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1. Determine the Type of Hinge

There are several pieces of information that are needed to select the proper type of hinge. What is the door material (wood or hollow metal)? What is the frame material (wood or hollow metal, or channel iron)?

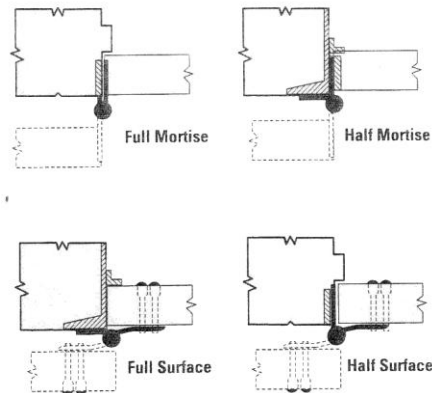
How do we determine the proper type of hinge? There are four classifications of hinges:

Full Mortise - Both leaves are mortised, one leaf to the door and one leaf to the frame. (WD or HM x WF or HMF)

Half Mortise – One leaf is mortised to the door and the other is surface applied to the frame. (HM x CIF)

Full Surface – Both leaves are applied to the surface: one to the door and the other to the frame.

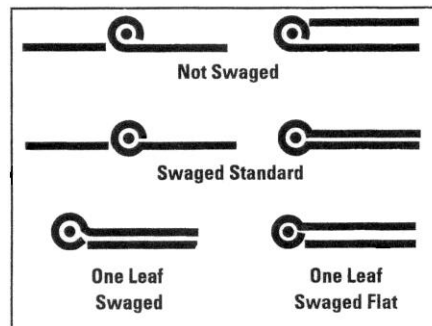
Half Surface – One leaf is mortised to the frame and the other is surface applied to the face of the door. (WD x WF or MCD x HMF)



There is one easy way to remember what the hinge is called. The Full Mortise and the Full Surface really are no problem; however, the Half Mortise and the Half Surface sometimes are difficult to keep straight.

You need only remember *what the hinge is called is what is done to the door*. A Half Mortise hinge is *mortised to the door* and surface applied to the frame. A Half Surface hinge is *surface applied to the door* and mortised to the frame.

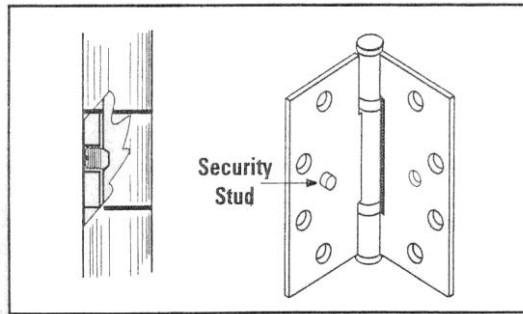
There are several features available for the Full Mortise hinge that must be indicated before going further.



One point that must be made when discussing the classifications of hinges is the term referred to as *swaging*. Waging is a slight offset of the hinge leaf at the barrel. This offset permits the leaves to come closer together when the door is in the closed position. If the hinge were to be left in the natural state after the knuckle was rolled, the hinge would be referred to as *flatback*. A flatback hinge has a gap between the leaves of approximately $5/32$ ". This would allow heat and air conditioning to escape, not to mention the unsightly gap between the door and the frame.

The standard swaging on standard weight and heavy weight Full Mortise hinges provides 1/16" clearance between the leaves when the leaves are in the closed position.

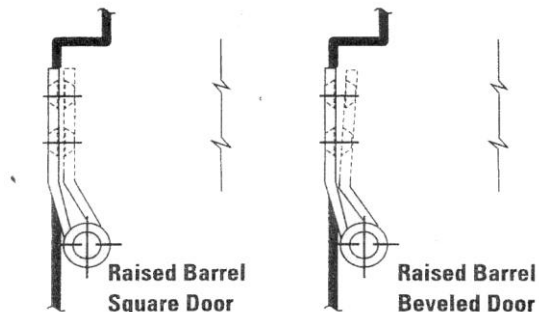
Two additional features that are used commonly are the Non-Removable Pin (NRP) and the Security Safety Stud (Sec Std).



