DOORS AND WINDOWS CHAPTER 8

This chapter covers the rough framing and finish carpentry for doors and windows. Before putting the exterior covering on the outside walls of a building, prepare the door and window openings for the frames.

DOORS

Before the exterior covering is put on the outside walls, the door openings are prepared for the frames. Square off uneven pieces of sheathing and wrap heavy building paper around the sides and top of the door opening. Since the sill must be worked into a portion of the rough flooring, no paper is put on the floor. Position the paper at a point even with the inside portion of the stud to a point about 6 inches on the sheathed walls, and tack it down with small nails.

NOTE: Rough openings are usually made 2 1/2 inches larger each way than the size of the door to be hung. (For example, a 2-foot 8-inch by 6-foot 8-inch door would need a rough opening of 2 feet 10 1/2 space allows for the jambs, the wedging, and the clearance space for the door to swing.

TYPES OF DOORS

Doors, both exterior and interior, are classified as job-built or mill-built. This classification is further broken down as batten, panel, and flush doors (Figure 8-1).

NOTE: No hinged interior door should open or swing against a natural entry, swing into hallways, or be obstructed by other swinging doors.

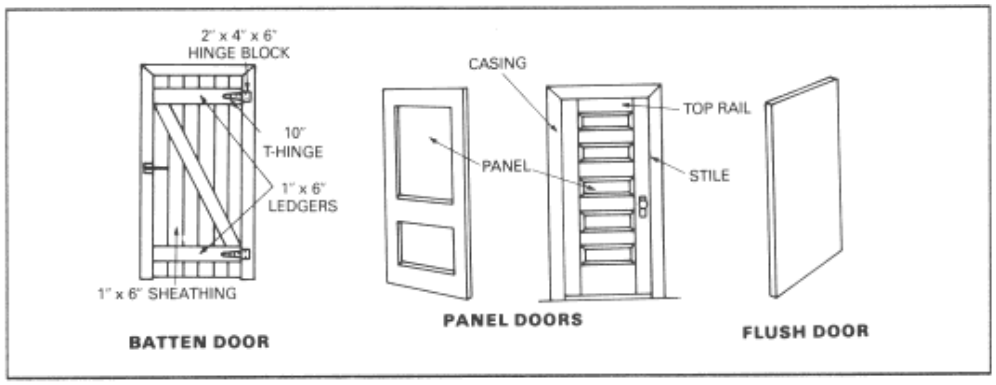

Figure 8-1. Types of doors

Job-Built Doors

The batten door is the most commonly used and most easily constructed type of job-built door. It can be constructed in several ways, such as—

- Using diagonal boards nailed together in two layers, at right angles to each other. This type of door is often used as the core for metal-sheathed fire doors.
- Using vertical boards that are tongue-and-grooved or shiplapped. The door is held rigid by two to four cross pieces, called *ledgers,* which may or may not be diagonally braced. If two additional pieces forming the sides of the door and corresponding to the ledgers are used, these are called *frames*.

In hasty construction *(on-site prefabrication),* the carpenter makes a batten door from several 2 x 6 boards with ledgers and braces, as follows:

- Nail the ledgers with their edges 6 inches from the ends of the door boards.
- Place a diagonal board between the ledgers. It begins at the top-ledger end, opposite the hinge side of the door, and runs to the lower ledger, diagonally across the door. On an outside door, use roofing felt on the weather side to cover the boards.
- Nail wooden laths around the edges and across the middle of the door to hold the roofing felt in place.

NOTE: When these doors are hung, 1/4 inch of clearance should be left around the door to allow for expansion.

- Fasten T-strap hinges to the door ledgers and the hinge blocks on the door casing or post.

Mill-Built Doors

The usual exterior door is the panel type (Figure 8-2). It consists of stiles, rails, and filler panels. Two frequently used interior doors are the flush and the panel types (Figure 8-2).

Panel Doors. Panel doors consist of vertical members called stiles and horizontal members called rails. Stiles and rails form the framework into which panels are inserted. Additional vertical and horizontal members called muntins are used to divide the door into any number of panels. Panels may be solid wood, plywood, particleboard or louvered or have glass inserts.

Flush Doors. Flush doors have flat surfaces on both sides and consist of a wood frame with thin sheets of material (plywood veneer, plastic laminates, hardboard, or metal) applied to both faces. Flush doors have either a solid or hollow core.

- *Solid-core* doors have a solid particle board or woodblock core which is covered with layers of veneer. They are usually used as exterior doors. Solid-core doors provide better sound insulation and have less tendency to warp.
- *Hollow-core* doors have a lightweight core made of various materials that are covered with layers of veneer. They are usually used as interior doors and are less expensive to produce.

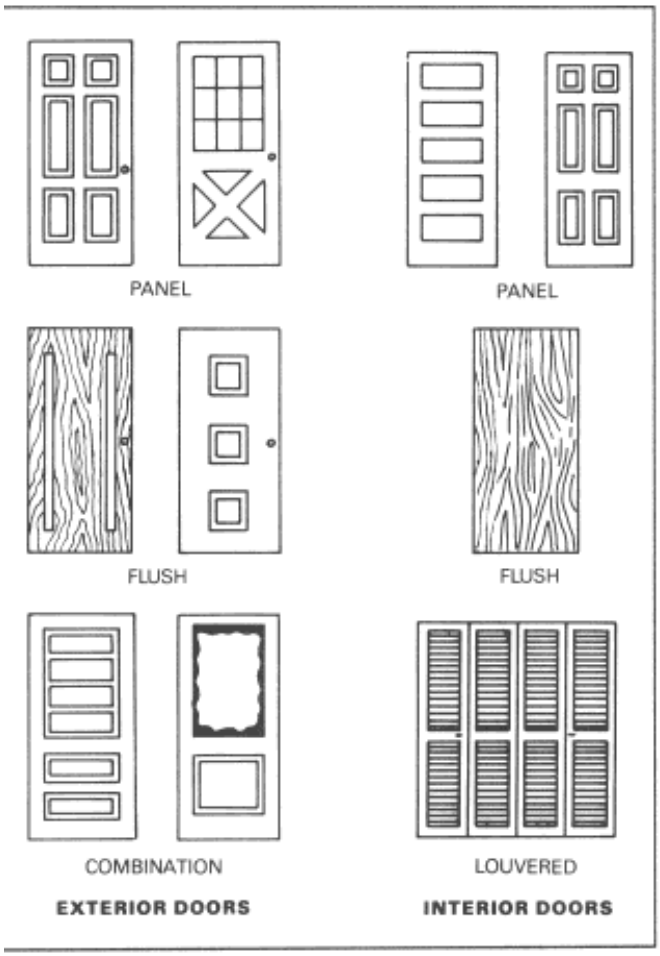

Figure 8-2. Mill-built doors

Specialty Doors

Specialty doors include double doors, sliding doors, and folding doors.

DOOR FRAMES

Door frames are made of the following parts: the head casing, the jambs (head and two sides), and the sill (on exterior doors only). (The principal parts of a door frame are shown in Figure 8-3.) Doors and frames may be fabricated in the shop and installed separately; they may also be Remanufactured (prehung), purchased ready for installation.

Door-frame layout calculations begin with the size of the door (height, width, and thickness), as given on the door schedule. Construction information for door frames is usually given in detail drawings like those shown in Figure 8-4. In the type of frame shown in Figure 8-4, the door jambs (linings of the framing of door opening are rabbeted to depths of 1/2 inch. The rabbet prevents the door from swinging through the frames. A strip of wood may be used instead a rabbet. The door stop also serves to weather proof the door. Most project drawings call for rabbeted exterior door jambs.

