driver sizes – T3 – T55

Robertson driver sizes - #0 - #4

Drywall Screws

Specialized screw with a bugle head that is designed to attach drywall to wood or metal studs, however it is a versatile construction fastener with many uses. The diameter of drywall screw threads is larger than the grip diameter.

Wood Screws

A metal screw with a sharp point designed to attach two pieces of wood together. Wood screws are commonly available with flat, pan or oval-heads. A wood screw generally has a partially unthreaded shank below the head. The unthreaded portion of the shank is designed to slide

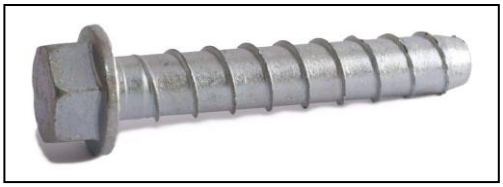
through the top board (closest to the screw head) so that it can be pulled tight to the board it is being attached to.

Deck Screws / Exterior Wood Screws

Similar to drywall screw except that it has improved corrosion resistance and is generally supplied in a larger gauge. Most deck screws have a type-17 (auger type) thread cutting tip for installation into decking materials. They have bugle heads that allows the screw to depress the wood surface without breaking it.

Tapcon / TItan

A stainless or carbon steel screw for fastening wood, metal, or other materials into concrete or masonry. Concrete screws are commonly blue in color, with or without corrosion coating. They may either have a Phillips flat head or a slotted hex washer head. Heads sizes range from 0.1875 to 0.375 in (4.763 to 9.525 mm) and lengths from 1.25 to 5 in (32 to 127 mm). Typically an installer uses a hammer drill to make a pilot hole for each concrete screw.



Lag Screws / Lag Bolts

Lag screws are basically large wood screws with either square-heads or hex-heads. A typical lag bolt can range in diameter from ¼ in (6.35 mm) to 1 ¼ in (31.75 mm), and lengths from ¼ to 6 in (6.35 to 152.40 mm) or longer, with the coarse threads of a wood-screw.

The materials are usually carbon steel substrate with a coating of zinc galvanization (for corrosion resistance). The zinc coating may be bright (electroplated), yellow (electroplated), or dull gray hot-dip galvanized. Lag bolts are used to lag together lumber framing, to lag machinery feet to wood floors, and for other heavy carpentry applications.

Mirror Screws

This is a flat-head wood screw with a tapped hole in the head, which receives a screw-in chrome-plated cover. It is usually used to mount a mirror.

Carriage Bolts

A carriage bolt, also known as a coach bolt, has a domed or countersunk head, and the shank is topped by a short square section under the head. The square section grips into the part being fixed (typically wood), preventing the bolt from turning when the nut is tightened. Carriage bolts are used to provide a smooth finish on automobile metal bumper exteriors, the square section aligning with a square hole in the bumper to provide anti-rotation. A rib neck carriage bolt has several longitudinal ribs instead of the square section, to grip into a metal part being fixed.

Framing Tools

Safety Issues
➢ Never leave unsecured tools lying on top of a wall or ladder. ➢ Never leave tools lying in walking paths. ➢ Never leave tools where they can be bent or damaged. ➢ Ensure tools are in good working order before using them.

Claw Hammer

Inspections
➢ Ensure the head is on tight. ➢ Ensure the head is not chipped. ➢ Ensure the handle is not cracked, broke or muddy.

The claw hammer is a tool primarily used for driving nails into, or extracting nails from dimensional lumber. It is not suitable for heavy hammering on metal surfaces (such as in machining work), as the steel of its head is somewhat brittle.

The heads will be made of steel and the handles may be wooden or fiber glass. Most claw hammers have a 16 oz head, but lighter weight versions can be found.

Anti-Vibration models are a good idea to help reduce carpal tunnel injuries.

Framing Hammer

Inspections
➢ Ensure the head is on tight. ➢ Ensure the head is not chipped. ➢ Ensure the handle is not cracked, broke or muddy.

The framing hammer is a heavy duty hammer with a heavier head, waffle face, longer handle and a straight claw used for framing houses. Heavy heads and longer handles increase the force delivered, driving the larger nails into dimensional lumber more easily and quickly. Used properly, a framing hammer will reduce arm fatigue and the risk of carpal tunnel syndrome.

