Designation: F537 – 01 (Reapproved 2014)

Standard Specification for Design, Fabrication, and Installation of Fences Constructed of Wood and Related Materials[1]

This standard is issued under the fixed designation F537; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 This specification covers all wood fences, including fences combined with wood and other materials.

1.2 This specification covers three classifications of wood fences. This specification is based on fundamental construction principles combined with long-standing traditional fence building skills, and covers the design, fabrication, and installation practices of wood fences.

1.3 This specification also provides a systematic method of purchase, inspection with basis for rejection, and certification of manufactured wood fences by the fence industry.

1.4 The values stated in inch-pound units are to be regarded as the standard. Acceptable industry-wide SI equivalents are being developed.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

A641/A641M Specification for Zinc–Coated (Galvanized) Carbon Steel Wire

A809 Specification for Aluminum-Coated (Aluminized) Carbon Steel Wire

B221 Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

D2605 Specification for Volatile Petroleum Solvent (LPG) for Preparing Pentachlorophenol Solutions (Withdrawn 1992)[3]

D3225 Specification for Low-Boiling Hydrocarbon Solvent for Oil-Borne Preservatives (Withdrawn 2006)[3]

D3506 Specification for Inhibited Grade Methylene Chloride for Preparing Pentachlorophenol Solutions (Withdrawn 1992)[3]

F1043 Specification for Strength and Protective Coatings on Steel Industrial Fence Framework

F1667 Specification for Driven Fasteners: Nails, Spikes, and Staples

2.2 *Federal Standards:*

TT-W-572B Fungicide: Pentachlorophenol[4]

2.3 *Canadian Standards Association Document:*

B111-74 Specification for Wire Nails, Spikes, and Staples[5]

2.4 *National Forest Products Association Standard:*

National Design Specification for Stress Grade Lumber and Its Fastenings[6]

2.5 *Voluntary Product Standards:*

PS 20-70 Softwood Lumber[7]

PS 1-74 Softwood Plywood[7]

2.6 *American Plywood Association Standard:*

Specification for Plywood Design[8]

2.7 *American Wood Preservers Association Standards:*

C1 All Timber Products, Preservative Treatment by Pressure Process[9]

C2 Lumber, Timbers, Bridge Ties, Mine Ties, Preservative Treatment by Pressure Process[9]

C5 Fence Post, Preservative Treatment by Pressure Process[9]

C9 Plywood, Preservative Treatment by Pressure Process[9]

C16 Wood Used on Farms, Preservative Treatment by Pressure Process[9]

C23 Round Poles and Posts Used For Building Construction, Preservative Treatment by Pressure Process[9]

---

[1] This specification is under the jurisdiction of ASTM Committee F14 on Fences and is the direct responsibility of Subcommittee F14.15 on Other Fence Systems and Components.

Current edition approved Oct. 1, 2014. Published November 2014. Originally approved in 1978. Last previous edition approved in 2007 as F537 - 01(2007). DOI: 10.1520/F0537-01R14.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] The last approved version of this historical standard is referenced on www.astm.org.

[4] Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

[5] Available from Canadian Standards Association, 178 Rexdale Blvd., Rexdale, Ontario, Canada M9W 1R3.

[6] Available from National Forest Products Association, 1619 Massachusetts Ave., N.W., Washington, DC 20036.

[7] Available from U.S. Department of Commerce, National Bureau of Standards, Washington, DC 20234.

[8] Available from American Plywood Association, 1119 A St., Tacoma, WA 98401.

[9] Available from American Wood Preservers Association, P.O. Box 849, Stevensville, MD 21666.

M 4 Care of Pressure Treated Wood Products[9]

3. Terminology

3.1 *Definitions:*

3.1.1 *back rails*—rails on which cover material is directly attached.

3.1.2 *boards*—lumber that is up to 1 in. in nominal thickness and 2 in. or wider in nominal width.

3.1.3 *cover material*—the face or fill material attached to a fence structural frame.

3.1.4 *custom fence design*—any fence design that is significantly different from those described in this specification. Custom fence designs are also required to meet all requirements regarding materials, fabrication, installation, workmanship, and structural equivalency as set forth within this specification.

3.1.5 *panel products*—all modular products available in standardized rectangular panels, many of which are suited to exterior applications such as privacy fencing. Examples are plywood, fiberglass, and corrugated metals.

3.1.6 *pickets*—narrow wood members that are sawn, split, sliced, milled, natural round or half-round, and are approximately 2 to 4 in. in face or coverage width.

3.1.7 *posts*—the vertical structural support members of the fence frame.

3.1.8 *rails*—the horizontal structural support members of the fence frame.

3.1.9 *slats or weave boards*—the horizontal or vertical members used in basketweave type fences normally ⅜ to ¾ in. thick and 3 in. or wider in nominal width.

3.1.10 *standard fence design*—any fence structural frame or fence-type classification covered within this specification.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *boards or pickets*—fence boards or pickets are specified by the desired shape or manufacture of the upright end when installed vertically as described in 3.2.2 through 3.2.9.

3.2.2 *California clipped corners*—corners similar to 3.2.8, except the clip angle is steeper at approximately 65°.

3.2.3 *diamond point*—a board or picket similar to the standard point (3.2.9), except it consists of additional angular cuts, front and back, so that the top appears as a triangle from four angles of view, or pyramid shaped.

3.2.4 *flattop*—a simple flat or 90° square cut end.

3.2.5 *gothic*—a picket or board in which the shape is formed by two arc-shaped cuts that meet at center to form a graceful point at the top.

3.2.6 *handsplit*—pickets, posts, and rails which are split by machine or by hand using an axe or froe, etc.

3.2.7 *pencil point*—a picket or board that is conical in shape, and common to round and half-round pickets.

3.2.8 *standard clipped corners (or dog-eared corners)*—corners which are clipped diagonally (approximately 45°).

3.2.9 *standard point*—a picket or fence board cut to a point at approximately 45° angles.

3.2.10 *posts*—fence posts are specified by the desired shape or manufacture of their above ground tops as described in 3.2.11 through 3.2.15.

3.2.11 *chamfered posts*—in round or square posts, the shallow diagonal cut or easing of the otherwise square-cut end. Usually measures from ¾ to 1½ in. along the chamfer.

3.2.12 *diamond-point posts*—the pyramid-shaped ends of post which are formed by angle cuts of approximately 45°.

3.2.13 *domed posts*—rounded ends of either round or square posts.

3.2.14 *flattop fence posts*—the square cut ends of post.

3.2.15 *pencil-point posts*—conically shaped round post tops.

4. Classification of Standard Fence Types

4.1 The generic classifications of wood fencing in 4.2 through 4.5 have gained common recognition throughout the fence industry and are adapted to this specification as a means of identifying a basic fence type. These classifications may be used in all cases as part of the purchase agreement between buyers and sellers of wood fencing; except a detailed description, drawing, or rendering of a custom fence design may be substituted where necessary.

4.2 *Type I—Rail Fences:*

4.2.1 *Split Rail*—The common country fence of alternating layers of handsplit rails laid up in zigzag tiers.

4.2.2 *Split or Sawn Post and Rail, or Both*—The rustic fence made up of split or sawn rails (two to four rails) installed into slotted split or sawn posts.

4.2.3 *Round Post and Rail*—A fence similar to that described in 4.2.2, except posts and rails are round or natural shaped; normally produced in two, three, and four rail fences. The rails are machined at ends to form a paddle-shaped scarf joint to be installed into post slots or formed into doweled ends for installing into posts with round connections.

4.2.3.1 *Herringbone Pattern Round Post and Rail*—A fence as described in 4.2.3, except it is normally a three-rail fence with small round wood inserts (doweled) which are installed between the upper two rails to form the familiar herringbone pattern.

4.2.3.2 *English Hurdle Fence*—A standard post and rail fence as described in 4.2.2 and 4.2.3, except that two smaller rails are installed diagonally from the fence posts (usually below the bottom rail connection) extending upwards to just above the fence top rail where they intersect and join a third decorative rail of the same approximate size, which extends downward to just below the bottom rail at a perpendicular angle.

4.2.4 *Post and Board*—The fence often referred to as corral fence is normally constructed using sawn wood posts, although round wood posts are sometimes used, with boards serving as rails. They are commonly constructed in two, three, or four board configurations.

4.2.4.1 *Crossbuck Post and Board*—A fence as described in 4.2.4, except that two boards diagonally cross each other between two standard top and bottom board rails.

4.2.4.2 *Crossbuck Post and Rail*—A fence as in 4.2.4.1, except rails are 2-in. or thicker nominal lumber.

4.2.4.3 *Hurdle Post and Board*—A fence having the same geometric arrangement as the English hurdle fence in 4.2.3.2, except all rails are sawn boards.

4.2.4.4 *Hurdle Post and Rail*—A fence as described in 4.2.4.3, except top and bottom rails are 2 in. or thicker nominal lumber.

4.3 *Type II—Board Fences:* Every design within this type may be supported by sawn wood posts, round wood posts, or metal posts.

4.3.1 *Solid Board Fence*—A fence that is constructed of ordinary wood fence boards which are usually installed vertically, but occasionally horizontally or diagonally, over a rather conventional fence frame of from two to four rails between posts.

4.3.2 *Spaced Board Fence*—A fence as described in 4.3.1, except that open space is provided between the boards either for eye appeal or for ventilation.

4.3.3 *Shadow Box*—A fence that is constructed like a solid board fence (see 4.3.1), except that fence boards are installed alternately from one side of the fence rails to the other, providing interesting shadow lines as well as excellent ventilation. This fence is commonly offered in either vertical or horizontal panels.

4.3.4 *Louver*—A fence which is similar to common board fences (4.3.1) in frame configuration, except that fence boards are installed angularly between the fence rails with the effect of directing sunlight and air in a desirable way. These fences may be constructed with the board louvers installed vertically or horizontally.

4.3.5 *Weave*—A fence similar to the shadow box (4.3.3), except each individual fence board, normally 1 in. nominal in thickness, is alternately attached to one side of the top rail and the opposite side of the bottom rail. It may be constructed vertically as described, or horizontally (minus rails) by alternating installation of the boards directly to the fence posts.

4.3.6 *Basket Weave*—A fence similar to the weave (4.3.5), except basket boards (commonly ⅜ to ¾ in. in thickness) are woven alternately between from one to five small wood members (sometimes 1 by 2, 1 by 3, or 1 by 4-in. nominal), which extend through the height of the weave perpendicularly. The fence may contain either a vertical or horizontal weave, but in either form, the top and bottom rails may be required for rigidity. The basket weave fence requires high quality wood because of its relative thinness.

4.4 *Type III—Picket Fences:* Every design within this type may be supported by sawn wood posts, round wood posts, or metal posts.

4.4.1 *Sawn Picket*—A fence in which the pickets are from 2 to 4-in. nominal width and are installed vertically. The pickets may be installed over two to four back rails of sawn lumber. The pickets may be installed solid or by specified spacing where desired for light and ventilation.

4.4.2 *Grape Stake Picket*—A fence that is sometimes referred to by the picket type, either handsplit or machine sliced. This is a popular fence in the durable species and is usually constructed with handsplit or machined back rails and posts. It is most often installed with solid picket cover, but can be utilized as a spaced picket fence.

4.4.3 *Stockade Picket*—A fence that is similar to other picket fences, except the pickets are natural, machine milled, round, or sliced to half-round; and are available with bark removed, or with bark on for an added rustic effect. This fence is popular in common wood species, and may be installed to round wood posts and round or half-round back rails, sawn posts, and back rails; or back rails attached to metal posts.

4.4.4 *Wire-Bound Picket*—This fencing is wire-bound, wooden picket fencing, in roll form. It is used for applications such as but not limited to, snow, shade, safety, sand, and screening. The fence is fabricated with a 2- or 4-in. maximum spacing between pickets as specified by the purchaser. Each picket is held firmly by five pairs of zinc-coated wires. Each pair of wires is tightly twisted by rotating a twister head a minimum of 2½ complete revolutions (900° of rotation) for 2-in. spacing and 5 complete revolutions (1800° of rotation) for the 4-in. spacing.

