Nails

Nailing is the most basic and most commonly used means of attaching members in wood frame construction. Usually, nailing is used as a structural connection and appearance is not a factor. Exceptions to this are nails used for cladding, decking and finish work, where care in the selection of the type of nail can lead to enhanced appearance.

Screws rely on their threads to develop resistance to withdrawal. Nails are faster to install but rely mainly on friction to resist withdrawal. For this reason, designs should ensure that nails are loaded laterally and that withdrawal loads are kept to a minimum as shown in Figure 1 in the previous section.

Nails are made in lengths from 13mm (1/2") to 150mm (6"). Spikes are made in lengths from 100mm (4") to 350mm (14") and are of sturdier proportion than nails.

Types of Nails

Nails are manufactured in many types as shown in Table 1 below, and shapes as shown in Table 2 (in the next section) to suit specific applications.

In Canada, nails are specified by the type and length and are still manufactured to Imperial dimensions. Diameter is specified by gauge number (British Imperial Standard) and is the same as the wire diameter used in manufacture.

In the U.S., the length of nails is designated by "penny" abbreviated "d". For example a twenty-penny nail (20d) has typically has a length of four inches.

Pneumatic or mechanical nailing guns have found wide-spread acceptance in North America due to the speed with which nails can be driven. They are especially cost effective in repetitive applications such as in shearwall construction where nail spacing may be as close as 75mm (3") to distribute load.

The nails for power nailers are lightly attached to each other or joined with plastic, allowing quick loading nail clips, similar to joined paper staples. Fasteners for these tools are available for every application from heavy framing nails up to 89mm (3-1/2") down to upholstery staples 4.8mm (3/16") in length. These fasteners are also available in galvanized form for corrosive applications.

Table 1: Nail Types							
Type of Nail	Head	Shank	Point	Material	Finishes and Coatings	Common Lengths	
						mm	in.
Common (spike)	F	C, S	D	S, E	B	100-350	4 - 14
							
Eavestrough (spike)	Cs, F	C, S	D, N	S	B, Ghd	125-250	5 - 10
							
Standard or Common	F	C, R, S	D	A, S, E	B, Ge	25-150	1 - 6
							
Box	F, Lf	C, R, S	D	S	B, Pt, Ghd	19-125	3/4 - 5
							
Finishing	Bd	C, S	D	S	B, Bl	25-100	1 - 4
							
Flooring and Casing	Cs	C, S	Bt, D	S	B, Bl, Ht	28-80	1-1/8 – 3-1/4
							
Concrete	Cs	S	Con, Bt, D	Sc	Ht	13-75	1/2 - 3
							
Cladding and Decking	F, O	C, S	D	A, S	B, Ghd	50-63	2 - 2-1/2
							
Clinch	F, Lf	C, S	Db	S	B	19-63	3/4 - 2-1/2
							

Table 1 (con't): Nail Types							
Type of Nail	**Head**	**Shank**	**Point**	**Material**	**Finishes and Coatings**	**Common Lengths**	
Hardwood Flooring	Cs	S	Bt	S	B, Ht	14-63	1-1/2 – 2-1/2
							
Gypsum Wallboard	Dw, F	C, R, S	D, N	S	B, Bl, Ge	28-50	1-1/8 - 2
							
Underlay and Underlay Subfloor	F, Cs	C, R	D	S	B, Ht	19-50	3/4 - 2
							
Roundwire Sash Pins	-	C	D	S	B	19-50	3/4 - 2
							
Roofing	Lf, F	C	D	A, S	B, Ghd	19-50	3/4 - 2
							
Wood Shingle	F	C, R, S	D	A, S	B, Ghd	31-44	1-1/4 - 1-3/4
							
Gypsum Lath	F	C, S	D, N	S	B, Bl, Ge	31	1-1/4
							
Wood Lath	F	C, S	D	S	Bl	25-28	1 - 1-1/8
							

Notes:
1. Refer to Table 2 for Head, Shank and Point abbreviations.
2. Refer to Table 3 for Materials, Finishes and Coatings abbreviations.

Shanks and Points

Shanks

Nail shanks are made smooth or deformed. The deformed shanks s usually spiral (or helical) or ringed.

Spiral nails provide greater withdrawal resistance than smooth shanks nails and are particularly effective in resisting shock loads. Some typical applications are for: flooring underlay, paneling, gusset plates, soffits, siding, and roofing.

Ring-threaded nails also have high withdrawal resistance created by the keying action of displaced wood fibres against the nail grooves. Applications include fastening for gypsum wallboard, plywood underlay for flooring, and sheathing.

Points

The shape of the point affects the tendency of the wood to split when a nail is used close to an end of edge because the shape dictates whether the nail acts like a wedge or like a punch. The sharper the point, the higher the holding power due to wedging of wood fibres against the fastener, the easier it is to drive the nail, but the greater the tendency of the nail to split the wood.

The most widely used nail point is the diamond which is a good compromise between ease of driving, minimization of splitting, and holding power.

Table 2: Nail Heads, Shanks and Points

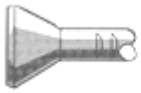
Part	Type	Abbr.	Remarks
Heads	Flat Counter-Sink	Cs	For nail concealment: light construction, flooring, and interior trim.
			