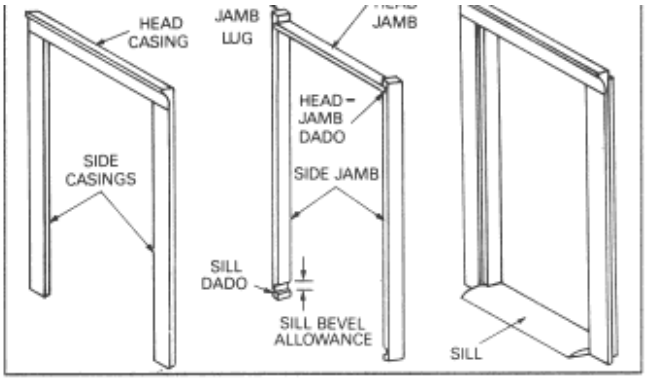

Figure 8-3. Principal parts of a door frame

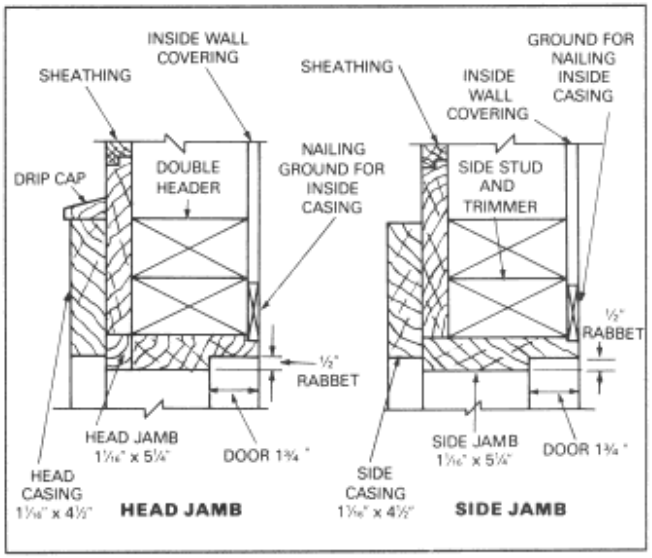

Figure 8-4. Typical door-frame details

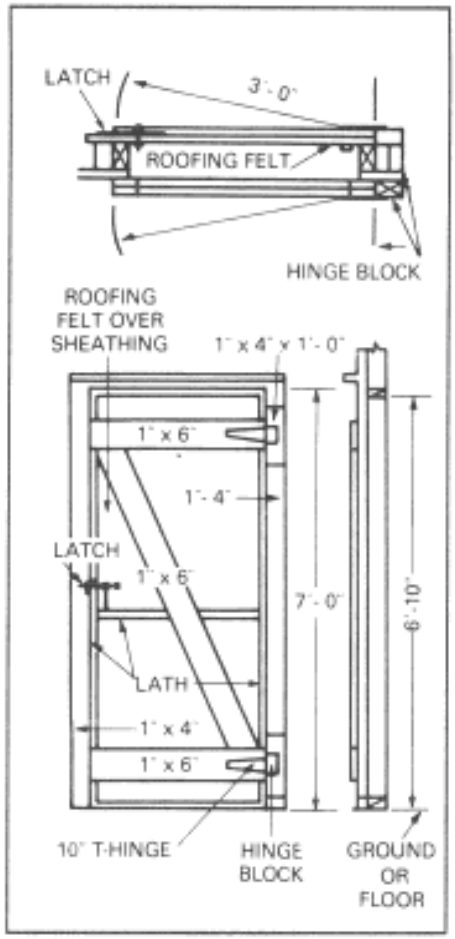

Figure 8-5. Single outside door

Exterior Door Frames

Exterior door frames are made up of two side jambs, a head jamb, a sill, and a stop. They are constructed in several ways. In hasty construction (on-site prefabrication), the frames will be as shown in Figure 8-5. This type requires no frame construction because the studs on each side of the opening act as a frame. Studs are normally placed 16 inches apart on center. Extra studs are added at the sides of door and window openings. Headers are usually used at the top and bottom of such openings.

The siding is applied to the outside wall before exterior doors are hung. The casing is then nailed to the sides of the opening. It is set back the width of the stud. A 3/4- x 3/4-inch piece is nailed over the door but set back the width of the stud; it supports the drip cap. Hinge blocks are nailed to the casing where the hinges are to be placed. The door frame is now ready for the door to be hung.

On an outside door, the outside casings and the sill are considered parts of the door frame. A prefabricated outside door frame—delivered to the site assembled—looks like the righthand view of Figure 8-3, page 8-3. It usually has the door installed, and the entire unit slides between studs.

Interior Door Frames

Interior door frames, like outside frames, are constructed in several ways. In hasty construction (on-site prefabrication), the type shown in Figure 8-6 is used. Interior door frames are made up of two side jambs, a head jamb, and stop moldings which the door closes against. Interior door frames have no sill and no casing, otherwise they are the same as the exterior frames. Figure 8-6 shows the elevation of a single inside door.

NOTE: Both outside and inside door frames may be modified to suit climatic conditions.

Door Jambs

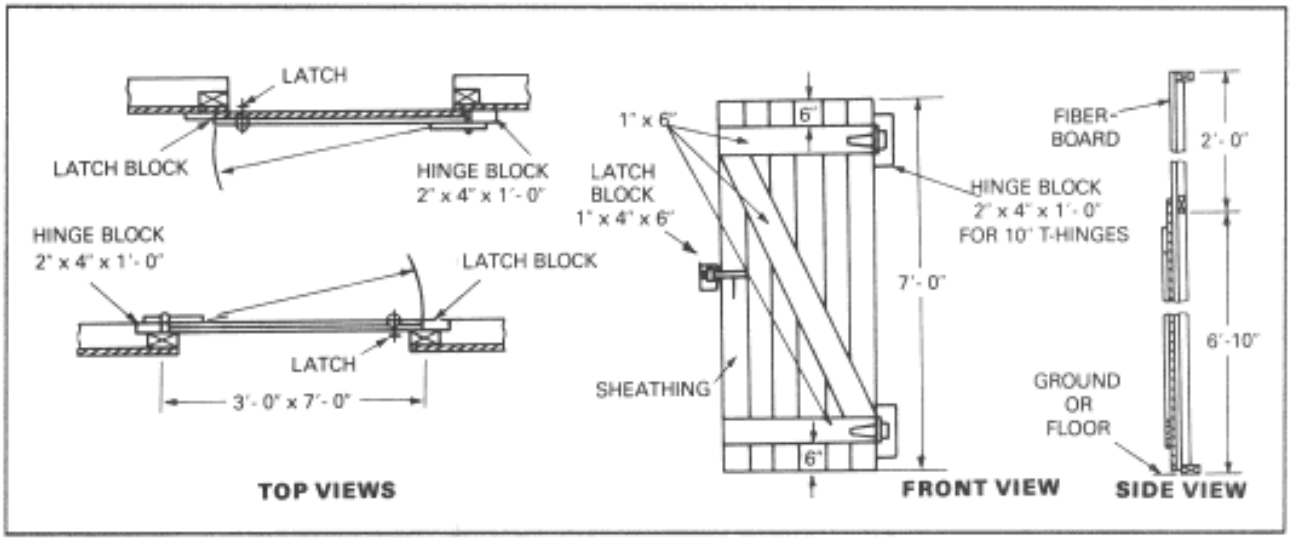

Figure 8-6. Single inside door

Door jambs (Figure 8-7) are the linings of the framing in door openings. The casing and stops are nailed to the door jambs, and the door is hung from them. Door openings should allow 1/2 inch between the frame and the jamb (Figure 8-8, page 8-6) to permit plumbing and leveling of jambs. Inside jambs are made of 3/4-inch stock; outside jambs are made of 1 3/8-inch stock. The width of the stock varies with the thickness of the walls. Inside jambs are built up with 3/8- x 1 3/8-inch stops nailed to the jamb. Outside jambs are usually rabbeted to receive the door.