4.4.4.1 The twist rotation shall be in opposite directions between each succeeding picket. The wire shall have a minimum coated diameter of 0.099 in. (12½ gage) and a minimum zinc coating of 0.30 oz/ft^2 (Specification A641/A641M, Class 1) or a minimum aluminum coating of 0.32 oz/ft^2 (Specification A809) as selected by the purchaser. It shall have a minimum tensile strength of 70 000 psi in accordance with Specification A641/A641M or Specification A809, Medium Temper. The wire spacing of top and bottom pairs of wires shall be not less than 3 in. and not more than 6 in. from the ends of the pickets, with the remaining pairs of wires spaced equidistant between the top and bottom wires.

4.4.4.2 The length of roll of fabricated fence shall be 50 ft ± 6 in. The pickets shall be made of spruce, hemlock, cedar, redwood, fir, or pine, air-dried and rough sawn. The pickets may be stained, painted with a red oxide coating, or pressure-treated in accordance with 9.4 as specified. Picket dimension shall be: length, either 48 or 72 ± 3⁄16 in.; width, 1½ ± 1⁄16 in.; and thickness, ⅜ ± 1⁄16 in.

4.5 *Type IV—Solid Panel Fences:* Every design within this type may be supported by sawn wood posts, round wood posts, or metal posts.

4.5.1 *Plywood Panel Fences*—A fence which includes any common post and back rail construction with an exterior grade of plywood that is installed on or within the frame.

4.5.2 *Other Panel Product Fences*—Other panel products suitable for exterior use and manufactured in standard panel sizes may be installed within any fence frame that provides adequate lateral support for the panel. Examples include corrugated fiberglass and corrugated metals.

5. Ordering Information

5.1 Complete information describing the desired fence product shall be provided with all purchase orders or inquiries. The information described in 5.1.1 through 5.1.10 shall be included as detailed within this specification:

5.1.1 *Fence-Type Classification or Description*—Provide the standard fence-type classification, as described in Section 4, or substitute a detailed description, drawing, or architectural rendering, depending on the complexity of a custom design, and the requirements of the fence supplier.

5.1.2 *Structural Frame Identification Number*—Provide the fence structural frame identification index number as provided in Tables 1-3 (see also Section 7). Also, specify the maximum post spacing in feet, center to center of posts and the height of the fence, which is the minimum measurement from ground level to the top of the cover material or top of the top rail, whichever is the greater when options are provided for a particular fence frame in the tables. For open post and rail fences, specify the desired number of rails where shown to be optional in Table 1. The fence frames listed in Tables 1-3 and Section 7 provide many common fence frame configurations and may be used for simplified specifying. Alternatively, fence frames of significantly different design may be used if they provide structural integrity equal or superior to those described in Section 7, or if justified by structural engineering as provided in NFPA Specification for Stress Grade Lumber and Its Fastenings and APA Specification for Plywood Design.

5.1.3 *Architectural Class or Grade of Materials*—Include the architectural class of all sawn posts, rails, or boards as provided in Section 6 or their acceptable equivalent commercial lumber grade as provided in Tables 4-7. If handsplit, machine-sliced, or sawn pickets are to be used, specify the architectural class in accordance with Section 6. All other wood products are required to meet their minimum quality standards as established within Section 6.

5.1.4 *Species of Wood*—It is normally desirable for the fence purchaser to specify the commercial species of wood to be used in the fence or its various component parts, as it relates vitally to the appearance, durability, and general performance of the fence structure (see Section 8).

5.1.5 *Preservative Pressure Treatment*—Specify the pressure treatment, where applicable, in accordance with AWPA Standards C1, C2, C5, C9, C16, C23, and M 4 (see Section 9).

5.1.6 *Sizes and Details for Cover Material(s)*—Sizes of boards, pickets, and other fence cover materials (such as basketweave stock) shall be included in all purchase orders and inquiries. Unless otherwise noted, all fence boards shall be taken to be 1 in. rough nominal in thickness. Details of cover material selection should be included where necessary (for example, nominal face widths of fence boards or pickets should be specified, including the style in which they are laid-up). Sizes are provided in Section 10.

5.1.7 *Manufacture*—Special shapes or dressed ends of vertical fence boards, pickets, or posts shall be specified by the terminology provided in Section 3. Round post and rail fences may be specified with paddle-shaped scarf joints in cases where rail scarfs are fitted into slotted posts; or rails may be manufactured with doweled ends for installation into posts with special round-hold connections. Other special manufacturing details may be specified by including a detailed description, drawing, or rendering of the fence.

5.1.8 *Post Embedment*—The required fence post installation shall be specified as compact soil embedment, gravel or sand-gravel embedment, or set in concrete collar footings in accordance with Section 11. However, if the fence is installed by the purchaser, only the required post length need be specified, based on the depth of embedment as determined in accordance with Section 11.

5.1.9 *Fastenings and Connections*—This aspect of fence construction may be specified with considerable detail or may be omitted, in which case all fastenings and connections shall comply with Section 11.

5.1.10 *Finish*—When and if a special finish is desired, the color, method of application, and number of coats shall be specified (see Section 12).

6. Quality of Materials of Manufacture

6.1 *Quality Classification of Sawn Posts and Rails*—The following quality classifications of sawn lumber posts and rails may be achieved by ripping or cross cutting commercial grades of lumber to meet the requirements as listed. Compliance can also be achieved by using the minimum commercial grades of

TABLE 1 Open Frame Post and Rail Fences

Fence Type Classification	Structural Frame Identification Index	Nominal Post Size, in.	Nominal Top Rail Size, in.	Nominal Center Rail(s), in.	Nominal Bottom Rail Size, in.	Post Spacings, ft	Above Ground Height of Fence, ft	Total Number of Rails per Section
Split post and rail	No. 1	3½ by 3½	1½ by 1½	...	1½ by 1½	6	3	2
	No. 2	4 by 4	2 by 3	...	2 by 3	8	4	2
	No. 3	4 by 4	2 by 3	2 by 3	2 by 3	8	4	3
	No. 4	4 by 5	2 by 4	...	2 by 4	10	5	2
	No. 5	4 by 5	2 by 4	2 by 4	2 by 4	10	5	3
	No. 6	5 by 5	2 by 3	2 by 3	2 by 3	8	6	3
	No. 7	5 by 5	2 by 4	...	2 by 4	10	6	2
	No. 8	5 by 5	2 by 4	2 by 4	2 by 4	10	6	3
Round post and rail	No. 9	4 diameter	...	3 diameter	...	8	1, 2	1
	No. 10	5 diameter	...	4 diameter	...	8 to 10	1, 2	1
	No. 11	4 diameter	3 diameter	...	3 diameter	8	2, 3, 4	2
	No. 12	4 diameter	3 diameter	3 diameter	3 diameter	8	3, 4, 5	3
	No. 13	5 diameter	4 diameter	...	4 diameter	8 to 10	3, 4, 5	2
	No. 14	5 diameter	4 diameter	4 diameter	4 diameter	8 to 10	4, 5, 6	3
	No. 15	5 diameter	4 diameter	4 diameter	4 diameter	8 to 10	5, 6, 7	4
Sawn post and board	No. 16	3 by 4	1 by 4	...	1 by 4	8	2	2
	No. 17	4 by 4	1 by 4	1 by 4	1 by 4	8	3, 4, 5	3, 4, 5
	No. 18	4 by 4	1 by 6	1 by 6	1 by 6	8	4, 5, 6	3, 4, 5

TABLE 2 Sawn Wood Fence Frames

Fence Type Classification	Structural Frame Identification Index	Nominal Post Size, in.	Nominal Top Rail Size, in.	Nominal Center Rail(s), in.	Nominal Bottom Rail Size, in.	Post Spacings, ft.	Above Ground Height of Fence, ft	Total Number of Rails per Section
Fence frames for use with cover materials (up to and including solid, 100 %, cover or fill designs)	No. 19	3 by 4	2 by 3	...	2 by 3	6	3, 4	2
	No. 20	4 by 4	2 by 3	...	2 by 3	8	3, 4	2
	No. 21	4 by 4	2 by 3	2 by 3	2 by 3	8	4, 5, 6	3
	No. 22	4 by 4	2 by 4	...	2 by 4	8	4, 5, 6	2
	No. 23	4 by 4	2 by 4	2 by 4	2 by 4	8	6	3
	No. 24	4 by 4	2 by 6	...	2 by 6	8	6	2
	No. 25	4 by 4	4 by 4	...	4 by 4	8	6	2
	No. 26	4 by 6	2 by 4	2 by 4	2 by 4	6	7	3
	No. 27	4 by 6	2 by 6	...	2 by 6	6	7	2
	No. 28	4 by 6	4 by 4	...	4 by 4	6	7	2
	No. 29	6 by 6	2 by 6	2 by 6	2 by 6	6	8	3
	No. 30	6 by 6	4 by 4	4 by 4	4 by 4	6	8	3
	No. 31	6 by 6	2 by 4	2 by 4	2 by 4	6	8	4
	No. 19A	3 by 4	1 by 4	...	1 by 4	6	3	2
	No. 20A	3 by 4	1 by 4	1 by 4	1 by 4	6	4, 5	3
	No. 21A	4 by 4	1 by 4	1 by 4	1 by 4	8	4, 5, 6	3

TABLE 3 Metal Fence Posts and Frames

Fence Type Classification	Structural Frame Identification Index	Nominal Outside Diameter or Dimensions of Metal Posts, in.	Nominal Top Rail Size-Wood, in.	Nominal Center Rail-Wood, in.	Nominal Bottom Rail-Wood, in.	Post Spacings, ft	Above Ground Height of Fence, ft	Total Number of Rails per Section
Metal/wood fence frames for use with cover materials (galvanized steel pipe)	No. 1M	1.90	2 by 3	...	2 by 3	8	3 to 4	2
	No. 2M	1.90	2 by 3	2 by 3	2 by 3	8	4 to 5	3
	No. 3M	1.90	2 by 4	...	2 by 4	8	4 to 5	2
	No. 4M	2.375	2 by 3	2 by 3	2 by 3	8	4, 5, 6	3
	No. 5M	2.375	2 by 4	...	2 by 4	8	4, 5, 6	2
	No. 6M	2.375	2 by 4	2 by 4	2 by 4	8	5 to 6	3
Same usage as above but post and rails are metal channels	No. 7M	1.875 by 1.625	2 by 3	2 by 3	2 by 3	8	3 to 4	2
	No. 8M	1.875 by 1.625	2 by 3	...	2 by 3	8	4 to 5	3
	No. 9M	1.875 by 1.625	2 by 4	2 by 4	2 by 4	8	4 to 5	2
	No. 10M	2.25 by 1.70	2 by 3	2 by 3	2 by 3	8	4, 5, 6	3
	No. 11M	2.25 by 1.70	2 by 4	. . .	2 by 4	8	4, 5, 6	2
	No. 12M	2.25 by 1.70	2 by 4	2 by 4	2 by 4	8	5 to 6	3
	No. 13M	2.375 × 2 aluminum	2.375 × 2 aluminum	. . .	2.375 × 2 aluminum	6 to 10	3 to 6	2
	No. 14M	2.375 × 2 galvanized steel	2.375 × 2 galvanized steel	. . .	2.375 × 2 galvanized steel	6 to 10	3 to 6	2

lumber which are acceptable alternatives and in reasonable accordance with these architectural quality classifications. Tables 4-7 relate commercial lumber grades by size and use categories to the following fence industry component-part quality classifications:

6.1.1 *Architectural Class I, Sawn Posts and Rails*—This classification is recommended where the highest combination of both strength and appearance is required. Allowable growth characteristics and limiting provisions are described in 6.1.1.1 through 6.1.1.7.

6.1.1.1 Stained sapwood allowed, stained heartwood in 25 % of the piece.

6.1.1.2 Seasoning checks not limited except through checks at end limited as splits; allowable splits equivalent in length to the width of the piece.