The hammer heads typically weigh from 20 oz to 32 oz for steel heads, and 12 oz to 16 oz for titanium heads. The face of the head consists of a waffle-like grid of small four sided pyramids. Nails typically used for framing have a grid of intersecting raised metal lines on the head of the nail. The raised marks on the head of the hammer grip is a grid, which helps to prevent the hammer from sliding off the nail head when striking a nail.

Speed Square (rafter square, rafter angle square, triangle square)

Inspections
➢ Ensure the square is not broken or bent.
➢ Ensure the tool is clean and the numbers are readable.

A **speed square** is a triangular shaped marking tool.

Speed squares are used:

- To create layout marks for framing.
- To mark perpendicular cutting lines on dimensional lumber.
- As a saw guide for making short 45 and 90 degree cuts.
- To create layout marks and angles for roofs and stairways.

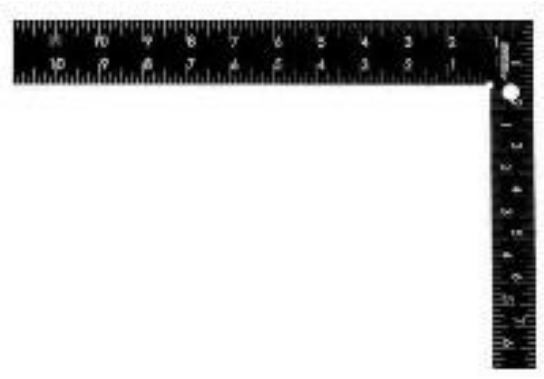
Embedded degree gradations on the tool eliminate complex trigonometry, making for speedy lines.

The tool is a right triangle with a ruler on one equal side and a fence on the other. It is marked with the word **Pivot** at the right angle point and displays **Degrees** on its hypotenuse, **Common** and **Hip/Val** markings on its midsection.

- **Degree** indicate the angle in degrees from 0° to 90°.
- **Common** indicate the rise in inches over a 12 inch run for common rafters from 1 in. to 30 in.
- **Hip/Val** indicate the rise in inches over a 12 inch run for Hip or Valley rafters from 1 in. to 30 in.

Framing Square (Steel Square)

Inspections
➢ Ensure the square is not bent or dented.
➢ Ensure the square lies flat.
➢ Ensure the tool is clean and the number are readable.



The framing square consists of a long arm and a shorter one, which meet at an angle of 90 degrees. The wider arm, two (2) inches wide, is called the **blade**; the narrower arm, one and a half (1 ½) inches wide, the **tongue**.

The framing square is used:

- To lay out a "square" or right-angle
- For measurement, especially of angles, as well as simple right-angles
- To lay out common rafters, hip rafters, and stairs.

It has a diagonal scale, board foot scale and an octagonal scale. On the newer framing squares there are degree conversions for different pitches and fractional equivalents.

Combination Square

Inspections
➢ Ensure the square is not broken or bent. ➢ Ensure the tool is clean and the numbers are readable.

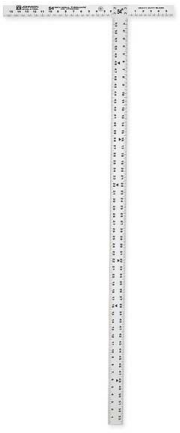
A **combination square** is composed of a ruled blade and one or more interchangeable heads that may be affixed to it. The most common head is the *standard* or *square* head which is used to lay out or check right and 45° angles. The head can be locked in place anywhere along the length of the rule to produce a fixed measurement.

Uses

- Measuring angles — A combination square can reliably measure 90° and 45° angles. The 45° angle is used commonly in creating miter joints.
- Measuring the center of a circular bar or dowel. The rule is assembled through the center of the center square, the two cast iron legs of the center square are then placed against the outside of the bar (dowel) allowing a center line to be scribed alongside the ruler. Perform this action at two locations and the intersecting lines will approximate the center of the bar (dowel).
- Protractor head allows angles to be set and measured between the base and ruler.
- A rudimentary level for approximating level surfaces is incorporated in the protractor and also the 45° holder.
- By moving and setting the head, it can be used as a depth gauge or to transfer dimensions.

