

Lesson 4: Fasteners and Fastening Systems

Lesson 4: Fasteners and Fastening Systems

Many forms of materials are used in construction.

They require a variety of fasteners and fastening systems. This lesson introduces some common fasteners and systems and gives some examples of where each could be used.

Groups and Uses of Fasteners

Fasteners can roughly be grouped into four categories: nails, screws, adhesives, and anchors. Nails are the most common and are generally used for attaching wood pieces together. Screws are also used for attaching wood pieces but may be used to attach metals as well. Adhesives are commonly used in agricultural construction and can bond many types of materials. For example, many trusses and roof support beams are glued together, dramatically increasing the strength of the roof, sometimes as much as 60 percent. Construction anchors are a large assortment of devices used to attach walls to foundations. Framing anchors are used to attach framing members together.

Selecting Nails

Duplex-head nails serve special purposes. Once driven into the wood, they still have a head extending above the surface, which allows them to be removed easily with the claws of a hammer.

Duplex-head nails are commonly used when nailing together concrete forms, so they can be taken apart and removed more easily. The extra head also provides a good place to tie strings for marking.

Roofing nails are used for nailing shingles in place. They have very wide, flat heads to hold shingles down. Often these nails are made of rust-resistant material, such as aluminum.

Ring-shank nails have small circles or rings around the shank. These rings make the nail hold tighter; they are also more difficult to remove. The heads of ring-shank nails are often cupped to increase their holding ability.

The most commonly used fasteners in building construction are nails. Factors that affect the selection of nails for construction are the uses of the nails, the nail length required, and exposure to weathering.

Nails come in many different styles, as shown in Figure 4.1. For example, common nails are the most commonly used type of nail, as their name implies. They are general purpose nails used anywhere a special purpose nail is not needed.

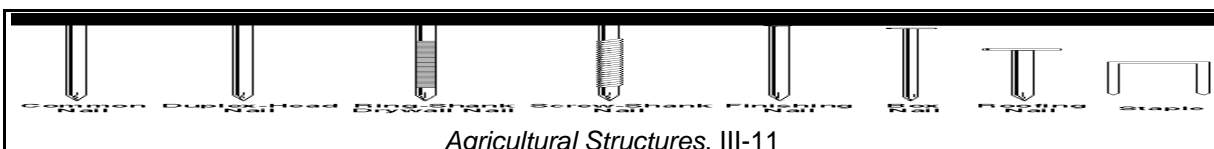
Box nails have a thinner head and shank, or body, than common nails. Being thinner makes them less likely to split the wood. The thinner heads are also easier to cover with paint. Box nails were originally used to make small boxes to ship food and other items. Now they are often used in finish cabinet work to avoid splitting. Box nails are often chemically coated to resist rusting, which can discolor paint or wood.

Finish nails have very small heads and smaller shanks than common nails. The small heads make them less noticeable, so they are useful for finishing. The nail may be countersunk, with the head of the nail set below the surface of the wood; the head is then concealed with wood putty, leaving a very nice finish for exposed, decorative wood. However, because the head is so small, the nails have less holding ability.

Ring-shank nails are used for applications where the nail will never be removed and the material needs to be held tightly. For example, ring-shank nails are often used for nailing the treads on a set of stairs. Using ring-shank nails will decrease the loosening of the boards later and help keep the steps from becoming shaky.

Screw-shank nails come in a variety of materials, like steel, copper, and aluminum, for different applications. These nails have a twisted shaft, which causes the nail to turn as it is driven into the material. Because of the twisting, the nail is difficult to remove. Screw-shank nails are used where good holding ability is needed, such as on decks. Some of these nails are very heavy duty and can be driven into concrete.

Staples are U-shaped fastening devices; its ends are driven into a surface to hold material in place.



They are commonly listed and sold with nails. Staples are frequently used for attaching wire but are also very commonly used to attach plastics or vinyl.

Other specialized nails have a variety of uses. Some special nails attach metal roofing. These nails have a rubber washer system next to the head to help seal out moisture. Cement-coated nails are coated with an adhesive to increase their holding ability. Other specialized nails are those for use with power or air nailers. These tools drive nails with air, electric current, or gun powder. The nails used in nailers are sold in strips or coils, with the nails attached to each other to make loading the gun easier. The nails are separated as the gun drives the nail into the material. A complete array of nail and staple sizes for nearly any application are available for use with these tools.

The many uses of nails require that they come in a variety of sizes. Figure 4.2 illustrates the most common sizes, although nails come in other sizes as well, such as spikes of eight or more inches in length. Nail lengths are designated by the term “penny” and the letter “d,” which was an abbreviation for penny in England.