Jambs are made and set as follows:

Step 1. Cut the side jambs of an entrance door to the height of the door, less the depth of the head jamb rabbet (if any), plus the—

- Diagonal thickness of the sill, plus the sill bevel allowance.
- Thickness of the threshold, if any.
- Thickness of the head jamb.
- Height of the side-jamb lugs.

Step 2. Cut the head jamb to the width of the door, less the combined depths of the side-jamb rabbets (if any), plus the combined depths of the head-jamb dadoes (grooves).

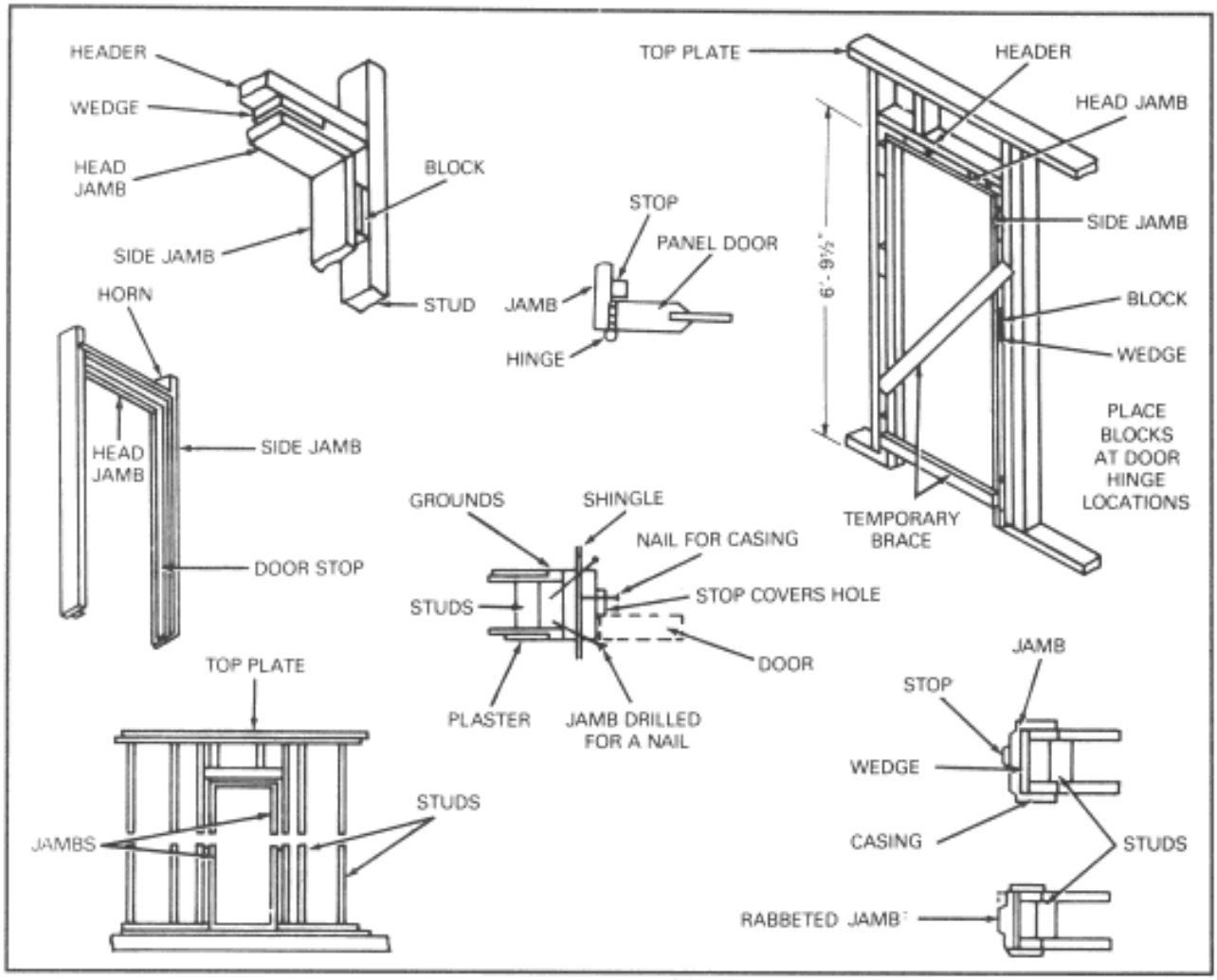

Figure 8-7. Door jambs

NOTE: Regardless of how carefully rough openings are made, be sure to plumb the jambs and level the heads when jambs are set.

Step 3. Level the floor across the opening to determine any variation in floor heights at the point where the jambs rest on the floor.

Step 4. Cut the head jamb with both ends square. Allow the width of the door plus the depth of both dadoes and a 3/16-inch door clearance.

Step 5. From the lower edge of the dado, measure a distance equal to the height of the door plus the clearance required under it. Mark it and cut it square. On the opposite jamb, do the same. Make additions or subtractions on this side for floor variations, if any.

Step 6. Nail the side jambs and jamb heads together with 8d common nails, through the dado into the head jamb.

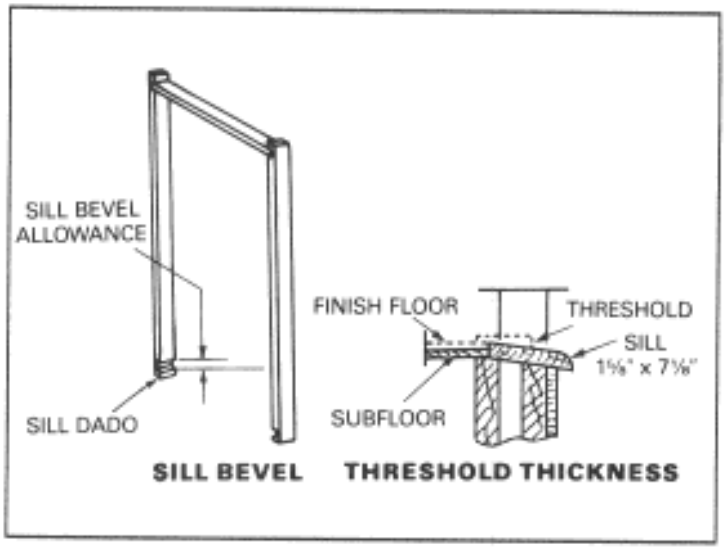

Figure 8-8. Jam allowances

Step 7. Set the jambs into the opening. Place small blocks on the subfloor under each jamb. Blocks should be as thick as the finished floor will be. This allows room for the finished floor to go under the door.

Step 8. Plumb the jambs and level the jamb head. Wedge the sides with shingles between the jambs and the studs, to align them. Nail them securely in place. Take care not to wedge the jamb unevenly. Use a straightedge 5 or 6 feet long inside the jambs to help prevent uneven wedging.

Step 9. Check the jambs and the head carefully. Jambs placed out of plumb will tend to swing the door open or shut, depending on the direction in which the jamb is out of plumb.