Drywall Square

Safety Issues
➢ Store the square securely, preferably hanging from a sheet of drywall.
Inspections
➢ Ensure the square is not bent.



A **drywall square** is a “T” shaped marking tool.

Drywall squares are used:

- To mark and cut lines on sheets of drywall.
- As a guide for scoring drywall with a utility knife.
- To mark cut lines on sheets of OSB.

Chalk Line / Chalk Box

Inspections
➢ Ensure the line pulls out easily and is free of knots. ➢ Ensure the line cranks back in easily.

A **chalk line** is a tool for marking long, straight lines on relatively flat surfaces.

Use

A chalk line draws straight lines by the action of a taut string that is coated with chalk. The string is laid across the surface to be marked and pulled tight. Next, the string is snapped sharply, causing the string to strike the surface, which then transfers its chalk to the surface along that straight line where it struck.

Chalk lines are typically used to mark relatively flat surfaces. However, as long as the line is taut and the two ends of the chalk line are in nearly the same plane, the chalk line will mark all points that the string touches on or near that plane once snapped. The objects to be marked do not need to be continuous along the line. Chalk lines can also be used across irregular surfaces and surfaces with holes in them, for example on an unfinished stud wall.

The primary problems associated with improper maintenance of a chalk line are string breakage due to excessive tension on the line, and degradation of the line associated with moisture contamination.

Plumb Bob

Inspections
➢ Ensure there are no knots in the string. ➢ Ensure the string is secure to the plumb-bob.

A **plumb-bob** is a weight, usually with a pointed tip on the bottom, suspended from a string and used as a vertical reference line. It is used to transcribe a position onto the ground below for placing a marker.

Levels, Bubble Levels, Spirit Level

Safety Issues
➢ Store the tool flat, do not lean or stand tool on end.
Inspections
➢ Ensure the level is not broken or bent.

- Ensure the tool is clean and readable.
- Set the level on a flat surface; note the position of the bubble; spin the level end-to-end; note the position of the bubble again. Ensure the bubble is in the same position before and after spinning it.
- If the level has more than one bubble, check each bubble separately.

A **spirit level**, **bubble level** or simply a **spirit** is an instrument designed to indicate whether a surface is level (horizontal) or plumb (vertical).

Today's levels have a barrel shaped tube incompletely filled with a liquid, usually a colored alcohol, leaving a bubble in the tube. The bubble will seek the highest point in the tube. The tube is calibrated with lines indicating the center of the tube. When the bubble rests in the center of the lines, the tube is level to the earth. At slight inclinations the bubble travels away from the marked center position.

Tubes are placed at each viewing point along a rectangular beam. The tubes will be positioned parallel to the beam for checking level; perpendicular to the beam for checking plumb; and sometimes at a 45 degree angle for checking inclines.

Checking and adjustment

To check the accuracy of a carpenter's type level (i.e. whether the level indicates that a truly horizontal surface is, in fact, level), it is placed on a flat and roughly level surface and the reading on the bubble tube is noted. This reading indicates to what extent the surface is parallel to the horizontal plane, according to the level, which at this stage is of unknown accuracy. The spirit level is then rotated through 180 degrees in the horizontal plane, and another reading is noted. If the level is accurate, it will indicate the same orientation with respect to the horizontal plane. A difference implies that the level is inaccurate.

Types

There are different types of spirit levels for different uses:

- Carpenter's level. These levels come is various lengths. The most common are 2', 4', 6' and 8'.
- Torpedo level. These levels are normally 12".
- Post level. These levels allow bubbles to be positioned on adjoining faces of the post, allowing for faster adjustments to the post.
- Line level. These levels are normally 2" long and hang on a taut string.

Pry Bar

Inspections
➢ Ensure the nail claws are not cracked or bent.

A pry bar is a bent piece of metal bar used for prying apart pieces of framing material. There is a slot in each end of the bar for hooking nails. The long arm provides leverage for prying.

Types:

- **Crow bar**.