6.1.1.3 Knots, sound and tight, approximately one third the face width; small unsound or not firmly fixed knots allowed.

6.1.1.4 Skips, hit and miss.

6.1.1.5 Slope of grain, not to exceed a 1-in. deviation in 8 in. of length.

6.1.1.6 No spike knot or other growth characteristic shall displace more than one third of a cross-sectional area.

6.1.1.7 Wane, one sixth of any face; or one fourth of any face up to half the length; except an occasional piece may have wane up to one half the thickness and one third the width for one fourth of the length.

6.1.2 *Architectural Class II, Sawn Posts and Rails*—This classification provides high strength in a fence, while providing a rustic appearance. Allowable growth characteristics and limiting provisions are described in 6.1.2.1 through 6.1.2.10.

TABLE 4 Lumber for Fence Boards (2 in. and Wider)

Species	Architectural Class I	Architectural Class II	Architectural Class III	Grade Rule Writing Agencies[A]
Western Red Cedar	select	quality	utility	ICA
	select	quality	utility	NLGA
Western Cedars (Incense and Red)	select merchantable	standard/construction	utility	WCLIB, WWPA, NLGA
	2 and btr common	3 common	4 common	WWPA, NLGA
Cypress	1 common	2 common	3 common or peck	SCMA, NHLA
Douglas Fir-Larch	select merchantable	standard/construction	utility	WCLIB, WWPA, NLGA
Douglas Fir-Larch	2 and btr common	3 common	4 common	WWPA, NLGA
Hem-Fir (Hemlock-White Fir)	select merchantable	standard/construction	utility	WCLIB, WWPA, NLGA
	2 and btr common	3 common	4 common	WWPA, NLGA
Western or Idaho White Pine	sterling	standard	utility	WWPA, NLGA
Western Pines	2 and btr common	3 common	4 common	WWPA, NLGA
Norway Pine	premium	premium	standard	NELMA
Eastern White Pine	premium	premium	standard	NELMA
Eastern White Pine	2 and btr common	3 common	4 common	NLGA
Northern Pine and Norway Pine (NHPMA)	2 and btr common	3 common	4 common	NHPMA, NELMA, NLGA
Southern Pine	No. 1 boards	No. 2 boards	No. 3 boards	SPIB
Eastern Hemlock and Tamarack	2 and btr common	3 common	4 common	NHPMA, NELMA
Aspen-Alder	2 and btr common	3 common	4 common	NHPMA, NELMA, NLGA, WWPA
Balsam Fir and Eastern Spruce	2 and btr common	3 common	4 common	NHPMA, NELMA, NLGA
Englemann Spruce	2 and btr common	3 common	4 common	WWPA
Sitka Spruce	select merchantable	standard/construction	utility	WCLIB, NLGA
Spruce-Pine-Fir	2 and btr common	3 common	4 common	NLGA
Redwood	select heart or select	construction heart or construction common	merchantable	RIS
Redwood				RIS
Northern White Cedar	2 and btr common	3 common	4 common	NELMA, NLGA
Alpine Fir	2 and btr common	3 common	4 common	WWPA, NLGA
All hardwoods	No. 1 construction	No. 2 construction	No. 3 construction	NLHA, SHLMA

[A] For identification of agencies, refer to Appendix X2.

TABLE 5 Lumber for Posts and Rails (2 to 4 in. Thick and 2 to 4 in. Wide)

Species	Architectural Class I	Architectural Class II	Architectural Class III	Grade Rule Writing Agencies[A]
Western Red Cedar	select	quality	utility	ICA
Western Cedars (Incense and Red)	construction/No. 2	standard, No. 3, or stud	utility	WWPA, WCLIB, NLGA
Cypress	1 common	2 common	3 common	SCMA, NHLA
Douglas Fir-Larch	construction/No. 2	standard, No. 3, or stud	utility	WWPA, WCLIB, NLGA
Hemlock-Fir	construction/No. 2	standard, No. 3, or stud	utility	WWPA, WCLIB, NLGA
Western Pine	construction/No. 2	standard, No. 3, or stud	utility	WWPA, NLGA
Eastern White Pine	construction/No. 2	standard, No. 3, or stud	utility	NELMA, NHPMA, NLGA
Western or Idaho White Pine	construction/No. 2	standard, No. 3, or stud	utility	WWPA, NLGA
Northern Pines	construction/No. 2	standard, No. 3, or stud	utility	NELMA, NHPMA, NLGA
Southern Pine	construction/No. 2	standard, No. 3, or stud	utility	SPIB
Eastern Hemlock, Tamarack	construction/No. 2	standard, No. 3, or stud	utility	NELMA, NHPMA
Aspen-Alder	construction/No. 2	standard, No. 3, or stud	utility	NELMA, NHPMA, NLGA
Balsam Fir, Eastern Spruce	construction/No. 2	standard, No. 3, or stud	utility	NELMA, NHPMA, NLGA
Engelmann Spruce	construction/No. 2	standard, No. 3, or stud	utility	WWPA
Sitka Spruce	construction/No. 2	standard, No. 3, or stud	utility	WCLIB, NLGA
Spruce, Pine, Fir	construction/No. 2	standard, No. 3, or stud	utility	NLGA
Redwood	select, select heart, or No. 2 open grain	construction common, construction heart, or No. 3 open grain, standard stud	merchantable utility	RIS
Alpine Fir	construction/No. 2	standard, No. 3, or stud	utility	WWPA, NLGA
All hardwoods	No. 1 dimension	No. 1 dimension	No. 2 dimension	NHLA, SHLMA
Northern White Cedar	construction/No. 2	standard, No. 3, or stud	utility	NELMA, NLGA

[A] For identification of agencies, refer to Appendix X2.

6.1.2.1 Stain and other rustic colorations due to normal weathering or seasoning not limited.

6.1.2.2 Seasoning checks not limited except through checks at end limited as splits; allowable splits equivalent in length to 1½ times the width of the piece.

6.1.2.3 Knots, unsound or not firmly fixed approximately one third the face width.

6.1.2.4 Holes, knot holes, or holes from any cause, approximately 1 in. or equivalent smaller for each 2 ft of length.

6.1.2.5 Skips, hit and miss.

TABLE 6 Lumber for Posts and Rails (2 to 4 in. Thick and 6 in. and Wider)

Species	Architectural Class I	Architectural Class II	Architectural Class III	Grade Rule Writing Agencies[A]
Western Red Cedar	select	quality	utility	ICA
Western Cedars (Incense and Red)	No. 1	No. 2	No. 3	WWPA, WCLIB, NLGA
Cypress	1 common	2 common	3 common	SCMA, NHLA
Douglas Fir-Larch	No. 1	No. 2	No. 3	WWPA, WCLIB, NLGA
Hemlock-Fir	No. 1	No. 2	No. 3	WWPA, WCLIB, NLGA
Western Pine	No. 1	No. 2	No. 3	WWPA, NLGA
Eastern White Pine	No. 1	No. 2	No. 3	NELMA, NHPMA, NLGA
Western or Idaho White Pine	No. 1	No. 2	No. 3	WWPA, NLGA
Northern Pines	No. 1	No. 2	No. 3	NELMA, NHPMA, NLGA
Southern Pine	No. 1	No. 2	No. 3	SPIB
Eastern Hemlock, Tamarack	No. 1	No. 2	No. 3	NELMA, NHPMA
Aspen-Alder	No. 1	No. 2	No. 3	NELMA, NHPMA, WWPA, NLGA
Balsam Fir, Eastern Spruce	No. 1	No. 2	No. 3	NELMA, NHPMA, NLGA
Engelmann Spruce	No. 1	No. 2	No. 3	WWPA
Sitka Spruce	No. 1	No. 2	No. 3	WCLIB, NLGA
Spruce, Pine, Fir	No. 1	No. 2	No. 3	NLGA
Redwood	No. 1 open grain, select/select heart	No. 2 open grain, construction common/ construction heart	No. 3 open grain, merchantable	RIS
Northern White Cedar	No. 1	No. 2	No. 3	NELMA, NLGA
Alpine Fir	No. 1	No. 2	No. 3	WWPA, NLGA
All hardwoods	No. 1 dimension	No. 1 dimension	No. 2 dimension	NHLA, SHLMA

[A] For identification of agencies, refer to Appendix X2.

TABLE 7 Lumber for Large Posts (5 in. and Thicker and 5 in. and Wider)

Species	Architectural Class I	Architectural Class II	Architectural Class III	Grade Rule Writing Agencies[A]
Western Red Cedar	select	quality	utility	ICA
Western Cedars (Incense	select structural	No. 1	No. 2	WWPA
& Red)	select structural	No. 1 structural	standard	WCLIB, NLGA
Cypress	1 common	2 common	3 common	SCMA, NHLA
Douglas Fir-Larch	select structural	No. 1 structural	standard	WCLIB, NLGA
Douglas Fir-Larch	select structural	No. 1	No. 2	WWPA
Hemlock-Fir	select structural	No. 1 structural	standard	WCLIB, NLGA
Hemlock-Fir	select structural	No. 1	No. 2	WWPA
Western Pines	select structural	No. 1	No. 2	WWPA
Western Pines	select structural	No. 1	standard	NLGA
Eastern White Pine	select structural	No. 1	No. 2	NELMA, NHPMA
Eastern White Pine	select structural	No. 1	standard	NLGA
Northern Pines	select structural	No. 1	standard	NLGA
Northern Pines	select structural	No. 1	No. 2	NHPMA
Northern Pines	select structural	No. 1	No. 2	NELMA
Southern Pine	No. 1 dense stress or dense structural “65”	No. 1 stress rated or No. 1 timber	No. 2 stress-rated or No. 2 timber	SPIB
Eastern Hemlock,	select structural	No. 1	No. 2	NELMA
Tamarack	select structural	No. 1	No. 2	NHPMA
Aspen-Alder	select structural	No. 1	No. 2	NELMA, NHPMA, WWPA
Aspen-Alder	select structural	No. 1	standard	NLGA
Balsam Fir, Eastern	select structural	No. 1	No. 2	NHPMA, NELMA
Spruce	select structural	No. 1	standard	NLGA
Engelmann Spruce	select structural	No. 1	No. 2	WWPA
Sitka Spruce	select structural	No. 1	standard	WCLIB, NLGA
Spruce, Pine, Fir	select structural	No. 1	standard	NLGA
Redwood	select, select heart or select structural open grain	construction common, construction heart, or No. 1 open grain	merchantable, No. 2 open grain	RIS
All hardwoods	No. 1 dimension	No. 1 dimension	No. 2 dimension	NHLA, SHLMA

[A] For identification of agencies, refer to Appendix X2.

6.1.2.6 Small spots or streaks of unsound wood, or peck, equal to one sixth the width permitted.

6.1.2.7 Light shake permitted; through shakes, in 2 through 4-in. material, up to 2 ft long permitted away from ends. If through at edges or ends, limited as splits.

6.1.2.8 Slope of grain, not to exceed 1-in. deviation in 8 in. of length.

6.1.2.9 No spike knot or other growth characteristic shall displace more than one third of a cross-sectional area.

6.1.2.10 Wane, one third of any face; except, that an occasional piece may have wane up to two thirds the thickness and one half the width for one fourth the length.

6.1.3 *Architectural Class III, Sawn Posts and Rails*—The most rustic of all classifications but suitable and even desirable for many wood fence designs. Allowable growth characteristics and limiting provisions are described in 6.1.3.1 through 6.1.3.10.

6.1.3.1 Stained wood permitted.

6.1.3.2 Seasoning checks not limited, except through checks at end limited as splits; allowable splits equivalent in length to twice the width of the piece, but in no case may exceed one sixth of the length.

6.1.3.3 Knots, unsound or not firmly fixed not larger than one half the face width.

6.1.3.4 Holes, knot holes, or holes from any cause, not larger than one third of the face width.

6.1.3.5 Skips, hit or miss up to ⅛-in. scant.

6.1.3.6 Unsound wood, honeycomb, or peck permitted in spots or streaks but shall not displace more than one third of a cross-sectional area.

6.1.3.7 Medium shake permitted; occasional through shakes permitted when tight and nearly parallel to edges, and limited in length as splits, measured on the through side.