SWING

The *hand* of a door describes the direction in which a door is to swing and from which side it is hinged. The hand is determined from the outside of the door. A standard door has the hinges on the right or left and swings away from you. A reverse door has the hinges on the right or left and swings toward you.

DOOR HARDWARE

Most doors are hung with the loose-pin *butt hinge.* The pin may be removed and as a result, the door can be removed without the hinges being unscrewed. Doors should be hinged so that they open in the direction of the natural entry, open out in public buildings, and swing against a blank wall whenever possible and never into a hallway. Exterior doors use three hinges to reduce warpage caused by the difference in exposure on opposite sides and to support wider and heavier exterior doors. Interior doors use two hinges.

When installing hinges, the *gain is* the cutout or mortise made to receive a leaf of the hinge. The depth is determined by the hinge's thickness, and the width is determined by the hinge's size. *Setback is* the distance that the hinge is placed away from the side of the door, usually 3/16 inch.

The *door closer is* a device that closes a door and controls the speed and closing action of the door. Install the door closer according to the manufacturer's instructions.

DOOR INSTALLATION

Doors, both mill-built and job-built, are installed in the finished door frames as described in the following steps (Figure 8-9):

Step 1. Cut off the stile extensions, if any.

Step 2. Plane the edges of the stiles until the door fits tightly against the hinge side and clears the lock side of the jamb by about 1/16 inch. Be sure that the top fits squarely to the rabbeted recess and that the bottom swings free of the finished floor by about 1/2 inch. The lock stile of the door must be beveled slightly so that the edge of the stile will not strike the edge of the door jamb.

Step 3. After proper clearances have been made, tack the door in position in the frame and wedge it at the bottom.

Step 4. Mark hinge positions with a sharp-pointed knife on the stile and the jamb. Hinge positions on the stile must be placed slightly higher than the lower door rail and slightly lower than the upper door rail to avoid cutting out part of the door-rail tenons that are housed in the stile. Three measurements must be marked:

- The location of the butt on the jamb.
- The location of the butt on the door.
- The thickness of the butt on both the iamb and the door.

Step 5. Door *butts* (or *hinges)* (Figure 8-10) are mortised into the door frames as shown in Figure 8-11, page 8-8. Use three butt hinges on all full-length exterior doors to prevent warping and sagging. Place the butts and mortise them with the utmost accuracy so that the door will open and close properly, and so that the door, when open, will not strike the casing. The butt pin must project more than half its thickness from the casing.

Step 6. Using the butt as a pattern, mark the butt dimension on the door edge and face of the jamb.

Step 7. Cut the marked areas, called *gains,* on the door jambs and door to fit the butts. Use a 1-inch chisel and mallet.

Step 8. Test the gains. The butts must fit snugly and exactly flush with the edge of the door and the face of the jamb.

Step 9. Screw half of each of the butt joints on the door and the other three parts on the jamb. Place the butts so that the pins are inserted from the top when the door is hung.

Step 10. Set the door against the frame so that the two halves of the top butt engage. Insert the top pin. Engage and insert pins in the bottom and center butts.

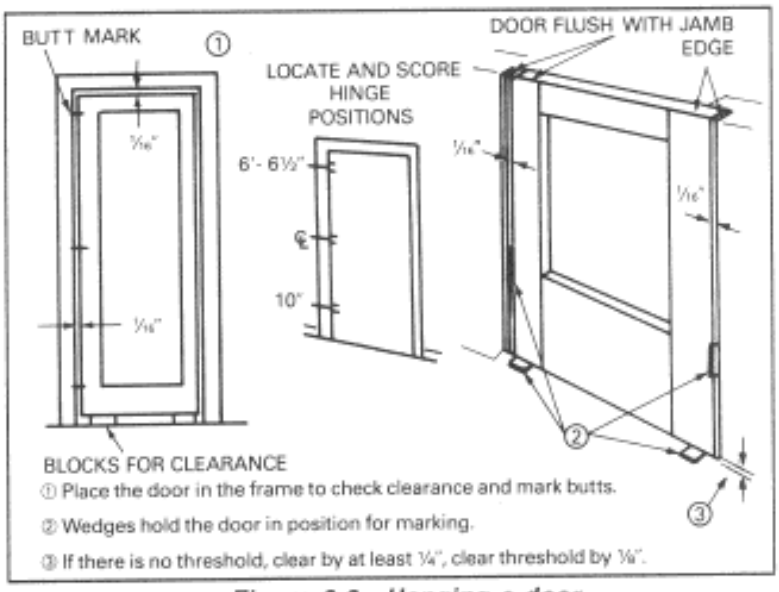

Figure 8-9. Hanging a door

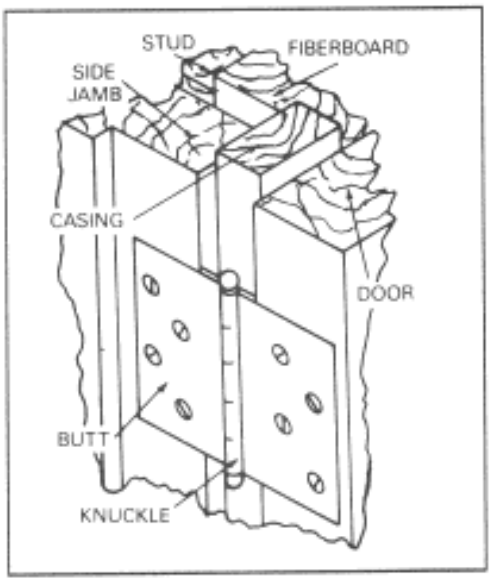

Figure 8-10. Door butt (hinge)

Door Stops

When fitting doors, the stops are usually nailed in place temporarily until the door has been hung. Stops for doors in single-piece jambs are generally 1/2 inch thick and 2 inches wide. They are installed with a butt joint at the junction of the side and head jambs. A 45° bevel cut at the bottom of the stop, about 1 to 1 1/2 inches above the finish floor, will eliminate a dirt pocket and make cleaning or refinishing the floor easier.