The Non-Removable Pin has a small set screw in the body of the barrel. This set screw is tightened down against the pin. In most cases, the pin has a groove in the position where the set screw makes contact, allowing the set screw to seat. The set screw is positioned so it cannot be reached unless the door is opened. In pin removal is necessary, the set screw merely is removed and the pin tapped from the bottom in the usual manner.

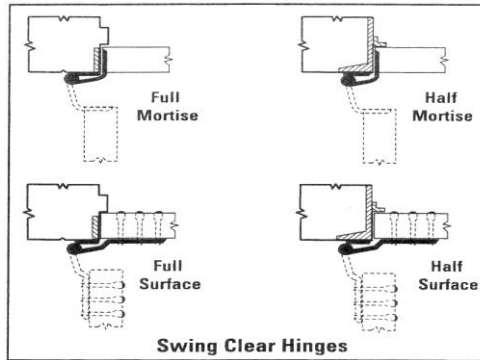
The Security Safety Stud is another feature which places a stud on one leaf and a locking hole in the other leaf. When the door is closed, the stud is anchored into the opposite leaf. Even if the hinge pin is removed, the door is secure because the leaves are locked together.

One important point must be made here. Both of these features are intended as *deterrents only*. If someone wants to gain entry through a door badly enough, they will eventually get through!



Another special function available is the raised barrel hinge, which is used when the door is set back into the frame. There are three different types of applications: Jamb Surface Mount, Raised Barrel for Square Edged Door and Raised Barrel for Beveled Edge Door. The hinge knuckle is offset to allow it to clear the obstruction of the frame.

On the Jamb Surface mount application, the door is mounted to accommodate both hinge leaves. This is sometimes referred to as double mortised. The Jamb Surface mount may be applied to either a square or beveled edge door.



The Raised Barrel for Square Edge Door and Raised Barrel for Bevel Edge Door applications are mortised into the frame and door as a standard full mortise hinge.

Depending on the depth of the frame, all three of these applications may restrict the degree of opening.

Another special feature hinge is the *swing clear* type. This is used mostly in hospitals and institutional buildings when the passage area must be the full width of the opening. One such case would be an 8' wide corridor that requires the full opening for the passage of two beds or carts. With the use of Swing Clear hinges, this passage can be accomplished.

The hinges are designed to swing the door completely clear of the opening when the door is opened 95°. The standard way to accomplish this degree of opening is to build a pocket in the wall to accept the door. This allows the door to be concealed in the wall and not obstruct the flow of traffic.

TABLE 1: Approximate Door Weights (lbs. Per Sq. Ft.)

DOOR MATERIAL	DOOR THICKNESS:				
	2/3"	1 3/4"	2"	2 1/4"	2 1/2"
Ash	4 1/2	5 1/4	6	6 3/4	7 1/2
Birch	3 3/4	4 1/3	5	5 2/7	6 1/4
Fir	3	4 1/3	4	4 1/2	5
Mahogany	4 1/2	5 1/4	6	6 3/4	7 1/2
Oak	6	7	8	9	10
White Pine	3	3 1/2	4	4 1/2	5
Hollow Core	2	2 1/2	-	-	-
Solid Core	3 1/2	4 1/2	5	5 1/2	-

Hollow Metal	6 ½	6 ½	6 ½	6 ½	6 ½
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The above table represents relative weights of most common doors and is Intended to be a guide or approximation.