6.1.3.8 Slope of grain, not to exceed a 1-in. deviation in 4 in. of length.

6.1.3.9 No spike knot or other growth characteristic, singularly or in combination, shall displace more than one half of a cross-sectional area.

6.1.3.10 Wane, one half of any face; except that an occasional piece may have wane up to two thirds the thickness for one fourth the length.

6.1.4 *Definitions of Growth Characteristics*—For definitions relating to allowable growth characteristics and limiting provisions as allowed in 6.1.1 through 6.1.3, refer to Appendix X1 of this specification.

6.2 *Quality Standards for Split Posts and Rails*—Split posts and rails shall be graded on the basis of strength and appearance. Tolerances for dimensional variation are also provided since it is impossible for each post or rail to be exactly alike due to its hand-crafted method of manufacture; therefore the dimensions are average and approximate within tolerances shown.

6.2.1 A −½-in. tolerance in girth shall be allowed for variation in the finished product.

6.2.2 All longitudinal shaping shall be developed by splitting with axe, froe, wedge, or machine. Cut, torn, or rough grain shall not be classified as defects.

6.2.3 Knots shall not exceed one half of the narrowest dimension in size.

6.2.4 Spiral grain shall not exceed a one-quarter twist within the length of the piece.

6.2.5 Kinks, bends, crooks, or sweep shall not be greater than the equivalent of the narrowest dimension, measured as a deviation from a straight line drawn along the center from end to end.

6.2.6 No outer bark, sap rot, char, or unsightly discolorations shall be permitted. Limited heart rot or peck in streaks or pockets shall be permitted. Rustic colorations due to normal weathering and seasoning shall be permitted.

6.2.7 Scars, wounds, or splits shall not exceed one fourth the depth of the member at the area affected.

6.3 *Quality Standards for Round and Half-Round Posts and Rails*—These posts and rails shall be graded on the basis of strength and appearance. Tolerances for diameter variation are also provided since it is impossible for each natural round post or round and half-round rails to be exactly alike; therefore, diameters are average and approximate within the tolerances shown.

6.3.1 A −¼-in. or a +½-in. variation in the nominal small-end diameter shall be allowed.

6.3.2 Natural taper shall be permitted.

6.3.3 Knots or limbs shall be trimmed flush and shall be limited to a maximum of a 50 % displacement within any 6 in. of length.

6.3.4 Kinks, bends, or crook shall be limited to an amount equivalent in inches to half the average diameter, measured as a deviation from a straight line drawn along the center from end to end.

6.3.5 No end rot, saw cut, or major defect shall be permitted. No outer bark shall be permitted, except for small spots or streaks limited to a maximum of 10 % of the total surface area. Rustic colorations due to normal weathering and seasoning shall be permitted.

6.3.6 Seasoning checks or cracks are normal characteristics and shall be limited to one half the diameter.

6.3.7 Length of round posts may be ±2 in. Length of rails may be ±1 in.

6.4 *Quality Classification of Sawn Fence Boards*—The following quality classifications of sawn lumber fence boards may be achieved by ripping or cross-cutting ordinary commercial grades of lumber to meet the requirements as listed. Compliance can also be achieved by using the minimum commercial grades of lumber which are acceptable alternatives and in reasonable accordance with these architectural quality classifications. Tables 4-7 relate commercial lumber grades by size and use categories to the following fence industry component-part quality classifications:

6.4.1 *Architectural Class I, Sawn Fence Boards*—This classification provides first-rate fence boards of high strength and appearance quality. In addition to disallowing such through-defects as knot holes, other allowable growth characteristics and limiting provisions are described in 6.4.1.1 through 6.4.1.9.

6.4.1.1 Light stain allowed; medium stain allowed on occasional pieces if otherwise superior quality.

6.4.1.2 Small seasoning checks permitted, with an occasional medium check not through.

6.4.1.3 Short splits, limited to one on each end.

6.4.1.4 Knots, sound and tight, approximately one third the face width.

6.4.1.5 Skips, hit and miss.

6.4.1.6 Scattered pin holes.

6.4.1.7 Shake, fine.

6.4.1.8 Spike knots, approximately one half the face width or equivalent; but no spike knot or other growth characteristic shall displace more than one third of a cross-sectional area.

6.4.1.9 Wane, not permitted.

6.4.2 *Architectural Class II, Sawn Fence Boards*—This classification provides good strength and appearance qualities, while allowing occasional through-defects and offering a decidedly more rustic look. Allowable growth characteristics and limiting provisions are described in 6.4.2.1 through 6.4.2.11.

6.4.2.1 Medium stain allowed; heavy stain allowed on occasional pieces if otherwise superior quality.

6.4.2.2 Medium seasoning checks permitted.

6.4.2.3 Short splits permitted, or one tight medium split.

6.4.2.4 Knots, sound and tight up to one half the face width but not over 4½ in. in diameter or equivalent; knots unsound or not firmly fixed limited to approximately one third the face width but not over 2½ in. in diameter or equivalent.

6.4.2.5 Skips, hit or miss.

6.4.2.6 Pin holes not limited.

6.4.2.7 Shake, light. Through shakes limited to one fourth the length.

6.4.2.8 Spike knots, approximately three fourths of face width; but, no spike knot or other growth characteristic shall displace more than one half of a cross-sectional area.

6.4.2.9 Wane, one half of the thickness, one third of the width.

6.4.2.10 Small spots or streaks of unsound wood, or peck, equal to one sixth the width and not more than one eighth of the area.

6.4.2.11 Holes, knot holes, or holes from any cause, approximately 1 in. or equivalent for each 3 ft of length.

6.4.3 *Architectural Class III, Sawn Fence Boards*—The most rustic of all fence board classifications but highly suitable and even desirable for many wood fence designs. Allowable growth characteristics and limiting provisions are described in 6.4.3.1 through 6.4.3.11.

6.4.3.1 Heavy stain permitted.

6.4.3.2 Large seasoning checks permitted.

6.4.3.3 Splits, approximately one fourth the length.

6.4.3.4 Knots, unsound or not firmly fixed up to approximately one half the face width.

6.4.3.5 Skips, hit or miss up to ⅛-in. scant.

6.4.3.6 Pin holes or small holes not limited.

6.4.3.7 Medium through shake permitted.

6.4.3.8 Spike knots, or other growth characteristics, shall not displace more than approximately one half of a cross-sectional area.

6.4.3.9 Wane, approximately one half the thickness and one third the width except heavy wane permitted on back. When through face, limited as holes.

6.4.3.10 Unsound wood, honeycomb, or peck permitted in spots or streaks over one third the surface area, but not displacing more than approximately one half of a cross-sectional area.

6.4.3.11 Holes, knot holes, or holes from any cause, not larger than approximately one third the face width. Knot holes, or loose knots, or both of maximum size are limited to one for each 4 ft of length, or equivalent smaller.

6.4.4 *Definitions of Growth Characteristics*—For definitions related to allowable growth characteristics and limitations described within 6.4.1 through 6.4.3, refer to Appendix X1.

6.5 *Quality Standards for Machined or Hand-Split Pickets*—These pickets are available in two quality levels, Architectural Class I and II; both will provide more than adequate performance while offering distinctly different appearance characteristics. Faces shall have 100 % longitudinal shaping by splitting with axe, froe, wedge, or machine.

6.5.1 *Class I*—Allowable growth characteristics and limiting provisions are described in 6.5.1.1 through 6.5.1.6.

6.5.1.1 Pickets shall be free of rot and bark with one clear split face. They may have saw marks on back.

6.5.1.2 Pickets shall have straight and parallel edges full width within a ±1/16-in. tolerance.

6.5.1.3 Pickets shall be split 9/16 in. thick; split end or top shall have a minimum thickness of 7/16 in.; minimum thickness at butt shall be not less than 3/16 in. at one point or one edge, average minimum 5/16 in.; maximum thickness at any point not to exceed 1⅛ in., including dimension at spike knot.

6.5.1.4 Pickets shall be square and trimmed to a length tolerance of ½ in. plus or minus.

6.5.1.5 Twist and knot curls shall not exceed ½ in.; further, two pickets standing side by side shall not show a hole or noticeable gap through, when viewed from a distance of approximately 10 ft.

6.5.1.6 A 6-in. bow or sweep in the flat surface that will pull out by bundling or nailing is allowed.

6.5.2 *Class II*—Allowable growth characteristics and limiting provisions are described in 6.5.2.1 through 6.5.2.6.

6.5.2.1 Rot spots or streaks of bark not to exceed one third of the edge thickness.

6.5.2.2 Small knots or holes not to exceed ½ in. in face.

6.5.2.3 Curved edges or edge sweep not to exceed ¼ in.; width tolerance may be ±⅛ in.

6.5.2.4 Thickness on split end allowed to be 9/32 in., minimum; allowable butt thickness, ⅛ in., minimum; maximum thickness not to exceed 1½ in.

6.5.2.5 Length tolerance permitted is ±¾ in.

6.5.2.6 Twist and knot curls allowed.

6.6 *Quality Standards for Machine-Sliced Pickets*—These pickets are available and acceptable in two qualities, Class I and II; both will provide more than adequate performance while offering distinctly different appearance characteristics.

6.6.1 *Class I*—Allowable growth characteristics and limiting provisions are described in 6.6.1.1 through 6.6.1.4.

6.6.1.1 Pickets shall be free of rot and bark with one clear sliced face. They may have saw marks on back.

6.6.1.2 Pickets shall have straight and parallel edges full width with a tolerance of ±1/16 in.

6.6.1.3 Pickets shall be sliced 11/16 in. thick. They shall have a minimum thickness of 7/16 in.

6.6.1.4 All pickets shall be square end trimmed to a length tolerance of ±⅛ in.

6.6.2 *Class II*—Allowable growth characteristics and limiting provisions are described in 6.6.2.1 through 6.6.2.4.

6.6.2.1 Sound knots not to exceed two thirds of the width.

6.6.2.2 Small loose knots or holes not to exceed ½ in. in face.

6.6.2.3 Curved edges not to exceed a ±¼ in. tolerance; the allowable width tolerance shall be ±1⁄16 in.

6.6.2.4 Length tolerance permitted is ±¼ in.

6.7 *Quality Standards for Round and Half-Round Pickets*—All round and half-round pickets shall be manufactured within the minimum standards as provided herein. Allowable growth characteristics and limiting provisions are described in 6.7.1 through 6.7.8.

6.7.1 It is impossible for all round and half-round pickets to be exactly alike; therefore, diameters or widths are approximate and average along the length of the picket.

6.7.2 A ±½-in. variation in the average nominal diameter or width is permitted.

6.7.3 Natural taper shall be permitted, but shall be reasonably uniform with extreme irregularities or natural deformations not permitted.

6.7.4 All knots or limbs shall be trimmed flush. Sound and tight knots may not exceed ¾ in. in diameter or equivalent, except that no single knot or combination of knots shall exceed a 50 % displacement along any 3 in. of length.

6.7.5 No loose knots, rot, or holes-through shall be permitted.

6.7.6 No outer bark shall be permitted, except for occasional very small spots or streaks, the combined area of which shall not exceed 10 % of the total surface.

6.7.7 The length tolerance permitted shall be ±¼ in.

6.7.8 *Bark-on Pickets*—Round and half-round pickets are optionally available and acceptable under all requirements of 6.7.1 through 6.7.7, with the exception that the natural outer bark is left on the picket, and the limbs are not trimmed as closely.

6.8 *Quality Standards for Sawn Pickets*—Sawn wood pickets are available and acceptable under two commercial grades of quality as provided by the regional lumber grading rules authorities. Table 8 lists the acceptable grades of sawn pickets which have been collated in accordance with the near equivalence to Classes I and II, as described in 6.5 and 6.6 (see also Appendix X2).

6.9 *Quality Standards for Machine-Moulded (Milled) Fence Pickets:*

6.9.1 *Class I*—This classification provides first-rate fence pickets of high strength and appearance quality. In addition to disallowing such through defects as knot holes, other allowable growth characteristics and limiting provisions are described in 6.9.1.1 through 6.9.1.10.