Longer and rounder, mostly used for demolition.

- **Flat Bar (Wonder Bar)**

A flat bar is a bent piece of flat steel used for prying apart pieces of framing material. There is a slot in each end of the bar for hooking nails. The long arm provides leverage for prying. The flat steel allows the bar to be driven into skinnier places.

- **Cat's Paw**

A shorter pry bar, mostly used to extract nails for framing materials.

Sledge Hammer

Safety Issues
➢ Ensure there is no one standing near or behind the volunteer using the sledge hammer.
Inspections
➢ Ensure the head is on tight. ➢ Ensure the head is not chipped. ➢ Ensure the handle is not cracked, broken or muddy.

The sledge hammer is a long handled hammer primarily used for driving stakes into the ground. If is also useful for breaking up concrete slabs.

The heads will be made of steel and the handles may be wooden or fiber glass.

Power Tools

Safety Issues

- Ensure tools are in good working condition. All guards and handles must be in place and the switches working correctly.
- If using a corded tool, ensure there are no nicks in the cord and the plug is securely mounted on the cord.
- Ensure cutting tools are sharp and clean.
- Use double insulated tools or ensure that the tools are grounded.
- All corded tools must be plugged into a GFCI outlet.
- If using a battery powered tool, ensure the battery pack is not cracked or damaged.
- Do not force the power tool. Use the correct power tool for your application. The correct power tool will do the job better and safer at the rate for which it was designed.
- Disconnect the plug from the power source before making any adjustments, changing accessories, or storing power tools.
- Turn off saws before leaving them unattended.
- Raise or lower tools by their handles, not by their cords.
- Follow the requirements for safe use of all tools.

Electrical Cords/Splitter Cords/Splitters

Safety Issues

- Don't use frayed or worn electrical cords or cables.
- Use only 3-wire type extension cords designed for hard or junior hard service. (Look for any of the following letters imprinted on the casing: S, ST, SO, STO, SJ, SJT, SJO, SJTO.)
- Maintain all electrical tools and equipment in safe condition and check regularly for defects.
- Extension cords that are exposed to automobile or equipment traffic must be protected from damage.
- Don't bypass any protective system or device designed to protect employees from contact with electrical current.
- Extension cords must not be laid across walking paths, working areas, or through doorways.
- Ensure cords will not be pinched or damaged by windows, doors, or other construction activities.

Wear eye and hearing protection. Always use safety glasses. Everyday eyeglasses are NOT safety glasses. USE CERTIFIED SAFETY EQUIPMENT. Eye protection equipment should comply with ANSI Z87.1 standards. Hearing equipment should comply with ANSI S3.19 standards.

Some tools can generate and disburse dust or other airborne particles, including wood dust, crystalline silica dust and asbestos dust. Direct particles away from face and body. Always operate tools in well ventilated area and provide for proper dust removal. Use a dust collection system wherever possible. Exposure to the dust may cause serious and

permanent respiratory or other injury, including silicosis (a serious lung disease), cancer, and death. Avoid breathing the dust and avoid prolonged contact with dust. Allowing dust to get into your mouth or eyes, or lying on your skin may promote absorption of harmful material. Always use properly fitting NIOSH/OSHA approved respiratory protection appropriate for the dust exposure and wash exposed areas with soap and water.

Circular Saw

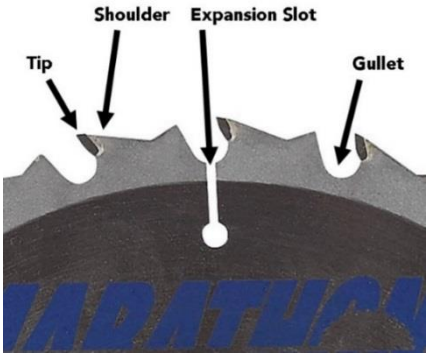
Inspections
Before energizing the saw, ensure: ➢ The blade guard and handle are in place and secure. ➢ The blade is sharp and secure. ➢ The correct blade has been installed. ➢ The plate is not bent and is positioned correctly. ➢ The plate is adjusted to the proper depth and bevel. If using a battery powered saw, ensure: ➢ The battery pack is not cracked or damaged. If using a corded saw, ensure: ➢ The cord is not nicked.