Penny comes from the early days of nail making and indicated that 100 nails of that length could be purchased for that number of pennies. This measurement was adopted world-wide as a standard for nails. Penny does not correspond to the shank diameter; a 6d common nail, 6d finish nail, and 6d box nail would all be two inches in length but have different diameters. The diameter varies by the manufacturer and material. Typically, the nail length selected for an application should be long enough to pass entirely through one board and at least half the thickness of the board to which it will be attached.

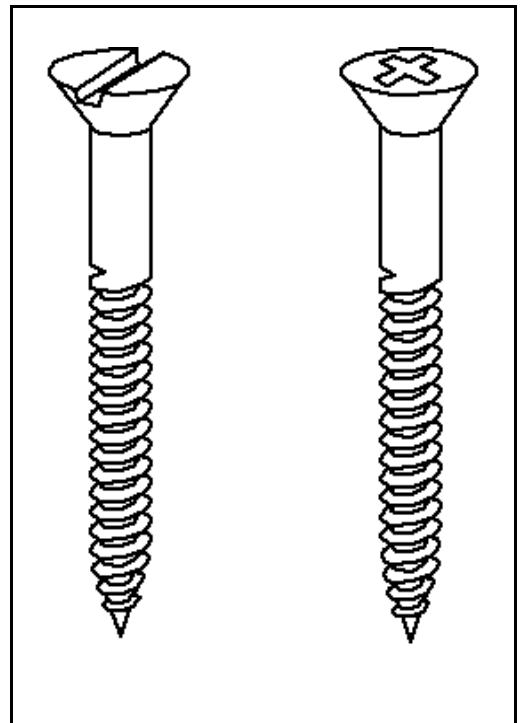
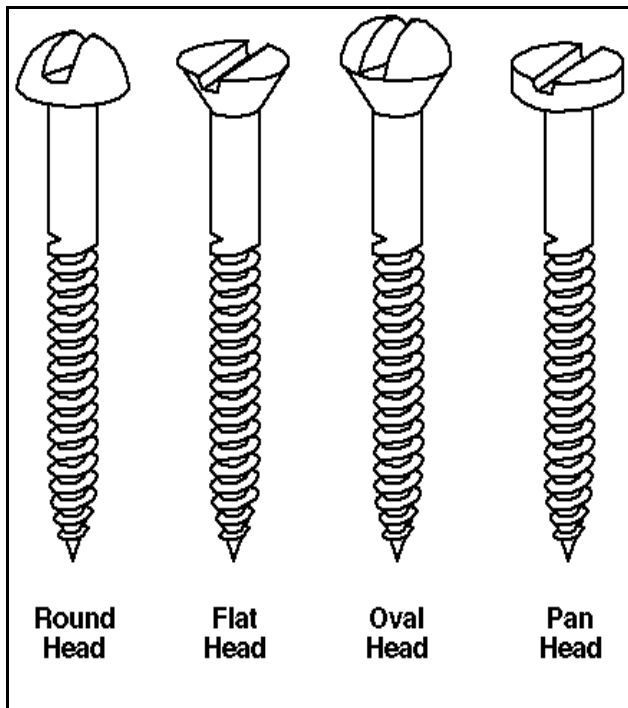
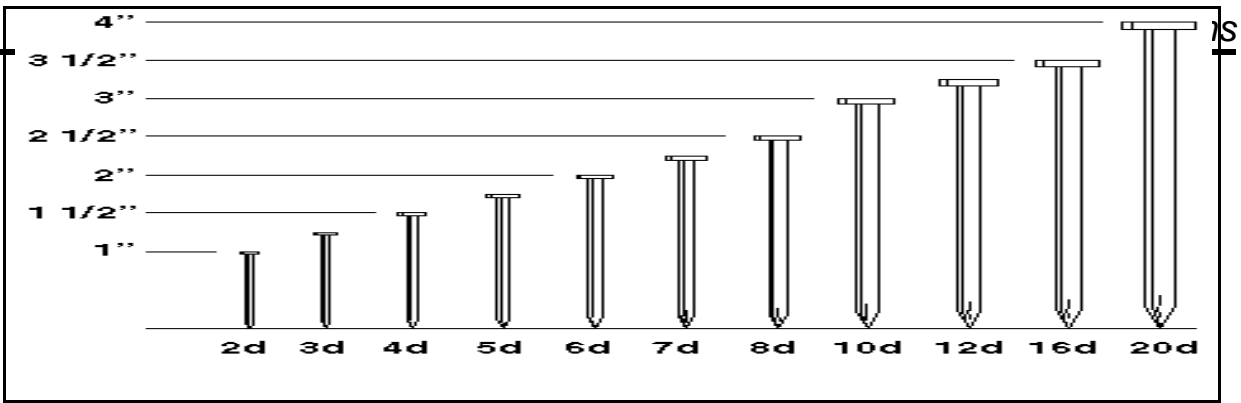
Another factor that affects the selection of nails is their exposure to weathering. If the nails will be exposed, the builder should choose nails that will resist corrosion or staining, such as zinc or aluminum nails.