6.9.1.1 Medium stain allowed.

6.9.1.2 Small seasoning checks allowed.

6.9.1.3 No splits allowed.

6.9.1.4 Knots, sound and tight approximately one third the face width.

6.9.1.5 Light skip (1⁄32 in. in depth and 2 in. in width).

6.9.1.6 No pin holes.

6.9.1.7 Shake, light.

6.9.1.8 No spike knot allowed.

6.9.1.9 Wane, not permitted.

6.9.1.10 Dimensional tolerances: width and thickness, ±1⁄16 in.; length, ±⅛ in.

6.9.2 *Class II*—This classification provides good strength and appearance qualities. Allowable growth characteristics and limiting provisions are described in 6.9.2.1 through 6.9.2.12.

6.9.2.1 Medium stain allowed.

6.9.2.2 Medium seasoning checks allowed.

6.9.2.3 Very short split allowed.

6.9.2.4 Knots, sound and tight up to one half the face width.

6.9.2.5 Medium skip, hit and miss.

6.9.2.6 No pin holes permitted.

6.9.2.7 Shake, medium.

6.9.2.8 No spike knot allowed.

6.9.2.9 Wane, limited to back face and back edge not to exceed one third the width of face or one third the length of piece. No inner or outer bark allowed. Saw marks allowed on back face.

6.9.2.10 Peck, not to exceed 1 % of surface area.

6.9.2.11 Holes, none permitted.

6.9.2.12 Dimensional tolerance: width and thickness 1⁄16 in.; length 3⁄16 in.

6.9.3 *Class III*—This classification provides fair strength and appearance qualities, while allowing some through defects and offering a decidedly more rustic look. Allowable growth characteristics and limiting provisions are described in 6.9.3.1 through 6.9.3.12.

6.9.3.1 Heavy stain permitted.

6.9.3.2 Large seasoning checks permitted.

6.9.3.3 Splits, approximately one fourth of the length.

TABLE 8 Acceptable Grades of Sawn Pickets

Commercial Species (Softwoods)	Architectural Class I	Architectural Class II	Grading Rule Writing Agency[A]
Western Red Cedar	No. 1	No. 2	WCLIB, WWPA, NLGA
Douglas Fir	No. 1	No. 2	WCLIB, WWPA, NLGA
Hemlock Fir	No. 1	No. 2	WCLIB, WWPA, NLGA
Sitka Spruce	No. 1	No. 2	WCLIB, NLGA
All other Western American species	No. 1	No. 2	WWPA
All other Canadian species	No. 1	No. 2	NLGA
Cypress	No. 1	No. 2	SCMA
Southern Yellow Pine	D and Btr.	No. 1	SPIB
Redwood	select	construction common	RIS

[A] For identification of agencies, refer to Appendix X2.

6.9.3.4 Knots, unsound or not firmly fixed up to approximately one half the face width.

6.9.3.5 Skips, hit and miss.

6.9.3.6 Pin holes or small holes not limited.

6.9.3.7 Medium through shake permitted.

6.9.3.8 Spike knots or other growth characteristics shall not displace more than approximately one half of the cross-sectional area.

6.9.3.9 Wane, approximately one third of any face, except one half of back surface. All bark shall be removed.

6.9.3.10 Unsound wood, honeycomb, or peck are permitted in spots or streaks over one third the surface area, but not displacing more than approximately one half of the cross-sectional area.

6.9.3.11 Holes, knot holes, or holes from any cause, not larger than approximately one fourth the face width. Knot holes or loose knots, or both, of medium size are limited to one for each 4 ft of length or equivalently smaller.

6.9.3.12 Dimensional tolerance: thickness 1⁄16 in., width 1⁄8 in., length 1⁄4 in.

6.10 *Quality Requirements for Plywood*—All exterior grades of plywood, all species, manufactured under the requirements of U.S. Department of Commerce Voluntary Product Standard PS 1-74 are acceptable for use under this specification.

6.11 *Requirements for Round Galvanized Steel Posts*—Round galvanized steel posts meeting the criteria outlined in 6.11.1, 6.11.2, and 6.11.3 may be selected from Table 3.

NOTE 1—Alternative design, strength calculations, and weight tolerances are derived from Specification F1043.

6.11.1 Bending strength is defined as the product ($Z \times Y$) of the section modulus (Z) and the yield strength (Y). Stiffness is defined as the product ($E \times I$) of the modulus of elasticity (E) and the moment of inertia (I).

6.11.2 Galvanized round steel posts of 1.900 in. outside diameter shall have a nominal weight of 2.27 lb/linear ft minimum. The bending strength shall not be less than 8150 lbf-in. and the stiffness shall not be less than 7.68×10^6 lbf·in.

6.11.3 Galvanized round steel posts of 2.375 in. outside diameter shall have a nominal weight of 3.12 lb/linear ft minimum. The bending strength shall not be less than 19 600 lbf-in. and the stiffness shall not be less than 16.0×10^6 lbf·in.

6.11.4 *Coatings*—Protective coating requirements on steel posts shall be as selected from Specification F1043.

6.12 *Requirements for Aluminum Channel Posts and Rails for Engineered Fence Framing*—The rectangular aluminum channel line posts and rails specified in Section 7 (Table 3) shall be extruded aluminum alloys 6061-T6 or 6063-T6 conforming to the requirements of Specification B221. The posts and rails shall be manufactured of sufficient weight or gage to resist all induced design loads as determined and justified by engineering analysis.

6.13 *Requirements for Steel Channel Posts and Rails for Engineered Fence Framing*—Roll formed C-Section steel line posts may be selected from Table 3 provided they meet the following criteria and will withstand all associated load requirements and shall meet the protective coating requirements as selected from Specification F1043.

6.13.1 Galvanized steel channel posts of 1.875 by 1.625 in. outside dimensions shall have a nominal weight of 2.28 lb/linear ft minimum. The bending strength shall not be less than 8150 lbf-in. and the stiffness shall not be less than 7.68×10^6 lbf·in.

6.13.2 Galvanized steel channel posts of 2.25 by 1.70 in. outside diameter shall have a nominal weight of 2.64 lb/linear ft minimum. The bending strength shall not be less than 19 600 lbf in. and the stiffness shall not be less than 16.0×10^6 lbf·in.

6.14 *Required Specifications for Factory-Built Fence Panels of Vertically Applied Wood Cover Material*—This specification provides a basis for specifying factory assembled fence panels. Due to the nature of the manufacturing process and economic factors prevalent in the industry, it has been the practice for a substantial portion of the stockade fence panels sold and manufactured in the northeast section of the country to be sold as factory assembled panels. A basis for specifying these panels is therefore felt to be necessary and desirable.

6.14.1 *General Specifications:*

6.14.1.1 All panels shall be manufactured in a rectangular form, with sides and top and bottom square and parallel to each other unless otherwise specified. Fence panels shall have a maximum length of 8 ft.

6.14.1.2 Terminal pickets shall be triple-nailed in all classes of panels in order to provide for safe handling. Double nailing, where specified, means that the pickets shall be fastened to the top and bottom backers with two nails per picket, and to the interior backers with at least one nail or fastener per picket. Single nailing, where permitted, means that all pickets with the exception of terminal pickets shall be fastened to the backers with one nail or fastener per picket. Boards or other cover material shall be similarly fastened.

6.14.1.3 The class of cover material shall be the same as the class of the panel, unless otherwise specified.

6.14.2 *Architectural Class I:*

6.14.2.1 *Frame*—In order to allow for local custom and technical constraints applicable to various mills, three alternative frame types are necessary. Unless otherwise specified, the use of any frame type will be deemed in accordance with this specification.

(*a*) A 2 by 3-in. minimum smooth sawn or dressed frame (see Section 7 and Table 2). Allowable defects are described in 6.1.1.

(*b*) A half-round frame shall be manufactured from material that has a minimum diameter of 4 in. before splitting. Allowable defects are described in 6.7.

(*c*) Full round and flattened frames shall be manufactured from material that has a minimum diameter of 3½ in. before flattening. Allowable defects are described in 6.7.

6.14.2.2 *Fasteners*—Corrosion-resistant fasteners are required. Staples are not permitted. Double nailing is required. The minimum length of fastener shall be 2 in.

6.14.2.3 *Length Tolerance*—The length tolerance shall be 1⁄8 in.

6.14.2.4 *Height Tolerance*—The height tolerance shall be in accordance with the requirements for cover material (see 5.1.2).

6.14.2.5 *Reinspection*—To allow for differences of opinion between graders, up to 5 % of panels may be below standard grade in any single shipment without causing the entire shipment to be downgraded or rejected.

6.14.3 *Architectural Class II:*

6.14.3.1 *Frame*—In order to allow for local custom and technical constraints applicable to various mills, three alternative frame types are necessary. Unless otherwise specified, the use of any frame type will be deemed in compliance with the specification.

(*a*) A 2 by 3-in. smooth sawn or dressed frame (see Section 7 and Table 2). Allowable defects are described in 6.1.2.

(*b*) A half-round frame shall be manufactured from material that has a minimum diameter of 3½ in. before splitting. Allowable defects are described in 6.7.

(*c*) Full round and flattened frames shall be manufactured from material that has a minimum of 3 in. before flattening. Allowable defects are described in 6.7.

6.14.3.2 *Fasteners*—Rust-resistant fasteners are required. Staples are not allowed. Double nailing is required. Minimum length of fastener shall be 2 in.

6.14.3.3 *Length Tolerance*—±3⁄16 in.

6.14.3.4 *Height Tolerance*—The height tolerance shall be in accordance with the requirements for cover material (see 5.1.2).

6.14.3.5 *Reinspection*—Up to 5 % of any single shipment may be below standard grade.

6.14.4 *Architectural Class III:*

6.14.4.1 *Frame*—In order to allow for local custom and technical constraints applicable to various mills, three alternative frame types are necessary. Unless otherwise specified, the use of any frame type will be deemed in accordance with this specification.

(*a*) A 2 by 3-in. minimum smooth sawn or dressed frame (see Section 7 and Table 2). Allowable defects are as specified in 6.1.3.

(*b*) A half-round frame shall be manufactured from material that has a minimum diameter of 2½ in. before splitting. Allowable defects are specified in 6.7.

(*c*) Full-round and flattened frames shall be manufactured from material that has a minimum diameter of 2½ in. before flattening. Allowable defects are specified in 6.7.

6.14.4.2 *Fasteners*—Rustproof or rust-resistant fasteners are recommended, but not required. Staples are permissible. Single nailing is allowed. The minimum length of fastener shall be 2¼ in. if single nailed, otherwise the length shall be 2-in. minimum.

6.14.4.3 *Length Tolerance*—The length tolerance shall be ±¼ in.

6.14.4.4 *Height Tolerance*—The height tolerance shall be in accordance with the requirements for cover material (see 5.1.2).

6.14.4.5 *Reinspection*—Up to 7 % of any single shipment may be below the standard grade.

6.15 *Top Design of Posts and Cover Material*—The tops of posts and cover material shall maintain a flat area on top of ½ by ½ in. to create a blunt area for safety purposes.

7. Standard Fence Structural Frames

7.1 Tables 1-3 contain commonly used fence frame constructions. The tables provide a means of determining acceptable constructions with the materials, fastenings, and workmanship described in this specification. Tables 1-3 also provide a structural frame identification index that may be used to identify a specific construction within a buyer's purchase order or inquiry. However, any wood or combination of wood with other interacting material(s), otherwise not shown within these tables, may be considered acceptable if it provides at least equal or superior structural integrity to those shown, or if it can otherwise be justified by structural analysis using methods provided in NFPA Specification for Stress Grade Lumber and Its Fastenings and APA Specification for Plywood Design.

7.1.1 *Handsplit or Machined Picket Fences*—Structural frame No. 2 may be used for the support frame of grape stake pickets (that is, handsplit or machined), which are 4 ft in total above ground height. Structural frames No. 3 and No. 4 are acceptable for use in fences which are 5 ft in total above ground height. Structural frames No. 6 and No. 7 are acceptable for use in fences which are 6 ft in total above ground height. Nominal rough sawn rails may be substituted. Allowable post spacing shall be as shown in Table 1.