A **circular saw** is a power-saw using a toothed or abrasive disc or blade to cut different materials using a rotary motion spinning around an arbor. A circular saw is a tool for cutting many materials such as wood, masonry, plastic, or metal.

In woodworking, the term "circular saw" refers specifically to the hand-held type of circular saws. "Skilsaw" has become a generic trademark for conventional hand-held circular saws. Circular saws are either powered by 120 volt a/c current or by a battery pack. Battery packs are specific to the brand and make of tool and require the proper charging station for that pack.

Circular saw blades are specially designed for each particular material they are intended to cut. For cutting wood, they are specifically designed for making rip-cuts, cross-cuts, or a combination of both. The types of blades are identified by the material and number of teeth per inch (TPI). Steel blades are cheaper and do not last as long as the carbide blades. The most common blades are general construction - 60 tpi; plywood – 80 tpi; and finish wood working – 90 tpi.

Circular Saw Blades



Components

There are four important parts on standard circular saw blades:

- **Tips** bite into the work piece.
- **Shoulders** support the tips.
- **Expansion slots** help prevent the blade from warping as it expands and contracts during use. The end result is less vibration and a straighter cut.
- **Gullets** remove material from the work piece. Deeper gullets remove more material with each pass, while more shallow gullets create a finer cut.

Other features you might see on a circular saw blade include **heat vents** which aid in reducing vibration and an **antifriction coating**, which decreases buildup on the blade. A blade may also have a **diamond shaped knockout** you can remove to allow you to use the blade on a saw with a corresponding shaft diameter.

In addition to the standard toothed blades, there are also **continuous rim** blades that do not have the typical tip / gullet configuration. Blades that cut materials such as concrete, brick and tile often have a continuous rim.

Good to Know: More teeth on a toothed circular saw blade produce a smoother cut, while fewer teeth allow a blade to quickly cut through material.

Circular Saw Blade Materials

The materials from which saw blades are manufactured play a significant role in the life and performance of the blade. There are several material types you will commonly see:

- **Steel blades** are inexpensive and work well for cutting softwood, but they dull quickly in hardwood.
- **High-speed steel blades** (HSS) are harder than steel blades and stay sharper longer.
- **Carbide blades** have carbide tips attached to their teeth. They're more expensive than other blades but stay sharp much longer than steel or high-speed steel.
- **Diamond blades** use diamond-tipped teeth designed for cutting ceramic tile, glass and concrete.
- **Abrasive blades** are made of rough material and are for cutting concrete, brick, cinder block and other masonry materials and metals.

Circular Saw Blade Types and Uses

Some circular saw blades are suited for stationary tools like table saws and compound miter saws, while others are suited for handheld circular saws. Know which blade your cutting tool will accept and make sure the blade you are considering is correct for the tool you'll be using.

It's also important to know what kind of material you'll be cutting and to match the material to the capability of the blade. In addition, some blades are suitable for dry cutting only while some are suitable only for wet cutting. Others are appropriate for either wet or dry applications.

The chart contains examples of blade types and uses. Always follow the saw and blade manufacturers' instructions for use, safety, compatible blade diameter for the saw and materials you can cut with a blade.

Circular Saw Blade Examples

Ripping	Use for cutting with the wood grain Has few teeth and large gullets for good chip removal	
Crosscutting	Use for cutting across the wood grain Has many teeth (48 or more) and small gullets for a smooth cut	
Combination	Use for cutting with or across the grain and miter cuts Can have groupings of teeth divided by large gullets	
Plywood	Use for cutting plywood or other sheet goods Usually has many fine teeth (100 or more)	
Hollow Ground	Use for making smooth cuts across the wood grain Thinner in the body than the teeth to prevent binding	
Thin Kerf	Use for cutting dimensional or engineered lumber Has a thin profile for easier cutting and less material waste	
Abrasive	Use for cutting masonry, tile or steel	
Diamond	Use for cutting materials such as glass, concrete or ceramic tile	

Miter Saw (Chop Saw)

Safety Issues
➢ Items to be cut must be held firmly against the fence and table. ➢ Hands must remain clear of the rotating table. ➢ Use the hold down clamps when possible. ➢ The saw must be securely anchored to a work surface.
Inspections
Before energizing the saw, ensure: ➢ The table and bevel adjustments work smoothly. ➢ The blade is secure and properly aligned to the table and fence. ➢ The blade guard and handle are in place and secure. ➢ The blade is sharp and secure. ➢ The tool is clean. ➢ The cord is not nicked. ➢ The saw blade is adjusted to the proper angle and bevel.