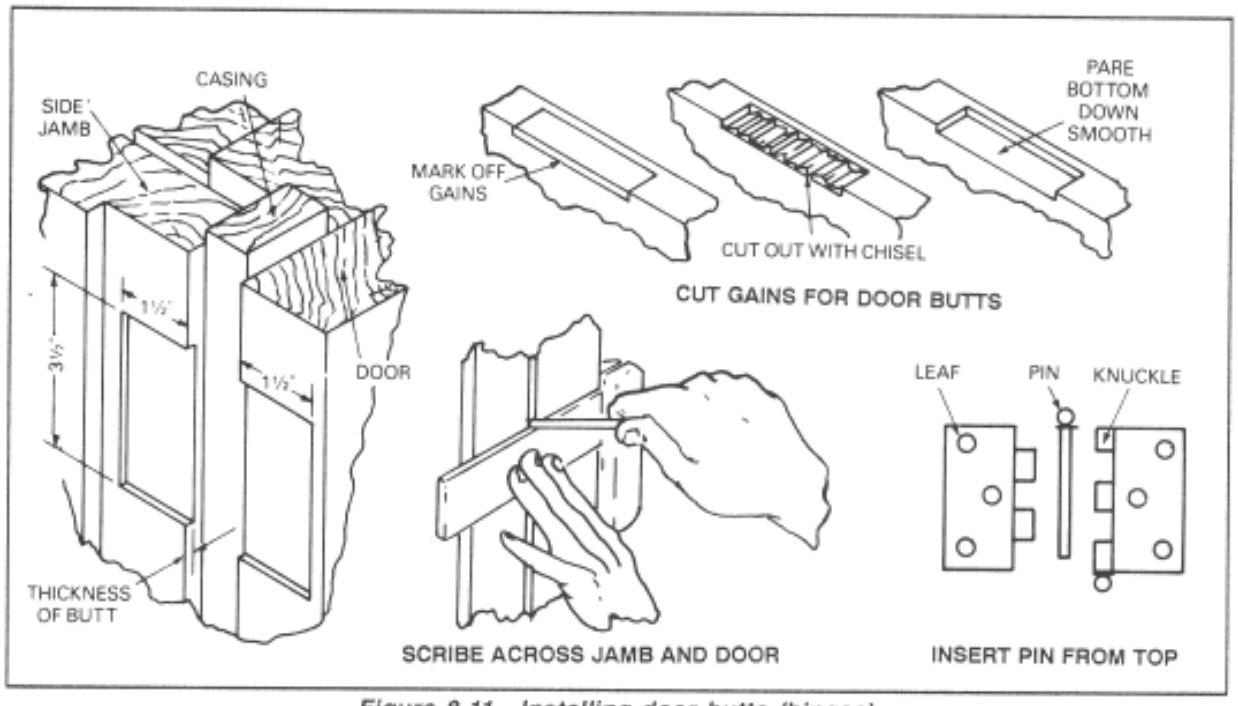

Figure 8-11. Installing door butts (hinges)

Finish Door Trim

Door trim is nailed onto the jambs to provide a finish between the jambs and the wall to cover wedging and spaces between the frame and studs. This trim is called casing. Sizes vary from 1/2 to 3/4 inch thick and from 2 1/2 to 6 inches wide. Most trim has a concave back to fit over uneven plaster. The casing layout depends on the way the side and head casings are to be joined at the corners. The casings are usually set back about 1/4 inch from the faces of the jambs. Care must be taken to make miter joints fit properly. If trim is to be mitered at the top corners, a miter box, a miter square, a hammer, a nail set, and a block plane will be needed. (Door trim and stop are shown in Figure 8-12.)

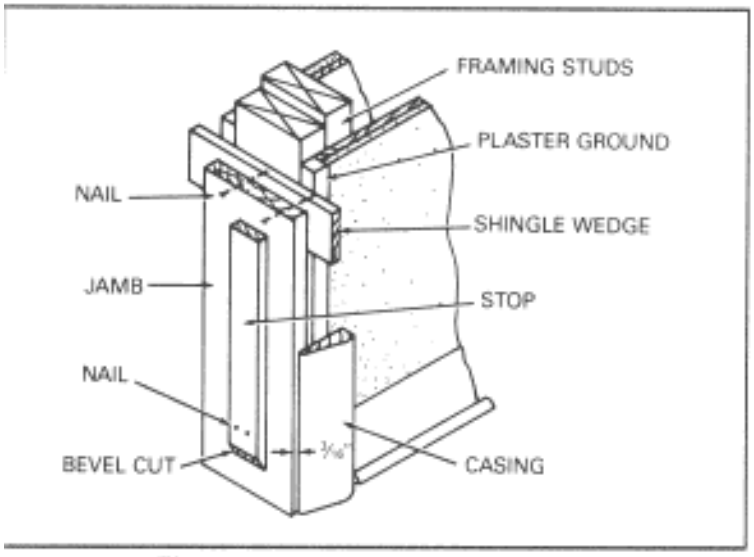

Figure 8-12. Door trim and stop

Door openings are cased up as follows:

Step 1. Leave a margin of 1/4 inch from the edge of the jamb to the casing, all around. Cut one (hinge-side first) of the side casings square and even with the bottom of the jamb. Cut the top or mitered end next, allowing a 1/4-inch margin at the top.

Step 2. Nail the casing onto the jamb, even with the 1/4-inch margin line. Start at the top and work toward the bottom. Use 4d finishing nails along the jamb side and 6d or 8d case nails along the outer edge of the casings. The nails along the outer edge will need to be long enough to go through the casing and into the studs. Set all nailheads about 1/8 inch below the surface of the wood with a nail set.

Step 3. Apply the casing for the other side and then the head casing.

LOCK INSTALLATION

Two types of locks used in TO construction are the *cylinder* and *tubular* locks. *Cylinder locks* are sturdy, heavy-duty locks designed for installation in exterior doors. They provide high security. *globular locks* are light-duty locks. They are used for interior doors on bathrooms, bedrooms, passages, and closets. Since door locks differ, use lock-set installation instructions, or perform the following steps:

Step 1. After placing the hinges in position, mark off the position of the lock on the lock stile, 36 inches from the floor level.

Step 2. Hold the case of the mortised lock on the face of the lock stile. With a sharp knife, mark off the area to be removed from the edge of the stile that is to house the entire case.

Step 3. Mark the position of the door-knob hub and the position of the key.

Step 4. Mark the position of the strike plate on the jamb.

Step 5. Bore out the wood to house the lock and the strike plate and mortises. (Figure 8-13, page 8-10, shows the installation of the lock and the strike plate.)

Step 6. Clean and install the lock set. The strike plate should be flush or slightly below the face of the door jamb.

Panic hardware is another type of lock. It is also known as a *paretic bar* or *fire-exit bolt.* It is often installed on the exit doors of public buildings. Slight pressure on the touch bar will retract the latch bolts at the top and bottom. Install panic hardware according to the manufacturer's instructions.

WINDOWS

The most common types of windows are *double-hung* and *hinged* (or *casement)* windows (Figure 8-14, page 8-11). All windows consist of two parts, the *frame* and the *sash.*

The double-hung window (Figure 8-14) is made of upper and lower sashes that slide vertically past one another. Screens can be located on the outside of a double-hung window without interfering with its operation. Ventilators and window air conditioners may be placed with the window nearly closed. However, for full ventilation of a room, only one-half of the area of the window can be used. Any current of air passing across its face is lost to the room. Its frame construction and operation are more involved than that of casement windows.

Casement windows (out-swinging or in-swinging) may be hinged at the sides, top, or bottom. Casements have the advantage of catching a parallel breeze and slanting it into a room.

- Out-swinging. The casement window that opens out requires the window screen to be located on the inside with a device cut into its frame to operate the casement.
- In-swinging. In-swinging casements, like double-hung windows, are clear of screens, but they are extremely difficult to make watertight, particularly against a driving rainstorm.

WINDOW FRAMES

Window frames are made of four basic parts: the head, the jambs (two), and the sill. (The sash is the framework that holds the glass in the window.) Where openings are provided, cut away the

studs and for equivalent strength, double the studs on each side of the opening to form trimmers. Insert a header at the top. If the opening is wide, the header should also be doubled and trussed. At the bottom of the opening, insert the rough sill.