7.1.2 *Stockade Picket Fences*—Structural frames No. 12 and No. 13 may be used for the support frame of the stockade picket fence (that is, round or half-round pickets), which are 4 ft in total above ground height. Structural frame No. 13 is acceptable for use in fences which are 5 ft in total above ground height. Structural frame No. 14 is acceptable for use in fences which are 6 ft in total above ground height. Structural frame No. 15 is acceptable for use in stockade fences which are 7 ft in total height. The back rails may be the half-round product of the round rail diameters shown in Table 1, or 2 by 3-in. nominal rails may be substituted. All post spacings shall be 8 ft maximum.

7.1.3 *Metal Channel Frames*—Frames, No. 13M and No. 14M may be used at heights and post spacings provided by manufacturer based on various cover materials or fill as related to wind loading and derived by structural analysis.

8. Species of Wood

8.1 Many species of both hardwoods and softwoods are suitable for wood fence construction. However, some may offer superior performance with respect to a particular physical or mechanical property. As an aid to selecting the best suited available commercial species for a specific fence installation, and in order to compare their general properties, refer to Table 9 and Table 10.

8.2 The properties or factors compared within these tables include: hardness, bending strength, stiffness, strength as a post, fastener withdrawal resistance or nail-holding power, ease of keeping well painted, conspicuousness of checking, resistance to cupping, dimensional stability, and decay resistance or durability of heartwood.

TABLE 9 General Comparison of a Few Properties of Common Commercial Species (Softwoods)

	Hardness[A]	Bending Strength[A]	Stiffness[A]	Strength as a Post[A]	Fastener Withdrawal Resistance[A]	Dimensional Stability[A]	Decay Resistance of Heartwood[A]	Ease of Keeping Well Painted[B]	Resistance to Cupping[C]	Conspicuousness of Checking[C]
Western Softwoods:										
Alpine Fir	C	B	C	C	C	B	C	III	2	2
Douglas Fir	B	A	A	A	A	B	B	IV	2	2
Ponderosa Pine	C	B	C	B	C	A	C	III	2	2
Western Hemlock	B	A	B	A	B	B	C	III	2	2
Western Red Cedar	C	C	C	B	C	A	A	I	1	1
White Firs	B	B	B	B	C	B	C	III	2	2
Redwood	B	B	C	B	B	A	A	I	1	1
Engelmann Spruce	C	C	C	C	C	B	C	III	2	2
Western Larch	B	A	A	A	A	B	B	IV	2	2
Sitka Spruce	B	B	B	B	B	B	C	III	2	2
Idaho White Pine	C	B	C	B	C	B	C	II	2	2
Sugar Pine	C	C	C	C	C	A	C	II	2	2
Lodgepole Pine	B	B	C	B	B	B	C	III	2	2
Port Orford Cedar	B	B	B	B	B	B	A	I	1	1
Incense Cedar	C	C	C	B	C	A	A	I	1	1
Alaskan Cedar	B	B	C	B	B	A	A	I	1	1
Northern and Southern Softwoods:										
Eastern White Pine	B	B	C	C	C	A	B	II	2	2
Red Pine	B	B	B	B	B	B	C	III	2	2
Jack Pine	B	B	B	B	B	B	C	III	2	2
Eastern Hemlock	B	B	C	B	C	B	C	III	2	2
Balsam Fir	C	B	C	C	C	B	C	III	2	2
Tamarack	B	B	B	B	A	B	B	IV	2	2
Eastern Spruces	B	B	C	B	B	B	C	III	2	2
Eastern Red Cedar	B	B	C	B	B	A	A	I	1	1
Northern White Cedar	C	C	C	C	C	A	A	I	1	1
Atlantic White Cedar	C	C	C	C	C	A	A	I	1	1
Baldcypress	B	B	C	B	B	A	A	I	1	1
Southern Pines	B	A	A	A	A	B	C	IV	2	2
Longleaf and Slash Pines	A	A	A	A	A	B	B	IV	2	2

[A] A = among the woods relatively high in that respect; B = among the woods intermediate in that respect; C = woods moderately low in that respect.
[B] I = easiest; V = most exacting.
[C] 1 = best; 4 = worst.

9. Durability of Wood

9.1 *Decay*—Like other materials used in construction, wood is susceptible to deterioration under adverse conditions. Accordingly, special consideration is required to ensure long-lasting service life of wood used in fence construction. Wood may be subject to decay under the following conditions: a moisture content of more than 19 %, sufficient oxygen, and moderate temperatures. Therefore, under such conditions, the wood should be preservatively pressure treated or the heartwood of a durable species as described in 9.2 should be used.

9.1.1 *Termites*—Protection against termites or similar destroyers shall be clearly stated as a requirement, otherwise, it will not be the responsibility of the vendor.

9.2 *Durable Species*—The expression "durable species" refers to the heartwood of the following species with the exception that an occasional piece with corner sapwood may be included if 90 % or more of the width of each side on which it occurs is heartwood:

9.2.1 *Decay Resistant:* Redwood, Cedars, Black Locust, Bald Cypress (Tidewater Red), and Black Walnut.

9.2.2 *Termite Resistant:* Redwood, Bald Cypress (Tidewater Red), and Eastern Red Cedar.

9.3 The following species are rated by the Wood Handbook,[10] as moderately durable. Although they are not acceptable for in-ground use without preservative pressure treatment, the species are recommended for above-ground use wherever preservative pressure treatment is not contemplated as follows:

Bald cypress (young growth)
Douglas Fir
Honeylocust
Larch, Western
Oak, Swamp Chestnut
Pine, Eastern White
Southern Pine:
  Longleaf
  Slash
Tamarack

9.4 *Preservative Pressure Treatments*—When species classified as durable are not selected or available, and are within the heartwood requirements specified in 9.2.1, in-ground structural members (posts) shall be preservative-treated under the requirements of this specification. Where maximum durability for above-ground wood is desired, and the species classified as durable in 9.2 are not selected or available, it may also be desirable for them to be preservative treated.

[10] *Wood Handbook No. 72*, U.S. Dept. of Agriculture, Forest Products Laboratory, August, 1974.

TABLE 10 General Comparison of a Few Properties of Common Commercial Species (Hardwoods)

	Hardness[A]	Bending Strength[A]	Stiffness[A]	Strength as a Post[A]	Fastener Withdrawal Resistance[A]	Dimensional Stability[A]	Decay Resistance of Heartwood[A]	Ease of Keeping Well Painted[B]	Resistance to Cupping[C]	Conspicuousness of Checking[C]
Northern, Appalachian and Southern Hardwoods:										
Ash	A	A	B	B	A	B	C	V	4	2
Aspen	C	B	C	C	C	A	C	III	2	1
Basswood	C	B	C	C	C	C	C	III	2	2
Beech	A	A	B	A	A	C	C	IV	4	2
Birch	A	A	A	A	A	C	C	IV	4	2
Black Cherry	A	A	B	B	A	B	A	V	. . .	. . .
Chestnut	B	B	C	B	B	A	A	V	3	2
Cottonwood	C	B	C	C	C	B	C	III	4	2
Elm	A	A	B	B	A	B	C	V	4	2
Hackberry	A	B	C	B	B	B	C	. . .	. . .	. . .
Hickory	A	A	A	A	A	B	C	V	4	2
Black Locust	A	A	A	A	A	B	A	. . .	. . .	. . .
Magnolia	A	B	B	B	B	B	C	III	2	. . .
Maple	A	A	B	B	A	B	C	IV	4	2
Red Oak	A	A	A	A	A	B	C	V	4	2
White Oak	A	A	A	A	A	B	A	V	4	2
Sweet Gum	B	A	B	B	A	C	C	IV	4	2
Sycamore	B	B	C	B	A	B	C	IV	. . .	. . .
Tupelo	B	B	C	B	A	B	C	. . .	. . .	. . .
Black Walnut	A	A	B	A	A	B	A	V	3	2
Black Willow	C	B	C	C	C	B	C	. . .	. . .	. . .
Yellow Poplar	B	B	B	B	B	B	C	III	2	1
Western Hardwoods:										
Red Alder	B	B	C	B	C	B	C	III	. . .	. . .
Oregon Ash	A	B	C	B	A	B	C	V	4	2
Aspen	C	B	C	C	C	A	C	III	2	1
Black Cottonwood	C	B	C	C	C	B	C	III	4	2
Bigleaf Maple	B	B	B	B	A	B	C	IV	4	2
Paper Birch	A	A	B	B	A	C	C	IV	4	2
Tanoak	B	A	B	B	A	C	C	V	4	2

[A] A = among the woods relatively high in that respect; B = among the wood intermediate in that respect; C = woods moderately low in that respect.
[B] I = easiest; V = most exacting.
[C] 1 = best; 4 = worst.

9.4.1 When painting, staining or other finishing is necessary after treatment, water-borne pressure treatments or pentachlorophenol in light solvent, LPG, or methylene chloride pressure treatment should be used (Specification D3225, Specification D2605, Specification D3506).

9.4.2 Where oil-borne treatments are used for wood fences, special preparation in accordance with manufacturers' recommendations must be used before paint, stain, or other finish is applied. Water-borne treatments may be painted, stained, or otherwise finished as soon as the material has sufficiently dried for the purpose.

9.4.3 Where preservative pressure treated wood products are cut after treatment, the affected area shall be brush coated with preservative in accordance with AWPA Standard M 4.

9.5 *Treatable Species:*

9.5.1 It is recognized that heartwood of all species is difficult to pressure treat with a chemical preservative, but in some species it is less difficult. APA Specification for Plywood Design and Wood Handbook No. 72[10]recognize this and accordingly list only those species which are readily treatable.

9.5.2 The commercial species of wood that are referenced as acceptable for treatment under the AWPA and ASTM standards are:

Southern Yellow Pine
Ponderosa Pine
Douglas Fir:
  Coastal or
  Intermountain
Douglas Fir South
Western Larch
Western Hemlock
Gum, Black or Red
Redwood
Jack Pine
Lodgepole Pine
Red Pine
Eastern White Pine
Western White Pine
Sugar Pine
Oaks, White or Red

10. Manufactured Sizes of Materials

10.1 *Lumber Sizes (Posts, Rails, and Boards):*

10.1.1 *Surfaced Sizes*—Lumber is normally identified by nominal sizes that are based on unseasoned sawn dimensions; however, when the lumber is dried and surfaced, the finished net sizes are somewhat less than nominal sizes of product nomenclature. For example, a nominal 2 by 4 would have a surfaced net size of 1½ by 3½ in. at a maximum moisture content of 19 % (dry). Table 11 shows net sizes for common board and dimensional lumber.

10.1.2 *Surfaced Posts and Timbers*—Nominal timber sizes 5 by 5 in. and larger are exceptions to Table 9 in that they are surfaced unseasoned to a net size ½ in. less than their nominal dimensions.

TABLE 11 Simplified Table of Standard S 4S Sizes[A]

Inch-pound Units			SI Units	
Nominal, in.	Net Dry, in.	Net Green, in.	Net Dry, mm	Net Green, mm
1[B]	¾	25/32	19.0	19.8
2	1½	1 9/16	38.1	39.7
3	2½	2 9/16	63.5	65.1
4	3½	3 9/16	88.9	90.5
6	5½	5⅝	139.7	142.9
8	7¼	7½	184.2	190.5
10	9¼	9½	235.0	241.3
12	11¼	11½	285.8	292.1

[A] Established by American Lumber Standards Committee in conjunction with the U.S. Dept. of Commerce Standard PS 20-70.
[B] See PS 20-70 for standard sizes of lumber less than 1 in. nominal.

10.1.3 *Minimum Rough Sizes*—Thicknesses and widths, dry or unseasoned, for all lumber requires that 80 % of the pieces in a shipment shall be at least ⅛ in. thicker than the standard surfaced size, with the remaining 20 % at least 3/32 in. thicker than the surfaced size. Widths shall be at least ⅛ in. wider than standard surfaced widths.

10.1.4 All fence lumber sizes less than 1 in. nominal shall be identified by their actual net thicknesses. Manufacturing tolerances for this material of less than 1 in. nominal (or ¾ in. net) thickness shall be ±1/16 in.