A power miter saw is a power tool used to make accurate crosscuts at a selected angle. Cuts are made by pulling a spinning blade down onto a work piece in a short, controlled motion. The main advantage of the miter saw is the *miter index* that allows the angle of the blade to be changed relative to the fence in one-degree increments. Stops are provided to allow the index to be quickly set to common angles (such as 15°, 22.5°, 30°, and 45°). Compound miter saws also provide the ability to adjust the angle of the blade relative to the table.

Uses – Framing, Interior and Exterior Trim

Blade - Eight to twelve inches.

Table Saw

Safety Issues
➢ The blade guard and kick-back arrest must be in place. ➢ Push sticks must be used for small items. Do not place hands near or in line with the blade. ➢ The table and bevel adjustments must work smoothly. ➢ The saw must be securely anchored to a work surface.
Inspections
Before energizing the saw, ensure: ➢ The table and bevel adjustments work smoothly. ➢ The blade can be raised and lower smoothly. ➢ The blade is secure and properly aligned to the table and fence. ➢ The fence locks in place. ➢ The blade guard and splitter is in place and secure. ➢ The tool is clean.

- The cord is not cut or nicked.
- The blade is adjusted to the proper depth and bevel.

A **table saw** is a woodworking tool consisting of a circular saw blade, mounted on an arbor, that is driven by an electric motor (either directly, by belt, or by gears). The blade protrudes through the surface of a table, which provides support for the material, usually wood, being cut.

The table saw is equipped with a locking fence. The fence provides a solid surface for holding the material securely, to provide an extremely straight cut when ripping lumber (cut with the wood grain). The fence must be parallel to the blade and must lock securely in place.

The table saw is also equipped with a sliding miter gauge for cross cuts (cuts opposite the grain). The gauge is adjusted to an angle off of the blade. The material must be held securely to the gauge. Do not use the fence during cross-cut operations.

The depth of the cut is varied by moving the blade up and down: the higher the blade protrudes above the table, the deeper the cut that is made in the material. In most cases, the blade should extend above the material by ½ of the height of a saw tooth.

The table saw can be used for dado cuts (cuts which do not extend completely through the material, such as slots). These cuts require the removal of the saw guards and must only be done in the Habitat Jobox).

Reciprocating Saw (Sawzall)

Safety Issues

- Keep hand and fingers out of pinch points.
- Ensure the blade will not cut unintended items, such as electrical wires inside the wall or material behind the material being cut.

Inspections

Before energizing the saw, ensure:

- The blade is sharp and secure.
- The cord is not cut or nicked.

A **reciprocating saw** is a type of saw in which the cutting action is achieved through a push and pull **reciprocating** motion of the blade.

The reciprocating saw, has a handle oriented to allow the saw to be used comfortably on vertical surfaces. The saw has a foot at the base of the blade. The user rests this foot against the surface being cut so that the tendency of the blade to push away from or pull towards the cut as the blade travels in and out is reduced.

Reciprocating saws almost all have variable speed, either through trigger sensitivity or through a dial. Another feature that has become important to the way these saws are used is the inclusion of an orbital action. The action consists of oscillating the traversed reciprocation in an up and down fashion (perpendicular to the motion of cut) causing the tip of the blade to move in an oval pattern, up and down as well as back and forth. This feature is primarily for wood, allowing quick cuts.

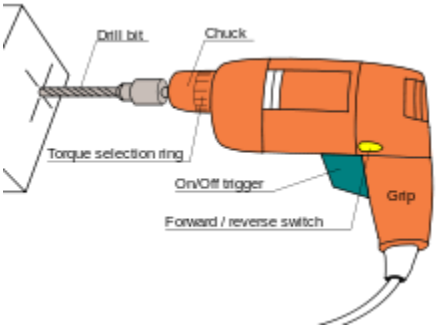
Blades are available for a variety of materials and uses. Common types include metal cutting blades, wood cutting blades, blades for composites, for drywall, and other materials.