TABLE 2: Frequency of Use

Type of Building/Use	Expected Frequency	
	DAILY	YEARLY
HIGH FREQUENCY		
Large Department Store Entrance	5,000	1,825,000
Large Office Building Entrance	4,000	1,460,000
Hospital Corridor and Surgical Doors	5,000	1,095,000
School Entrance	1,250	456,250
Office Stairwell	500	182,500
MEDIUM FREQUENCY		
Hospital Consultation Rooms	100	36,500
School Corridor	100	36,500
Office Building Corridor	80	29,200
Storage Room	50	18,250
LOW FREQUENCY		
Residential Entrance	30	10,950
Residential Interior	20	7,300

2. Select the Proper Weight and Bearing Structure

Because of the large variety of door sizes and weights, hinges are placed into three groups:

- Heavy Weight/Ball Bearing*
- Standard Weight/Ball Bearing*
- Standard Weight/Plain Bearing*

There are two factors that determine the weight and structure of the hinge, namely weight of door and frequency of use.

The weight of the door is based strictly on how much the material of the door weighs. It also is advisable to include the approximate weight of additional hardware that will be installed on the door. (See Table 1 for approximate weights.)

The next factor is the frequency of use. How often is the door opened and closed in a given time frame? This usually is figured on a daily basis. Some general guidelines for high, medium and low frequency are listed in Table 2.

These frequency chart recommendations apply to all average weight doors. Heavy ball bearing hinges should be used for larger doors (i.e., doors having a thickness of 2" or more and over a width of 3'4").

Another critical note which is often neglected relates to doors on which a closing device is used. These doors should be equipped with ball bearing hinges, regardless of frequency of use.

3. Determine the Size of Hinge

In order to determine the proper size of the hinge, several bits of information will be necessary: door height, door width, door thickness, door weight and trim dimension required.

The first thing to find is the height of the hinge. Follow the examples indicated in the chart below. These are only examples. Job situations will offer many more variables.

TABLE 3: Hinge Height

Thickness Of Door	Width Of Door	Height Of Hinge
1 3/8" Door	To 32"	3 1/2"
1 3/8" Door	32" to 37"	4"
1 3/4" Door	To 36"	4 1/2"
1 3/4" Door	36" to 48"	5" *
1 3/4" Door	Over 48"	6" *
2", 2 1/4", 2 1/2" Door	To 42"	5" Heavy Wgt.
2", 2 1/4", 2 1/2" Door	Over 42"	6" Heavy Wgt.

**Heavy weight hinges should be specified for heavy doors and for doors which are expected to receive high frequency use.*

The next determination is the number of hinges per door leaf. A general rule of thumb is one hinge for every 30" of door height or fraction thereof (see Table 4).

TABLE 4: Number of Hinges

Doors up to 60" in height:	2 hinges
Doors over 60" and not over 90" in height:	3 hinges
Doors over 90" and over 120" in height:	4 hinges

There are three dimensions to know in order to determine width of the hinge: door thickness, back-set and clearance required.

When figuring the calculations for a wood door and wood frame, the door is flush with the casing or face of the frame. When figuring the calculations for a wood or metal door with a hollow metal frame, the door inset is 1/8". For doors up to 2-1/4" thick, the hinge is set back 1/4" from the backface of the door. For doors over 2-1/4" thick, the hinge is set back 3/8" from the back face of the door.

Once these dimensions are know, the formula then can be applied. Take the door thickness minus the backset times two plus the clearance required. If the size of hinge is not standard, go to the next larger hinge.

As explained before, the Full Mortise type hinge has two dimensions. The first size is the height and the second size is the width when the leaves are in the open position. In the formula just mentioned, it may be necessary to have the width of the hinge extended in order to clear trim or wall conditions. If the width of the hinge is greater than the height of the hinge (e.g., 4-1/2" x 6"), this is referred to as a *wide throw hinge*. This would apply only to full mortise hinges.

4. Determine the type of Material

There are three base materials from which hinges are manufactured: steel, stainless steel and brass. Each base material has different qualities.