10.2 *Split Posts and Rails Sizes*—Standard sizes are shown in Table 12.

10.3 *Round and Half-Round Post and Rail Sizes*—Round and half-round posts and rails are measured by their nominal top diameter, or width if half-round. Sizes are approximate within the tolerances allowed under their quality standards provisions in 6.3. They are available in the following sizes: 6½-ft lengths are manufactured in top-sizes ranging from 2½ to 7 in. in diameter, on ½-in. intervals; 8-ft lengths are available in the same top-sizes, except that an 8-in. top is also provided; 10, 12, and 14-ft lengths are available with 4, 5, or 6-in. top-sizes.

10.4 *Machine or Hand-Split Picket Sizes*—These pickets are available in 2½, 3, and 4-in. nominal widths, and 4, 5, and 6-ft lengths, within the manufacturing tolerances allowed under the quality standards provisions in 6.5.

10.5 *Machine-Sliced Picket Sizes*—Machine-sliced pickets are available in 2 and 2½-in. nominal widths, and 4, 5, and 6-ft lengths, within the manufacturing tolerances allowed under the quality standards provisions in 6.6.

10.6 *Round and Half-Round Picket Sizes*—These pickets are produced in 2, 2½, and 3-in. nominal diameters (or width if half-round), and in 4, 5, 6, and 7-ft lengths, within the manufacturing tolerances allowed under the quality standards provisions in 6.7.

10.7 *Standard Sawn Picket Sizes*—Since the standard net sizes of sawn pickets vary between the commercial lumber grading rules published by the regional grading rules writing agencies, it is necessary to compare the sizes in Table 13 with the species and grades in Table 8 in order to determine the standard dressed size.

10.7.1 *Sawn Picket Lengths*—Sawn wood pickets are produced in 3, 4, 5, and 6-ft lengths, and shall be square end-trimmed to a tolerance of ±⅛ in.

10.8 *Moulded (Milled) Picket Sizes*—The minimum thickness shall be not less than ⅝ in. thick for pickets 2 to 3 in. wide, ¾ in. minimum for 3¼ in. and wider.

10.9 *Plywood Sizes*—Sizes of plywood used in construction are actual net sizes within tolerances prescribed in Voluntary Product Standard PS 1-74.

11. Installation

11.1 *Wood Cover Materials*—All wood cover materials which are acceptable under appropriate sections of this specification, may be installed to any fence frame shown in Section 7 (see also Tables 1-3), as applicable.

11.2 *Non-Wood Cover Materials*—All non-wood fence cover materials, such as corrugated metal, fiberglass, chain link, wire, and other fill materials, may be specified for installation on or within any of the fence frames shown in Section 7 (see also Table 1, Table 2, and Table 3), as applicable.

11.3 *Expansion Allowance Fence Boards and Pickets*—When wood pickets or fence boards are attached to a fence frame as a solid fill or cover material, a small space between the fence boards shall be allowed to account for expansion due to change in moisture content as a result of wetting and drying cycles. For widths from 2 to 4 in., a 1/16-in. space shall be

TABLE 12 Standard Sizes for Split Posts and Rails

Item	Inch-pound Units			SI Units		
	Length, in.	Minimum Girth, in.	Approximate Proportions, in.	Length, m	Minimum Girth, mm	Approximate Proportions, mm
Post	96	20	5 by 5	2.44	508.0	127.0 by 127.0
Post	78	18	4 by 5	1.98	457.2	101.6 by 127.0
Post	64	18	4 by 5	1.63	457.2	101.6 by 127.0
Post	78	16	4 by 4	1.98	406.4	101.6 by 101.6
Post	64	16	4 by 4	1.63	406.4	101.6 by 101.6
Post	48	13	3.5 by 3.5	1.22	330.2	88.9 by 88.9
Rail	120	12	2 by 4	3.05	304.8	50.8 by 101.6
Rail	96	12	2 by 4	2.44	304.8	50.8 by 101.6
Rail	120	10	2 by 3	3.05	254.0	50.8 by 76.2
Rail	96	10	2 by 3	2.44	254.0	50.8 by 76.2
Rail	72	8	1.5 by 1.5	1.83	203.2	38.1 by 38.1

TABLE 13 Standard Sawn Picket Sizes

Inch-pound Units		SI Units		Grading Rules Agency[A]
Nominal Size, in.	Net Size, in.	Nominal Size, mm	Net Size, mm	
1 by 1	13/16 by 13/16	25.4 by 25.4	20.6 by 20.6	SCMA
1¼ by 1¼	1 by 1	31.8 by 31.8	25.4 by 25.4	SPIB
1¼ by 1¼	1 1/32 by 1 1/32	31.8 by 31.8	26.2 by 26.2	NLGA
1¼ by 1¼	1 1/16 by 1 1/16	31.8 by 31.8	27.0 by 27.0	WWPA, WCLIB, SCMA
1½ by 1½	1¼ by 1¼	38.1 by 38.1	31.8 by 31.8	SPIB
1½ by 1½	1 9/32 by 1 9/32	38.1 by 38.1	32.5 by 32.5	NLGA
1½ by 1½	1 5/16 by 1 5/16	38.1 by 38.1	33.3 by 33.3	WWPA, WCLIB, SCMA
¾ by 3	11/16 by 2½	19.1 by 76.2	17.5 by 63.5	RIS
1 by 3	¾ by 2¼	25.4 by 76.2	19.1 by 57.2	SPIB
1 by 3	11/16 by 2½	25.4 by 76.2	17.5 by 63.5	NLGA
1 by 3	¾ by 2½	25.4 by 76.2	19.1 by 63.5	WWPA, RIS, WCLIB, SCMA

[A] For identification of agencies, refer to Appendix X2.

provided; for 6 and 8-in. widths, a minimum space of ⅛ in. shall be provided; for 10-in. wide material, a 3/16-in. space shall be provided; and for 12-in. material, a ¼-in. space shall be provided.

11.4 *Expansion Allowance for Plywood*—When solid panel fences are constructed of plywood, care should be taken to allow space for expansion due to moisture. A minimum of ⅛ in. shall be allowed along the long edge of the panel, and ¼ in. at the end of the panel.

11.5 *Installation of Wood Posts:*

11.5.1 All wood posts shall be set in holes at least 4 in. larger in diameter than the largest dimension or diameter of the post.

11.5.1.1 Footings must extend to a depth of one half the finished height of fence minus 6 in. (maximum depth 48 in.).

11.5.2 Posts tamped into place with good tamping material can be considered as set in the next firmer soil. For example, instead of using loose or medium soil, use medium- or hard-packed soil, respectively.

11.5.2.1 When concrete is used as a footing depth extension, the post should extend to within 6 in. of the bottom of the footing, unless the footing is three times the cross section of the diameter of the post.

11.5.3 All wood posts shall be set and embedded in holes with minimum depths as specified in Table 14, based on soil-type classification and method of embedment.

11.5.4 Concrete footings may be one of two basic types as follows:

TABLE 14 Footing Table for Solid Covered Fences

NOTE 1—For fence with posts on 8-ft centers. For 10-ft spacing add 25 % to diameter or depth.

Fence Height, ft	Diameter and Depth of Footing, in.		
	Loose Soil	Medium Soil	Hard-Packed Soil
4	9 by 24	8 by 24	7 by 24
5	9 by 24	8 by 24	7 by 24
6	10 by 30	8 by 30	7 by 30
7	11 by 36	9 by 36	7 by 36
8	12 by 42	10 by 42	8 by 42
9	13 by 48	11 by 48	9 by 48
10	14 by 48	12 by 48	10 by 48
11	15 by 48	13 by 48	11 by 48
12	16 by 48	14 by 48	12 by 48

11.5.4.1 A concrete collar footing is employed by simply filling standard post holes with 2000 psi (13.8 MPa) minimum concrete.

11.5.4.2 Where high risk of frost or expansive soil upheaval is present, the concrete collar footing should be worked to approximately 4 in. in diameter larger at the base than at the top of the standard post hole. This may be accomplished by tapering the hole larger to the base or by otherwise enlarging the diameter at the base to provide equivalence. In loose soils it is necessary to employ a fine wire mesh or other suitable material to hold back the soil until the concrete can be poured.

11.5.4.3 In areas where frost is common, footings shall extend a minimum of 6 in. below maximum frost level or above rule, whichever is deeper.

NOTE 2—Grave diggers frost conditions usually more closely resemble fence conditions than water pipes in the street.

11.5.5 If water fills the post hole, a sturdy plastic bag may be used as a liner, into which the concrete may be slowly poured, causing it to sink and displace water without dilution of the concrete mix.

11.5.6 Post installations based on the allowable soil loading and engineering analysis are not prohibited as an alternative to these simplified criteria.

11.6 *Installation of Metal Posts:*

11.6.1 All metal posts should be set in holes having a diameter at least 3 times the size of the largest dimension or diameter of the post.

11.6.2 All metal posts shall be set in concrete, 2000 psi (13.8 MPa) minimum.

11.6.3 The metal post shall be submerged in the concrete to a depth sufficient to adequately support the post.

11.6.4 All other requirements for metal post installation are identical to those for wood, as specified in 11.5.

11.7 *Fastenings:*

11.7.1 The strength and utility of any wood component is in great measure dependent upon the fastenings used to hold the assembly together. The most common wood fasteners are nails and spikes, followed by screws, bolts, metal connectors, and straps of various shapes.

11.7.2 The NFPA Specification for Stress Grade Lumber and Its Fastenings shall be used for all engineered fastener design when specific information is not included in this specification.

11.7.3 *Nails:*

11.7.3.1 In order to ensure satisfactory durability, all nails or spikes shall be corrosion-resistant such as hot-dipped galvanized, aluminum, or stainless steel, unless otherwise specified. Protection of metal parts against rust or corrosion shall be clearly stated in a requirement or it shall not be the responsibility of the vendor.

11.7.3.2 Smooth shank nails are acceptable for all uses under this specification, except where wood members are subjected to direct withdrawal loads induced primarily by wind forces.

11.7.3.3 Deformed-shank nails are recommended for wood members, such as fence boards or pickets, which are exposed to direct withdrawal forces. Such nails are available as annularly threaded (ring shanked), helically threaded (spiral shanked), or barbed shank.

11.7.3.4 Always fasten a thinner member to a thicker member, unless clinched nails are used.

11.7.3.5 Use blunt nails, or any nail with a point not sharper than the standard medium-diamond point.

11.7.3.6 With very hard, dense woods or those otherwise tending to split when nailed, predrilling may be employed; however, predrill only three fourths of the nail diameter.

11.7.3.7 Place nails no closer to the edge than one half of the board thickness, and no closer to the end than the board thickness.

11.7.3.8 Toenailing may be used with the following stipulations: allow an end distance (distance from the end of the attached member to the point of initial nail entry) of approximately one third the length of the nail; drive the nail at a slope of 30° with the attached member; and bury the full shank of the nail while avoiding excessive mutilation of the wood from hammer blows.

11.7.3.9 Use only two nails per crossing for fence boards 4 in. and wider (nominal), and only one nail per crossing for pickets up to, but not including, 4-in. nominal widths.

11.7.3.10 Avoid end-grain nailing. When unavoidable, use screws or a side grain wood cleat adjacent to end-grain member (as in posts); or use deformed shank nails or spikes. However, end-grain nailing shall not be allowed under any circumstances when subjected to withdrawal forces.

11.7.3.11 A nail shall be long enough to penetrate the receiving member a distance twice the thickness of the thinner member but not less than 1½ in. (for example, in ¾-in. board, the nail should penetrate the receiving member 1½ in.; thus, at least a 7-penny nail is required). Slant-driven, clinched, or deformed shank nails shall be used when the combined thickness is less than the recommended nail length. Refer to Table 15 for aid in proper nail selection.

11.7.4 *Wood Screws:*

11.7.4.1 A screw should be long enough to penetrate the receiving member at least the thickness of the thinner (outside) member, but with not less than 1 in. of penetration (for example, fastening a ¾-in. member to a 2-by-4 wooden plank would require a 1¾-in. long screw).