Drill

Safety Issues
➢ The work piece must be attached to the structure or secured with a clamp. ➢ Drill bits will be very hot after they are used for boring. Avoid contact with skin or combustible materials.
Inspections
Before energizing the drill, ensure: ➢ The bit is securely locked in the chuck. ➢ The tool is clean. ➢ The cord is not cut or nicked.

A **drill** is a hand tool with a rotating chuck which can be fitted with a boring tool or driving tool. For boring, a drill bit is fitted into the chuck. For driving, a driving bit is fitted into the chuck. The drill can be powered either by 120 V A/C current (corded) or by 12 – 20 V battery (cordless).
There are various types of drill and driving bits for various types of materials.
Drill bits will be sized by the diameter hole to be made.
Driver bits are sized by the type and size of screws being installed.

Pistol-grip (corded) Drill



Drills with pistol grips are the most common type in use today. Many have variable speeds and most are capable of spinning forward (clockwise) and backward (counter clockwise).

Right-Angle-Drill

A less common type is the right-angle drill, a special tool used by tradesmen such as plumbers and electricians. The bit is offset from the drill motor by 90 degrees allowing the drill and bit to fit into smaller openings.

Hammer Drill

The **hammer drill** is similar to a standard electric drill, with the exception that it provides a hammer action for drilling masonry. The hammer action may be engaged or disengaged as required. The cam-type hammer drill is a rotary/pneumatic hammer drill which accelerates the bit through a piston design. Rotary hammers have much less vibration and penetrate most building materials. They can also be used as "drill only" or as "hammer only" which extends their usefulness for tasks such as chipping brick or concrete. A typical application for a rotary hammer drill is boring large holes for lag bolts in foundations, or installing large lead anchors in concrete for handrails or benches.

Rotary hammer drill (SDS Drill)

The rotary hammer drill combines a primary dedicated hammer mechanism with a separate rotation mechanism, and is used for more substantial material such as masonry or concrete. A standard hammer drill accepts 6 mm (1/4 inch) and 13 mm (1/2 inch) drill bits, while a rotary hammer uses Spline Shank (SDS) bits. These heavy bits are adept at pulverizing the masonry and drill into this hard material with relative ease. Generally, standard chucks and drills are inadequate and chucks such as SDS and carbide drills that have been designed to withstand the percussive forces are used.

Cordless drills

A cordless drill is an electric drill which uses rechargeable batteries. These drills are available with similar features to a corded drill. They are available in the hammer drill configuration and most have a clutch, which aids in driving screws into various substrates while not damaging them. Also available are right angle drills, which allow a worker to drive screws in a tight space.

For continuous use, a worker will have a spare battery pack charging while drilling, and quickly swap them instead of having to wait an hour or more for recharging, although there are now Rapid Charge Batteries that can charge in 10–15 minutes.
Over the years battery voltages have increased, with 18 V - 20 V drills being most common, but higher voltages are available, such as 24 V, 28 V, and 36 V. This allows these tools to produce as much torque as some corded drills.

Impact Driver

An **impact driver** is a power tool that delivers a strong, sudden rotational and downward force. Powered impact drivers use a motor to rapidly and repeatedly deliver rotational and impact forces, providing considerable speed and productivity advantages. They are often used in construction to replace screwdrivers where speed and operator fatigue are significant issues. In some situations however, this type falls short since current designs cannot deliver as much downward blow as a manual unit. This can be especially true on very stubbornly stuck fasteners, or screws (particularly Phillips) with damaged/"stripped" head slots.

Ramset

Safety Issues
➢ Goggles, gloves, and ear protection must be used. ➢ Limit the number of volunteers in the area. ➢ Strictly follow the manufacturer's instructions and precautions.
Inspections
➢ Ensure the tool is clean. ➢ Ensure the tool has been lubricated with WD-40, (Small can is in each kit).