	Gypsum Wallboard	Dw	For gypsum wallboard.
			
	Finishing	Bd	For nail concealment; cabinetwork, furniture.
			
	Flat	F	For general construction.
			
	Large Flat	Lf	For tear resistance; roofing paper.
			
	Oval	O	For special effects; cladding and decking.
			

Table 2 (con't): Nail Heads, Shanks and Points			
Part	**Type**	**Abbr.**	**Remarks**
Shanks	Smooth	C	For normal holding power; temporary fastening.
			
	Spiral or Helical	S	For greater holding power; permanent fastening.
			
	Ringed	R	For highest holding power; permanent fastening.
			
Points	Diamond	D	For general use, 35º angle; length about 1.5 x diameter.
			
	Blunt Diamond	Bt	For harder wood species to reduce splitting, 45º angle.
			
	Long Diamond	N	For fast driving, 25º angle; may tend to split harder species.
			
	Duckbill	Db	For ease of clinching.
			
	Conical	Con	For use in masonry; penetrates better than diamond.
			

Materials

The types of materials used for nails are shown in the Table 3 below. The most common nails are made of low or medium carbon steels or aluminum. Medium-carbon steels are sometimes hardened by heat treating and quenching to increase toughness. Nails of copper, brass, bronze, stainless steel and other special metals are available if specially ordered.

Uncoated steel nails used in areas subject to wetting will corrode and result in staining of the wood surface. In addition, the naturally occurring extractives in the cedars react with unprotected steel and with copper and blued or electro-galvanized fasteners. In such cases, hot-dip galvanized nails or stainless steel or copper nails should be used.

Table 3: Nail Materials, Finishes and Coatings

Material	Abbr.	Application
Aluminum	A	For improved appearance and long life: increased strain and corrosion resistance.
Steel - mild	S	For general construction.
Steel - high carbon	Sc	For special driving conditions: improved impact resistance.
Stainless steel, copper and silicon bronze	E	For superior corrosion resistance: more expensive than hot-dip galvanizing.
Finishes and Coatings		
Bright	B	For general construction, normal finish, not recommended for exposure to weather.
Blued	Bl	For increased holding power in hardwood, thin oxide finish produced by heat treatment.
Heat treated	Ht	For increased stiffness and holding power: black oxide finish.
Phoscoated	Pt	For increased holding power; not corrosion resistant.
Electro galvanized	Ge	For limited corrosion resistance; thin zinc plating; smooth surface; for interior use.
Hot-dip galvanized	Ghd	For improved corrosion resistance; thick zinc coating; rough surface; for exterior use.

Sheathing Nailing

Nail popping may occur if a sheathing material is applied to lumber with a high moisture content. As the lumber shrinks, the depth of the hole in which the nail sits reduces and the nail head is pushed above the surface of the plywood. This tendency can be reduced by:

- Using dry lumber whenever possible. If unseasoned lumber is used, allow time for on site drying and reseat nails which project from the sheathing.
- Using ringed nails and driving nails at a slight angle or using screws. Set all nail heads prior to laying resilient flooring.
- Using a length of fastener which gives the minimum acceptable depth of penetration in the framing member.

Screws

Wood screws are usually used for millwork and finishing rather than for structural framing. They are used in fastening millwork where resistance to withdrawal is a requirement.

Screws find some applications in structural framing as in the case of floor sheathing which is glued and screwed to the joists or the positive attachment of gypsum wallboard to support members. They are higher in cost than nails because of the machining required to make the thread and the head.

Screws are designed to be much better at resisting withdrawal than nails. However, when used for structural purposes, it is better that screws not be loaded in withdrawal as shown in Figure 1 but rather use the withdrawal resistance properly to produce and maintain close contact between the elements being joined.

The types of wood screws commonly used are shown in Table 4 below.

Table 4: Types of Screws

Part	Type	Use
Head Shapes	Flat	For countersinking flush with or below the surface.
		
	Oval	For partial countersinking.
		
	Pan	Recommended to replace round headed screws; for use with washers or thin side pieces.
		

Table 4 (con't): Types of Screws		
Part	**Type**	**Use**
Head Drive Shapes	Slot Recess	Common use.
	 Slot	
	Cross Recess	To minimize screwdriver slipout.
	 Phillips  Pozidriv	
	Square Recess	To minimize screwdriver slipout.
	 Socket (Robertson)	
Shanks	Double Lead	For faster turning; requires greater torque.
		
	Single Lead	For shorter screws (less than 25mm (1")).
		
	Tapping	For better penetration; higher strength; designed for sheet metal but can be used with wood.
		
Points	Gimlet	For wood and some tapping screws.
		
	Blunt	For some tapping screws.
		

Table 5: Wood screw Lead Hole Diameters and Depths		
	Diameter	**Depth**
Countersink	Same Diameter as Head	Same Depth as Head
Shank	Slightly smaller than shank diameter; 7/8 shank diameter for withdrawal loading.	For softwoods, about 1/2 of screw length for shank and thread lead holes combined (may be same diameter); for hardwoods or soft screws, lead holes nearly as deep as screw.
Thread	About 70% if loaded in withdrawal; about 90% of diameter for hardwoods.	Overall depth to match screw length.