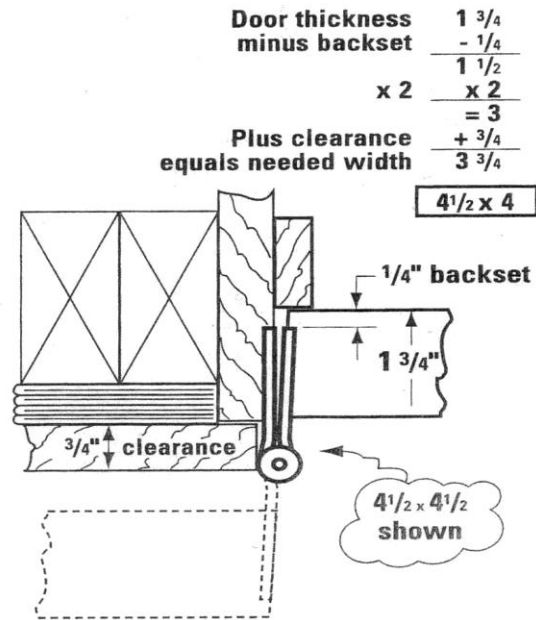
Steel – This has great strength but it is a corrosive material. If the atmosphere in which steel is used is not stable, it will begin to rust. The best application for steel is in an environment such as the inside of a building where the temperature and humidity are controlled.

Stainless Steel – This also has great strength. It is rust resistant and has decorative value in that it can be polished to a satin or bright finish. Stainless steel can be used in chemical storage or highly corrosive areas and not become rusted. Other considerations may be geographical, such as on the seacoast or in industrial areas where acids or atmospheric conditions exist.

Brass – This material is non-corrosive, rust resistant and very decorative. However, it has less strength than steel or stainless steel material. Brass is often used where appearance is of great concern. It may be polished and plated in various finishes.

Both steel and stainless steel hinges may be used on listed or labeled door openings. Brass material may not be used on fire-rated or labeled openings because of its low melting point.

Aluminum base material is not available for contract grade hinges. This material is too soft and will not withstand the abuse that normal hinges receive. Several manufacturers attempted to manufacture hinges from aluminum a number of years ago, but this practice has now been discontinued.



5. Determine the Type of Finish

All steel and brass material hinges can be plated to match the available finishes that are listed in ANSI/BHMA A156.18, "Material and Finishes." Most finishes are lacquered to resist oxidation or tarnishing of the finish. Also listed are various painted finishes. These are applied to the hinges in a variety of ways. The most common are *bonderizing* and *electro-disposition*. These methods avoid chipping and peeling of the paint during shipping and installation.

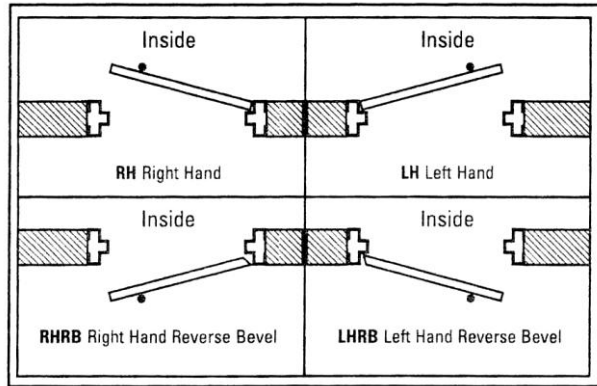
Please carefully read the specific paragraphs 4.2, "Categories" and 4.3 "Finishes" in the above referenced standard. These discuss the compatibility of finishes and how finishes are to be viewed when comparing them to products of various base materials.

For a further explanation of the finishes, it is advisable to read the most current issue of this standard. This will be extremely helpful during the specification process.

6. Determine Handing

On some applications, it will be necessary to order hinges that are handed. Most manufacturers use the suffixes RH (right hand) and LH (left hand). Another general rule of thumb: most manufacturers make the half surface, half mortise and full surface hinges for right hand use. Conversion from right hand to left hand is very simple. Take the pin out of the knuckle, remove the bottom plug, turn the hinge over, replace the plug in the bottom and the pin in the top of the knuckle, and the handing is reversed. There are many methods to determine the proper handing of a door.