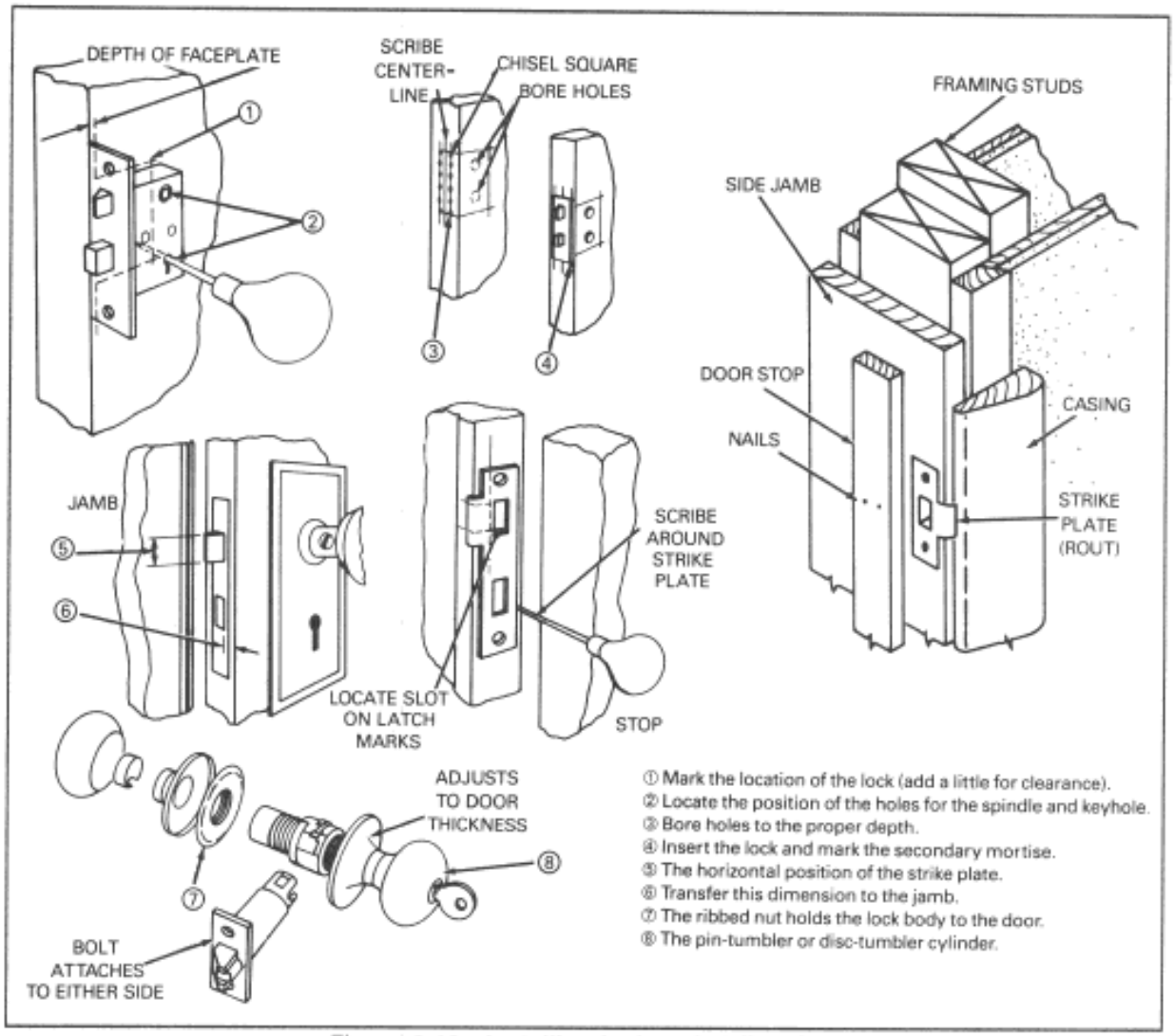

Figure 8-13. Installing lock and strike plate

In hasty construction, millwork window frames are seldom used. Instead, simple openings are left in the walls with the stops all nailed to the stud. The sash may be hinged to the inside or outside of the wall or may be constructed to slide. The sliding sash with overlapping panes is most common in Army construction because it requires little installation time.

Sills have a usual slope of 1 to 5 inches so that they shed water quickly. They are wider than frames, usually extending about 1 1/2 inches beyond the sheathing. They also form a base for the outside finished casing.

WINDOW SASHES

A window is normally composed of an upper and a lower sash. There are two ordinary types of wood sashes: fixed or movable. Fixed sashes are removable only with the aid of a carpenter. Movable sashes may slide up and down in channels in the frame (double-hung), or they may swing in or out and be hinged at the side (casement type).

Sliding sashes are counterbalanced by sash weights that weigh half as much as the sash. Sashes are classified as single or divided, according to the number of pieces of glass (or *lights).*

A sash may be made of 1 x 3 material with reinforced, rolled plastic material, which can be cut to any desired size. For hasty construction of window sashes, perform the following steps:

Step 1. Make two frames with the glass substitute installed on one.

Step 2. Nail the frames together. When the two frames are nailed together, they should be turned so that the joints are not over each other. This staggers the joints and strengthens the sash. Do not make the window sash larger than the available glass substitute. If the sash is too large for the glass substitute to cover, a muntin may be placed in the sash to hold the glass substitute; this should be fastened with corrugated metal fasteners. Where long sashes are made, a muntin should be placed in the center for added strength. Figure 8-15, page 8-12, shows the window frame and sash details.

Step 3. Cut the side pieces to a length equal to the height of the sash, less the width of one piece of material.

Step 4. Cut the top and bottom pieces the same length as the window, less the width of the material.

Step 5. Fasten at the joints with corrugated metal fasteners.

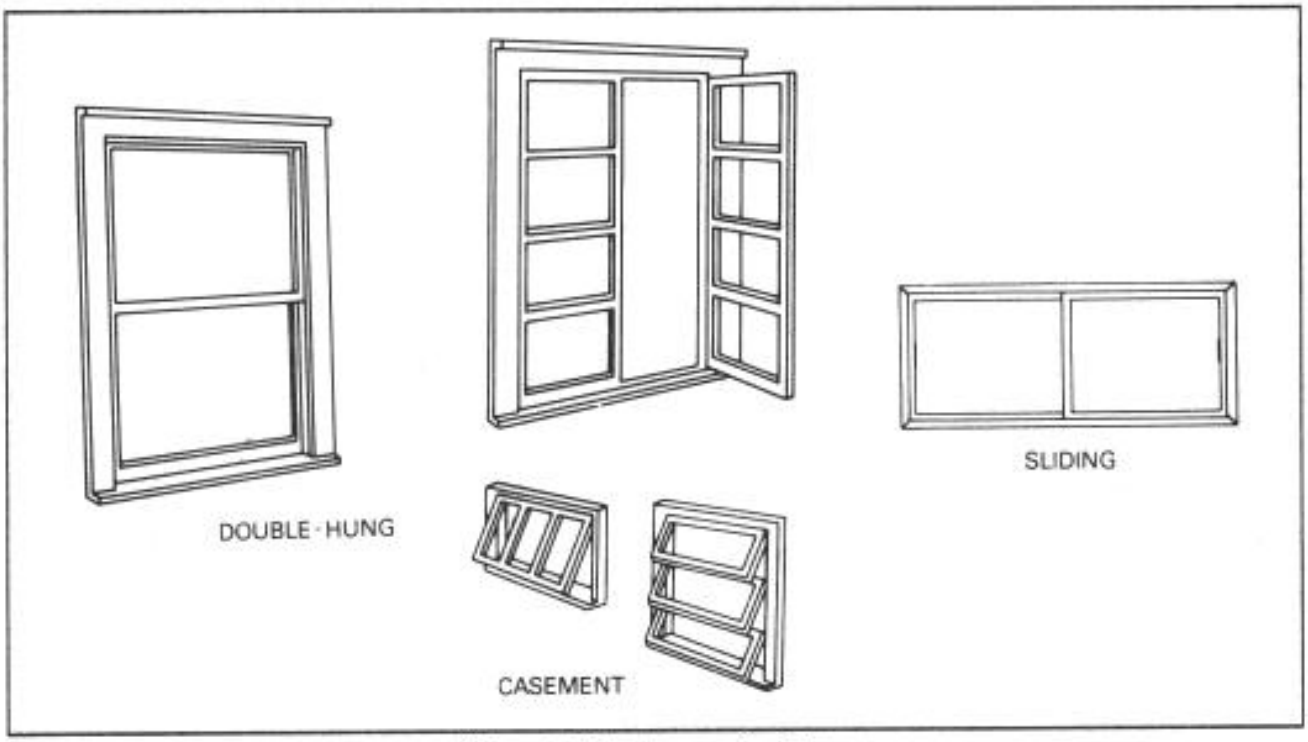

Figure 8-14. Types of windows

ACCESSORIES

The following are a few items that can be added to a structure to enhance efficiency:

WINDOW SCREENS

Screen sash is usually 3/4-inch stock; however, for large windows and doors 1 1/8-inch material is frequently used or 3/4-inch lumber is braced with a horizontal member.