Screws

Screws are used frequently in building construction because they have a higher holding capacity than nails. As shown in Figure 4.3, several styles of screw heads are used. Round or oval heads are strong in design, but the head

remains above the surface. Flat head screws are flush with the surface and are easier to hide with paint. With pan head screws, a small head remains above the surface after insertion. Pan head screws are commonly used when the head of the screw will also be decorative, as for some cabinets.

Screws most commonly come with one of two types of slots in their head, straight-slot or Phillips (Figure 4.4). Either is available for most common screws, and both work well. Often screws with Phillips heads are more popular because they lend themselves to being driven using electric screwdrivers or drills with Phillips head bits. Other styles of slots are available, such as square, Allen, or star configurations, but they are usually designed to work with a specific tool.



Building Construction

Wood screws are used to attach wood. They are often used in combination with adhesives, which can produce a bond much stronger than the screw itself. Wood screws may be made of several materials: brass, which is rust resistant for outside use; steel, which is stronger and less expensive than brass; or aluminum. Galvanized screws are also available for outdoor applications. Screws are sold in various lengths, usually $\frac{1}{4}$ inch to 4 inches, and by gauge, which indicates the screw's diameter. The larger the gauge, the larger the diameter; common gauges range from zero to eighteen.

Self-tapping metal screws are used with sheet metal or metal siding in building construction. These screws do not require a guide hole and will enter into the material more easily than other screws. They are usually mechanically placed and have Phillips-type heads or some type of star configuration. They are similar in appearance to wood screws and vary according to manufacturer or designated use.

Drywall screws are used to secure drywall to walls and ceilings. They have a flat head that countersinks into the surface of the drywall. They may be placed using a screw gun or an electric drill with a special drywall bit attachment.

Nails may also be used with drywall, but screws provide better holding power.

Adhesives

Adhesives are commonly used in building construction and are gaining in popularity. Their uses are increasing due to improvements in manufacturing in recent years. Two important terms need to be defined concerning adhesives. Adhesion refers to the ability of materials to stick to each other, while cohesion refers to the attraction between the molecules of a material, like the particles of wood. An adhesive with good adhesion but poor cohesion will stick to a material and then be easily pulled off.

Wood glues are used for joining woods. In the past, wood glues were made from animal products. These glues have now largely been replaced by glues based on some form of plastic.

Polyvinyl, or white wood glue, is very good for most interior or furniture woodwork. Urea formaldehyde, which is a plastic resin glue, is strong, water resistant, and adheres well to wood.

It can be used to make repairs in wood splits or to reinforce joints in a defective truss. Waterproof resorcinol resins are used on wood where water exposure is likely.

Epoxies are modern and extremely strong bonding materials. They are now being used in the assembly of automobiles, for bridge repair, and on structural steel joints. Epoxies are commonly used on fiberglass and plastics. If an exceptionally strong bond is required, consult a retailer about an epoxy product.

Mastics use cohesion to attach materials with large surface areas, such as floor coverings. They usually have a synthetic rubber base. Most mastics are water resistant. Contact cements, which are a type of mastic, are commonly used to attach laminates to counter tops or for vinyl floor coverings.

