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GENERAL OBSERVATIONS ON THE NAILING OF WOOD

Three principal factors determine the efficiency of a nailed joint, namely: The wood, the nail, and the conditions of use.

The harder woods hold nails better than the softer woods, although they are more difficult to nail and have a greater tendency to split. Wood that is green or not thoroughly dry may lose most of its nail-holding power when it dries after the nails are driven. This is one of the reasons why green wood is not recommended for building construction. The resistance to withdrawal is higher when nails are driven into the side grain than when driven into the end grain of the wood, and therefore side grain nailing is always to be preferred.

The common wire nail has attained by far the widest use of the many types developed. By varying the number and size, the kind of point, and the type of surface, the common nail can be adapted to cover a wide range both of every-day and of exacting uses.

The resistance to withdrawal of common nails increases directly with the depth to which driven and increases almost directly with the diameter or surface area; that is, if the diameter of a common nail is doubled the holding power is doubled, provided, of course, that splitting of the wood does not occur. When the nails are subjected to side loads (lateral resistance) the increase in load is greater than the increase in diameter (1-1/2 power of the nail diameter); that is, if the diameter of a common nail is doubled, the lateral resistance is nearly three times as great. The development of the maximum lateral resistance of a nail, requires a depth of penetration into the member receiving the point of from not less than one-half the length of the nail for dense hardwoods to two-thirds the length of the nail for the softer woods.

The softer woods are often preferred for construction purposes because of their greater ease of nailing -- the lack of nail-holding power being compensated for by the use of additional or larger nails. For example,

in tests of diagonally sheathed panels an increase of about 40 percent in strength (resistance to racking forces) was obtained by nailing with three, rather than two 8d nails at each stud crossing. In tests of wall panels made of a soft pine, a 30 percent increase in stiffness and 40 percent increase in strength was obtained with horizontal sheathing by increasing the size of nails from 8d to 10d.

The nail-holding power of wood can be increased by changes in the surface condition of the nail. One of the common methods of surface treatment is the so-called "cement coating," which, if properly applied, may double the resistance to withdrawal in the softer woods, the increase dropping off for the denser woods, like hard maple, birch, or oak, to no advantage over the plain nail. All cement-coated nails on the market are not subjected to the same treatment, so that nails may sometimes be obtained that will show only a slight initial advantage over the plain nail. The increase in holding power of cement-coated nails is not permanent, dropping off about one-half after a month or so for the softer woods. Because boxes are usually built for short-time service, cement-coated nails have been used extensively in their construction.

Many other types of nails have been developed for ordinary or special uses. These include chemically etched, barbed, annular grooved, spirally grooved, and sand-blasted nails. In general, they have been developed to provide higher resistance to withdrawal than the common nail. Under conditions involving changes in the moisture content of the wood, annular grooved and spirally grooved nails provide considerably greater withdrawal resistance than the common wire nail. This is especially true of nails driven into green wood that subsequently seasons.

Sometimes in nailing it is found that the wood splits with the ordinary sharp-pointed nail. One way of preventing splitting is to use blunt-pointed nails. Blunt-pointed wire nails may be obtained on the market, or if only a small quantity is needed, the points of common nails can be blunted, a handful at a time, on a grindstone or emery wheel. While blunt-pointed nails have a smaller tendency to split wood than do sharp-pointed nails, too much blunting results in a loss of holding power. Another way to reduce splitting is to use nails of smaller diameter, increasing the number, if necessary, to give the required strength. For special purposes, holes may be bored that are of slightly smaller diameter than that of the nail to be used.

When used under conditions favorable to corrosion, a nail of special material or coating is desirable. One of the most common types is the zinc-coated nail. For the most effective holding, an even uniform coating is essential.