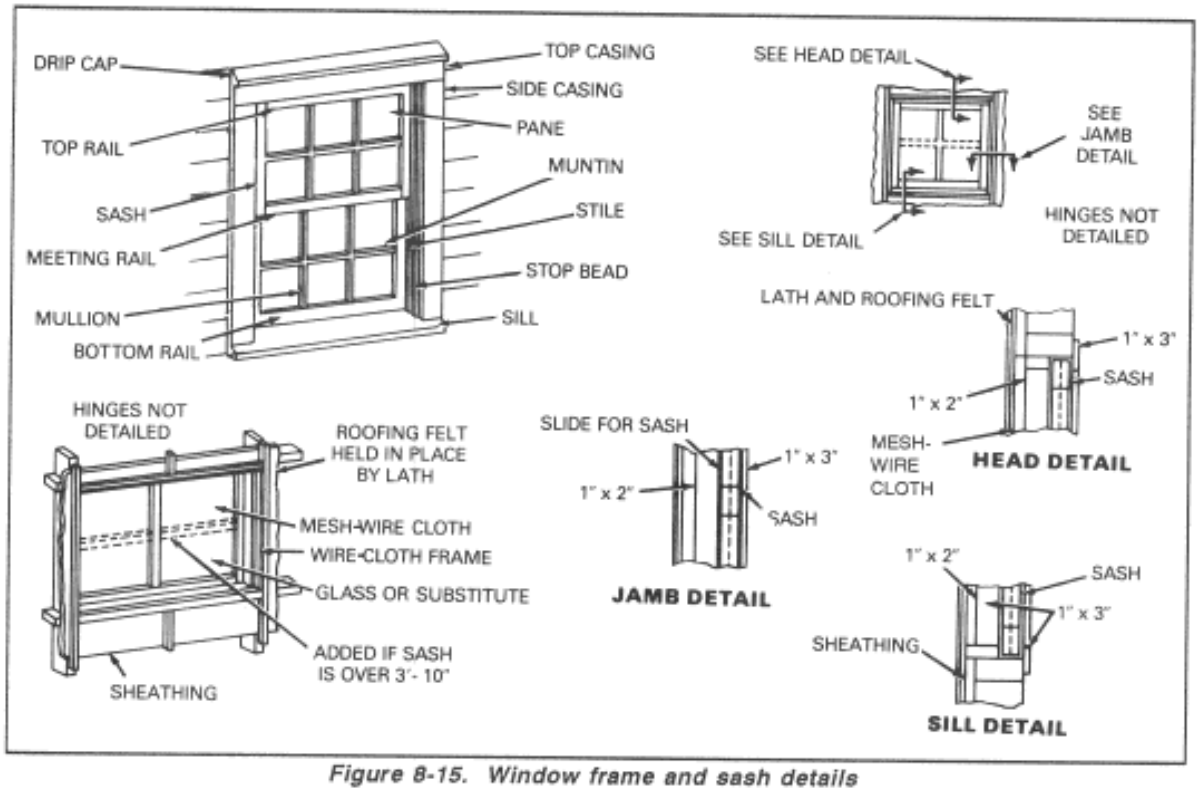

Figure 8-15. Window frame and sash details

Construction

Window screen sash is usually 13/4 or 2 1/4 inches wide. Screen may be attached by stapling or tacking. Cut the screen 1 inch wider and longer than the opening. Cover the edges with molding. Next, rabbet the inside edges about 3/4 x 1/2 inch. Attach the screen in the rabbet, and nail 3/8- x 1/2-inch molding flush with the sash face.

Joints

Window sashes may be made with open mortise, four tenons, and with rails tenoned into stiles; with half-lap corners; or with butt joints or corrugated fasteners. In either of the first two cases, the joints may be nailed or glued.

Attaching Screen Material

When attaching screen material, start at one end and tack or staple it with copper staples, holding the screen tightly. Next, hand-stretch the screen along the side, working toward the other end. Attach it, making sure the weave is parallel to the ends and sides. Tack the sides and apply the molding. Copper staples should be used for bronze or copper screen and cadmium staples for aluminum screens.

DOOR SCREENS

Door screens are made as shown in Figure 8-16. Two separate frames are made of 1 x 4 material for the sides and top; 1 x 6 material is used for the bottom and middle pieces. (Figure 8-17 shows door screen sizes.) The first frame is made of two side pieces as long as the door. The crosspieces are as wide as the door, less the width of the two side pieces. This frame is put together with corrugated metal fasteners or triangular corner splices; then, the screen wire is applied. The second frame is made with the crosspiece as wide as the door. The side pieces are cut to correspond with the distance between the cross-pieces. The second frame is placed over the first frame and

nailed securely. For push-and-pull plates, two short 1 x 4 braces are nailed to the side opposite the hinge side.