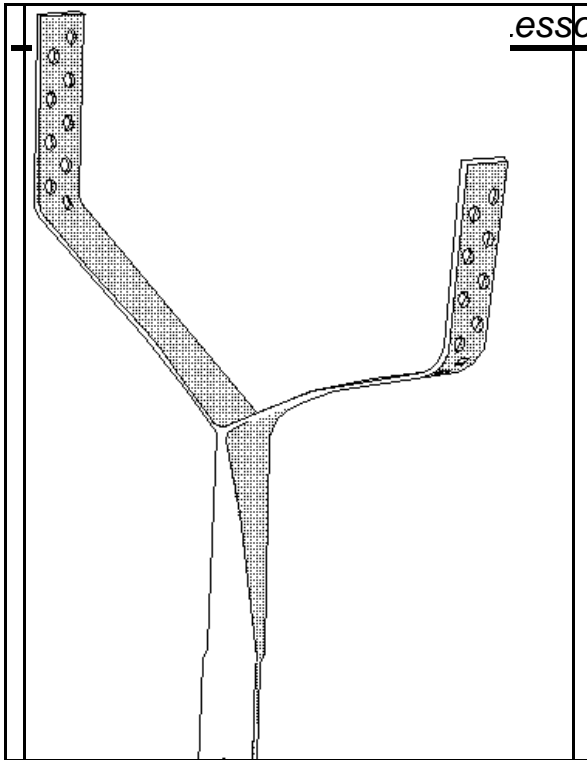
Adhesive applications or alternatives exist for nearly any fastening situation. A combination of adhesives and other fasteners is also very common and can create excellent bonds. Often cost and time are the limiting factors when deciding if adhesives are the best option.

Adhesives should always be used with caution. Many of them are highly toxic or produce toxic fumes, may be absorbed through the skin, and can be very flammable. Read and follow all manufacturer's recommendations when using these products.

Construction Anchors

Construction anchors are generally used to attach walls to foundations. Anchor systems are often used to help protect the structure against damage from high winds by adding more strength and stability. Factors such as wind shear, weight, soil type, and foundation conditions will affect the type of anchor system chosen.

One type of construction anchor is an anchor bolt. Bolts are threaded pieces of metal used with nuts and usually either washers or metal plates, both of which distribute the bolt's holding strength over a larger area. Large bolts are set into the foundation to serve as anchors. They secure the bottom of the wall to the concrete.



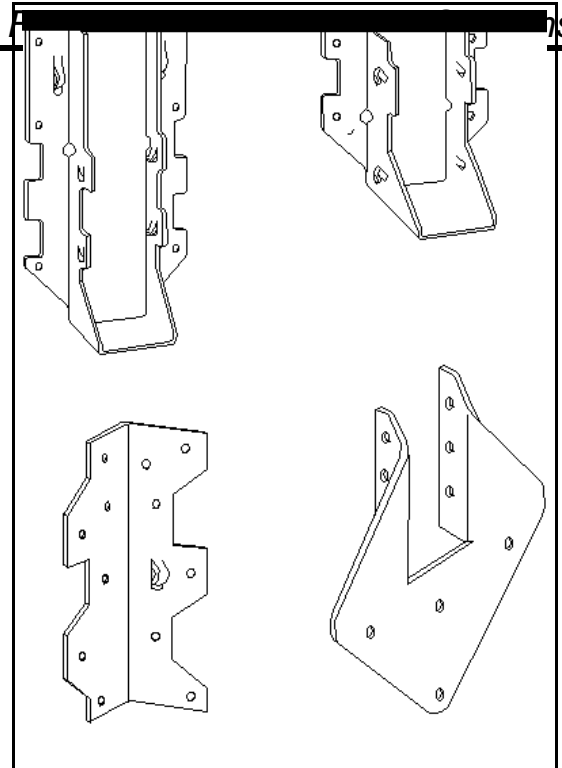
Various types of anchor systems can also be used. One type of anchor involves metal straps set in concrete and then attached to the wooden member in the wall; an example is shown in Figure 4.5. Other designs involve anchors screwed into the ground with metal cables attaching them to the structure.

Framing Anchors

Framing anchors differ from construction anchors in that they attach framing pieces together. Usually, they are used for activities like setting joists in place, attaching the roof to the walls, attaching walls to each other, and joining the parts of a truss together. The anchors therefore have specific shapes for a particular purpose. Figure 4.6 shows some different types of framing anchors.

Summary

Nails, screws, adhesives, and anchors are the most commonly used fastener groups. Nails are the most common and come in sizes and



styles appropriate for nearly any situation. Screws also come in a vast assortment of sizes to meet the many demands placed on them. Adhesives are becoming more cost effective and useful for many types of materials and may replace many of the other fasteners in the future.

Anchors are used to attach walls to foundations and join framing members.

Credits

Huth, Mark W. *Construction Technology*. 2nd ed. Albany, N.Y.: Delmar Publishers, Inc., 1989.

Lindley, James A., and James H. Whitaker. *Agricultural Buildings and Structures*. Rev. ed. St. Joseph, Mich.: American Society of Agricultural Engineers, 1996.

Wagner, Willis H. *Modern Carpentry*. South Holland, Ill.: Goodheart-Willcox Co., Inc., 1987.