TABLE 15 Selection of Nails

Penny Size	Gage	Length, in. (mm)		Diameter, in. (mm)
Bright, Common Wire Nails:				
6d	11½	2	(50.8)	0.113 (2.87)
8d	10¼	2½	(63.5)	0.131 (3.33)
10d	9	3	(76.2)	0.148 (3.76)
12d	9	3¼	(82.6)	0.148 (3.76)
16d	8	3½	(88.9)	0.162 (4.11)
20d	6	4	(101.6)	0.192 (4.88)
30d	5	4½	(114.3)	0.207 (5.26)
40d	4	5	(127.0)	0.225 (5.72)
50d	3	5½	(139.7)	0.244 (6.20)
60d	2	6	(152.4)	0.262 (6.66)
Smooth Box Nails:				
3d	14½	1¼	(31.8)	0.076 (1.93)
4d	14	1½	(38.1)	0.080 (2.03)
5d	14	1¾	(44.5)	0.080 (2.03)
6d	12½	2	(50.8)	0.098 (2.49)
7d	12½	2¼	(57.2)	0.098 (2.49)
8d	11½	2½	(63.5)	0.113 (2.87)
10d	10½	3	(76.2)	0.128 (3.25)
16d	10	3½	(88.9)	0.135 (3.43)
20d	9	4	(101.6)	0.148 (3.76)
Helically and Annularly Threaded Nails:				
6d	. . .	2	(50.8)	0.120 (3.05)
8d	. . .	2½	(63.5)	0.120 (3.05)
10d	. . .	3	(76.2)	0.135 (3.43)
12d	. . .	3¼	(82.6)	0.135 (3.43)
16d	. . .	3½	(88.9)	0.148 (3.76)
20d	. . .	4	(101.6)	0.177 (4.50)
30d	. . .	4½	(114.3)	0.177 (4.50)
40d	. . .	5	(127.0)	0.177 (4.50)
50d	. . .	5½	(139.7)	0.177 (4.50)
60d	. . .	6	(152.4)	0.177 (4.50)

11.7.4.2 Screws shall also be rustproof or made of rust-resistant metals (see 11.7.3.1).

11.7.5 *Other Timber Fasteners*—All other connectors such as lag screws, common bolts, or drift bolts shall be used in accordance with the recommendations of the NFPA Specification for Stress Grade Lumber and Its Fastenings.

11.7.6 *Other Light Fasteners (Mechanically Installed):*

11.7.6.1 Different types of staples have been developed with various modifications in points, shank treatment and coatings, gage, crown width, and length. These fasteners are available in clips or magazines to permit their use in pneumatically operated portable staplers. The withdrawal resistances vary almost directly with the circumference and depth of point when the type of point and shank are similar.

11.7.6.2 Staples shall be manufactured in accordance with Specification F1667 or Canadian Standards Association Specification B111.

11.7.6.3 Staples shall be of the corrosion-resistant type.

11.7.6.4 Use and installation of staples and other mechanically driven light fasteners shall be in accordance with I-SANTA Manual 19-73.[11]

[11] *I-SANTA Manual 19-73*, Pneumatic and Mechanically Driven Building Construction Fasteners, Industrial Stapling and Nailing Technical Assn., 1973.

12. Finish

12.1 Exterior finishes for wood include natural finishes, penetrating stains, and paint. In general, the natural finishes and stains containing a water repellent and a preservative are preferred over paint for exposed wood, primarily because they penetrate the surface, are usually more durable, and are easily renewed. For finish application recommendations, refer to Table 16.

12.2 Because of the many possible finish applications and options available, this section is intended only as a guide to selection of finish-type and application method. Manufacturers recommendations for application and use of the various finish products shall be considered mandatory.

12.3 *Natural Finish, or Water-Repellent Preservatives*—These finishes are often used for exposed wood, not only because they afford some degree of protection to the wood during the weathering process, but because they enhance the natural colors and grain of wood, and are easily reapplied. Further, the use of a good water-repellent preservative, conforming to U.S. Fed. Specification TT-W-572B, Composition A can greatly improve the lasting quality of surface coatings of wood (paint). The most commonly used of these water-repellent preservatives consists of a 5 % solution of pentachlorophenol.

12.4 *Semitransparent Stains*—These stains, sometimes called penetrating stains, are lightly pigmented but still allow the wood grain and texture to show through. They penetrate deeply into the wood and are formulated for exterior use.

12.5 *Opaque Stains*—This type of stain forms a nongloss, opaque finish that will not crack, blister, or peel. The heavily pigmented stain generally hides the wood color and grain, but not the texture.

12.6 *Paint*—Paint is still one of the most widely used finishes for wood. However, due to the relative difficulty in maintaining a paint finish under extreme exterior conditions, opaque stains are finding much wider use where opaque finishes are desired out of doors. Still, a properly applied paint job can provide many years of satisfactory service. Proper application methods and materials have been published.[10],[12]

13. Inspection

13.1 Commercial lumber, plywood, and other wood products quality standards and grades shall be inspected in accordance with provisions provided by their respective industry grading rules and standards.

13.2 In all other cases, including prefabricated fence sections, inspection of the material shall be as agreed upon between the purchaser and seller as part of the purchase contract.

13.3 The complainant buyer shall unload the shipment and request inspection within 10 days after unloading. The seller shall acknowledge the inspection request within 10 days after receipt of such request. The disputed material must be held intact for a period not exceeding 30 days after filing of the request.

14. Certification

14.1 Upon request of the purchaser in the contract or order, the manufacturer or installer, or both, shall furnish a certification that all materials and workmanship meet all requirements stipulated or implied by this specification at the time of shipment or installation.

[12] Research Note FPL-0123,*Wood Finishing: Painting Outside Wood Surfaces*, U.S. Dept. of Agriculture, Forest Products Laboratory.

TABLE 16 Finish Application Recommendations

Desired Effect	Type of Finish	General Product Type	How Applied	Instructions
Durable opaque finish	paint	alkyd-base	brush, roller, spray	apply alkyd primer and two finish coats
	paint	oil-base	brush, roller, spray	use a zinc-free primer plus two finish coats
	paint	latex	brush, roller, spray	use a zinc-free primer plus two finish coats
Durable semi-opaque finish	heavy-body stain	oil-base	brush, dip, roller, spray	one coat for dark colors; two coats for light colors
Durable semi-transparent finish, subtle colorations		semi-transparent oil-base stains	brush, dip, roller	apply two coats (may be sprayed if smoothed with brush)
		semi-transparent resin stains	brush, dip, roller	apply two coats
Natural finish	water repellent preservative	. . .	brush, dip, roller, spray	apply two coats (preferably dip first coat)
Weathered-gray (driftwood)	commercial bleaching agents	. . .	brush	apply one coat initially, apply second coat in approximately 6 months

APPENDIXES

(Nonmandatory Information)

X1. DESCRIPTIONS OF TERMS RELATING TO ALLOWABLE GROWTH CHARACTERISTICS AND LIMITING PROVISIONS OF SAWN LUMBER FENCE POSTS, RAILS, AND BOARDS

X1.1 *stain*—stained sapwood has no effect on the strength or intended use of the pieces in which it is permitted, but affects appearance in varying degrees. It is usually brown, red, or blue.

X1.1.1 *light stain*—sapwood is so slightly discolored that it does not materially affect the natural appearance.

X1.1.2 *medium stain*—has a pronounced difference in coloration in obvious contrast to the unstained wood.

X1.1.3 *heavy stain*—has so pronounced a difference in color that the grain may be partially or totally obscured.

X1.2 *checks*—a separation of the wood normally occurring across or through the rings of annual growth and usually as a result of seasoning.

X1.2.1 *surface check*—occurs only on one surface.

X1.2.2 *through check*—extends from one surface to the opposite or adjoining surface.

X1.2.3 *small check*—not over 1⁄32 in. wide and not over 4 in. long.

X1.2.4 *medium check*—not over 1⁄32 in. wide and not over 10 in. long.

X1.2.5 *large check*—larger than medium.

X1.3 *splits*—a separation of the wood due to the tearing apart of the wood cells.

X1.3.1 *short split*—equal in length to the width of the piece and in no case exceeding one sixth the length.

X1.3.2 *medium split*—equal in length to twice the width and in no case exceeds one sixth the length.

X1.4 *knots*—a portion of a limb or branch that has become incorporated in a piece of lumber.

X1.4.1 *round knot*—one cut at right angles to the length of the knot (limb).

X1.4.2 *spike knot*—a knot cut either lengthwise of a limb, or diagonally across it.

X1.4.3 *small knot*—not over 3⁄4 in. in diameter.

X1.4.4 *sound knot*—contains no decay. It may be red or black.

X1.4.5 *unsound knot*—contains decay.

X1.4.6 *tight knot*—so fixed by growth, shape, or position that it retains its place in the piece. It may be red or black.

X1.4.7 *not firmly fixed knot*—a loose knot or one not held in place by growth, shape, or position.

X1.5 *skips*—areas on a piece that failed to surface clean.

X1.5.1 *hit and miss*—series of skips not over 1⁄16 in. deep with surface areas between.

X1.5.2 *hit or miss*—completely surfaced, partly surfaced, or entirely rough. Scantness may be 1⁄16 in.

X1.6 *wane*—bark or lack of wood from any cause, except eased edges, on the edge or corner of a piece of lumber.

X1.7 *shake*—a lengthwise separation of the wood which usually occurs between or through the rings of annual growth.

X1.7.1 *light shake*—not over 1⁄32 in. wide.

X1.7.2 *medium shake*—not over 1⁄8 in. wide.

X1.7.3 *surface shake*—occurs only on one surface of a piece.

X1.7.4 *through shake*—extends from one surface to the opposite or adjoining surface.

X1.8 *unsound wood*—contains decay, or a general disintegration of the wood substance due to action of wood-destroying fungi.

X1.9 *holes*—extends partially or entirely through a piece and may be from any cause.

X1.9.1 *pin holes*—not over 1⁄16 in. in diameter.

X1.9.2 *small holes*—not over 1⁄4 in. in diameter.

X1.10 *honeycomb*—large white specks or pockets caused by the fungus “Fomes pini.” It develops in living trees and does not develop further in wood in service. It is no more subject to decay than pieces which do not contain it.

X1.11 *peck*—channeled or pitted areas or pockets as often found in cedar and cypress. Wood tissue between pecky areas remains unaffected in appearance and strength. All further growth of the fungus causing peckiness ceases after the trees are felled.

X1.12 *occasional piece*—not over 10 % of the pieces.

X2. LUMBER GRADING RULES AND AGENCIES

X2.1 *ICA*—Inland Cedar Assn., 105 N. Fourth St., Couer d'Alene, ID 83814.

X2.2 *NELMA*—Northeastern Lumber Manufacturers Assn., Four Fundy Rd., Falmouth, ME 04105.

X2.3 *NHLA*—National Hardwood Lumber Assn., P.O. Box 34518, Memphis, TN 38104.

X2.4 *NHPMA*—Northern Hardwood and Pine Manufacturers Assn., Suite 50—Northern Building, Green Bay, WI 54301.

X2.5 *NLGA*—National Lumber Grades Authority, 1460-1055 W. Hastings St., Vancouver, B.C., V6E 2G1 Canada.

X2.6 *RIS*—Redwood Inspection Service, 591 Redwood Highway, Suite 3100, Mill Valley, CA 94941.

X2.7 *SCMA*—Southern Cypress Manufacturers Assn., 805 Sterick Building, Memphis, TN 38103.

X2.8 *SHLMA*—Southern Hardwood Lumber Manufacturers Assn., 805 Sterick Building, Memphis, TN 38103.

X2.9 *SPIB*—Southern Pine Inspection Bureau, 4709 Scenic Highway, Pensacola, FL 32504.

X2.10 *WCLIB*—West Coast Lumber Inspection Bureau, P.O. Box 23145, Portland, OR 97225.

X2.11 *WWPA*—Western Wood Products Assn., 1500 Yeon Building, Portland, OR 97204.