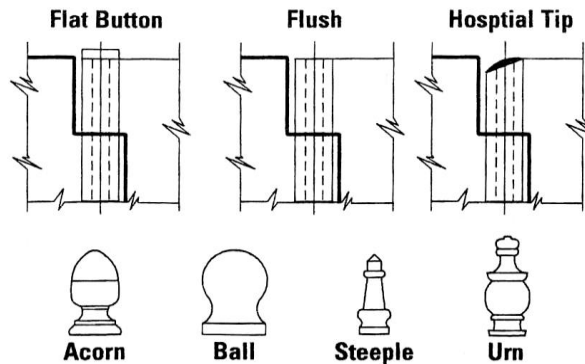
The hand of a hinge is determined from the outside of the door to which it is applied, usually the locked side. If the door opens away (into the area) to the right, it takes a right hand hinge (also referred to as RH). If it opens to the left, it takes a left hand hinge (LH).



When standing outside, if the door opens toward the right (out of the area), it takes a left hand hinge (also referred to as right hand reverse bevel, RHRB). If it opens to the left, it takes a right hand hinge (also referred to as a left hand reverse bevel, or LHRB). This may be a difficult concept to grasp at first, but do not be discouraged. Just practice during everyday encounters with various openings.

7. Hinge Tips

There are a variety of tips from which to choose. The standard in the industry is the *flat button tip*. These normally are furnished unless something else is specified.



The *flush/concealed tip* is the second most commonly used tip, and this is concealed inside the knuckle. It is often more pleasing to the architect because of the fewer lines across the face of the hinge knuckle.

Hospital tips are used primarily for security areas in hospital mental wards and in prison areas. This type prevents hanging any objects on the tip of the hinge.

Decorative type tips are available from most manufacturers, such as *Acorn*, *Ball*, *Steeple*, and *Urn*. These are used in highly decorative areas of offices and in more expensive residences.

Oval head tips are usually used for industrial or farm applications. *Fast riveted pins* are also available. This is a pin that is spun on both ends, making the pin permanent.

8. Special Applications

Hinge Pins

Most hinges have loose or removable pins. This means that the pin is capable of free movement and can be easily slipped in or out, thereby simplifying the hanging of a door. A fast pin hinge is one in which the pin is firmly set once it is put into the hinge. It cannot be easily removed. These pins are usually riveted or spun into the barrel when they are assembled at the factory. A fast pin hinge must be applied to the door and frame fully assembled. There are many situations in which a fast pin is desirable, particularly on reverse bevel doors where an extra measure of security is desired.

Because of the way a hinge functions, the hinge pins on reverse bevel doors are on the outside of the opening. If the hinge pins can be easily removed or loosened, the door is not secure. For this reason, manufacturers have made considerable effort to provide security where it is needed. Two optional security features offered are the non-removable pin (NRP) and the security/safety stud (SS).

NRP Hinge

An NRP hinge has a set screw inserted into the barrel, securing the hinge pin and holding it in place. The set screw is inaccessible when the door is closed. NRPs are available for all types of conventional hinges.

Security Studs

The security/safety stud is a pin-like projection in one leaf of a full mortise hinge. When the door closes, the hinge leaves come together and the stud fits into a hole in the opposite hinge leaf, interlocking the two leaves together. This helps prevent an intruder from sliding the hinge side of the door open after he or she has removed the hinge pins.

Spring Hinges

Frequently used on hotel and motel unit entrances, spring hinges are used, in lieu of door closers, to ensure the doors are kept in the closed position. Spring hinges contain a spring, which can be wound, creating closing tension. Unlike door closers, spring hinges cannot control the closing speed of a door. Spring hinges typically close a door very rapidly. They are available as either single or double acting.

Certain models of spring hinges have been tested and approved for use on fire-rated openings. The National Fire Protection Association (NFPA) publication #80 – ‘Standard for Fire Doors and Windows’ permits the use of listed spring hinges on fire-rated openings, provided that two spring hinges are used in conjunction with one listed anti-friction or ball-bearing hinge.