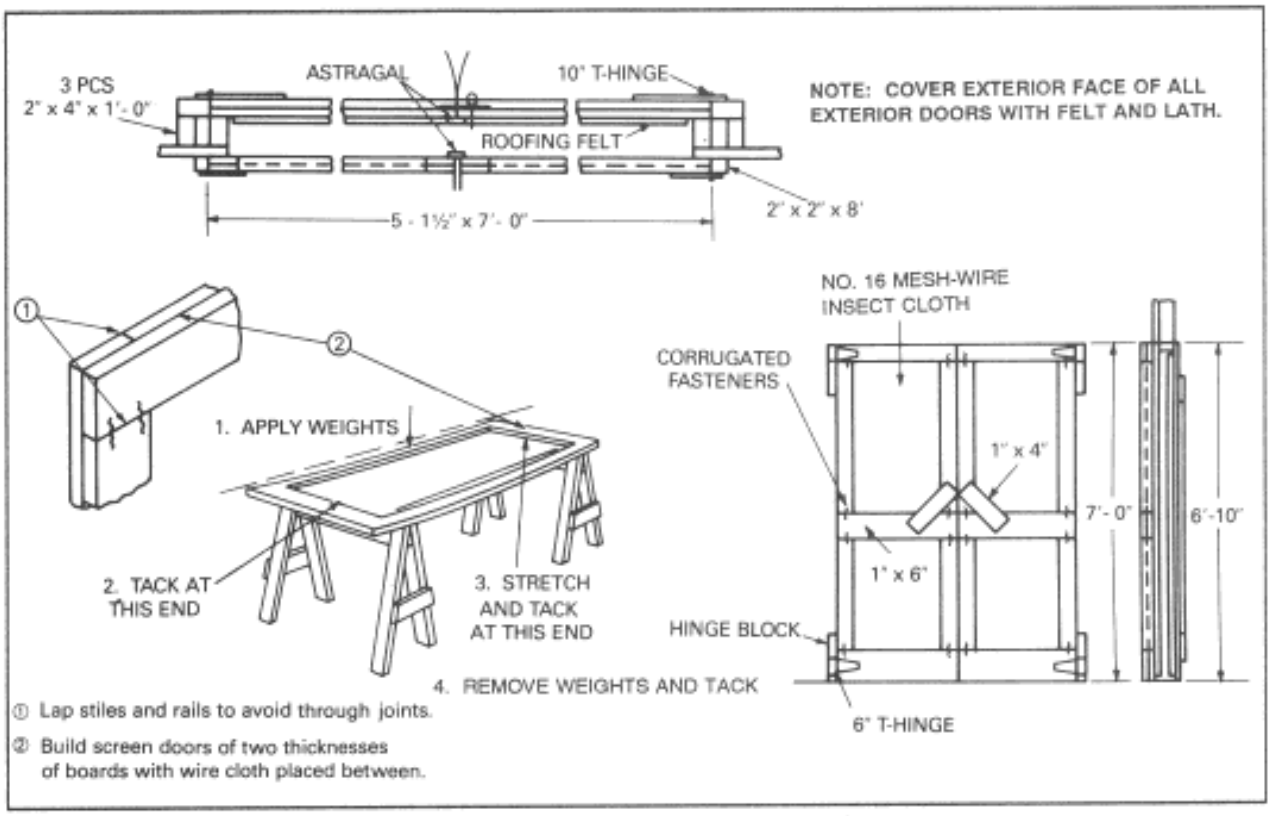

Figure 8-16. Door screen construction

HOODS OR CANOPIES

Hoods or canopies are used in tropical climates to protect the screened opening at the ends of the buildings. They are framed to the end walls with short rafters, which are nailed to the building with knee braces. The rafters are nailed to the wall, their bottom edge flush with the bottom of the end plate. The rafters and braces are made of 2 x 4s nailed with 8d or 10d nails. The sheathing is of the same material as the roof sheathing and is covered with roll roofing. The hood should extend about 2 1/2 or 3 feet from the building. Figure 8-18, page R-14. shows hood or canopy details.

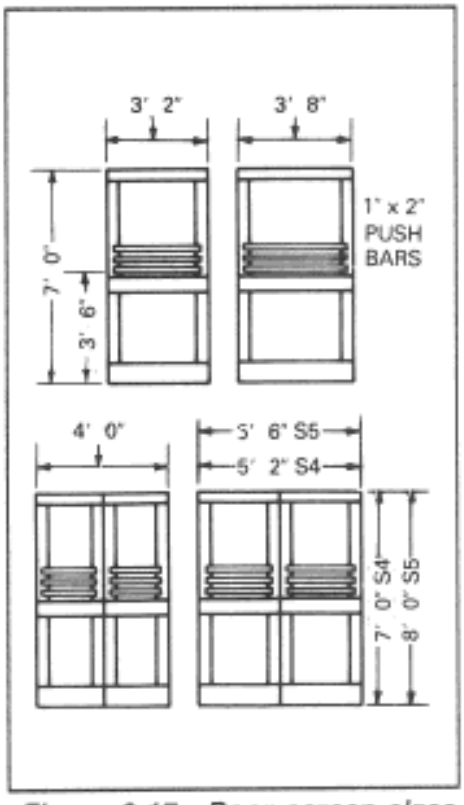

Figure 8-17. Door screen sizes

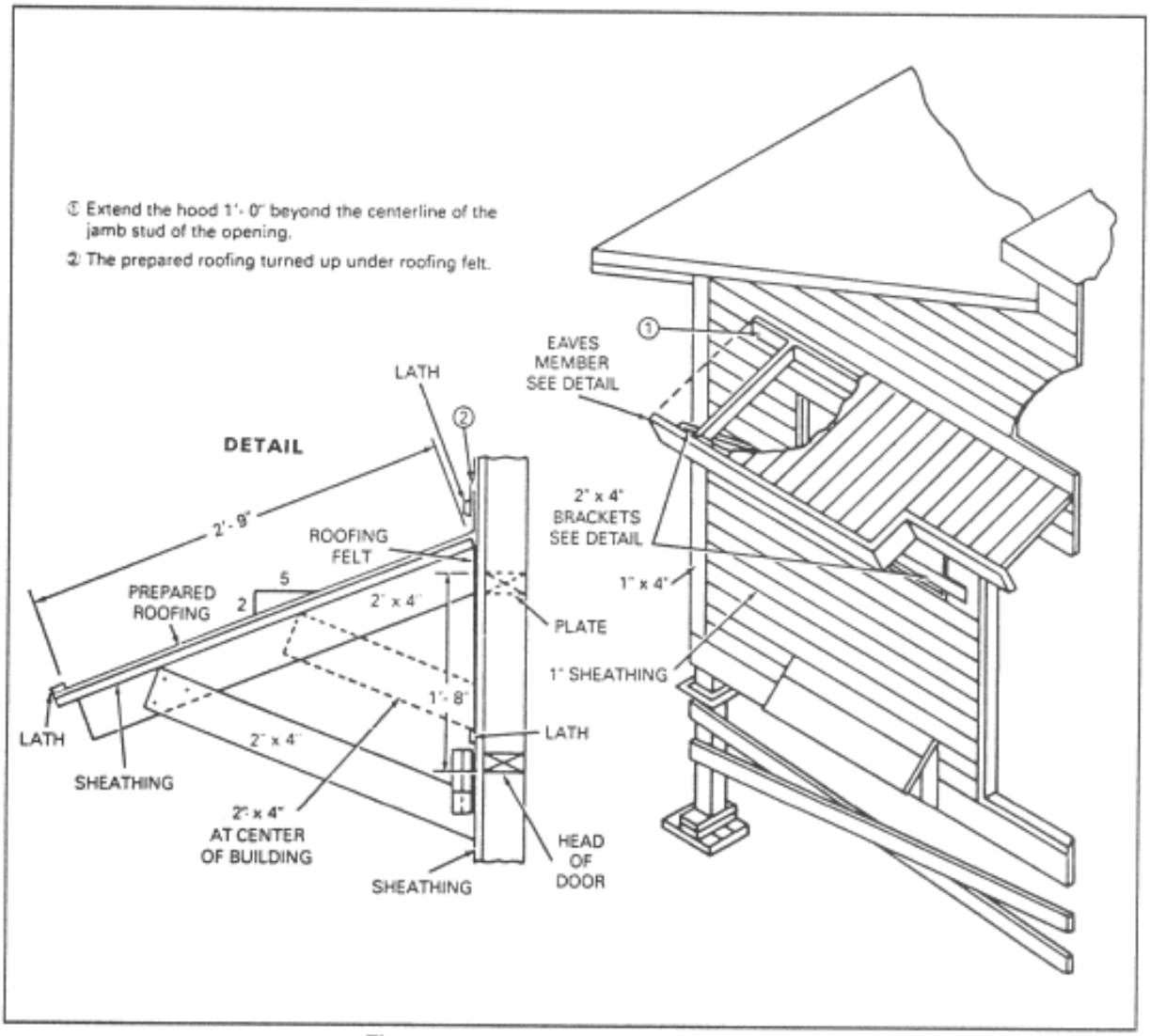

Figure 8-18. Hood or canopy details